

**AN EVALUATION OF THE EFFECTIVENESS OF SMASSE PROGRAM IN  
PERFORMANCE OF SCIENCE AND MATHEMATICS IN PRIMARY SCHOOLS  
IN KENYA**

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**Abstract**

The purpose of the study was an evaluation of the effectiveness of SMASSE program in performance of science and mathematics in primary schools in Kenya. SMASSE was introduced due to consistently poor performance in science and mathematics became a matter of serious concern (waititu & Orando 2009). Although dismal performance in these subjects had already been accepted as the norm in some schools, the government of Kenya and other stakeholders felt there had to be an intervention, hence the Strengthening of Mathematics and Science in primary schools (Waititu & Orando 2009). The INSET Curriculum was thus designed to improve and strengthen the teacher's competence in the teaching of Science and Mathematics subjects. The program activities are centred on the ASEI (Activity, Student, Experiment, and Improvisation) & PDSI (Plan, Do, See and Improve) approach, which emphasize on learner-centered preparation and presentation of lessons. The study was an evaluation using documented data that shows the performance of Science and Mathematics. The study adopted the Kirkpatrick model of training evaluation. Although there was some significant improvement in performance of Science and Mathematics subjects, a lot needs to be done to improve the attitude of teachers. It clearly emerged that, majority of teachers are coerced to attend the INSET training. Few teachers are willing to be observed by others during teaching and learning while the modern technology using ICT is rarely used.

**KEYWORDS:** SMASSE, Primary schools, Mathematics Performance, Science performance INSET, CEMASTEIA

## **Background of the study**

Mathematics and science subjects are very crucial to the development and improvement of industrial and economy as they lay the foundation for fields such as engineering, medicine, computer and technological specializations. Their importance cannot be over emphasized as observed by Komber and Keere (1993) and Sibandon, (1984). Science is of fundamental importance to technological development and modernization of Nations.

The strategy for the implementation of SMASE is through capacity building in both science and mathematics through national INSET for trainers and teachers in the Districts. A national training for trainers is conducted by the Japanese and a technical team of Kenyan expert. These trainers conduct INSET for teachers at District level held in public secondary schools in the county. CEMASTE is a national INSET centre with sixty one academic staff and 4 experts from Japan, 1442 trainers in the district conduct INSET for 16251 teachers every year for 108 district centers.

Mathematics study has long been recognized worldwide as important in the understanding of other subjects like chemistry, biology, and physics. Salau (2000) points out that there exists an impregnable link between mathematics and other science subjects. For example, the teaching of practical aspect of chemistry can hardly be achieved without the knowledge of mathematics. He concludes that there is a relationship of mathematics' ability on students' overall outcomes. That is to say, a student who is performing well in mathematics is most likely to have high scores in overall outcomes.

The SMASSE is an INSET program that trains Science and Mathematics teachers in the country so as to improve the performance of the subjects by pupils in Kenya Certificate of Primary Education (KCPE). INSET is a collection of limited tasks, which have a direct impact on the quality of instruction offered (Harris and Bessent, 1969). INSET's are essential for updating knowledge and improving professional development, current issues and policy matters as well as training and certification needs (common wealth secretariat, 1995). Berth (1990) and Fullan (1991) recognize the

need for a deliberate and sustained effort to provide opportunities for continued professional growth and self-renewal for teachers; this would impact on teachers new concepts on teaching as an art.

The project was officially launched on 27<sup>th</sup> February 1998 after the government of Kenya through ministry of education science and technology(MOEST) and Japanese Government through Japanese International Co-operation (JICA) signed an agreement and SMASSE coordination office were set up at the ministry of education headquarters and at then Kenya Science Teachers College (KSTC).According to JICA (1998) this was followed by baseline studies on the causes of poor performance in secondary science and mathematics in Kenyan schools in nine pilot districts namely Kisii,Butere Mumias, Gucha, Makueni, Kakamega, Lugari, Maragua, Murang'a and Kajiado District. Results from the baseline studies revealed that the teaching and learning of science and mathematics subjects were facing numerous problems of which some were beyond the scope of SMASSE and some within its scopes .The main problems included: Poor attitude towards mathematics and science (By teacher's students, head teachers and parents). This poor attitude in teachers was seen through little or no lesson plans, missed lessons, lateness and lack of exercises in student's books. On the other hand, poor attitude by students was shown through students poor performance and untidy work, missed classes by teachers, teacher's and learners absenteeism, low morale and dislike for mathematics and sciences .For school managers in most schools were not very supportive of science and mathematics. Laboratories were rare and often empty rooms while schools boasted of magnificent administrative blocks and school buses. Poor mastery of content by teachers, in appropriate teaching methodologies manifested by lack of basic practical skills and innovativeness, teacher centered approach to teaching; less or no interactive forum for teachers; low morale among teachers, fact attributed to poor remuneration,working condition and supportive school administrations; and frequent professional guidance by subject quality assurance and standards officers.

