

**EFFECTIVENESS OF SMASE PROGRAMME TOWARDS
ENHANCEMENT OF MATHEMATICS PERFORMANCE IN
PUBLIC PRIMARY SCHOOLS IN EMBAKASI DISTRICT,
NAIROBI COUNTY, KENYA**

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REG No. E55/CE/24322/2012

**A RESEARCH PROJECT SUBMITTED IN PARTIAL
FULFILMENT FOR THE AWARD OF THE DEGREE OF
MASTER OF EDUCATION IN EDUCATION
ADMINISTRATION IN KENYATTA UNIVERSITY**

JULY 2015

DECLARATION

I declare that this research project is my original work and has not been presented in any other University for consideration of any certification. This research project was complimented by referenced sources duly acknowledged. Where text, data, pictures, or tables were borrowed from other sources including the internet, these are specifically accredited and references cited using current APA System and in accordance with anti-plagiarism regulations.

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DEDICATION

This work is dedicated to my lovely family and to my lovely mother; Agatha Karuri Nyakinyua whose sacrifice saw me attain high school and university level of education.

ACKNOWLEDGEMENT

I most sincerely acknowledge the contributions of my astute supervisors at Kenyatta University namely; Prof. J. A Orodho and Prof. J. Olembo of the Department of Educational Management, Policy and Curriculum Studies, School of Education, for the stewardship accorded to me in spite of their tight schedules. Secondly, I acknowledge the SMASE INSET regional trainers at Thogoto Teachers College namely, P. Gachoka, P. Mugo, B. Simiyu (late) and B. Magu for the effective facilitation of SMASE INSET to me as a Trainer of Teachers from 2009 to 2013.

Thirdly, I want to thank my wife, Beatrice Seiya Shololoi, my sons; Bryan Gachagua and Quincy- Joe Karuri for their emotional and physical support.

Finally, I would like to thank my friends and student colleagues at Kenyatta University namely, Benard Kiunga Mwenda and Jacob Ayaya for their worthwhile counsel and encouragement.

May God bless you all most abundantly

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ABBREVIATIONS AND ACRONYMS

ADEA:	Association for Development of Education in Africa
AFT:	American Federation of Teachers.
ASEI:	Activity, Student, Experiment Improvisation
CEMASTEА:	Centre for Mathematics, Science Technology Education in Africa
DEO:	District Education Office
ICADETA:	Institute for Capacity Development of Teachers in Africa
INSET:	In-service Training
JICA:	Japanese International Corporate Agency
KCPE:	Kenya Certificate of Primary Education.
KEMI:	Kenya Education Management Institute.
KESSP:	Kenya Education Sector Support Program
KICD:	Kenya Institute of Curriculum Development
KSTC:	Kenya Science Teachers College
MOEST:	Ministry of Education Science and Technology
MTEF:	Medium Term Expenditure Framework
NDP:	National Development Policy
NACOSTI:	National Council of Science, Technology and Innovation.
PDSI:	Plan, Do, See and Improve.
QASO:	Quality Assurance and Standards Officers
SMASE:	Strengthening Mathematics and Science Education.
SMASSE:	Strengthening Mathematics and Science in Secondary Education.
SPSS:	Statistical Package for Social Science.
TIVET:	Technical Industrial Vocation and Entrepreneurship Training
TTC:	Teachers Training College
WECSA	Western Eastern Central Southern Africa
WGMSE:	Working Group for Mathematics and Science Education

