

**CHALLENGES FACING THE IMPLEMENTATION OF  
SMASSE PROJECT IN KERICHO DISTRICT, KERICHO  
COUNTY, KENYA**

**BY**

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## DECLARATION

This Research project is my original work and has not been presented for any other study programme in any other university.

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## **DEDICATION**

This Research project is dedicated to my wife Rose Chepkwony and my daughters Beryl Chelangat, Cindy Chepkorir and Mercyjoy Chebet for their understanding and support during the study.

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## **LIST OF ABBREVIATIONS AND ACRONYMS**

ASEI	-	Activity, Student, Experiment and Improvisation
B/ED	-	Bachelor of Education
BA	-	Bachelor of Anthropology
BSC	-	Bachelor of Science
CEMASTE	-	Center for Mathematics, Science and Technology in Africa
CRT	-	Center for Research and Technology
DPC	-	District Planning Committee
GOJ	-	Government of Japan
GOK	-	Government of Kenya
INSET	-	In-Service Education and Training
JICA	-	Japan International Cooperation Agency.
K.C.S.E.	-	Kenya Certificate of Secondary Education.
KESSP	-	Kenya Education Sector Support Programme
KNEC	-	Kenya National Examination Council
MA	-	Master of Arts
MED	-	Master of Education

- MOE - Ministry of Education.
- MOEHRD - Ministry of Education Human Resource Department.
- MOES &T - Ministry of Education Science and Technology
- MOEST - Ministry of Education Science and Technology
- MTEF - Medium Term Expenditure Framework
- NEPAD - New Partnership for Africa's Development
- PDSI - Plan, Do, See and Improve.
- ROK - Republic of Kenya
- SMASSE - Strengthening Mathematics and Sciences in Secondary Education
- STI - Science Technology and Innovation
- UNECA - United Nations Economic Commission

## ABSTRACT

The purpose of the study was to identify the challenges facing the implementation of SMASSE project in Kericho District, Kericho County. The study was guided by the following objectives: 1. To identify the challenges faced by public secondary school principals as they facilitate the implementation of SMASSE project. 2. To investigate the challenges faced by mathematics and science teachers on the use of ASEI/PDSI concept in their lessons. 3. To find out the effect of ASEI/PDSI approach on student attitude and participation in mathematics and science lessons. 4. To make suitable recommendations. The study was conducted using survey design. The target population for the study was 21 principals, 84 Mathematics and Science teachers and 1763 form 2 students. The study sampled 7 out of 21 public secondary schools using purposive simple random sampling. Lottery technique was employed to get samples from different categories of schools. 7 principals, 28 teachers and 210 students were sampled to participate in the study out of which all the 7 principals, 25 teachers and 201 students responded to the questionnaires which were used to collect data in the study. 2 schools were randomly selected for piloting of the instruments. These schools were not part of the sample for the main study. Content validity of the instruments was ascertained by a panel of three district SMASSE-INSET trainers. Reliability of the instruments was tested during piloting using test-retest method. After the piloting and testing, the instruments were adjusted accordingly before the actual data collection. Having established the validity and reliability of the instruments, the researcher administered the questionnaires to the sampled respondents. After collection, the data was organized to facilitate analysis. The coded data was entered into the computer using the statistical package for social sciences (SPSS). Descriptive statistics was used to analyze data quantitatively. Data was analyzed using means, frequencies and percentages. Results were presented in form of frequencies, charts and percentages as they easily communicate the research findings to the majority of the readers. From the findings the main challenge faced by the principals was shortage of teachers in mathematics and science subjects. The teachers on the other hand listed low morale, lack of sufficient time, heavy workload, overloaded syllabus, large class sizes and pressure to cover the syllabus as major impediments to the application of ASEI-PDSI approach in teaching. Despite the challenges, use of ASEI-PDSI approach has contributed to students having a positive attitude towards Mathematics and Science subjects and increased their participation in learning activities. Follow-up visits on the project implementation by the Quality Assurance and Standards Officers were found to be minimal. These findings will be of great significance to CEMASTE and District planning committees, Principals and teachers who are charged with implementation of the SMASSE project. From the study many students express a positive attitude and were satisfied with the teaching of mathematics and sciences. However performance in these subjects in the K.C.S.E examination is still very poor in most schools. There is need for further research to find out the causes of poor performance despite the positive change in attitude of students and implementation of SMASSE project.

## **CHAPTER ONE**

### **INTRODUCTION**

#### **1.1 .1 Background of the study**

Kenya government's vision for education is "Elimu Bora kwa Maendeleo" or "Quality Education and Training for Development" as translated into English. In order to fulfill this mission the Ministry of Education and stakeholders developed the Sessional paper No.1 of 2005 which stipulated the policies and strategies the government will implement in order to address the challenges facing education and training. Among the goals outlined in this paper is the need to improve all aspects of education and training quality so that recognized and measurable learning outcomes are achieved, especially in literacy, numeracy and essential life skills relevant to the world of work by 2010.

Vision 2030 on the other hand proposes intensified application of science, technology and innovation to raise productivity and efficiency levels across the three pillars of economic, social and political governance.

It recognizes the critical role played by research and development in accelerating economic development in all the newly industrializing countries of the world. The aim of vision 2030 is to accelerate transformation of Kenya into a rapidly industrializing nation by the year 2030. The government will create the Science, Technology and Innovation (STI) policy framework to support vision 2030. More resources will be devoted to scientific research, technical capabilities of the work force and raising the quality of teaching Mathematics, Science and Technology in schools, polytechnics and universities.

In an effort to realize quality education for secondary level mathematics and science, MOES&T recognizes the importance of in-service training of teachers. It is for this reason that the ministry of education converted the former Centre for Research and Technology (CRT), Karen to CEMASTEIA. This development has enabled the establishment and institutionalization of INSET activities at the national level. With the assistance of Japanese International Corporation Agency (JICA), INSET centres at district level have been established throughout the country. The INSET activities that were initially organized for teachers have now, due to demand, targeted Head teachers, QASOs, DEOs, tutors of diploma mathematics and science colleges and TIVET tutors.

The CEMASTEIA is also offering INSET courses for educators from other African countries in collaboration with NEPAD and ADEA. Currently, INSET is funded from JICA, Headteachers' associations and MOES & T

According to Kenya Education sector support program (ROK, 2005) evidence of relevance of in-service education and training in Kenya may be deduced from policy documents such as National development policy, medium term Expenditure frame work (MTEF), PRSP and sessional paper No.1 of 2005.

The INSET investment programme will focus on upgrading the capacity of young Kenyans in mathematics and science. The objectives of the program, is to strengthen mathematics and science education at secondary level through INSET for serving teachers of these subjects. The overall aim of the programme is to improve the teaching and learning quality of classroom teachers and the management and leadership skills of education managers and college tutors.

The programme is largely based at CEMESTEA and schools that have been selected as district INSET centres. The review and revision of the programme is done by MOES&T and JICA. A decentralized planning and management system for implementation has been developed within the district offices. The implementation of the programme is primarily the responsibility of the CEMESTEA and the District planning committees (DPC) chaired by the DEOS.

The Strengthening of Mathematics and Science Education (SMASSE) project was officially launched on 27<sup>th</sup> February 1998 following the signing of records of discussion and minutes of agreements between the government of Kenya (GOK) and the Government of Japan (GOJ). Offices were then set up at the ministry of Education headquarters and at Kenya Science Teachers College. According to JICA (1998), this was followed by baseline studies on the causes of poor performance in Secondary Mathematics and Science in Kenyan schools in nine pilot districts. The districts were Gucha, Butere, Kakamega, Kisii, Lugari, Makueni, Maragwa, Muranga and Kajiado. The study observed that poor performance posed a serious problem considering that the country required well trained personnel in science and technical fields so as to achieve or realize Kenya's dream of being industrialized by the year 2020.

### **1.1.2 Baseline survey findings**

Results from the baseline studies revealed that Mathematics and Science education was facing numerous problems of which some were beyond the scope of SMASSE and some within its scope. Many teachers displayed poor mastery of content, lacked practical skills and innovative and poor teaching methods.

This was manifested in the theoretical teacher- centered approach to teaching, little or no lesson planning, missed lessons, lateness and lack of exercises in the students' books. Teachers morale was generally low, a fact attributed to poor remuneration, working conditions and unsupportive school administrators. JICA (1998) further observed that students manifested negative attitude towards school in general and mathematics and science in particular. This was manifested in poor performance, untidy work, missed lessons, absenteeism and indiscipline, low morale and general dislike for mathematics and sciences. School managers in most school were not very supportive of science and mathematics. Laboratories were rare and often empty rooms. Teaching was predominantly knowledge based, teacher- centered and theoretical.

The few experiments carried out were large scale and recipe type as described in learning textbooks. The result was negative attitude of students towards mathematics and science. Students were less interested in mathematics and science than other subjects. Participation in academic activities like science congress was low with students relying entirely on their teachers for projects. At the tertiary level of education, the enrollment of students in the science based courses was notably low, including K.C.S.E. students performance in mathematics and science.

In addition to government intervention such as provision of physical and motivation of teachers, SMASSE focuses on the classroom activities, that is teaching. The SMASSE pilot project was to run from 1998 to 2003 covering 9 District but in 2000 it was extended to six more districts owing to its successful implementation.

In phase II, 2003-2008, the SMASSE activities were scaled up to cover the whole country. From January 2009, the implementation of the project activities was further scaled up to cover primary level education as well until the year 2013

### **1.1 .3 SMASSE project evaluation**

The effectiveness of the SMASSE project was assessed by evaluating the extent to which the project had achieved its purpose and was based on the purpose-output relationship.

The purpose had been improving quality of mathematics and science education in secondary school. But still, it was viewed that better performance in these subject could be achieved using drilling other than teaching for understanding since it seemed to be declining, District trainers needed for reinforce their proficiency so as to impact more on teachers teaching skills.

The Evaluation further examined the connection between outputs such as the establishment of INSET system at the Centre for Mathematics, Science and Technology Education in Africa (CEMASTEA) and in various districts and the value and extent of inputs. Impacts of the project were assessed on the basis of both constructive and negative influences caused by the project .It were rated fairly high even though the quality of teaching and learning had not attained the expectation.

### **1.1.4 Classroom impact of SMASSE programs**

The classroom impact of SMASSE programs has been monitored and evaluated using two sets of instruments based on the content of INSET. Lessons were monitored and evaluated using ASEI-PDSI checklist. With this instrument an observer evaluates the extent of use of ASEI and PDSI aspects in the lesson. The evaluation is on a 5-point scale

(0-4), with 0 indicating non-application and 4 indicating that the ASEI-PDSI aspect was applied to great extent. The methodology was a trace study in which lessons were observed in the 2003/04 before they undertook training and in 2007 just after completion of the 4<sup>th</sup> module of training. The results were that in 2003 the extent of ASEI-PDSI aspect in lesson stood at 0.8 while in 2007 it stood at 2.3. This indicate that SMASSE trained teachers were practicing more of the ASEI and PDSI in their classroom than the SMASSE untrained, however, this overall rating is still far below the desired rating of 4, hence the need to find out the challenges facing the application ASEI and PDSI in the classroom. Quality of lesson delivery was evaluated using the lesson observation instrument. The evaluation examines and rates the lesson on scale of 0 to 4 (poor to very good) in three aspects: teaching procedures, fundamental techniques/methodology and class management. The findings were of a trace study, same teachers were observed in 2003/04 and 2007. The findings were thus: in 2003, the quality of lesson delivery stood at 1.0 while in 2007 it had risen to 2.4. This indicates a great improvement but it is still far below to desirable scale of 4. Quality of learning was evaluated was also evaluated using leaner participation instrument. The scale used for evaluating quality of lesson delivery was applied on the same teachers observed in the same period (2003, then 2007). The findings were that in 2003, the quality of learning was at 2.0 and 2.5 in 2007. This indicates improvement but still below the ideal scale of 4.

#### **1.1.5 SMASSE Project impact assessment survey**

SMASSE project has also been evaluated using SMASSE project impact assessment survey (SPIAS) instrument. According to Waititu M. and Orado G. (2009) the purpose of SPIAS was to monitor effect and impact of INSET on teachers in professional

development and how such is linked to student ability. The SPIAS traces impact of the quality of INSET and the role of school principals, teachers and students and an achievement test for form 2 students. From the analysis of data gathered, the following inferences were made: SMASSE INSET has impact on students capacity and there is significant improvement in students cognitive skills, change on teachers pedagogical practices depends on principals encouragement on professional development, change in attitude is critical for success of INSET, student attitude towards mathematics and science affect their achievement, student participation in classroom significantly influences their attitude towards mathematics and sciences and gradual improvement on impact of INSET indicates that professional development requires sustained effort overtime .

#### **1.1.6 Hindrances to SMASSE implementation after training**

A study conducted by Ombaso D. (2008) on the impact of SMASSE-INSET in upgrading the capacity of mathematics and science teachers in terms of teaching methods, knowledge level and management of experimental equipment in mathematics subjects in Gucha District identified hindrances that prevented implementation of SMASSE after training. They include lack of sufficient time heavy teaching workload, lack of support from administration, large class size, inadequate teaching resources, pressure to cover, syllabus, lack of laboratory assistants, low morale, low entry behavior of learners and encouragement from other teacher.

### 1.1.7 Limitation of the cascade system of training

The cascade system of training which was initiated at the international training level up to the Kenyan classroom level was designed and adopted as illustrated in the figure 1.1 below.

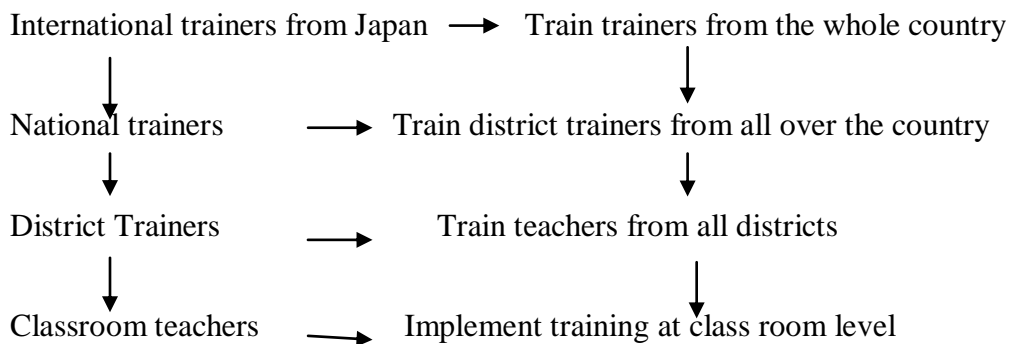


Fig.1.1 Cascade system of training. Waititu and Orado(2009)

Waititu and Orado (2009) stated that though the cascade system of training succeeded, it had the following limitations: First the training process was lengthy and thus took along period before the learners could gain at the classroom level. Secondly the content could be diluted and distorted down the ladder of training and in such cases, the trainers needed to do a comprehensive preparation and mastery of Knowledge and information that they were required to disseminate, unless quality assurance vetted the trainers' content before it was disseminated. Finally, at times, the trainees in the flow system may not have readily accepted the trainers and consequently may have been opposed or failed in response to the training.

### **1.1.8 Current state of SMASSE project in Kenya and academic achievement.**

The SMASSE project in Kenya is currently experiencing difficulties with teachers storming out of the SMASSE –INSET centres. The Nation newspaper (2012) reported that at least 200 teachers who had converged at Njonjo Girls and Nyanyuki Boys High school for SMASSE seminar refused to sleep in their designated dormitories and went home. Another group in Asumbi Girls National School, Homa Bay stormed out of the training hall when they were told they would be accommodated in dormitories and would not be paid daily allowances. Consequently the seminar whose theme was “Information Communication Technology” (ICT) integration in Education had to be disbanded. The Kenya Union of Post Primary Education Teachers (KUPPET) officials said that they are not against the seminar but the way it was being administered. They said they had not been involved in the planning of the seminars even though the Permanent Secretary, Ministry of Education had directed the District Education Officers to do so. When the DEO threatened to take disciplinary action against the teachers who had boycotted the seminar, KUPPET officials dared him to execute the threat. The officials also asked Japanese International Co-operation Agency (JICA) to withdraw their sponsorship until the issues raised are addressed. On the issue of academic achievement, in Kenya Mathematics is a compulsory subject up to secondary school level. The performance in this subject in national examinations together with science subjects has not been good. During the release of 2010 K.C.S.E results the then Minister of Education Prof. Sam. Ongeru cited a shortage of 12,000 Science and Mathematics teachers in Secondary schools as a major contributing factor into the declining grades. He further cited that teachers were ill equipped and that they needed intensive in-service training if at all

performance in these subjects was to be boosted “The decline in performance was worrying given the fact that Kenya’s Vision 2030 is anchored on the sound performance in mathematics and science subjects”(National correspondent 2011).Performance in mathematics and science subjects in Kericho District fits in scenario described above.