In Kenya, mathematics and science are a prerequisite subject to many advanced careers like medicine, pharmacy, and other business courses (accounting, finance, and banking). One has to score high in mathematics for him or her to be allowed to pursue any of the above careers (University of Nairobi, 2008). According to Baldacchino and Farrugia (2002) the quality of education cannot be seen or improved by simply providing physical resources like books, extending duration of learning, training more teachers and providing other learning resources, but by teachers interpreting the learning to the pupils and appropriately using teaching and learning approaches. It is the teacher who has to establish the right climate for learning, use learning resources and appropriate teaching methods to attainment of mathematical greatness (Baikie, 2000). Onwuakpa and Nweka (2000) state that mathematics learning largely depends on the teacher. The job of a teacher is to impart knowledge, skills, attitudes and mathematical concepts into the learner. To achieve this, teachers are advised to give assignments, projects and tests to their pupils and discuss the results with them.

Performance in mathematics has remained of a global concern. Studies conducted by American Institute for Research (AIR) to investigate mathematics performance on USA students – 4th and 8th grades as compared with their peers around the world and another by National Assessment of Education Progress (NAEP) assessed the progress in mathematics of students in grades 4, 8, and 12. The results showed that grade 4 pupils performed below the average mark consistently from 1996-2007. The survey also revealed that teachers are the major cause of poor mathematics performance in the US (AIR, 2007). In another study, Schmidt et al. (2002) found out that teachers in USA follow textbooks which are too wide because publishers produce elementary mathematics text books that cover a variety of topics so that they can sell in different states. As a result, teachers have

not developed in their pupils an understanding of all the topics in these subjects and their application (Schmidt, Houang, & Cogan, 2002).

According to Opolot-Okurut et al. (2008) the public in Uganda continues to complain for the poor performance of pupils in mathematics in national examinations. In his study at Makerere University, Opolot-Okurut investigated factors hindering learner's opportunities to learn mathematics in primary schools. The findings revealed that 83% of the factors that hinder mathematics' learning are teacher-related factors, which include: poor teaching methods, lack of teaching experience, teachers' weak academic background, poor teacher attitudes towards mathematics, and lack of a continuous professional development. The Kenya government has been financing recurrent expenditures while JICA caters for the cost of training materials, training development for Kenyan people in Japan, Malaysia and Philippines.

SMASE originally focused on secondary schools, but it was necessary to include teacher trainers in diploma teacher's training colleges. The INSET focuses on the attitude of the teacher and mastery of content and teaching/learning materials. ASEI pedagogic paradigm and the PDSI approach are the focus of SMASSE INSET. It was the duty of the teacher to improvise the materials required in the teaching/ learning process. This study therefore evaluated the effectiveness of SMASSE program in performance of Science and Mathematics in primary schools in Kenya.

### **Statement of the Problem**

SMASSE was as a result of the declining performance in science and mathematics even after the government recruiting and employing professional teachers, better remuneration for teachers and availing all the materials needed for the teaching and learning of mathematics and science. Kenya envisages being a middle level economy by the year 2030 also popular known as vision 2030.

However, the performance in mathematics and science at primary school level in Kenya is very poor. According to Kigotho (2009), 151,712 (50.3%) of the total candidature in Kenya Certificate of Primary Education (KCPE) scored grade D+ to E in 2008 KCPE mathematics results. This he said was the trend he noted for the previous years. As an example, 2003 mathematics mean score as 24.58%. Good performance in these subjects remains a key factor towards realization of the industrialization dream and general production of scientific oriented young Kenyans. All efforts must be and have been geared towards improved performance in these subjects.

The INSET was availed to all teachers teaching the two subjects in Kenya in 2004 at all levels. The ASEI/PDSI aimed at improving the performance of these two subjects. The purpose of this study was to evaluate the effectiveness of SMASSE program and the teacher's attitude and utilization of the SMASSE-INSET. The findings of the research indicated that teachers who teach mathematics and science have not fully adopted the ASEI/ PDSI approach in their teaching. They also have developed a negative attitude towards the INSET training. Only a very small percentage of the teachers use the approach. It is for this reason that a thorough evaluation of the effectiveness of SMASSE program in performance of mathematics and science in Kenyan primary schools was necessary.