ABSTRACT

The purpose of the study was to identify the effectiveness of (SMASE) Strengthening Mathematics and Science Education towards enhancement of mathematics performance in public primary schools in Embakasi District, Nairobi County. The study was guided by the following objectives; i) To identify the effects of public primary school managers on the management of SMASE programme as they facilitate its implementation at school and cluster level. ii) Identify challenges encountered by mathematics teachers while using the SMASE approaches. iii) Find out the effects of ASEI – PDSI concept on the participation of learners in mathematics lessons. iv) To review the effects of SMASE project on learners' performance in mathematics in KCPE since 2009. The study was based on Bruners' Constructivist theory that states that learning is an active process where learners create meaning from different experiences. Learners construct new ideas based on their past and current experiences, they build on what they already know so as to discover key principles by themselves, the teacher simply facilitates/guides. The target population was 20 head teachers, 60 mathematics teachers and 3,000 standard eight pupils making a total population of 3080 in the entire Embakasi District. The study sampled 5 out of 20 public primary schools using convenient sampling technique. From the sampled, an equal number of 60 standard 8 pupils from each school were selected giving a total of 300 school pupils and 20 standard eight mathematics teachers including five head teachers totaling to 325 respondents. For content validity, the researcher piloted the instruments in two (2) randomly selected primary schools to ascertain the degree to which the instruments fully measured the construct of interest in the questionnaires. Reliability of the instruments was tested using the split half reliability index and cronbachs' co-efficient alpha to check on internal consistency of the questionnaires before the actual data collection commenced. The researcher asked for permission to do the research from the MOEST through the DEO Embakasi District after presenting a research permit from the NCSTI and an introductory letter from Kenyatta University. Confidentiality, anonymity and informants consent was strictly adhered to. Data was collected using structured interviewing technique, questionnaires as well as through structured observation checklists. The collected data was organized and coded then entered into the SPSS computer programme. The techniques that were used to analyze the data were Pearson Product Moment correlation co efficient (r) and qualitative data analysis using thematic approaches. Data was presented using frequencies, mean, percentages, pie charts, tables and bar graphs as well as explanations. Generalizations were then made. The study revealed that the SMASE programme has aided the improvement of mathematics performance in public primary schools even though it has been faced with several challenges such as lack of enough text books for learners. The researcher made several recommendations such as the need for curriculum developers, to integrate SMASE programme seriously in primary schools and also ensuring that SMASE acquired knowledge is put into practice by mathematics teachers who have attended SMASE INSET trainings.

CHAPTER ONE

INTRODUCTION

1.1 Background to the Study

In an effort to realize quality education for primary level mathematics, Ministry of Education, Science and Technology (MOEST) recognizes the importance of in-service training for teachers. It is for this reason that MOEST changed the former Centre for Research and Technology, Ngong, Karen to Centre for Mathematics and Science Technology Education in Africa (CEMASTEА) in 2004. It did this so as to institutionalize and regularize in-service training (INSET) for teachers of Mathematics and Science at primary and secondary level. Prior to that, the Strengthening Mathematics and Science in Secondary Education (SMASSE) was housed as an INSET at the then Kenya Science Teachers College (KSTC) which is today Nairobi University – Kenya Science Campus (Njoroge, 2014). CEMASTEА has enabled the establishment of INSET activities at national level with the assistance of Japanese Government through Japanese International Corporation Agency (JICA).

INSET centers at regional levels or district levels have been established all over Kenya, the INSETS at first targeted mathematics and science subject teachers but have now been broadened to include head teachers, Teachers Advisory Centres, Quality Assurance and Standards Officers (QASO's), District Education Officers (DEO's), Tutors at Diploma Colleges, Primary Teacher Education tutors as well as Technical, Industrial, Vocational and Entrepreneurship Training (TIVET).

CEMASTEА is also now offering INSET courses for educators from other African states as it is the only one of its kind in the region. CEMASTEА is being gradually converted into Institute for Capacity Development of Teachers in Africa (ICADETA) a state corporation to in-service all teachers in all subjects as opposed to mathematics and science only (Njoroge, 2014).

According to Kenya Educational Sector Support Programme (KESSP) as per ROK (2005), evidence of in-service relevance in education and training may be deduced from policy documents like the National Development Policy, Medium Term Expenditure Framework (MTEF) and Sessional Paper No.1 of 2005 as well as Sessional Paper No. 14 and TSC Act 2012. This last one made it mandatory for any registered teacher in Kenya to undertake Continuous Career Progression and Continuous Professional Development. Once again, this puts CEMASTEА at a vantage point to work with Teachers Service Commission on continuous professional development as well as on training teachers under the laptop project notes Kaimenyi (2014).