### **1.1.9 K.C.S.E. Examination performance in Mathematics and Sciences in Kericho District**

Table 1.1 below contains the K.C.S.E. examination mean scores for mathematics and sciences in Kericho District for the last 5 years.

Subject/year	2006	2007	2008	2009	2010
Mathematics	3.1065	3.1278	3.8503	3.450	3.9514
Biology	4.3742	5.6698	5.3458	4.627	7.0843
Physics	4.9679	5.1482	5.0147	4.330	4.9939
Chemistry	3.8373	4.0625	4.0193	3.653	4.2602

**Source:** Kericho District Education Office on KCSE Results, 2006-2010

From the table 1.1 above mean scores for each subject fluctuates differently from one year to another. SMASSE project aims at improving the teaching and learning process in mathematics and science subjects. This is expected to produce improved learning

outcomes including improved subject mean scores in K.C.S.E. examination. The fluctuation of subject mean score in table 1.1 above could be attributed to negative attitudes towards the subjects by the learners ,teachers' low morale ,understaffing, heavy workload, inadequate guidance of teachers by the Quality Assurance and Standards department and poor teaching methods.

#### **1.1.10 Success and shortfalls of SMASSE project in Kenya.**

Onderi and Malala(2012) state that SMASSE project in Kenya has experienced a number of successes and shortfalls alike. Among the successes include intensive interaction of SMASSE Kenya with African countries and sharing its experience on ASEI and PDSI principle done through technical exchange programmes and visits to other countries and through regional conference which resulted in the formation of SMASSE-WESCA Association. SMASSE Kenya has also established SMASSE in service training centers both at the National and District level whose core functions include publishing newsletters and journals for disseminating information, conducting technological and technical exchange programmes with member countries, holding join seminars and workshops with member countries in order to discuss issues affecting SMASSE project in their countries and promoting and implementing mathematics and science activities. Also National SMASSE offices have been constructed at Kenya science Teachers college to facilitate and coordinate SMASSE activities in Kenya. Again during phase I project, a number of positive changes were realized. First, teachers' attitude towards Mathematics and Science changed positively, Secondly, student interest in mathematics and science

had been enhanced and this was expected to be a greater positive impact on these subjects in Kenya in the subsequent phases through positive changes of teaching approaches by teachers to students than in phase 1.

Alongside its successes the SMASSE project has had the following the following major shortfalls: despite the SMASSE INSET having been strengthened, teaching in schools is examinations oriented and rote learning is the order of the day in most schools. Little attention is paid to individual differences, teaching and effective evaluation methods and classroom management .This has therefore been reflected in the declining performance in the national examination, with only a few exceptions. There is urgent need therefore to address this problem so that necessary measures can be taken by the stakeholders in SMASSE, Ministry of Education, local residents and the government at large in order to solve this conflicting situation of successes and shortfalls.

#### **. 1.1.12 Challenges facing SMASSE project in Kenya**

Since its inception in 1998, the SMASSE project has contributed greatly to the improvement of performance in Science and Mathematics in Kenya. However, the improvement in performance has not been much as expected, despite the change in teaching and learning approaches towards these subjects by the teachers. This could be attributed to the following factors: first Students' attitude is generally negative due to low entry behavior, belief that these subjects are hard, peer pressure, lack of proper learning facilities, teacher absenteeism and theoretical approach to teaching science and mathematics. Also teachers are reluctant to perform experiments especially the dangerous ones and the fear that the experiments might fail and therefore most teachers prefer

carrying out teacher demonstrations. Again, most parents are not interested in their children performance, especially in sciences and mathematics and some feel that their role is only fees payment. Still in appropriate methods of teaching are employed and most teaching methods are teacher centered. There is inadequate use of assignment to reinforce the mastery of content and infrequent inspection from subject inspectors. There is a missing link between primary and secondary school teaching methods. Other factors include lack of adequate teacher preparation hence poor mastery content, expenses needed for training SMASSE personnel and expenses needed to dispatch them for exchange visits and technical advice to other member countries, expenses necessary for holding regional and international conferences and SMASSE delegates meetings, Sciences and mathematics teachers are given little opportunities to interact amongst, themselves and exchange ideas since they are most held in school during the term and communities lack information about schools. Waititu and Orado (2009) identified some challenges beyond the scope of SMASSE but affect the implementation of the project as: unfair transfer of teachers by Teachers Service Commission, interruption of school programme by issues such as fee collection, stagnation in one job which demoralizes teachers thus lowering their effectiveness in delivery to the learner, understaffing in some areas of curriculum, poor communication and funding of school activities and programmes, food, child labour and the other family problems, teachers' poor working conditions and terms of service including incentives, overloaded syllabus and time heavy workload and Provision of infrastructure and instructional material and equipment to school.

Kibe (2008) states that despite the above challenges, there have been cases of schools with sufficient equipment and materials, yet student's achievement in Mathematics and Science subjects had not been very high on the converse there were schools that had poor facilities, teaching and learning materials yet they produced comparatively better results in national examinations due to effective teaching .Through SMASSE policy makers in education have been made to identify the importance of INSET to teachers as professionals that need to upgrade their skills.

#### **1.1.13 Problems facing education sub-sector**

Studies undertaken by Kenya Institute of Education (KIE) and SMASSE project indicate the following as the current problems facing the education sector in Kenya include:

Understaffing and under-qualification in some areas of curriculum, an overloaded curriculum, inadequacy of teaching and learning facilities and materials, teachers' low morale, examination oriented teaching and learning, students low morale, inappropriate teaching method used by teachers,

lack of integration of theory and practical work and inadequate education management.

#### **1.1.14 Challenges existing in secondary education sub-sector**

Inyenga and Thomson (2002) and Prof. Sam. Ongeru (Nation correspondent 2011) stated that performance in mathematics and sciences has been poor. The reasons for poor performance could be attributed to the following:

##### **Curriculum.**

The secondary school curriculum is broad and the number of examinable subjects are many. The curriculum especially in mathematics and science is overloaded.

### **Teaching methods**

Teaching methods used are poor since they lack in many areas such as student centeredness, student activities, experiment and improvisation. 'Chalk and talk' method is very common in many schools. Teaching is examination oriented and rote learning is practiced in most countries. In some cases teachers lack mastery of content.

### **Teaching/learning materials.**

In most Africa countries, it is reported that teaching/learning resources are inadequate and at times not available. Many countries have similar problems with textbooks, laboratories and equipments/chemicals. However, the problem is that there is no experiment/practice due to teachers' negative attitude although materials are available.

### **Teachers**

The common problems facing Kenya and the rest of regional countries are lack of qualified teachers especially in mathematics and science and lack of funds to hire those available. The issue of very few Mathematics and Science female teachers is common in all African countries. Negative attitude towards mathematics and science by teachers eventually get to the learners.

### **Learners.**

Students dislike some subjects especially mathematics and sciences. Some display negative attitude in learning and attending school. Poverty and family misunderstanding affect teaching and learning in many of the countries.

### **Administration**

The administrative processes of provision and maintenance of physical facilities, curriculum instruction, staff development and financial management are poor.

This study therefore was aimed at finding out the challenges faced by the Principals and teachers in the implementation of SMASSE project in Kericho District. It was further aimed at finding out the effect of the application of ASEI/PDSI Principle in the Mathematics and Science lessons. The findings of the study are to be used in making recommendation that will be useful in improving the implementation of the SMASSE project.

### **1.2 Statement of the Problem**

From the foregoing, SMASSE project has realized a number of successes. However, these successes have been accompanied by limitations, shortfalls and challenges. Studies undertaken by KIE and SMASSE project identified understaffing, overloaded curriculum, teachers low morale, exam-oriented teaching and learning methods and inadequate education management. Ombaso(2008) identified similar problems faced by teachers as they try to implement aspects of SMASSE after training. Onderi. H and

Malala.G (2012) found out similar challenges facing SMASSE project. The Nation newspaper(2012) reported that teachers are storming out of SMASSE INSET centres over poor accommodation facilities and payment of daily allowances and their officials were asking JICA to withdraw sponsorship until their issues are addressed. The phase II of SMASSE-INSET (2003-2008) has been completed in Kericho District. No studies have been carried out to establish the challenges facing the implementation of this project in this particular district despite poor performance in mathematics and science subjects over the years, hence the basis for this study.

### **1.3 Purpose of study.**

The purpose of study was to identify the challenges facing the implementation of SMASSE project in Kericho District. The study identified the challenges faced by principals and teachers in implementation of SMASSE project in the various schools.

The study also focused on identification of the effect of ASEI/PDSI approach on student attitude and participation in Mathematics and Science lesson.

### **1.4 Objectives of the study**

The study focused on the following objectives:

- i. Identification of challenges faced by public secondary school principals as they facilitate the implementation of SMASSE project.
- ii. Investigation of the challenges faced by mathematics and science teachers on the use of ASEI/PDSI concept in their lessons.

- iii. Finding out the effect of ASEI/PDSI approach on student attitude and participation in mathematics and science lessons.
- iv. Making suitable recommendations.

### **1.5 Research questions**

The study was guided by the following research questions:

- i. What challenges do public secondary school principals face as they facilitate implementation of SMASSE project?
- ii. What challenges do mathematics and science teachers face when they apply ASEI/PDSI concept in their lessons?
- iii. What are the effects of ASEI/PDSI approach on student attitude and participation in Mathematics and science lessons?
- iv. What can be done to address the challenges facing the implementation of SMASSE project?

### **1.6 Assumptions**

The researcher made the following assumptions during the research:

- i. Respondents were conversant with SMASSE project so that they can provide reliable data
- ii. ASEI/PDSI concept was applied in mathematics and science lessons.

### **1.7 Limitations of the study**

Mugenda and Mugenda (1999) defines limitations as the anticipated difficulties that might hinder effective data collection process of any study and which might also reduce the scope, the sample and the extent to which generalization of findings can be made.

The study limited itself to Secondary Schools in Kericho District, Kericho County. For more conclusive results all secondary schools in the county could be studied. However it was not possible because of limited time to complete the project and financial constraints .To overcome these limitations, stratified random sampling techniques was adopted to obtain a representative sample of the school in the county. By so doing it was then possible to utilize the available funds and time to conduct the study in the sampled schools.

### **1.8 Delimitation**

Only public secondary schools in the district were sampled for the study because SMASSE INSET is compulsory for serving mathematics and science teachers in these schools. It is optional for teachers serving in private schools.

### **1.9 Significance of the study**

This study informs the policy makers in the ministry of Education, the Teacher Service Commission, the Department of Quality Assurance and Standard, the CEMASTEAs and the District planning Committee under leadership of the District Education officer on the

challenges facing the implementation of SMASSE project. To address some of the challenges like understaffing which is seriously affecting the SMASSE project implementation, the Ministry of Finance has to allocate money to the T.S.C to hire more teachers to ease the shortages of teachers. The Kenya Institute of Education has to address the issue of overloaded syllabus. The Teachers Service Commission alongside the District Planning Committees have to consider ways of awarding certificates, giving allowance and considering for promotion teachers who have attended the full cycles of SMASSE-INSET. The District planning Committee will have to address the teachers' grievances on poor catering service, boarding facilities and timing of the SMASSE-INSET.

When these challenges are addressed by relevant institutions and committees it will make the implementation of the SMASSE project more effective. When the challenges facing the implementation of SMASSE are identified and addressed, the principal and teacher will be in a position to effectively implement the SMASSE project. This will lead to improved performance in Mathematics and Science subjects in K.C.S.E examinations. Findings also form a basis for further research on challenges facing implementation in different district in the country.

### **1.10 Theoretical framework**

This study was based on Piaget (1969) constructivism Theory. Constructivism is a set of assumptions about the nature of human learning that guide learning theories and teaching

methods of education. It refers to the idea that the learners construct knowledge for themselves, each learner individually and socially construct meaning as he or she learns from his or her experiences.

Piaget (1969) suggested that through processes of accommodation and assimilation, individuals construct new knowledge from experiences. When learners assimilate they incorporate the new experience into an already existing framework without changing the framework. According to this theory accommodation is a process of reframing ones mental representation of the external world to fit new experiences. According to constructivist approach, instructors have to adapt the role of facilitators and not teachers. Whereas a teacher gives a didactic lesson that covers the subject matter, a facilitator helps the learner to get his own understanding of the content. In the former scenario the learner plays an active role in the learning process. Constructivists view learning as an active process where learners should learn to discover principles, concepts and facts for themselves. Most approaches that have grown from constructivism suggest that learning is accomplished best using hands on approach. Learners learn by experimentation and not being told what will happen. It also emphasises that learning is not “all or nothing” process but students learn the new information that is presented to them by building upon knowledge they already possess. Piaget (1969) states that, human intelligence developed through a process of adaptation in order to fit with its circumstances. A person constructs concepts from the experiences the person gains. He says that.

“To know an object is to act on it. To know it is to modify, to transform the object and to understand the processes of this transformation as a consequence to understand the way of the object is constructed” (Piaget, 1969, p .176) Piaget’s epistemological view was that

learners do not acquire knowledge passively but they actively construct it into viable schemes. Piaget (1969) believed that knowledge is not passively acquired, rather it is discovered and constructed by the activity of the child.

“All knowledge is tied to action and knowing an object or an event is to use it by assimilating it into an action scheme..... This is true on most elementary sensory motor learning and all the mathematical operations” (Piaget, 1967, p 14).

In Piaget’s epistemology, the child’s cognitive development as well as the cognitive structure it has accumulated from the past experience which influence the child apprehension of reality. For this reason, the entry behavior of the student is very crucial, when a teacher is planning for a lesson in his class.

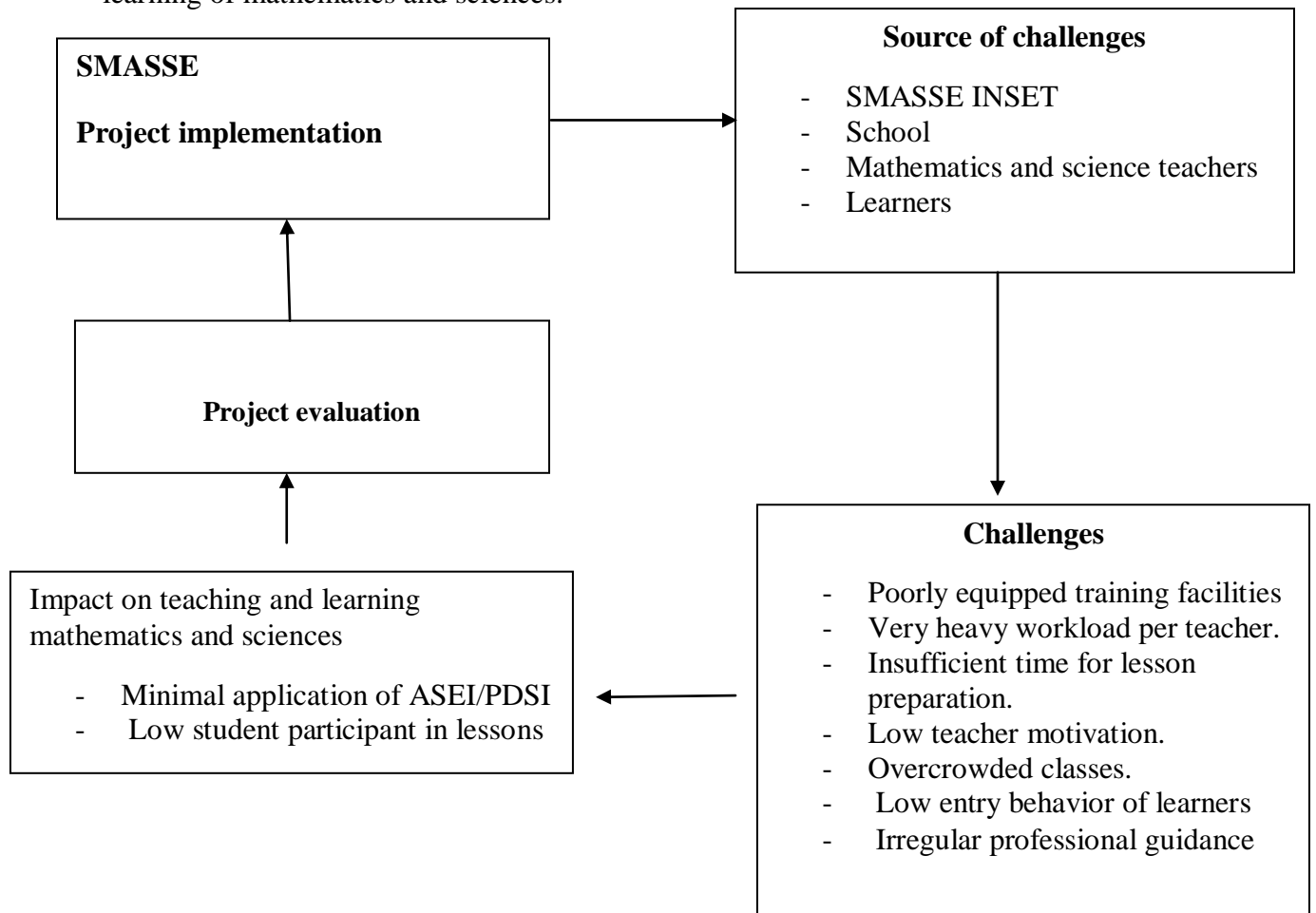
The ASEI/PDSI approach to teaching and learning of mathematics and sciences borrows heavily from the constructivist theory. Students are given the opportunity to construct their own knowledge and meaning in the respective subject areas as they actively participate in the lessons by way of conducting experiments, observing, discussing and answering or attempting to solve problems. This is in line with Piaget proposition that knowledge is not passively acquired but is discovered and constructed through the activities of the child.