**Table 1.1 Average countries' performance in Mathematics and Science subjects at KCPE**

<b>Subject</b>	<b>2012</b>	<b>2012</b>	<b>2013</b>
Mathematics	34.7%	39.0%	36.8%
Science	41%	38.2%	36.5%

The performance of Mathematics and Science subjects has been below average since the introduction of the SMASSE program in primary schools. This indicates that the program might

not be effective in improving the performance of the two subjects in primary schools. It might be due to other factors in the program that are not effective in realization of better performance in Mathematics and Science subjects. The study therefore sought to investigate the effectiveness of SMASSE program in performance of Science and Mathematics in primary schools in Kenya.

### **Purpose of the Study**

The article intended to evaluate effectiveness of SMASSE program in performance of mathematics and science in Kenyan primary schools.

### **Research Objectives**

The study was guided by the following specific objectives:

- i. To investigate the influence of teachers training in the performance of Science and Mathematics in primary schools in Kenya.
- ii. To examine the influence of teaching approaches in performance of Science and Mathematics in primary schools in Kenya.

### **Research Design and Methodology**

The study adopted a descriptive survey design that provided quantitative and qualitative data which described the effectiveness of SMASE program in performance of mathematics and science in primary schools in Kenya. It established whether ASEI/PDSI teaching approaches actually influenced performance of Science and Mathematics in Kenyan primary schools. For this pedagogy to be put in place, it was necessary that mathematics and science teachers undertake the four cycles of SMASSE-INSET. It was necessary to ascertain whether or not the training effects were being undertaken in the classroom. Evaluation research was to determine whether or not desired changes were made. (Craig & Charles, 2005).

The behavior and achievement of students during Mathematics and science lessons are ways of evaluating the pedagogy, but the attitudes of the teachers towards the innovation are also important. The level at which SMASSE project decisions will be put into practice largely depends on the reactions of the Mathematics and science teachers. It was therefore necessary that the views of the teachers on the program, implementation and its effect in the teaching and learning of Mathematics and science be evaluated (ijess volume 1 no. 4, 2011).

### **Results and findings**

The first objective of this study was to establish the influence of teachers training in the performance of science and mathematics in primary schools in Kenya. From the study it showed that the training did not impact positively on the performance of the two subjects. This could be as a result of teachers negative towards the training since most of them were coerced into attending it. The attitude of the teachers also had a negative effect of performance in the two subjects despite the teachers attending the training.

The second objective of this study was to establish the influence of teaching approaches in performance of science and mathematics in primary schools in Kenya. Results of the findings showed that majority of the teachers had not adopted the ASEI and PDSI approaches leading to poor results in the two subjects. For good results in the two subjects teachers need to adopt the approaches which help learners to have a positive attitude towards science and mathematics. The attitude of the teachers towards the innovations is very important.

### **Conclusion**

Despite the introduction of the SMASSE program in primary schools, performance in Mathematics and Sciences remain below average. This shows that the training that teachers have undergone has had no effect on the performance of mathematics and science. There is need for the teachers to take

the INSET training seriously for through them they will acquire skills needed for the teaching of the two subjects. On the other hand the government needs to motivate the teachers by remunerating them and appraising them for attending this training. The Ministry of Education also needs to know that teaching methods and attitudes towards Science and Mathematics in schools is not a Kenyan issue alone but a global rooted one.

It's the responsibility of the quality assurance department in the ministry of education to ensure teachers adopt the ASEI/PDSI approach in the teaching of the two subjects. It has for far been adopted by many countries in the world more so the developing countries. It is believed that industrialization in Japan is because of this emphasis and hence the need for developing countries to emulate it if they aspire to be industrialized. So there is a need for teachers to use this approach not only for short term goals but also for long term goals.

### **Recommendations**

The ministry of education should come out strongly on sensitizing all the stakeholders on the importance of INSET training, more so the teachers since they are the curriculum implementers at national, regional and district level. The training should be made mandatory for all teachers at all levels and thorough follow-up by the quality and assurance department in the ministry of education. Teachers should make their lessons learners centered. The head teachers should work closely with the Quality Assurance and Standard Officers (QASO) in ensuring the supervision of SMASSE program. The head teachers should be trained on effective management of teacher professional development. The SMASSE Program should aim at creating a positive attitude in the learners. For this to happen teachers need to use the skills acquired in the training into the classroom instruction.

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