The SMASE under CEMASTEА is an INSET that focuses on upgrading capacity of young Kenyans in mathematics and science. The objective of the SMASE INSET is to strengthen mathematics and science education at primary and secondary level through INSET's for teachers of mathematics and science. The overall aim of SMASE programme/INSET therefore, is to improve the teaching and learning quality of classroom teachers and also improve the management and leadership skills of educational managers.

The SMASE programme is based at CEMASTEAs headquarters in Ngong, Karen. Teacher training colleges such as Thogoto and Muranga Teachers Training Colleges among others have been selected as INSET regional training centres. The review and revision of SMASE programme is done by MOEST and JICA. Implementation programme of SMASE is normally the responsibility of CEMASTEAs and District Planning Committees (DPC) chaired by DEO(s).

Ideally, SMASSE was officially launched on 27th February 1998 after the signing of agreements between Government of Kenya and Government of Japan with the first offices being at the then Kenya Science Teachers College which is today, University of Nairobi – Kenya Science Campus. As per JICA (2009) this signing was followed by baseline survey studies in Kenyan schools in 9 pilot districts namely; Gucha, Butere, Kakamega, Kisii, Lugari, Makeni, Maragua, Muranga and Kajiado. In 2009, SMASE INSET phase three was launched in primary schools.

1.1.1 SMASE Baseline Survey Finding

The baseline survey study of 2009 showed that mathematics and science education were encountering challenges. Many teachers showed poor content mastery or lacked practical skills and innovativeness. They also used inadequate or poor teaching methods. The teachers were using theoretical, teacher centred approaches in teaching or lecture methods, instead of the hands-on approach. The teacher, the baseline survey revealed, had little or no lesson plans. Teachers missed lessons and there was acute lateness to schools and to classes in addition to lack of giving exercises to the learners by teachers.

The teacher morale, according to the baseline survey of 2009, was low probably due to low remuneration. There was poor working conditions and also unsupportive school managers. JICA (2009) also deduced that learners/pupils had a negative attitude towards school in general and to mathematics and science in particular. This was manifested in poor academic performance, untidy work, missed lessons, absenteeism and indiscipline coupled with low morale both in teachers and learners. School managers were not very supportive of mathematics and science. Science kits were rare as were laboratories in secondary schools. Experiments done were largely large-scale recipe type as shown in text books.

The results of all these was negative attitude of pupils towards mathematics. Many pupils were less interested in mathematics as opposed to other subjects. At the Kenya Certificate of Primary Education (KCPE) level, performance of mathematics has been low. The Kenya government had to intervene hence the inception of SMASSE and later SMASE.

SMASSE focuses on classroom activities such as teaching and learning. SMASSE pilot project run between 1998 – 2003. It was extended to six more districts due to its successful implementation from 2003 – 2008. In 2009, the implementation of SMASSE was expanded to primary schools as Strengthening Mathematics and Science Education (SMASE) and not as Strengthening Mathematics and Science in Secondary Education (SMASSE).CEMASTE (2012) notes that in primary school mathematics, the baseline survey of 2009 identified several topics that teachers and learners found to be challenging and which needed urgent attention in SMASE INSET , these were : measurement, scale drawing, ratios, proportions, money and postal charges, geometry and decimals among others.

1.1.2 Strengthening of Mathematics and Science Education (SMASE) Programme

SMASSE (2004) stated that SMASE's project main activity was INSET for serving mathematics and science teachers so as to reduce/eradicate contributory factors of poor performance in these two subjects as outlined by the Baseline Survey of 2009 undertaken by JICA. The SMASE programme chose to address only those challenges that were within its ability of solving such as;

Teachers and Pupils/learners attitude towards mathematics and science, teaching methods used by teachers-pedagogical skills, content taught and its understandability to learners and mobilization and management of resources.