It also agrees with other constructivists view that learning is active process where learners should learn to discover principles, concepts and facts. The teacher helps the learner through the process of assimilation and accommodation to reorganize their memory structures. Learners have to be aided to correct their points of view and ideas by

replacing what they know, with what is right. Involving learners in designing activities and experiences reinforces concept formation.

## **1.11 Conceptual Framework**

The following conceptual framework (Fig1.1.) shows the relationship between the challenges facing SMASSE-Project implementation and its impact on the teaching and learning of mathematics and sciences.



**Fig 1.2** Challenges facing implementation of SMASSE

The conceptual framework Fig1.1 summarizes the challenges facing the implementation of SMASSE-project and how they are interrelated. During the INSET some of the Challenges faced by the teachers include inadequate and sub standard boarding facilities, low quality catering services and trainers who are not well prepared. At school shortage of teachers leads to heavy workload and lack of sufficient time to prepare for lessons

using the ASEI-PDSI approach .Other school-based challenges are overcrowded classes, overloaded syllabus and pressure to cover the syllabus. low morale among the teachers and low entry of the learners also constituted challenges to the project implementation. As a result there is minimal application of ASEI-PDSI concept in lessons and low student participation in lessons until project evaluation is carried out and the necessary remedial measures taken based on the evaluation report.

#### **1.1.12 Definition of operational terms**

Achievement : Grades students score in K.C.S.E from A-E

Attitude : Having incline interest and emotion towards mathematics and science

Class : Group of pupils or students being taught by a teacher in the same place at the same time.

Curriculum : Refers to all the selected, organized integrative, evaluative and Innovative learning experiences meant to achieve designated learning outcomes.

Learning : Refers to constructional of knowledge through experience which usually Causes persistent change in individual potential behavior.

Improvisation : use of alternative materials in learning to replace what is believed to be ideal. In most cases local materials are used.

Implementation: The act of putting into practice set procedures, policies or projects to meet certain objectives.

Integration : Combination of various teaching strategies in teaching to improve performance of students in class

INSET : Training offered to teachers while still offering their teaching service.

Tertiary level education: Any post secondary education acquired as at university or college.

Student : person enrolled in an education programme

- SMASSE** : Project started in collaboration between JICA and government of Kenya  
aimed at strengthening the teaching of Mathematics and sciences  
in secondary schools
- Teacher:** Person employed (full time or part time) in an official capacity for  
the purpose of Guiding and directing the learning experience of pupils  
and students irrespective of his/her qualification or delivery mechanism.
- Pedagogy** : Refers to the study of and theory of methods and principles of teaching.
- Performance** : The level of achievement of set standards or objectives in the teaching  
service Public schools: Refers to schools which are developed, equipped  
and provided with staff from public funds by government, parents and  
communities.
- Stakeholders** : Persons or institutions with interest in education matters of the country.

## **CHAPTER TWO**

### **LITERATURE REVIEW**

## **2.1 Introduction**

This chapter focuses on the review of literature on SMASSE project and the challenges faced in its implementation and the challenges faced in its implementation specifically it areas the purpose of SMASSE, the baseline finding, the SMASSE INSET, evaluation of SMASSE, classroom impact of SMASSE program, limitation of cascade system, current State of SMASSE project in Kenya and academic achievement in Kenya, hindrances of implementation of aspects of SMASSE after training, challenges facing SMASSE project in Kenya, problems facing Education sub-sector, challenges existing in secondary education sub-sector and importance of Science and Mathematics.

## **2.2. Purpose of SMASSE**

SMASSE project is a joint venture between the Kenya government through MOEST and the government of Japan through JICA. SMASSE project is mainly involved in in-service training (INSET) of serving teachers in mathematics and science in secondary schools in Kenya. According to Wambui N. and Nyacombe A. (2006) SMASSE came into being when consistently poor performance in mathematics and science that is, Biology, Chemistry and Physics, became a matter of serious concern. Broad curricula, lack of facilities and inadequate staffing were always cited as the major causes of the problem. Although dismal performance in these subjects had almost been accepted as the norm in some schools, the Ministry of Education Science and Technology (MOEST) and other stakeholders felt there had to be an intervention, hence the Strengthening of Mathematics and Science in Secondary Education (SMASSE)

### **2.3.1 Baseline survey findings**

The SMASSE team conducted a baseline survey in the nine pilot Districts of Kajiado, Gucha, Kakamega, Lugari, Butere-Mumias, Kisii, Muranga, Maragua and Makueni. The survey was carried out to determine the areas that needed intervention and come up with a strategic plan of operation.

Waititu M. and Orado G.(2009) states that the baseline survey identified many challenges there were contributing to poor performance in mathematics and sciences. The survey categorized the challenges into 3; those relating to teachers, those relating to students and those relating to the school.

According to MOE( 2003), the challenges affecting teachers included: poor working conditions causing low esteem among the teachers, overloaded syllabus and timetables, feeling of being foreigners in their schools, stagnation in one Job group, lack of guidance from headteacher, teachers attitude towards teaching profession, school administration, the subject and students, use of inappropriate approaches and methods, inadequate mastery of content and inadequate quality assurance mechanism.

The challenges affecting students were mostly related to inadequate learning time in school occasioned by absence due to fees, high cost of secondary education a factor also acknowledged by Education sector strategic plan (2003-2007). For those who were day scholars, they found themselves with other home chores that were competing for the time that otherwise could have been used for learning. The school based challenges affecting the quality of education included: inadequate facilities, inadequate teaching and learning materials, lack of electricity and piped water, poor communication networks to and from schools, poor fees payments, inadequate staffing, unfavorable parents' attitude towards

the school and the discipline of mathematics and sciences and inadequate staff housing. Other challenges affecting schools are poor or weak management.

Wambui N. and Nyacombe A. (2006) list the following as the challenges within the scope of SMASSE: Attitude towards mathematics and science. Students' attitude was generally neutral or negative. This was attributed to low marks at admission, belief that the subjects are difficult, peer influence, lack of facilities, harsh teachers, teacher absenteeism and theoretical approach to teaching.

Teachers attitude was generally neutral. They were reluctant to perform experiments, especially in chemistry which were deemed dangerous. In some cases experiments failed. Most practical sessions were merely teacher demonstrations.

The head teachers' neutral to negative attitude was reflected in their development project priorities. Text books, laboratories and laboratory equipment rarely were ranked high.

Most parents on the other hand were not interested in their children performance, least of all in mathematics and science. Progress reports were not a matter of concern. Some were ignorant, others felt paying fees was their only role. PTAS were eager to construct prestigious structures to be seen to be development conscious at the expense of basic teaching and learning resources. Other challenges included inappropriate teaching methodology, poor mastery of subject content, inadequate assignments, few or no interactive forums for teachers, infrequent professional guidance by subject quality assurance and standards officers, missing link between primary and secondary school levels and lack of information about schools by the community.

### **2.3.2 The SMASSE- INSET**

In order to address the challenges within the scope of SMASSE, an INSET curriculum was developed covering a duration of 40 days. In the process of developing the curriculum, a pedagogical paradigm of 'ASEI' movement by application of 'PDSI' approach was constructed.

The acronym ASEI stands for Activity (practical work, discussion and presentation) based teaching, student centre (use of interactive learning strategies), making experiment effective to lesson objectives and improvisation, innovativeness to enhance curiosity and to supplement conventional resources for promoting participation of as many students in the lessons. The PDSI stands for plan (of lesson activities and flow based on learners need and abilities), do the lesson activities systematically see learners growth in knowledge skills and attitudes at all stages of the lesson and improve instructional process based on evaluation results.

The 40 days curriculum was split into 4 modules, each module being covered in 10 days in a year. The theme for module in the first year was on "Attitude change," with objectives of creating among the teachers a reason to accept teaching circumstances as they find themselves in and to do the best in those circumstances. The training explored rationale for continuous professional development and accorded participants with opportunity to own findings of the baseline survey, particularly the challenges relating to teachers. It then went on to handle topics on pedagogical issues in relation to how they limited or impeded quality learning outcomes. Such topics were: teachers and student attitudes, teaching approaches and methods, instructional design, adolescent psychology and gender issues, stress and stress management and classroom communication skills. These topics were contextualized using some subject matter which had been identified as

challenging to teachers and learners. In module 2 in the second year the theme for training was “Hands on activities.” During this training, only 3 pedagogical topics were covered: resource utilization, the use of practical work in teaching and learning mathematics and sciences and ASEI instructional design. Pedagogical topical issues in module 1 and in module 2 were contextualized in additional subject matter content identified as challenging to teachers and learners. In modules 3 in the third year, the training focused on “Actualizing lesson based on ASEI-PDSI paradigm.” Training in this third module moved the trainers into actual classrooms where teaching was done, with collegial support and evaluation.

The actualization was strengthened by training on how to use communication skills for effective classroom interaction and also how to assess and evaluate teaching and learning process. More subject content matter from those areas that were challenging to teachers and learners was covered.

In the 4<sup>th</sup> year, fourth module, the theme was “impact transfer”. It was tempered with review of some topics on pedagogical issues covered in module 1,2, and 3, with key emphasis on how to impact on learners.

Actualization was then carried out besides covering more of the content matter that had been identified as challenging to teachers and learners.

The SMASSE project applies “key trainers strategy” with 2-tier cascading levels in unfolding its training. In the first level of the cascade, district trainers are trained, while at the second level, the district trainers offer training to all other mathematics and science

teachers in their respective districts. The district trainers are developed firstly as practitioners of good classroom practices and then as trainers (INSET providers).

SMASSE INSET is administered through two tier system; national and district levels. District INSET is managed by the District planning committee (DPC). The DPC comprises of the District Education Officer as chair, district quality assurance and standards officer as coordinator, principal of INSET center as member, District chairman KSSHA (Kenya Secondary School Heads Association) as treasurer and Trainer's representative as secretary.

According to SMASSE ( 2008) a workshop for secondary school principals was conducted to capacity build them to play their roles effectively in the project activities.

Areas covered during the workshop include:

Appreciation of baseline findings and how they affect teachers, students and the general performance and outlook of a school; conceptualization of the meaning of ASEI/PDSI pedagogical paradigm so that they can support and supervise the teachers for quality teaching and learning of mathematics and sciences, understanding how the INSET system was being constructed with specific emphasis of their roles in the administrative structure, the quality control system, budgeting sourcing, remittance and utilization of funds, appreciate impact of INSET and interrogate extent to which their respective schools and districts have improved in mathematics and sciences. This topic serves to focus the principals on what to check as they monitor teachers and students performance in their schools. The principals are required to reflect on the quality of management in their schools by making visits to carefully selected schools. These are schools with good

and bad management of the human and capital resources .Workshops have also being organized for QASOs and DEOs to help them in the project implementation and monitoring in their respective capacities.

#### **2.4.1 Evaluation of SMASSE project**

The effectiveness of the SMASSE project was assessed by evaluating the extent to which the project had achieved its purpose and was based on the purpose-output relationship.

The purpose had been improving quality of Mathematics and Science education in secondary school. But still, it was viewed that .better performance in these subject could be achieved using drilling other than teaching for understanding since it seemed to be declining. District trainers needed to reinforce their proficiency so as to impact more on teaching Skills.

The evaluation further examined the connection between outputs such as the establishment of INSET system at the Centre for Mathematics, Science and Technology Education in Africa (CEMASTE) and in various districts and the value and extent of inputs. Impacts of the project were assessed on the basis of both constructive and negative influences caused by the project .It were rated fairly high even though the quality of teaching and learning had not attained the expectation.

#### **2.4.2 Classroom impact of SMASSE programs**

Kibe, Odhiambo and Ogwel (2008) states that ASEI principles and PDSI approach enables the teachers to explore ways of creating opportunity for learners to take responsibility for their own learning. They also employ inquiry-based approach as opposed to recipe-type experiments. It allows them to use interactive learning methods, to improvise not only to augment conventional equipment, apparatus/materials but also to arouse interest and curiosity among learners. It affords teachers the opportunity to draw content and examples from the learners' real life experiences in order to capture interest and imagination, it also helps them enhance ability and appreciation for work planning with specific reference to sequencing learning concepts, activities and events. It further assists them in systematic execution of learner-centred teaching/learning process. It also facilitates evaluation of the teaching-learning process against lesson objectives and outcomes.

Impact of the SMASSE project has been monitored and evaluated using two sets of instruments based on the content of INSET. They are; instruments for monitoring and evaluating lessons which include ASEI-PDSI checklist, lesson observation instrument and an instrument for evaluating the extent of learner participation in lessons.

Another instrument is for monitoring attitudes, practices and student achievement in schools, the SPIAS (SMASSE project impact Assessment Survey) instrument. According to Kibe et al (2008) ASEI-PDSI checklist is an instrument used by an observer to

evaluate extent of the use of ASEI and PDSI aspects in the lesson. The evaluation is on 5 point scale (0-4), with 0 indicating the aspect was not observed in the lesson, and 4 indicating that the aspect was applied to a great extent. The methodology was a trace study in which lessons for particular teachers were observed in the 2003/04 before they undertook training and in 2007 just after completion of the fourth module of training. The overall rating stood at 0.8. before SMASSE INSET and 2.3. after the INSET.

The results demonstrate that SMASSE trained teachers were practicing more of ASEI and PDSI in their classrooms than the SMASSE untrained. However, the overall rating of SMASSE trained teachers is far below the desired rating of 4, indicating there is a lot of room for improvement in the use of ASEI-PDSI . Quality of lessons delivery was evaluated through examination and rating of lessons on a scale of 0 to 4 (poor to very good) in three aspects, teaching procedure, fundamental techniques/ methodology, and class management. The findings were of a trace study, same teachers were observed in 2003/4 and 2007. In all the lesson evaluation aspects, the quality was higher after the training, however, the overall rating of 2.4. for lessons of SMASSE trained teachers indicates that there is a lot of room for improving quality of lessons.

Higher application of ASEI-PDSI principles and high quality of lessons delivery ought to result in high quality learning. The quality of learning was evaluated using learners participation instrument. The instrument asked learners to evaluate own participation in the lessons in three aspects; process skills, affective skills. Findings indicate that learners in classes of SMASSE trained teachers participated more in these essential aspects necessary for development of mathematical and scientific skills.

SMASSE project impact assessment survey (SPIAS) was used to monitor effect and impact of INSET on teachers in their professional development and how such is linked to student's ability. The SPIAS traces impact of quality of INSET and the role of school principals as instructional leaders on students' ability/achievements, by gathering data through questionnaires to principals, teachers and students and an achievement test to Form two students. The findings was that achievement for students taught by teachers who had attended INSET was higher in all subjects than that of students taught by SMASSE non trained teachers. The findings on the impact of quality of INSET and the role of school principals as instructional leaders on students' ability/achievements are as follow: SMASSE INSET has impact on students' capability and there is significant improvement in students' cognitive skills, change in teachers pedagogical practices depends on principals encouragement on professional development. Change in teachers pedagogical practices depends on the quantity and quality of INSET. Change in attitude is critical to success of INSET and students attitude towards mathematics and sciences affect their achievement. Students' participation in classroom significantly influences their attitude towards mathematics and sciences .And finally, gradual improvement on impact of INSET indicates that professional development require sustained effort over time.

### 2.5.1 Limitations of the cascade system of training

The cascade system of training which was initiated at the international training level up to the Kenyan classroom level was designed and adopted as illustrated in the figure 1.1 below.

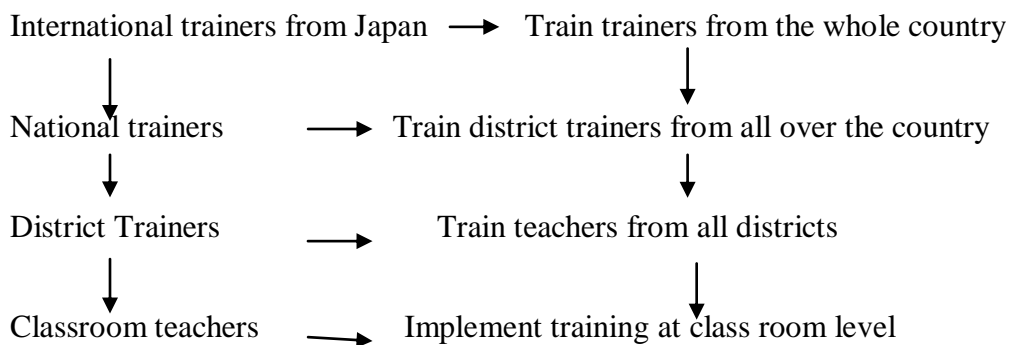


Fig.1.1 Cascade system of training. Waititu and Orado (2009)

Waititu and Orado (2009) stated that though the cascade system of training succeeded ,it had the following limitations: First the training process was lengthy and thus took along period before the learners could gain at the classroom level. Secondly the content could be diluted and distorted down the ladder of training and in such cases, the trainers needed to do a comprehensive preparation and mastery of Knowledge and information that they were required to disseminate ,unless quality assurance veted the trainers' content before it was disseminated. Finally, at times, the trainees in the flow system may not have readily

accepted the trainers and consequently may have been opposed or fail to act in response to the training.

### **2.5.2 Current state of SMASSE project in Kenya and academic achievement.**

In Kenya Mathematics is a compulsory subject up to secondary school level. The performance in this subject in national examinations together with science subjects has not been good. During the release of 2010 K.C.S.E results the then Minister of Education Prof. Sam.Ongeri cited a shortage of 12,000 science and Mathematics teachers in Secondary schools which is a major contributing factor into the declining grades. He further cited that teachers were

ill equipped and that they needed intensive in-service training if at all performance in these subjects was to be boosted “The decline in performance was worrying given the fact that Kenya’s Vision 2030 is anchored on the sound performance in mathematics and science subjects”(National correspondent 2011).Performance in mathematics and science subjects in Kericho District fits in scenario described above

### **2.5.3 Success and shortfalls of SMASSE project in Kenya.**

Onderi and Malala(2012) state that SMASSE project in Kenya has experienced a number of successes and shortfalls alike. Among the successes include intensive interaction of SMASSE Kenya with African countries and sharing its experience on ASEI and PDSI principle done through technical exchange programmes and visits to other countries and through regional conferences which resulted in the formation of SMASSE-WESCA Association. SMASSE Kenya has also established SMASSE in service training centers both at the National and district level whose core functions include publishing newsletters

and journals for disseminating information, conducting technological and technical exchange programmes with member countries, holding joint seminars and workshops with member countries in order to discuss issues affecting SMASSE project in their countries and promoting and implementing mathematics and science activities. Also National SMASSE offices have been constructed at Kenya science Teachers college to facilitate and coordinate SMASSE activities in Kenya. Again during phase I project, a number of positive changes were realized. First, teachers' attitude towards Mathematics and Science changed positively, Secondly, student interest in mathematics and science had been enhanced and this was expected to be a greater positive impact on these subjects in Kenya in the subsequent phases through positive changes of teaching approaches by teachers to students than in phase 1.

Alongside its successes the SMASSE project has had the following the following major shortfalls: despite the SMASSE INSET having been strengthened, teaching in schools is examinations oriented and rote learning is the order of the day in most school. Little attention is paid to individual differences, teaching and effective evaluation methods and classroom management .This has therefore been reflected in the declining performance in the national examination, with only a few exceptions. There is urgent need therefore to address this problem so that necessary measures can be taken by the stakeholders in SMASSE, Ministry of Education, local residents and the government at large in order to solve this conflicting situation of successes and shortfalls.

#### **2.5.4 Hindrances to implementation of aspects of SMASSE after Training**

Ombaso D. (2008) identified the following as hindering the inclusion of carefully selected activities: lack of sufficient time for preparation inadequate resource, lack of support from administration and large class sizes that made it hard for teacher to give individual attention to students. Hindrances to focusing on students and involving them in learning included large class sizes, pressure to cover syllabus, inadequate teaching resources and lack of adequate time and lack of laboratory assistants.

Hindrances to designing small scale experiments included lack of adequate time, inadequate teaching resources, very long syllabus which is hard to cover within the limited time, low morale due to low pay and lack of promotion even with completion of SMASSE cycles. Another hindrance was low entry behavior of learners With regard to improvisation in the absence of conventional equipments or apparatus, the following hindrances were identified: limited time for improvisation, discouragement from other teachers, laziness or laxity on the part of the teachers and unmotivated learners leading to low morale by teachers and heavy workload leading to lack of time.

Inability to plan lesson was attributed to inadequate time, lack of a written plan in school. Unavailability of materials at the right time affected planning, laxity due to lack of supervision and large class sizes made planning difficult.

Hands on activities could not be used due to large classes, lack of sufficient time, inadequate materials, lack of support staff and pressure to cover syllabus. Lessons evaluation could not be carried out due to mischievous students and bad relationship existing between teachers and students. Other teachers did not want criticism and

challenges from students, other hindrance to lesson evaluation included absence of evaluating materials and lack of time.

### **2.5.5 Challenges facing SMASSE project in Kenya**

Since its inception in 1998, the SMASSE project has contributed greatly to the improvement of performance in Science and Mathematics in Kenya. However, the improvement in performance has not been much as expected, despite the change in teaching and learning approaches towards these subjects by the teacher this could be attributed to the following factors: first Students' attitude is generally negative due to low entry behavior, belief that these subjects are hard, peer pressure, lack of proper learning facilities, teachers absenteeism and theoretical approach to teaching science and mathematics. Also teachers are reluctant to perform experiments especially the dangerous ones and the fear that the experiments might fail and therefore most teachers prefer carrying out teacher demonstrations. Again, most parents are not interested in their children performance, especially in sciences and mathematics and some feel that their role is only fees payment. Still in appropriate methods of teaching are employed and most teaching methods are teacher centered. There is inadequate use of assignment to reinforce the mastery of content and infrequent inspection from subject inspectors. There is a missing link between primary and secondary school teaching methods. Other factors include lack of adequate teacher preparation hence poor mastery content, expenses needed for training SMASSE personnel and expenses needed to dispatch them for exchange visits and technical advice to other member countries, expenses necessary for holding regional and international conferences and SMASSE delegates meetings, Sciences and mathematics teachers are given little opportunities to interact amongst,

themselves and exchange ideas since they are most held in school during the term and communities lack information about schools. Waititu and Orado (2009) identified some challenges beyond the scope of SMASSE but affect the implementation of the project as: unfair transfer of teachers by Teachers Service Commission, interruption of school programme by issues such as fee collection, stagnation in one job which demoralizes teachers thus lowering their effectiveness in delivery to the learner, understaffing in some areas of curriculum, poor communication and funding of school activities and programmes, food, child labour and the other family problems, teachers' poor working conditions and terms of service including incentives, overloaded syllabus and time heavy workload and Provision of infrastructure and instructional material and equipment to school.

Kibe (2008) states that despite the above challenges, there have been cases of schools with sufficient equipment and materials, yet student's achievement in Mathematics and Science subjects had not been very high on the converse these were school that had poor facilities, teaching and learning materials yet they produced comparatively better results in national examinations due to effective teaching .Through SMASSE policy makers in education have been made to identify the importance of INSET to teachers as professionals that need to upgrade their skills.

### **2.6.1 Problems facing education sub-sector**

Studies undertaken by Kenya Institute of Education (KIE) and SMASSE project indicate the following as the current problems facing the education sector in Kenya include: Understaffing and under-qualification in some areas of curriculum, an overloaded

curriculum, inadequacy of teaching and learning facilities and materials, teachers' low morale, examination oriented teaching and learning, students low morale, inappropriate teaching method used by teachers,

lack of integration of theory and practical work and inadequate education management.

### **2.6.2 Challenges existing in secondary education sub-sector**

Inyenga and Thomson (2002) and Prof. Sam. Onger (Nation correspondent 2011) all state that performance in mathematics and sciences has been poor. The reasons for poor performance could be attributed to the following:

#### **Curriculum.**

The secondary school curriculum and the number of examinable subjects are many. The curriculum especially in mathematics and science is overloaded.

#### **Teaching methods**

Teaching methods used are poor since they lack in many areas such as student centeredness, student activities, experiment and improvisation.' Chalk and talk" method is very common in many schools. Teaching is examination oriented and rote learning is practiced in most countries. In some cases teachers lack mastery of content.

#### **Teaching/learning materials.**

In most Africa countries, it is reported that teaching/learning resources are inadequate and at times not available. Many countries have similar problems with textbooks,

laboratories and equipments/chemicals. However, the problem is there is no experiment/practice due to teachers' negative attitude although materials are available.

### **Teachers**

The common problems facing Kenya and the rest of regional countries are lack of qualified teachers especially in mathematics and science. The issue of very few mathematics and science female teachers is common in all African countries. Negative attitude towards mathematics and science by teachers eventually get to the learners.

### **Learners.**

Students dislike some subjects especially mathematics and sciences. Some display negative attitude in learning and attending school. Poverty and family misunderstanding affect teaching and learning in many of the countries.

### **Administration**

The administrative processes of provision and maintenance of physical facilities, curriculum instruction, staff development and financial management are poor.

This study therefore was aimed at finding out the challenges faced by the Principals and teachers in the implementation of SMASSE project in Kericho District. It was further aimed at finding out the effect of the application of ASEI/PDSI Principle in the Mathematics and Science lessons. The findings of the study are to be used in making recommendation that will be useful in improving the implementation of the SMASSE project

## **2.7 Importance of science and mathematics**

According to Savage M. and Naido P. (2002), science and technology and science and technology education play an important role in the development of a country's economy, environment and social relations. Kenya vision 2030 (ROK, 2007) proposes intensified application of science, technology and innovation to raise productivity and efficiency across the three pillars of economics, social and political governance. The goal of vision 2030 is to transform Kenya into a rapidly industrializing middle income nation by the year 2030.

Kuznets S. (1961) establish that scientific knowledge is the critical ingredient for modern economic growth. Nagoa M. Rogan J. and Marcelita C. (2007) states that mastering science and technology separates winners from losers, be it for military industrial or economic competition in the twentieth century. However rapid and massive expansion of scientific knowledge is characterized by a very uneven distribution of scientific and technical manpower. Hence came the realization that in order to benefit from technical progress educating a large number of scientific manpower may be a necessary condition. Nagoa et al (2007) says that it is against such a background that mathematics and science education has come to receive special attention both from ministries of education of developing countries and from external funding agencies. According to Makulu (1981) scientific and technological literacy is a major precondition for continued modernization, wealth generation and the development of a democratic society. He further argues that science culture addresses the need for innovation and problem solving, acquisition of transferable skills, capacity to think and act rationally in response to new experiences and to appreciate new technological developments as well as ethical issues involved in active

participation in modern democracies. The commonwealth secretariat report (2002) observes that our future depends on a popular understanding and application of science hence human resource development in science is crucial to building a critical mass of skilled people.

The report further says that Africa needs scientifically literate citizens who can better promote development by better decision making about science and their impacts on every day life, thus promoting the quality of life, providing the workforce with appropriate skills for delivery of quality products for national and international markets, thereby promoting economic growth and socially development and also produce scientists and technologists who generate and apply knowledge and technology to solve local problems and create innovations that can be put into commercial use at national and international levels.

According to Skillbeck (1984), any educational discipline such as science education has three fundamentally different purposes namely cultural transmission of knowledge, vocational needs and social reconstruction.

Skillbeck (1984) observes that the accumulated knowledge of science and technology should be passed on to the next generation of research scientist. He further argues that students should be given transferable skills that will enable them to secure jobs as middle level manpower. Such skills necessarily include familiarity with science as practiced in industry, positive attitude to science and desire to learn about industry. According to Skillbeck (1984), reconstruction of society involves inculcating what is called “scientific culture” and “scientific” and technological literacy and “public

understanding of science” in the population. In this era of great scientific and technological achievements that affect the daily lives of citizens, it is the democratic right of every citizen to be fully involved in the scientific and technology culture. Every individual should be provided with an understanding and appreciation of science and technology concepts as they relate to their daily lives. They should also develop a positive attitude to science and technology and should find them enjoyable.

Harvard (1996) observes that science and mathematics are subjects thought to be hard by many pupils. However this pattern of thinking can be corrected through the use of simple and interesting approaches by teachers for example by use of ASEI/PDSI concept.

According to JICA report (2000) on Science Education, school science and mathematics teaching should be learners centered. The teacher’s role should be that of a facilitator, guide, counselor, motivator, innovator and researcher. As such it is recommended that there must be many activities during any one lesson as possible. These must be student centered activities involving a lot of improvisation in the experiments.

Improvisation will help to demystify the science and mathematics besides helping the learner to appreciate the ever-present science in the environment.

## **2.8 Summary of literature review.**

From this review SMASSE project implementation is facing challenges in its implementation. These challenges are linked to the problems that are generally experienced in secondary education sub-sector like understaffing, overloaded curriculum, negative attitude towards the Mathematics and Science and low morale among the teachers. From the review it is evident that although SMASSE project has registered a

number of successes. However these successes have been accompanied by shortfalls. For instance while the application of ASEI-PDSI approach has aroused and encouraged student interest and participation in the Mathematics and Science lessons some teachers prefer to use the chalk and talk method which is a teacher centered approach .Others adopt examination oriented and rote learning methods. Due to poor teaching methods ,negative attitude and the other challenges listed above, performance in K.C.S.E Examination are declining in most school as reported by a journalist during the release of 2010K.C.S.E results(Nation correspondent 2011).Evaluation of the project on the classroom impact show that SMASSE trained teachers practice more of ASEI-PDSI in their lessons than their untrained counterparts and their lesson quality was higher compared to their lesson before attending the training .Inadequate supervision and management of school has also impacted negatively on the implementation on SMASSE project. Quality Assurance and Standard Officers are tasked with ensuring quality of teaching and learning in School. The INSET-trainers presentation may also impact negatively on the trainees if trainers are not well prepared.

All these challenges individually and collectively affect the implementation of SMASSE and the study focused the identification of these challenges, their extent and effect and effect on the implementation of the SMASSE project in the sampled schools.

## **CHAPTER THREE**

### **METHODOLOGY**

#### **3.1 Introduction**

This section consist of research design, study location, target population, sample size and sampling procedure, research instruments, validity and reliability of research instruments, data collection procedure and data analysis plan and ethical consideration.