Going by CEMASTE (2011), in SMASE INSETS, the key concept or approach used is the Activity, Student, Experiment, and Improvisation (ASEI). This ASEI concept is implemented using the Plan, Do, See and Improve (PDSI) approach.

SMASE is a joint vehicle between the Kenya Government and JICA, where JICA provides all materials for INSET facilitation like stationeries, laptops etc while the Kenya government provides HR (Human Resource) and remuneration of participants (SMASE 2009).

1.2 Statement of the Problem

Despite the rationale for SMASE programme on the enhancement of mathematics, learners' performance for a long time has continued to be low. The problem has been that factors influencing learners' performance in mathematics have not been well conceptualized not only at national level but also in Embakasi District, Nairobi County. Among the challenges encountered is the quality of teaching which needs to

be strengthened and made more effective. Instructions by teachers to learners hardly dwell on design, use of locally available resources or on students' real life situations to improve on teaching materials that enhance learner's participatory skills. Mathematics teachers in classes 6-7 and 8 in primary schools in Kenya and specifically Embakasi District have been trained on the application of SMASE approaches such as ASEI-PDSI among others however, it has been found out that that what teachers learn during SMASE INSETs is sometimes not used back in the schools. It is only a few lessons that could be classified as tending towards learner centred approaches. A Baseline Survey conducted in 2011 revealed that over 80% of the lesson time was dedicated to giving verbal instructions and theoretical teaching in cases that needed practical or hands- on activities.

1.3 Purpose of the Study

The purpose of this study was to identify the effects of the implementation of SMASE project on the performance of mathematics at KCPE level in public primary schools in Embakasi District, Nairobi County. This is due to the fact that capacity building for teachers through SMASE in- service programme is integral to enhanced mathematics performance in an ever changing society.

1.4 Objectives of the Study

The study focused on the following objectives; to,

- i) Find out the effects of SMASE approaches on pupils participation in mathematics lessons.
- ii) Identify the effects of school managers on the management of SMASE project at the school and cluster level.

- iii) Identify challenges encountered by mathematics teachers while applying SMASE approaches in classroom practices.
- iv) Review the effects of SMASE project on the performance in mathematics in KCPE since 2009.

1.5 Research Questions

- i. What are the effects of SMASE approaches on pupils' participation in mathematics lessons in public primary schools in Embakasi District?
- ii. What are the effects of school managers on the management of SMASE project at school and cluster level?
- iii. Which challenges are encountered by public primary schools mathematic teachers while using SMASE approaches?
- iv. How has the performance of mathematics been in Embakasi District public primary schools since inception of SMASE in 2009?

1.6 Assumptions of the Study

According to Orodho (2009), assumption in any study is the unique facts presumed to be true but have not been verified. In this study, several assumptions will be made such as: Respondents are familiar with SMASE project so as to give reliable data, that SMASE approaches were applied in mathematics lessons, that mathematics teachers have undergone SMASE INSET cycles and finally that respondents will be honest in responding to items of the questionnaires and interviews.

1.7 Limitations of the Study

Limitation of the study as Orodho (2009) observes, constitute to the aspect of the study that the researcher knows may affect the results generalization to the wider area negatively. The vastness of the district made it harder to cover all schools. Secondly, finances were outstretched hence; it was challenging to cover the entire district. Finally, time limits could not allow the coverage of the whole district.

1.8 Delimitations of the Study

The study was limited to primary schools only it did not cover secondary schools, only public primary schools and not private schools were factored. Finally, the study confined itself to mathematics only, other subjects were not included.

1.9 Significance of the Study

This study is bound to inform policy makers at MOEST, CEMASTEAM and TSC among others on the effects of SMASE project on mathematics performance since its' inception in 2009. It advises that other SMASE like projects to be initiated for the other subjects based on the success of mathematics and science as result of SMASE approaches. These findings also form a basis for further research on effectiveness of SMASE approaches on mathematics performance in different districts of the country.