### **3.2.1 Research Design**

Kerlinger (1973) defines research design as a plan and strategy of investigating a problem and seek to obtain answers to questions. This study employed survey design to find out the challenges facing the implementation of SMASSE- project in selected schools in Kericho District. Mugenda and Mugenda (1999) defines survey design as an attempt to collect data from members of a population in order to determine the current status of that population with respect to one or more variables. A survey design was suitable for this study since the researcher intended to get information that describes the current status of a phenomenon in this case SMASSE implementation and the challenges that faces it in relation to teaching and learning of mathematics and sciences. In adopting this approach, the researcher attempted to determine the challenges faced by principals in relation to SMASSE implementation at school level, challenges faced by teachers in the use ASEI/PDSI approach in teaching mathematics and sciences and the effects of ASEI/PDSI approach on student attitude and participation in mathematics and science lessons. According to Orodho (2002) survey design allows researcher to gather information, summarize, present and interpret for the purpose of clarification. The researcher used questionnaires to collect information on challenges facing SMASSE project implementation from principals, mathematics and science teachers and students on the effects of the use of ASEI/PDSI approach on their attitude and participation

mathematics and science lessons. By involving many respondents, diverse answers to the same questions were obtained.

### **3.2.2 Variables**

The dependent variable in this study was the use of ASEI/PDSI approach in the teaching of mathematics and sciences. The main independent variables that were considered for this study are:

- i. Challenges faced by secondary school principals in implementing SMASSE at school level.
- ii. Challenges faced by mathematics and science teachers in the use of ASEI/PDSI approach in their teaching.
- iii. Effects of ASEI/PDSI approach on student attitude and participation in mathematics and science lessons

### **3.3. Locale of the Study**

The study was carried out in Kericho District in Kericho County. The district is surrounded by Mau tea estates to the East, Kipkelion District to the north, Belgut District to the south and Nyando District to the west. The region has well drain fertile soil and well distributed rainfall of about 2000mm per year and is suitable for mixed farmings. Tea is the main cash crop while dairy farming and maize production supplement farmers' income as well meeting subsistence needs.

The district is served by the Kericho-Kisumu highway, Kericho Sotik road and Kapsoit-Sondu road, all of which are tarmac roads. Murram roads serve the rural areas. Poor

maintenance of murrum roads render some of them impassable during periods of heavy rains.

Accessibility of schools to be sampled was therefore be considered. The trend of performance in the mathematics and sciences in K.C.S.E. examinations in the district for the last five years from records in the District Education office have been low in some subjects. Singleton (1993) observed that the ideal setting is one that is related to the researcher's interest. The rampant poor performance in mathematics and science in K.C.S.E. examination in the district raised concern to the researcher who is a resident and seen the majority of K.C.P.E. graduates enroll in these secondary schools.

### **3.4. Target population**

The population for this study was from 21 public secondary schools in Kericho District . The district has 1763 form 2 students of which 1005 (57%) are boys and 758 (43%) are girls. There are 84 mathematics and science teachers and 21 principals. These 21 public schools are of different boarding and gender status (heterogeneous). There are plans by the ministry of education to elevate some provincial schools to national school status.

Classification of these schools is shown on Table 3.1

### **3.5.0 Sampling Techniques and Sample Size**

#### **3.5.1. Sampling Techniques**

Amin (2005) defines sampling as the process of selecting a subset of cases in order to draw conclusions about the entire set. Sekaran U. (2006) defines sampling as a process of selecting a sufficient number of elements from the population, so that a study of the subset of the population and an understanding of its properties or characteristics can enable the generalization of such properties or characteristics to the population elements. There were limitations that did not allow the researcher to study the whole population, namely, limited time to complete the research and financial constraints. Sampling was the most convenient and practical way to collect data. It was less costly and less time consuming. Only public secondary schools were purposively selected since SMASSE INSET was mandatory for its mathematics and science teachers. Also only 30 form 2 students were randomly selected to participate in the study using the lottery technique. Form 2 students were chosen because sciences subjects are compulsory at this level in most schools and they have been sufficiently exposed to ASEI/PDSI approach.

According to Orodho (2008) purposive sampling involves selecting samples using set criteria such as type of school category, boarding status or sex.

Simple random sampling procedure was used to select school category. According to Sekaran U. (2006) this technique is the best when the generalization of the findings to the whole population is the main objective of the study. Further, every element has a known and equal chance of being selected as a subject. School categories that existed in the

district based on gender were boys, girls and mixed schools. These schools were further subdivided into boarding and day status.

**Table 3.1:** Schools sampled by boarding and gender status (N=21)

Boarding status	Gender status	Total No. of schools	Sample of schools	Percentage (%)
Boarding	Boys	3	1	33
	Girls	3	1	33
	Mixed	6	2	33
Day	Boys	-	-	
	Girls	-	-	
	Mixed	9	3	33
Total		21	7	33

Source: District Education Officer (Kericho District, 2010) on secondary school student statistics

Table 3.1: describes the target population in terms of boarding and gender status. It summarizes a sampling grid of 6 rows representing school category in terms of boarding status (boarding and day) and gender status (boys, girls and mixed). A total of 7 (33%) of the total 21 secondary schools were sampled for the study. 7 secondary schools were randomly sampled systematically for equal representation.

### 3.5. 2. Sample size

Sekaran (2006) defines a sample as a subject of the population. A sample size of 7(33%) schools out of the total of 21 public secondary schools in Kericho District was sampled for the study.

According to Nkpa (1999), a sampling fraction of between 10-20% of the total population in a descriptive research is appropriate.

The sample was drawn from a population of 1763 form 2 students, 84 mathematics and science teachers and 21 principals as shown in table3.2.

**Table 3.2:** Sampling matrix table

Target population	Population (N)	Sample	%
Form 2 students	1763	210	12
Teachers	84	28	33
Principals	21	7	33

The sampling matrix will yield 210 form 2 students, 28 teachers and 7 principals from the sampled schools.

### 3.6.1 Research Instrument

Research instruments are tools that are used to collect necessary information. Students', teachers' and principals' questionnaires were used to collect data in this study.

According to Sekaran (2006) a questionnaire is a pre formulated written set of questions to which respondents record their answers, usually within rather closely defined alternatives.

The advantages of personally administered questionnaires are that they can establish rapport and motivate respondent and are less expensive when administered to groups of respondents and almost 100% response rate is ensured. Anonymity in questionnaires helps to produce more candid answers than is possible in interviews.

### **3.6.2 Student's questionnaire on the effects of ASEI-PDSI approach on student attitude and participation in mathematics and science lessons**

Sekaran (2006) defines questionnaire as a pre formulated written set of questions to which respondents record their answers, usually within rather closely defined alternatives. The student questionnaire had both close ended and open ended questions. They were used to solicit information on their participation in learning activities such performing experiments, solving problems on the blackboard, asking and answering question during the lesson, doing assignments and finding out their attitude towards the mathematics and science subjects.

A questionnaire is suitable for collecting this data because according to Sekaran (2006) it is less expensive when administered to group of respondents, establishes rapport and motivates the respondent, and anonymity in questionnaires helps to produce more frank responses than in interviews. The information helped the researcher to achieve the third objective and the third question in the study.

### **3.6.3 Teacher's questionnaire on the challenges faced in the use of ASEI-PDSI approach**

The first part of the questionnaires covered personal data. The subsequent sections covered the teacher's opinion on SMASSE- INSET, application of ASEI-PDSI in teaching mathematics and science, impact on student participation and teacher assessment of SMASSE-INSET on classroom practice. The questions herein were aimed at bringing out the difficulties and hindrances teachers face as they use the ASEI/PDSI concept in the mathematics and science lessons. The information assisted the researcher achieve the second objective and answer question 2.

### **3.6.4 Principal's questionnaire on the challenges they face as they facilitate SMASSE implementation**

The structure of the questions included background information, staffing situation in the school, entry behavior of students, professional guidance and challenges facing the use of ASEI-PDSI in teaching mathematics in the school. Both open-ended and close ended questions were used. The information gathered assisted the researcher to achieve objective 1 and answer question 1.

### **3.7. Pilot study**

A pilot study was conducted independently before the main study in two randomly selected schools. Wiersmia (1995) define pilot study as one conducted prior to the major

research study for the purpose of gaining additional information by which the main study can be improved.

According to Wiersemia (1995), piloting of instruments refers to administration of the research instruments to get rid of ambiguities, misunderstanding, useless and inadequate items. The pilot study is aimed at determining the ease of use of instruments by identifying ambiguities, flaws in questions and inadequacies in the coding system. Each instrument was piloted separately in two randomly selected schools which were similar to the samples for the main study but were not included in the main study. The respondents consisting of 2 principals, 6 mathematics and science teachers and 10 form two students were be encouraged to make comments and suggestions concerning instructions, clarity of questions and relevance. This in turn was used lead to evaluate and improve the questionnaires as appropriate.

### **3.7.1. Validity**

Amin (2005) state that a research instrument is said to be valid if it actually measures what it is suppose to measure. According to Borge and Gall (1989), validity is the degree by which the sample of test items measures the content the test is designed to measure. The instruments will be evaluated for their content validity. This was done by a panel of three district SMASSE-INSET trainers. They were requested to assess the relevance of the content used in the questionnaires developed. They examined the questionnaires individually and gave the feedback. Their recommendations were incorporated into the final questionnaire.

### **3.7.2. Reliability**

According to Sekaran (2006) reliability of a measure indicates the extent to which it is without bias (error free) and hence ensure consistent measurement across time and a cross various items in the instrument. Orodho (2008) defines reliability of measurements as the degree to which particular measuring procedure give similar results over a number of repeated trials. A test-retest method was used to estimate the degree to which the same results could be obtained with a repeated measure of accuracy of the same concept in order to determine the reliability of the instrument. The following steps were followed in determining the reliability of the instrument using the test-retest method.

- i. The developed questionnaires were given to 5 students, 3 teachers and 1 principal in each of the two different schools not included in the study sample.
- ii. The completed questionnaires were scored manually.
- iii. The same questionnaires were administered to the same group of subjects after a period of two weeks.
- iv. The completed questionnaires were again scored manually.
- v. A comparison between answers obtained in (ii) and (iv) above was made.

Spearman rank order correlation was used to compute the correlation co-efficient in order to establish the extent to which the contents of the questionnaire were consistent in eliciting the same responses every time the instruments were administered. A correlation co-efficient ( $r$ ) of (0.7) was established. This high correlation of (0.7) shows that the responses were consistent. According to Orodho (2009) a correlation coefficient ( $r$ ) of about (0.75) will be considered high enough to judge the reliability of the instrument.

### **3.8.1 Ethical consideration in Data Collection and Analysis**

Sekaran (2006) defines ethics as a code of conduct or expected behavior while conducting a research. The ethics govern the research right from instituting the study to collecting, analysing and interpreting the data to report writing. It also guides researchers on how to relate to the respondent and handle the data collected. In this study, the researcher's instituted the research in good faith. The respondent were informed about the purposes of the research and assured that the information they were going to give was going to be treated with confidentiality. To achieve this respondent remained anonymous right from the time of collection, analysis and interpretation of data and report writing. In the questionnaires used the respondent were instructed not to write their names or the name of their institution in order for them to remain anonymous. For purpose data analysis respondents from different categories of Schools were assigned letters and numbers to protect their privacy. None of the respondents were forced to respond to the questionnaires and those willing to respond were encouraged to be honest in their responses.

### **3.8.2 Data collection procedure**

The researcher sought a letter of introduction from the School of Education. With this letter a visit was made to office of National Council for Science and Technology to apply for a research permit. The permit was collected after three weeks allowing the collection of data in Kericho district Secondary schools to start. Permission was further be sought from the Kericho District Commissioner and the District Education Officer to visit sampled schools for the piloting of the instrument and the eventual study. The researcher conducted a pre visit to each of the schools sampled to be conversant with each school setting and introduced himself to the principal and be introduced to the heads of

departments and teachers who were to facilitate data collection. The researcher used the opportunity to explain the purpose of the research study and assured all those involved that the information they were to give was going to be treated with confidentiality.

The researcher and the parties concerned, that is, the principal, the mathematics and science teachers agreed on a specific date and time for data collection in each individual school. On different days and in different schools, the researcher administered the questionnaires to the principals, teachers and students and gave clear instructions on how to complete them. The researcher allowed sufficient time for the questionnaires to be completed and collected them.

### **3.8.3 Data Analysis plan**

Kerlinger (1973) defines analysis as categorization, ordering, manipulation and summarizing of data to obtain answers to research questions. The researcher edited, that is, examined the collected raw data to detect errors and omissions and corrected them when possible. Blank responses were handled carefully. According to Sekaran (2006) if 25% or more of the items in questionnaire have been left unanswered, the questionnaire may be left out data analysis. If however two or three items are left blank in questionnaire, it can be given the midpoint in scale as the value or that particular item can be ignored during the analysis.

Completed questionnaires were scrutinized to ensure that the data was accurate, consistent with the data gathered and uniformly entered to facilitate coding. Coding is the process of assigning numerical or other symbols to answers so that responses can be put into a limited number of categories or classes. The coded data was entered in the

computer using the statistical package for social sciences (SPSS). Data was analyzed by using means, frequencies and percentages. Results were presented in form of frequencies and percentages as they easily communicate the research findings to majority of readers.

## **CHAPTER FOUR**

### **PRESENTATION OF FINDINGS AND DISCUSSION**

#### **4.1 Introduction**

This study sought to find out the challenges facing the implementation of SMASSE project in Kericho District. The findings of the study are presented based on the following research objectives:

- i. To identify the challenges faced by public secondary school principals as they facilitate the implementation of SMASSE project.
- ii. To investigate the challenges faced by mathematics and science teachers as they apply ASEI/PDSI concept in their lessons.
- iii. To find out the effects of ASEI/PDSI approach on student attitude and participation in mathematics and science lessons.

The research was carried in 7 (33%) of the public secondary schools in Kericho District. The study sampled 7 principals, 28 teachers and 210 students from the sampled schools and questionnaires were administered to them. For the principals the response was 7 out of 7 (100%). The study sampled 4 teachers per school giving a total of 28 teachers. The teachers' response was 25 (89%) out of 28 teachers. The

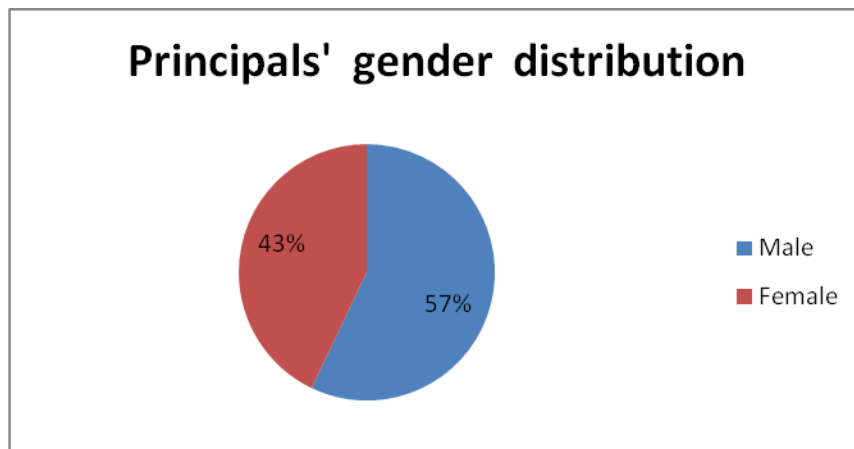
study further sampled 30 students per school giving a total of 210 students. The students' response was 201 (96%) out of 210 students. The findings were presented in percentages, frequencies, charts and tables. Discussion of the results was done according to the objectives of the study.

#### 4.2.0 Challenges facing principals

#### 4.2.1 Principals gender distribution.

The Figure 4.1 and Table 4.1 shows the gender distribution of principals

**Figure 4.1: Principals gender distribution. (N=7)**



**Table 4:1 principals' gender distribution.(N=7)**

	Frequency	percent
Male	4	57.1
Female	3	42
Total	7	100.0

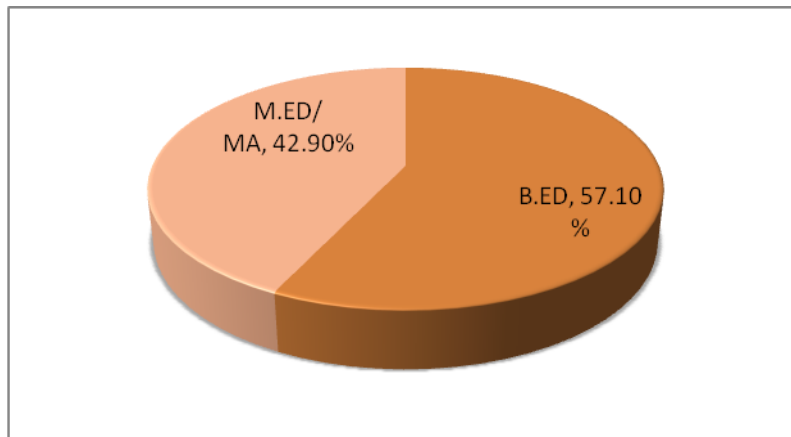
The study revealed that 4 (57.1%) of the principals were male and 3 (42.9%) were female.

From these findings, male principals are more than female principals.

#### 4.2. 2 Principals Professional qualification

A summary of principals' professional qualification are presented in Figure 4.2.and Table 4.2

**Figure 4.2: Principals' Professional qualification (N=7)**



**Table 4.2 Principals' Professional Qualification (N=7)**

	Frequency	Percent
B.ED	4	57.1
M.ED/MA	3	42.9
Total	7	100.0

It is evident from Figure 4.2 and Table 4.2 that all the principals were professionally qualified teachers with 3 (42.9%) having a masters degree and 4 (57.1%) with Bachelor of Education Degree. They were therefore capable of giving reliable information about their schools.

#### **4.2.3 Principals duration of service in their present schools.**

Table 4.3 below shows the number of years the principals had served in their present schools.

**Table 4.3 Principals duration of service in their present schools. (N=7)**

No. of years of Service	Frequency	percent
2-5 years	3	42.9
6-10 years	3	42.9
Above 11 years	1	14.3
Total	7	100.0

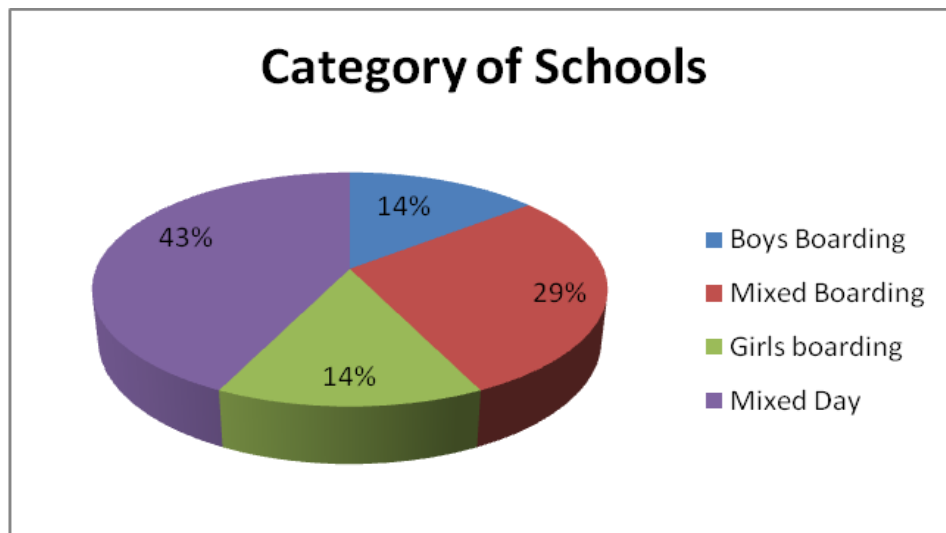
It was evident from the Table4.3 that 3 (42.9%) of the principals had served for 1 – 5 years while another 3 (42.9%) had served for between 6 – 10 years in their respective stations. Only 1 (14.3%) had served for more than 11 years in their stations. This means

that all of them had served long enough in their station to be in a position to identify the problems facing the implementation of SMASSE project in their stations.

#### 4.2.4 Category of schools

The categories of schools covered in this study are shown on Figure 4.3 and Table 4:3

**Figure 4.3: category of schools (N=7)**



**Table 4.4. Category of schools (N=7)**

Frequency	percent
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Boys Boarding	1	14.3
Mixed Boarding	2	28.6
Girls Boarding	1	14.3
Mixed Day	3	42.9
Total	7	100

From Figure 4.3 and Table 4.3 the schools covered in this study included 1 (14.3%) boys boarding, 2 (28.6%) mixed boarding, 1 (14.3%) girls boarding and 3 (42.9%) mixed day secondary schools. This represents 33% of each category of schools available in the district. It implies that majority of secondary schools in the district are mixed day, followed by mixed boarding while pure boys or girls boarding are the minority.

#### 4.2.5 Staffing status of schools.

The staffing status of schools covered in the study is summarized in Table 4.5

**Table 4.5 Staffing status of schools (N=7)**

Staffing	Frequency	percent
Understaffed	6	85.7
Adequate staffed	1	14.3

Total	7	100.0
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The study revealed that 6(85.7%) out of 7(100%) schools sampled were understaffed. This means that 85.7% of schools experience shortage of teachers. The shortage of teachers in mathematics and science subjects has affected the implementation of SMASSE project as it leads to heavy teaching load for the few available teachers. This was evident in the responses of the teachers sampled in this study. Heavy teaching load was noted as a challenge to the implementation of SMASSE project according to 6 (85.7%) of the principals and 21 (85.7%) of the teachers sampled for this study. Ombaso (2008) states that heavy workload leaves a teacher with limited time for planning lessons, organizing experiments in sciences and giving out assignments. Teachers require lighter workload in order to be able to plan for the lessons, design experiments and improvise the available resources in line with SMASSE – INSET principles which advocate for student-centered teaching method according to Orado G and Waititu M (2009). A Shortage of teachers therefore make it difficult for principals to ensure teachers embrace the learner-centered approaches encouraged by SMASSE project.

#### **4.2.6 Range of marks required for admission.**

The range of marks required for form admission is presented in Table 4.6

**Table 4.6 Range of marks required for admission. (N=7)**

	Frequency	percent
250-299	5	71.4
Between 300-349	2	28.6
Total	7	100.0

Boys boarding and girls boarding schools representing 6(28.6%) required 300 – 349 marks out of 500 marks in KCPE for form one admission. Mixed boarding and mixed day school representing 15 (71.4%) of the secondary schools in the district required between 250 – 299 marks for form one admission .A total of 250 marks out of 500 in KCPE constitute pass-mark for KCPE candidates and allows a student to proceed to enroll for secondary education. On the other hand a learner who joins form one in Kenya with less than 250 marks out a maximum of 500 marks is considered a low entrant. If secondary schools Principals admitted students according to the above stated admission requirements, issues of low entry should not arise.However,18(71.4%) of teachers in the study cited low entry behavior as a challenge to the use of ASEI-PDSI approach in their lessons. Ombaso(2008) also found out that low entry behavior of the learners was identified as a challenge to application of ASEI-PDSI approach by teachers in Gucha district.

#### **4.2.7 Percentage of mathematics and science teachers that have attended SMASSE – INSET.**

The percentage of teachers that had attended SMASSE-INSET in various schools is presented in Table 4.7 while Table 4.8 represents the cycles of SMAASE-INSET attended by teachers.

**Table 4.7 The percentage of teachers that had attended SMASSE-INSET in various schools**

Percentage of teachers that have attended SMASSE INSET		
School	Percent	

75%	2	28.6
100%	5	71.4
Total	7	100.0

According to the finding on table 4.7, in 2 schools,75% of Science and Mathematics teachers had attended SMASSE-INSET while 25% had not. In the other 5 schools,100%of the teachers had attended SMASSE-INSET. This means that they were well versed with SMASSE-INSET and hence were capable giving reliable and relevant information. Questionnaires were administered to teachers who had attended SMASSE-INSET only.

**Table 4.8 The cycles of SMASSE-INSET attended by teachers (N=25)**

Cyles of SMASSE-INSET	Frequency	percent
1 cycle	2	7.1
2cycle	5	21.4
3 cycles	4	14.3
4cycles	14	57.1
Total	25	100.00

In Table 4.8, when these teachers who had attended SMASSE INSET were asked to list the cycles they had attended the findings according to Table 4.8 were as follows: 14 (57.1%) had attended 4 cycles, 4 (14.3%) had attended 3 cycles, 5 (21.4%) had attended 2 cycles and 2 (7.1%) had attended only 1 cycle. This is an indication that all of them were conversant with SMASSE-INSET and gave reliable data.

#### 4.2.8 Challenges facing the implementation of SMASSE programme.

Table 4.9 present the challenges faced by teachers in the implementation of SMASSE according to principals.

**Table 4.9 Challenges facing the implementation of SMASSE programme. (N=7)**

Challenges	SA	A	U	D	SD
Lack of sufficient time	5	1	-	-	1
Lack class size	4	2	-	-	1
Heavy teaching load	3	3	-	3	-
Low Morale	1	3	-	3	-
Overloaded syllabus	1	4	1	1	-
Pressure to cover the syllabus	3	4	-	-	-
Law entry behavior of learners	2	2	-	3	-

**Key: SA** = Strongly Agree, **A**= Agree, **U** = Undecided, **D** = Disagree, **SD** = Strongly Disagree

Principals were asked to identify the challenges faced by mathematics and science teachers in their stations. The following list of challenges was given according to their responses and recorded in table 4.9; 6(85.7%) agreed that lack of sufficient time, large class sizes and heavy teaching load were challenges while 1(14.3%) did not consider them as such. Low entry behavior of learners and low morale among teachers were cited by 4 (57.2%) of the principals as challenges while 3 (42.8%) disagreed. An overloaded syllabus posed a challenge according to 5(71.4%) of the principals as another 2(28.6%) did see it to be a challenge. All the 7(100%) principals cited pressure to cover the syllabus as challenges.

According to Ombaso (2008) these challenges limits the use of ASEI – PDSI approach in Mathematics and science lessons and by extension makes it difficult for the principals to ensure the implementation of SMASSE program at their respective stations

#### **4.2.9 Ways of checking use of ASEI – PDSI approach in teaching.**

Table 4.10 gives an outline of the ways used by principals in checking the use of ASEI-PDSI approach in teaching.

**Table 4.10 Ways of checking use of ASEI – PDSI approach in teaching (N=7)**

Ways of checking use of ASEI-PDSI Approach	Frequency	percent
Through heads of department	3	42.9
By attending lessons	1	14.3
All of them	3	42.9

In this study, it was established that 3 (42.9%) of the principals used the Heads of Department and also attend lessons .Another 3(42.9%) use heads of departments only

while 1(14.9%) attend lessons as the only means of checking use of ASEI-PDSI in teaching

These findings indicate that principals are involved in the implementation of SMASSE project at the school. As a result they able to identify the challenges facing teachers in the use of ASEI – PDSI approach.

#### **4.2.10 Number of visits by the Quality Assurance and Standards Officers to schools**

Table 4.11 gives the number visits by the Quality Assurance and Standards Officers to schools to check on SMASSE project implementation in the last 3 years.

**Table 4.11 Number of visits by the Quality Assurance and Standards Officers to schools (N=7)**

No.of visits	No. of schools	Percent
Nil	2	28.6
Once	5	71.4
Total	7	100.0

In table 4.8, 2(28.6%) schools had not been visited by Quality Assurance and Standards Officers in last 3 years, while 5 (71.4%) had been visited only once. It can

therefore be concluded that the Quality Assurance and Standards Office have not conducted adequate follow-up activities to gather sufficient information. Information gathered from principals and also science and mathematics teachers is vital for making decision towards the improvement of the project.

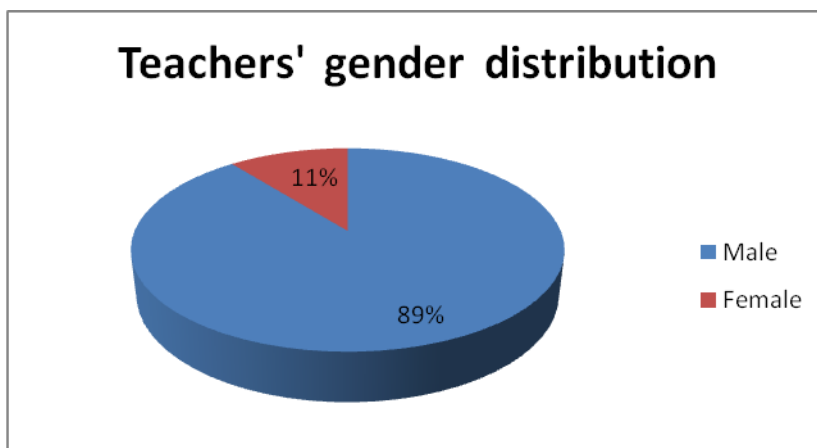
When follow-up visits are very few the challenges facing the implementation of the project take time to see come to the attention of those responsible for implementing the project.

According to Kenya Education Sector Support Programme (ROK, 2005), the implementation of the SMASSE programme is primarily the responsibility of the CEMASTEAs and the District Planning Committees (DPC) chaired by the District Education Officers. They therefore need relevant information to make the necessary adjustment in the implementation of the SMASSE project.

#### **4.3.0 Challenges facing teachers in the use of ASEI / PDSI approach.**

##### **4.3.1 Teachers Gender Distribution**

The figure 4.4 and table 1.12 shows the gender distribution of mathematics and science teachers in the involved in the study.



**Figure 4.4: Teachers Gender Distribution (N=25)**

**Table 4.12 Distribution of Teachers by gender (N=25)**

	Frequency	Percent
Male	22	89.3
Female	3	10.7
Total	25	100.0

The study revealed that 22 (89.3%) of the respondent teachers were male and 3 (10.7%) were females.

From this findings there were more male than female mathematics and science teachers.

#### **4.3.2 Teachers Professional qualification**

The Table 4.13 gives a summary of teachers' professional qualification.

**Table 4.13 Teachers professional qualification (N=25)**

Qualification	Frequency	Percent
Diploma	6	25.0
B.A/B.SC with PGDE	2	7.1
B.ED	15	60.7
M.ED/MA	2	7.1
Total	25	100.0

It emerged from the study that 6 (25%) of the teachers had diploma 2 (7.1%) had Bachelor of Anthropology or Bachelor of Science degree with a Post Graduate Diploma in Education, 15 (60.7%) had Bachelor of Education Degree and 2 (7.1%) had Masters Degree. From these findings, majority of the teachers are Bachelor of

Education degree graduates. All of them were professionally qualified and therefore were able to give reliable data.

#### **4.3.3 Number of years spent teaching in the present school.**

The Table 4.14 gives a summary of the years served by the teacher in the present school.

**Table 4.14 Number of years spent teaching in the present school. (N=25)**

	Frequency	Percent
Boys Boarding	4	14.3
Mixed Boarding	8	32.1
Girls boarding	4	17.9
Mixed Day	9	35.7

Total	25	100.0
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The study revealed that 5 (21.4%) had been teaching in their present schools for over 15 years 3 (10.7%) had been teaching for 11 – 15 years, 4 (17.9%) had been teaching for 6 – 10 years 10, 39.3% had been teaching for 1 – 5 years while 3 (10.9%) had been teaching for less than one year. This is summarized in figure 4.14.

It is evident that majority had taught long enough in their station to know the challenges facing use of ASEI – PDSI approach in teaching mathematics and sciences

#### 4.3.4 Category of schools served by teachers in the study

The Table 4.15 contains the category of schools served by the teachers involved in the study.

**Table 4.15 Category of schools served by teachers in the study (N=25)**

School category	Frequent(No.of Teachers)	Percent
Boys Boarding	4	14.3
Mixed Boarding	8	32.1
Girls Boarding	4	17.9
Mixed Day	9	37.7
Total	25	100.0

The study revealed that 9 (36%) of the respondent teachers were from mixed day secondary schools, 8 (32%) were from mixed boarding schools, 4 (16%) were from girls boarding and 4 (16%) were from boys boarding school. The distribution of teachers corresponds to prevalence of each school category. For example majority of the teachers sampled in the study are from mixed day secondary schools implying majority of the schools in the district are mixed day secondary schools.

#### **4.3.5 Average classroom population in Mathematics and Science subjects**

The Table 4.16 summarizes the average classroom population of the schools included in this study.