1.10 Theoretical Framework

This study adopted Bruner's (1966) Constructivist theory of learning which states that learning is an active process where learners create meaning from different experiences. The facets of the process include, selection and transformation of information, decision making, generating hypothesis and making meaning from

information and experiences while relying on cognitive structures to do so hence, providing meaning and organization to experiences and thereby allowing the individual to go beyond the information given so as to find out more on his or her own.

To Bruner, learners construct new ideas based on their past and current experiences/knowledge. Instruction can be made more effective by giving carefully sequenced materials to allow learners to build on what they already know so as to discover key principles by themselves. The teacher simply facilitates while allowing learners to experiment or ask questions. The teacher may also help the learners to make conclusions by giving them problem solving and inquiry based activities.

Constructional learning gives learners ownership of what they have learnt. It stimulates and engages learner's constructivist posits that knowledge is constructed when individuals engage in talk and activity about a problem. Learning is seen as a process by which individuals are introduced to a culture by some more skilled member such as a teacher.

Constructivist theory of learning has many variations like active learning where upon SMASE is based. Constructivists promote a learners' free explanation within a given framework/structure. The teacher acts as the facilitator encouraging learners to discover concepts on their own and then construct knowledge by working to solve realistic problems. Constructivist learning has wide ranging effects on teaching methods hence; it is an important component of SMASE programme and the SMASES' approaches which are hands-on, hearts-on, minds-on concepts of teaching and learning. Kahare (2011).

1.11 Conceptual Framework

The following conceptual framework (Figure 1.1) shows the relationship between the effects of SMASES approaches and the performance of mathematics