**Table 4.16 Average classroom population in Mathematics and Science subjects (N=25)**

Average classroom population	Frequency	Percent
30 students and below	2	7.1
31-40 students	5	21.4
41-49 students	10	39.3
50 students and above	8	32.1
Total	25	100.0

From the study, it emerged that 10 (39.3%) of the teachers had between 41 – 49 students in their classes, 8 (32.1%) had 50 students and above and another 5(21.4%) had between 31 – 40 students in their classes. Only 2 (7.1%) had 30 students and below.

From this findings 18(71.4%) of the teachers had over 41 students in their classes

10 (39.3%) of which had over 50 students in their classes. According to Ombaso (2008) these large classes made it difficult for the teachers to focus on individual learners needs which is one of the aspects of ASEI – PDSI approach. Large classes which was identified by 21(85.7%) of the teachers posed a challenge to giving out assignments and marking them on regular basis.

#### **4.3.6 Number of lessons per week**

The Table 4.17 gives the number of lessons per week for teachers in this study.

**Table 4.17 Number of lessons per week (N=25)**

No. of lesson	Frequency(No. of teachers)	Percent
15-19	3	10.7
20-24	14	57.1
25-29	6	25.0
30 and above	2	7.1
Total	25	100.0

The study revealed that 2 (7.1%) had 30 lessons and above and 6(25%) had 25 – 29 lessons, and 14 (57.1%) had 20 – 24 lessons per week. Another gives 3 (10.7%) had 15 – 19 lessons. This gives a total of 8(32.1%) of the teachers with a teaching load of 25 lessons and above. Students centered learning approaches that are encouraged by the SMASSE project demands that teachers have a lighter teaching load. This is meant to give them sufficient time to plan for the lessons, prepare teaching materials, involve the learners in the learning activities and afterwards evaluate the lessons and make improvements. Heavy teaching load, for example, teachers with 30 lessons and above will find it very difficult to apply ASEI – PDSI approach in teaching Mathematics and Sciences.

#### **4.3.7 Students to text book ratio in Mathematics and Science subjects.**

The Table 4.18 gives a summary of students to textbook ratio in Mathematics and Science subjects in the schools sampled.

**The table 4.18 Students to text book ratio in Mathematics and Science subjects.**

**(N=25)**

Students of textbook ration	Frequency	Percent
2:1	10	39.3
3:1	11	46.4

4:1	2	7.1
5:1 and above	2	7.1
Total	25	100.0

From the study 10 (39.3%) of the teachers had a student to book ration of 2:1, 11(46.4% had a student to book ratio of 3:1 while 2 (7.1%) had a 4:1 student to book ratio. A further 2 (7.1%) had a 5:1 ratio. It reveals a total 15 (60.6%) of the teacher had a student to book ratio of 3:1 and above. These ratios are not favorable for the purpose of involving the students in learning activities in class and assignments during and after the lessons. This is in the ASEI – PDSI of approach which calls for increased student participation in the learning process.

#### **4.3.8 Cycles of SMASSE INSET attended**

The Table 4.8 outlines the cycles of SMASSE-INSET attended by teachers in the study.

The study showed that 14(57.1%) of the science and mathematics teachers had attended 4 cycles of SMASSE INSET. Another 4(14.3%) had attended 3 cycles while 5(21.4%) had attended 2 cycles. Only 2 (7.1%) had attended 1 cycles. It is evident from these findings that all these teachers were conversant with SMASSE project and its objectives and

were in a position to apply the ASEI-PDSI approach. With the application of ASEI – PDSI approach they were capable of identifying the problems that hinders its use.

#### **4.3.9 Challenges experienced by the teachers during SMASSE- INSET.**

A summary of the challenges experience by the teachers during SMASSE- INSET is given in Table 4.19

**Table 4.19 Challenges experienced by the teachers during SMASSE- INSET (N=25)**

Challenges	SA	A	U	D	SD
The trainers were adequately prepared	4	9	2	7	3
The time allowed for training was sufficient	2	3	1	9	10
The timely of the training was appropriate	10	2	3	7	3
Boarding facilities of low standards	10	5	1	7	2
Boarding facilities were inadequate	8	4	1	8	4
Catering service were of low quality	7	8	2	5	3
Trainees were served the same food Staffs throughout the training	4	10	2	3	6

**Key:**

**SA**=Strong Agree

**A**=Agree

**U** = Undecided, **D** = Disagree, **SD** = Strongly Disagree

It was evident from the findings that according to 13 (53.6%) of the teachers sampled the trainers were not adequately prepared while 12(46.4% ) disagreed with the view that trainers were not adequately prepared. Another 15(60.7%) stated that the boarding facilities were of low standards as 10(39.3%) disagreed with this opinion. Another 13 (52%) considered those boarding facilities' inadequate as 12(48%) considered them adequate. Still 13 (51%) were of the opinion that catering services offered to them during the training were of low quality and 12(49%) did not agree with this observation. Another 13(53.6%) asserted that they were served the same foodstuffs throughout the training, while 12(46.4%) said that this was not true.

The above stated problems highlighted by some teachers might have impacted negatively on their perception of the SMASSE – INSET. This could be linked to responses they

gave when asked about their opinion about SMASSE – INSET. In this study when mathematics and science teachers were asked their opinion about SMASSE INSET, 16 (64.3%) stated that the project was a waste of time and resources and had not improved the teaching and learning of mathematics and sciences. Only 9(35.7%) stated that the INSET had improved teaching and learning of mathematics and sciences

#### **4.3.10 Challenges faced by mathematics and science teachers in the use of ASEI-PDSI approach**

The Table 4.20 gives the challenges faced by teachers in the use of ASEI-PDSI approach.

**Table 4.20 Challenges faced by mathematics and science teachers in the use of ASEI-PDSI approach (N=25)**

Challenges	SA	A	U	D	SD
Lack of sufficient times	14	8	1	2	-
Large class size	12	10	-	2	1
Heavy teaching load	13	8	-	4	-
Low morale among teachers	8	13	-	3	1
Overloaded syllabus	5	10	1	8	1
Syllabus	12	12	-	1	1
Low entry behaviour of learners	10	8	2	5	-

**c**

**Key:**

**SA** = Strongly Agree, **A**= Agree, **U** = Undecided, **D** = Disagree, **SD** = Strongly Disagree

The findings revealed that 22(89.2%) of the teachers lacked sufficient time to apply ASEI-PDSI concept in lessons, while 3(10.8%) did not. Another 21 (85.7%) stated that heavy teaching load was a challenge as 4(14.3%) did not consider it as such. Still 21(82.1%) considered low morale among teachers a challenge and 4(17.9%) disagreed with this view. According to 15(60.7%) of the teachers, overloaded syllabus posed a challenge and for 10(39.3%) this was not a challenge to them, as for another 23 (92.8%) pressure to cover the syllabus was challenging the use of ASEI – PDSI approach in their lessons as 2(7.2%) disagreed with this opinion. Ombaso (2008) found out that similar challenges were encountered by teachers in the application of certain aspects of ASEI-PDSI approach in the lessons. It is also indication that teachers who

have attended SMASSE INSET experience similar challenges in the use of ASEI-PDSI approach in teaching

**4.3.11 Teachers rating of student participation in learning activities during the lesson since the use of ASEI-PDSI approach.**

The Table 4.21 gives the teachers rating of student participation in lessons since the use of ASEI-PDSI approach in lessons.

**Table 4.21 Teachers rating of student participation in lessons (N=25)**

Teachers' rating	Frequency	percent
Below average	2	7.1
Average	19	75.0
Above average	4	17.9
Total	25	100.0

The finding revealed that 19(75%) of the respondent teachers rated student participation in learning activities are average,4(17.9%) rated their participation as above average and 2(7.1%) rated the same as below average. The reason behind the high percentage (75%) of teachers rating student participation as average could be attributed to the various challenges that limit the use of ASEI-PDSI approach in lessons. However these findings show that the use of ASEI-PDSI approach has exerted a positive effect on the student participation in lessons.

**4.4.0 Effects of ASEI – PDSI approach on student attitude and participation in mathematics and science.**

#### 4.4.1 Gender distribution of students

The Table 4.22 gives the distribution of students by gender.

**Table 4.22 Gender distribution of students (N=201)**

	Frequency	percent
Male	115	57.1
Female	86	42.9
Total	201	100.0

The study revealed that 115 (57.1%) of the student respondents were male and the remaining 86 (42.9%) were female. This indicates that there were more male than female students enrolled in secondary schools in Kericho District.

#### 4.4.2 Distribution of students by school category

It emerged from the study that 89 (44.3%) of the student respondents were from mixed day schools, 58 (29%) were from mixed boarding schools 28 (13.8%) were from boys boarding schools and 24 (12.9%) were from girls boarding school. This reflects composition of the secondary schools in the district with mixed day schools being the majority, followed by mixed boarding schools. Pure boys and girls boarding school are the least in the category of schools available in the district. It implies that the findings on students will to great extent be reflecting the views of students from mixed day and mixed boarding schools who make up 147 (73.3%) of the total number of student sampled in the study.

#### 4.4.3 Challenges faced by students in learning mathematics and science subjects

Table 4.23 contains the challenges faced by students in learning Mathematics and Science subjects.

**Table 4.23 Challenges faced by students in learning mathematics and science subjects**

(N=201)

Challenges	True	False
What is being taught is hard to understand	53	148
The language used in teaching is above my understanding	31	170
The teacher speech very vast	74	127
The teacher writes very fast and rubs the chalkboard before I copy	45	156
I cannot speak well in English and therefore, cannot ask Or answer questions during the lesson	65	136
I don't get individual attention from the teacher	82	119

It emerged from the study that 53 (26.2%) of the student respondents stated that what was being taught was hard to understand while 148(73.8 %) said this was not true. Also 31 (15.2%) of the students sampled said that the language used in teaching was beyond their understanding as 170(84.8%) disagreed. Again 74 (36.7%) stated that the teacher speak very fast and 127 (63.3%) said this was false. Still 45 (22.4%) stated that the teacher writes very fast and rubs the chalkboard before they copy as 156(77.6%) disagreed. Whereas 82 (41%) stated that they were not getting individual attention

from the teacher, 119 (59%) acknowledged they received individual attention from the teacher. Another 65 (32.4%) of the students said they could not speak well in English hence could not ask or answer questions during the lessons even as 156 (67.6%) declared that they had no difficulty speaking in English. These findings suggest few students encounter problems in learning mathematics and science subjects in Kericho District. However, performance in KCSE examination in the last five years gives a different picture. Over this period, except for Biology, the other subjects have recorded a mean score of between 3.0(D) and 5.0(C-). Mathematics has never gone beyond a mean score of 3.9(D+). Physics mean score has been oscillating between 4.0(D+) and 5.0 (C-), while chemistry has been registering between a mean score of between 3.6(D+) and 4.2(D+). When students state that they are not experiencing learning difficulties, it follows that teaching and learning has been going on effectively. This ought to translate into better learning outcomes in the form of high mean scores in the examinations. These findings on the challenges facing students in learning Mathematics and sciences are not consistent with the performance in KCSE examination outcomes in the district.

#### **4.4.4 Number of assignments per week.**

From the findings, students do 5 assignments per week in mathematics, 4 assignments each in Physics, chemistry and Biology. It can therefore be concluded that students are given adequate assignments by the teachers. These assignments serve as a basis of evaluating the effectiveness of a teaching method and a way of involving the students in the learning process. By giving out assignments and marking them, teachers are in a

position to gauge the effectiveness of teaching employed in lessons delivery and identify student weakness of challenges. This will assist in adopting making the necessary adjustments to the approaches used in teaching and help learners learn better. All this is in line with goal of SMASSE which aims at strengthening the teaching and learning of mathematics and sciences subjects.

#### **4.4.5 Number of experiments per week in science subject**

The findings revealed that students conducted 3 experiments per week in both physics and chemistry, while they conducted 2 experiments per week in Biology. This number of experiments conducted is adequate and they serve to involve the students in the learning process and afford them the opportunity to interact with teacher and asks questions. This is in line with ASET-PDSI approach as the teacher can design experiment and use improvised material to arouse curiosity and sustain in contrast in the learning of science subjects.

#### **4.6.6 Participation in learning activities during lessons.**

Students were asked state whether they ask questions, answer questions, solve problems on the chalkboard or engage in group discussion. From the findings 111 (52.9%) actively participated in the 3 or all of the above listed learning activities during the lessons. This is a pointer to involvement of students in the learning process which represents some aspects of ASEI – PDSI. In particular, focus on the individual student is meant to enhance learning in the individual subject

#### **4.6.7 Students attitude towards mathematics and science lessons.**

The study revealed that 203 (96.6%) of the students attended all the lessons in Mathematics and Sciences. Another 170 (76.2%) completed their assignment on time, 148 (70.6%) did corrections after their work is marked, 185 (88.1%) had allocated time for each subject during private study time. A total 183 (87.1%) stated that they enjoyed learning mathematics and science subjects. This is an indication of attitude change from negative before the implementation of SMASSE INSET to positive attitude after implementation of the SMASSE project. The change in attitude towards mathematics and science subjects from negative to positive is attributed to the impact of SMASSE project in teaching and learning of these subjects.

The ASEI – PDSI approach used in teaching mathematics and science subject has raised the level of student participation in lesson to average and change the student attitude towards these subjects from negative to positive.

## **CHAPTER FIVE**

### **SUMMARY, CONCLUSIONS AND RECOMMENDATIONS**

#### **5.1 Introduction**

This chapter gives a summary of the findings of the study, conclusions and recommendations.

#### **5.2 Summary**

The main purpose of the study was to find out the challenges facing the implementation of SMASSE project in Kericho District. The study found out the challenges faced by public secondary school principals as they facilitate the implementation of SMASSE project, the challenges faced by Mathematics and Science teachers on the use of ASEI/PDSI concept in the lessons were also identified. The effects of ASEI/PDSI approach on student attitude and participation in mathematics and science lessons were established. The study adopted a survey design. Descriptive statistics was used to analyze the data.

The first objective of the study was to identify the challenges faced by public secondary school principals as they facilitate the implementation of SMASSE project. From the study it emerged that the main challenge faced by the public secondary school principals as they facilitate the implementation of SMASSE project was understaffing. A total of 85.7% of the principals stated that their schools were understaffed, that is, 6 out of 7 schools sampled were understaffed.

Some of the challenges that would have arisen from understaffing and hindered the use of ASEI – PDSI approach in teaching include heavy teaching load and lack of sufficient time. According to the findings of this study, 84.6% of the principals identified lack of sufficient time while 85.7% cited heavy teaching load as the as challenges to the use of ASEI-PDSI approach by teachers in their schools . Based on the findings other the challenges that affect the implementation of SMASSE project are:- large class size (85.7%), overloaded syllabus (71.4%), pressure to cover syllabus (100%), low morale among teachers (57.2%) and low entry behaviour of learners (57.2%).

The second objective was to investigate the challenges faced by mathematics and science teachers on the use of ASEI/PDSI concept in their lessons. 33% of all the teachers in these subject areas were sampled. From the findings of this study all of them were qualified and could give reliable data. According to them the following constitute challenges to the use of the ASEI-PDSI approach in the lessons: Lack of sufficient time according to 89.2%, heavy teaching load (85.7%), large class size (85.7%), low morale among teaches (82.1%), overloaded syllabus (60.7%), pressure to cover the syllabus according to 92.8% and low entry behaviour according to (71.4%).

Ombaso Daniel (2008) had identified similar challenges as hindrances to implementation of certain aspects of SMASSE project like focusing on students, designing small scale experiments and use of improvised materials. The finding of the current study on the challenges facing the implementation is a indication that these challenges are not limited to one region.

The third objective of the study was to find out the effect of ASSEI/PDSI approach on student attitude and participation in mathematics and science lesson. 201 students participated in the study out of which 115 were males and 86 were female. The study revealed that the 75% of the teachers rated student participation in lessons as average since they started using ASEI-PDSI approach while 97.1% of the students stated that they enjoyed learning mathematics and science subjects.

### **5.3 CONCLUSIONS:**

It can be concluded from the findings of this study that SMASSE project implementation is facing challenges. The major challenge faced by the principals is attributed to understaffing in public secondary schools. Due to understaffing teachers have heavy workload with some with over 30 lessons in a week. They therefore do not have time to plan for the lessons, design experiments, improvise learning materials, give out assignments and mark them or even evaluate the lessons so as to make improvements. Teachers further, have to handle overcrowded classes with some having over 50 students. In these circumstances it becomes difficult for the teacher to involve the students in learning activities, attend to individual students or even mark their assignments on time. All the Principals and majority of the teachers cited pressure to cover the syllabus as a challenge to use of student-centered teaching methods encouraged by SMASSE-INSET. This could be linked to the need to have adequate time for revision in form 4 as candidates prepare for their terminal examination, the KCSE. Teachers seem to be having a negative attitude towards SMASSE-INSET. This could be deduced from their opinions about the program when majority of them asserted that SMASSE-INSET had not made any difference in the teaching and learning of Mathematics and Science subjects and that

the INSET was a waste of time and resources. This negative attitude could be as a result of the challenges they faced during the INSET and the low morale which was stated by both the Principals and the Teachers as a challenge to the implementation of SMASSE project. The students' increased participation in the learning activities and positive attitude towards Mathematics and Science subjects could be attributed to the teachers' attempt to apply ASEI-PDSI approach despite the numerous challenges. On the other hand the Quality Assurance and Standards Officers (QASO) were reported to have conducted very few follow-up visits to schools on implementation of SMASSE project in a period of 3 years. Some schools however had not been visited even once in the same period. The District Planning Committee (DPC) chaired by the District Education Officer (DEO) in conjunction with the CEMASTEAs are responsible for the implementation of SMASSE project. The department of QASO in the DEO's office should be conducting frequent and regular visits to schools to monitor and evaluate the implementation of the project and advise the District Planning Committee and CEMASTEAs who plan and manage the implementation process.

#### **5.4 RECOMMENDATIONS**

The following recommendations are made from the study:-

- 1) It emerged that understaffing in public secondary schools was the cause of most of the challenges facing SMASSE project implementation. The ministry of Education should employ more mathematics and science teachers to address the widespread teachers' shortage and in the process deal with some of these challenges.

- 2) More than half of the teachers (64%) who participated in the study stated that the SMASSE – INSET was a waste of time and resources. This negative attitude towards the project can be changed through payment of allowances for those attending the INSET, provide decent boarding facilities during the training and improving the catering services. On completion of the training cycles, the teachers should be awarded certificates, salary increment or promotion to the next job group.
- 3) All the principals (100%) and (92.8%) of the teachers stated that pressure to cover the syllabus was a challenge. The Kenya Institute of Education in consultation with other stakeholders in the education sector should review the syllabuses for the mathematics and science with a view of making them manageable.
- 4) According to 2 principals 25% of the teachers in their stations had not attended SMASSE INSET. The principles of SMASSE INSET should be incorporated into the training curriculum of secondary teacher training institutions. This would save on costs and time and ensure that all teachers are equipped with knowledge, skills and attitude as outlined in the SMASSE- INSET curriculum.
- 5) From the findings of this study it emerged that 5 schools had been visited once in 3 years by the Quality Assurance and Standards Officers on follow up of the SMASSE project implementation. However, 2 schools had not been visited during the same period. It can be therefore concluded that the visits are minimal. These visits should be regular for those tasked with implementation of SMASSE-INSE, that is, the CEMASTEAs and District Planning Committees chaired by the

District Education Officers to come up with timely intervention to the various challenges hampering the implementation of the project.

## **5.5 SUGGESTIONS FOR FURTHER STUDY**

1. The study on challenges facing the implementation of SMASSE project was carried out in one district. Similar studies should be conducted in different parts of the country to collect sufficient information on the subject to be able to generalize.
2. Many students declared that they are not experiencing difficulties in learning mathematics and science subjects. However, K.C.S.E examination performance in these subjects in the last five years in Kericho District has been dismal. There is need to find the cause of this dismal performance in spite of the positive attitude of students towards the subjects, sufficient assignments per week and increased student participation in the learning of these subjects.
3. Low entry behavior was mentioned as challenge to the implementation of the application of ASEI-PDSI approach in lessons in public Secondary Schools in Kericho District by both the Principals and teachers. However the admission

requirement given during the study by the Principals of these schools does not give room for low entrants to be enrolled. There is need therefore for a study to be conducted to establish the cause, extent and effect of low entry behavior on Secondary school education in Kenya.

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**APPENDIX 1: LETTER OF INTRODUCTION**

P.O. BOX 1144,

KERICHO.

Dear Respondent,

**RE: ASSISTANCE IN THE FIELD RESEARCH SURVEY**

I am a postgraduate student in the department of Education management, policy and curriculum studies at Kenyatta University currently undertaking research on the topic; “CHALLENGES FACING THE IMPLEMENTATION OF SMASSE PROJECT IN KERICHO DISTRICT”.

You have been identified as one of the respondents and the questionnaire is designed to study the challenges of SMASSE project implementation. The information you provide

will help in understanding and addressing the challenges. Because you play a key role in the implementation, I kindly request you to respond to the questions frankly and honestly. Your response will be kept strictly confidential and anonymous and shall only be utilized for the purpose of this study. Please respond to the questions by following the instruction given.

Thank you very much for your time and cooperation. I greatly appreciate your school and your help in furthering this research endeavor.

Yours faithfully

David Kipkoech Chepkwony

## **APPENDIX 2: LETTER OF RESEARCH AUTHORIZATION**

REPUBLIC OF KENYA



## NATIONAL COUNCIL FOR SCIENCE AND TECHNOLOGY

Telegrams: "SCIENCETECH", Nairobi  
Telephone: 254-020-241349, 2213102  
254-020-310571, 2213123.  
Fax: 254-020-2213215, 318245, 318249  
When replying please quote

P.O. Box 30623-00100  
NAIROBI-KENYA  
Website: www.ncst.go.ke

Our Ref: **NCST/RRI/12/1/MED011/144**

Date:  
**16<sup>th</sup> September, 2011**

David Chepkwony Kipkoech  
Kenyatta Univesity  
P.O.Box 43844  
Nairobi

### RE:RESEARCH AUTHORIZATION

Following your application for authority to carry out research on; *"Challenges facing the implementation of SMASSE project in Kericho District,"* I am pleased to inform you that you have been authorized to undertake research in **Kericho District** Kenya for a period ending **30th November 2011**

You are advised to report to **The District Commissioner and The District Education Officer Kericho District** before embarking on the research project.

On completion of your research project you are advised to submit **one hard** copies and **one soft** copy of your thesis/ project to this office.

**P.N NYAKUNDI**  
**FOR: SECRETARY/CEO**

Copy to:

The District Commissioner  
Kericho District

The District Education Officer  
Kericho District

**APPENDIX 3: RESEARCH PERMIT**

PAGE 2 PAGE 3

**Research Permit No. NCST/RRI/12/1/MED011/144**

**THIS IS TO CERTIFY THAT:**

**Prof./Dr./Mr./Mrs./Miss/Institution** **Date of issue** **15<sup>th</sup> September, 2011**

**David Chepkwony Kipkoech** **Fee received**

**of (Address) Kenyatta University**

**P.O Box 43844, Nairobi**

**has been permitted to conduct research in**

**Location**

**Kericho District**


**Rift Valley Province**

**on the topic; Challenges facing the implementation of SMASSE project in Kericho District**

.....

**Applicant's**

**Signature**



.....

**Secretary**

**National Council for**

**Science and Technology**

**for a period ending 30<sup>th</sup> November 2011**

**APPENDIX 4: PRINCIPAL'S QUESTIONNAIRE ON THE CHALLENGES FACING IMPLEMENTATION OF SMASSE PROJECT IN KERICHO DISTRICT.**

Please read the questions below and kindly give the appropriate response by either ticking (√) or by giving information in the spaces provided. This study is purely for academic purposes and all information given shall be treated with strict confidentiality.

### **Section A: Personal Information**

1. Gender: (Tick as appropriate) Male (  ) Female (  )
2. State your highest professional qualification: ( Tick as appropriate)  
M.ED/MA (  ) Graduate (B/ED) (  ) BA/BSC with PGDE (  ) Diploma(  )
3. How many years have you been a principal in this school? (tick as appropriate);  
Below 1 year (  ) 2 -5 years (  ) 6 - 10 years, (  ) Above 11 years (  )

### **Section B information about school**

4. Categorize your school (tick one)  
Boys Boarding (  ) Boys day (  ) Mixed Boarding (  )  
Girls boarding (  ) Girls Day (  ) Mixed Day (  )
5. What is the staffing status of your school with regard to mathematics and sciences?  
Overstaffed (  ) Adequately staffed (  ) Understaffed (  )
6. Indicate the range of marks required for form one admission in your school. (Tick one)  
Above 400(  ) Between 300-399(  ) 250-299(  ) 249 & below (  )

### **Section C: SMASSE project implementation**

7. State the percentage of mathematics and science teachers that have attended SMASSE –INSET.

25% ( ) 50% ( ) 75 % ( ) 100% ( )

8. (a) The following is a list of challenges faced in mathematics and science teachers in the implementation of SMASSE program. Please state the level of agreement to which these are challenges in your station.

Challenge	SA	A	U	D	SD
Lack of sufficient time					
Large class size					
Heavy teaching load					
Low morale among teachers					
Syllabus too long					
Pressure to cover syllabus					
Low entry behavior of learners					
Lack of laboratory assistant					
Lack of supervision					
Mischievous students					

Key

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

Others

(specify).....

9. How do you ensure mathematics and science teachers use ASEI-PDSI approach in teaching?(Tick as appropriate)

Through heads of department ( )

By checking schemes of work/lesson plans ( )

By attending lessons ( )

Others (specify) .....

10. How many times have the Quality Assurance and Standards Officers visited your school on follow up of SMASSE project implementation in the last three years.

(Tick as appropriate)

Thrice ( ) Twice ( ) Once ( ) Nil ( )

11. What should be done to address the challenges facing SMASSE project implementation?

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**APPENDIX 5: TEACHER'S QUESTIONNAIRE ON THE CHALLENGES FACING THE IMPLEMENTATION OF SMASSE PROJECT IN KERICHO DISTRICT, KERICHO COUNTY.**

Please read the questions below and feel free to provide the appropriate response by either ticking or by giving further information in the spaces provided. This study is purely for academic purposes and all information given will be treated with strict confidentiality

**Section A: Personal information**

1. Gender: (tick as appropriate) Male (  ) Female (  )
2. State your highest professional qualification :( Tick as appropriate)  
M.ED/MA (  ) Graduate (B/ED) (  ) BA/BSC with PGDE (  ) Diploma (  )  
Untrained Teacher (  )
3. How many years have you taught in your present station? ( Tick as appropriate)  
Less than one year (  ) 1-5 years (  ) 6-10 years (  )  
11-15 years (  ) above 15years (  )
4. Categorize your school (tick one)  
Boys Boarding (  ) Boys day (  ) Mixed Boarding (  )  
Girls boarding (  ) Girls Day (  ) Mixed Day (  )

**Section B: Teaching science and mathematics**

5. What is the average classroom population in mathematics and sciences? (Tick one)  
30 students and below (  ) 31-40 students (  ) 41-49 students (  ) 50 students and above (  )
6. How many lessons do you have per week? ( Tick as appropriate)

14 and below ( ) 15-19 ( ) 20-24 ( ) 25-29 ( ) 30 and above ( )

7. What is the average student to book ratio in mathematics and science subjects? (

Tick as appropriate)

1:1 ( ) 2:1 ( ) 3:1 ( ) 4:1 ( )

other (specify) \_\_\_\_\_

### Section C. Challenges

8. How many cycles of SMASSE INSET have you attended?

4 ( ) 3 ( ) 2 ( ) 1 ( ) none ( )

9. The following is a list of challenges that science and mathematics teachers face during SMASSE-INSET. Indicate your level of agreement.

Challenge	SA	A	U	D	SD
(a) The trainers are not adequately prepared					
(b) The trainers did not create an atmosphere that allowed for exchange of ideas.					
(c) The time allowed for the training is insufficient					
(d) The timing of the training is inappropriate for the teachers					
(e) Boarding facilities are of low standards					
(f) Boarding facilities are inadequate					
(g) Catering services are of low quality					
(h) Trainers are served the same foodstuffs throughout the training.					

Key

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

10. The following is a list of challenges faced by mathematics and science teachers in the use of ASEI-PDSI approach in teaching. Kindly indicate your level of agreement to which these are challenges to you as a teacher.

Challenge	SA	A	U	D	SD
Lack of sufficient time					
Large class size					
Heavy teaching load					
Low morale among teachers					
Syllabus too long					
Pressure to cover syllabus					
Low entry behavior of learners					
Lack of laboratory assistant					
Lack of supervision					
Mischievous students					

Key

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

Others (specify)

.....

11. How do you rate student participation in your lesson since you started using ASEI-PDSI approach. (Tick as appropriate)

Above average (     ) Average (     ) Below average (     )

12. Which of the following statements describe your opinion about SMASSE -INSET?

(Tick as appropriate)

i. SMASSE- INSET has improved the teaching and learning of mathematics and sciences. True (     ) False (     )

ii. SMASSE- INSET has made no difference to the teaching and learning of mathematics and sciences. True (     ) False (     )

iii. SMASSE- INSET is a waste of time and resources. True (     ) False (     )

13. What should be done to address the challenges facing SMASSE implementation?

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**APPENDIX 6: STUDENT’S QUESTIONNAIRE ON THE CHALLENGES FACING THE IMPLEMENTATION OF SMASSE PROJECT IN KERICHO DISTRICT.**

Please feel free to answer the questions below by either ticking (✓) or giving further information in the spaces provided. This study is purely for academic purposes and all information given shall be treated with strict confidentiality.

**Section A: Personal data**

1. State your gender. (Tick as appropriate)

Male (     )     Female (     )

2. Categorize your school (tick one)

Boys Boarding (     ) Boys day (     )     Mixed Boarding (     )

Girls boarding (     ) Girls Day (     )     Mixed Day (     )

**Section B Pertinent issues**

3. The following are challenges faced by students in learning Mathematics and Science subjects. (Tick as appropriate)

(a) What is being taught is hard to understand. True (     ) False (     )

(b) The language used in teaching is above my understanding. True (     ) False (     )

(c) The teacher speaks very fast. True (     ) False (     )

(d) The teacher writes very fast and rubs the chalkboard before I copy. True (     )  
False (     )

(e) I can not speak well in English and therefore cannot ask or answer questions during the lesson. True (     ) False (     )

(f) I don’t get individual attention from the teacher. True (     ) False (     )

4. Indicate the number of assignments you do every week for each of the following subjects.

Subject	Assignments						
	0	1	2	3	4	5	Others (specify)
Mathematics							
Physics							
Chemistry							
Biology							

5. Indicate the number of experiments you carry out each week for the following science subject.

Subject	Number of Experiments				
	0	1	2	3	Others (specify)
Mathematics					
Physics					
Chemistry					
Biology					

6. The following is a list of learning activities in mathematics and science lessons.

Tick the one you commonly do individually during the lesson.

- i. Asking questions (      )
- ii. Answering questions (      )
- iii. Solving problems on chalkboard (      )
- iv. Engaging in group discussion (      )

7. Please indicate your opinion about the following statements concerning Mathematics and Science subjects.

Statement	Strongly Agree	Agree	Undecided	Disagree	Strongly disagree
(a) I attend all the lessons					
(b) I complete all the assignments on time					
(c) I do corrections after my work is marked					
(d) I have allocated time for each of these subjects in my private study time					
(e) I enjoy learning these subjects.					

8. What should be done to improve your learning in Mathematics and Science subjects.

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Thank you for your responses

## **APPENDIX 7 -: LIST OF SCHOOLS IN KERICHO DISTRICT**

1. Kericho High Secondary
2. Kipsigis Girls High Secondary
3. Milimani Secondary\*
4. Soliat Boys Secondary
5. Kabokyek Adventist Secondary\*
6. Kericho Day Secondary
7. Moi Kipsitet Girls Secondary
8. Poiywek Secondary
9. Kericho Tea Secondary
10. Chebigen Secondary
11. Kaitui Secondary
12. Kenegut Secondary
13. Matobo Secondary
14. Kapsoit Secondary
15. Keongo Secondary
16. Moi sitotwet Secondary
17. Ketitui Secondary
18. Chepngobob Secondary
19. Moi Tea Secondary
20. Ainamoi Secondary
21. Kipchimchim Secondary
22. Chagaik Secondary
23. Marinyin Secondary

\*Private Schools