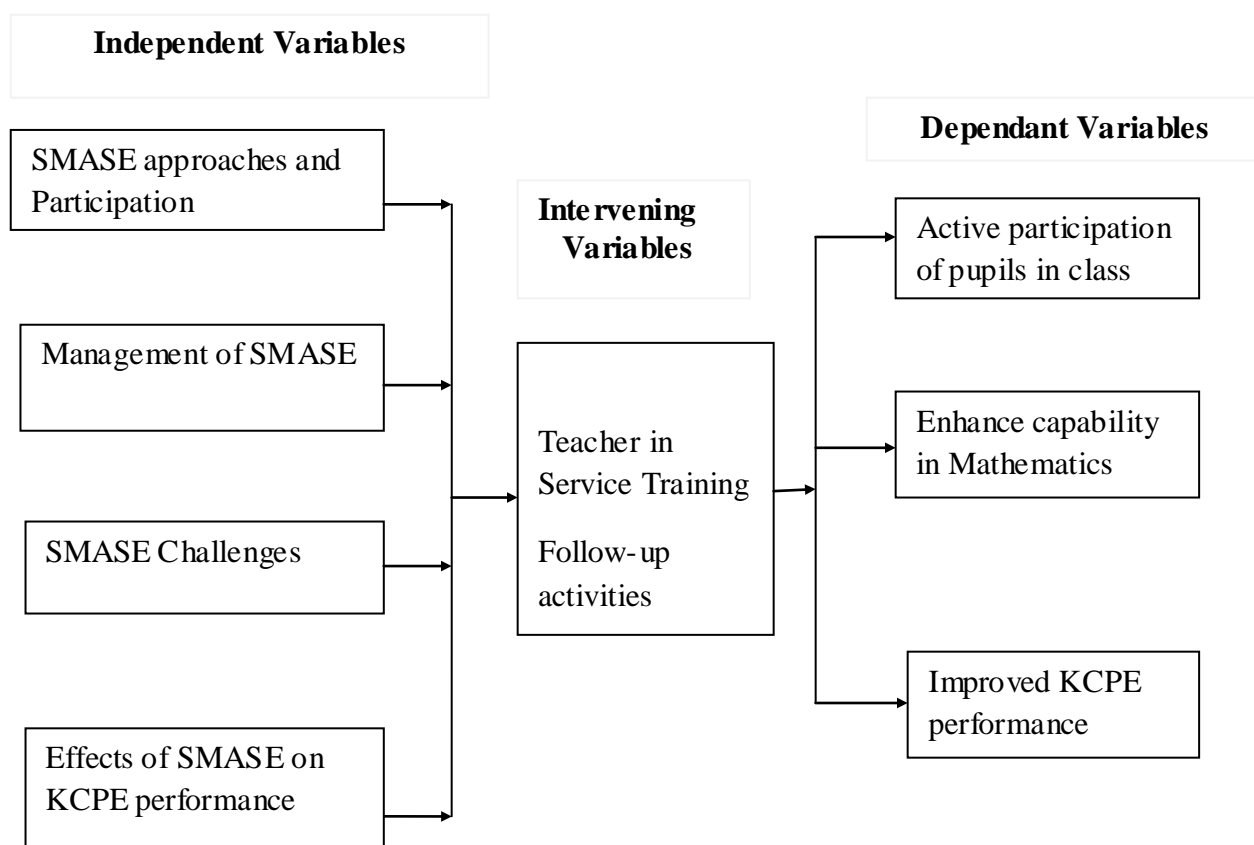


Figure 1.1: Conceptual framework on effects of SMASE project on mathematics performance

Several variables have been looked at above; the first independent variable is SMASE approaches and pupil participation which are geared towards eliminating factors that contribute to poor performance of mathematics. These factors can be overcome by SMASE INSET approaches such as changing the attitude of teachers and pupils towards being positive, improving pedagogy by making the lessons learner-centred, making the content being taught to be easily understood by learners through effective communication skills and finally mobilizing and managing resources effectively.

The other independent variables are management of SMASE, effects of SMASE on KCPE performance and finally, SMASE challenges. The intervening variables are teacher inservice training and follow-up activities. The dependent variables are active participation of learners as advanced by Bruners Constructivist Theory where learners using cognitive structures discover concepts better on their own and construct knowledge by working to solve realistic problems. The other dependent variable is enhanced capability in mathematics where learners are able to apply the knowledge taught to their daily lives and finally, improved KCPE performance.

In conclusion, Bruners' Constructivist theory promotes learners free explanation within a given framework. The teacher acts as a mere facilitator encouraging learners to discover concepts on their own. Constructivists' theory involves active discovery learning where upon SMASEs' theme is based. Constructivist learning has expansive effects on learning methods hence, an important ingredient of SMASE project and the SMASEs' teaching approaches that are learner-centered.

1.12 Operational Definitions of Central Term

Activity:	A state of being operational
Effects:	Refers to results or outcomes of SMASE INSET in teaching and learning Mathematics in primary schools.
Experiment:	It is a scientific test done to study what will happen hence gain knowledge.
INSET:	Refers to training offered to teacher while still in the job.
Improve:	Refers to how the teacher uses what he or she has gathered in the step of “see “to improve learning.
Improvisation:	It is use of alternative rather than convectional materials for learning; it is creating something in the absence of ideal tool.
Pedagogy:	Refers to theory of methods and principles of teaching.
Performance:	learner’s achievement in the mathematics examinations.
Plan:	Refers to a set of intended actions that are related to achieve a goal.
SMASE:	Started through joint venture between MOEST and JICA for the purpose of strengthening mathematics and science education in primary schools in Kenya
SMASE cycle:	A period of two weeks of continuous training made up of seventy hours per cycle.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

This chapter focuses on the importance of continuous teacher development, Teacher development in Kenya, the concept of training mathematics and science teachers in Japan, SMASE project in Africa and Kenya in particular, Effective teaching and a review of studies carried on SMASE as well as a summary of reviewed literature.

2.2 Importance of Continuous Teacher Development

The American Federation of Teachers (2006) stipulates that in a school organization, the most important asset is the teaching force. Therefore, the most important investment a school system can make is to ensure there is continuous learning of teachers.

Townshed and Bates (2007) say that in-service programmes are expected to help respective teachers in forming positive images of them as they acquire knowledge, skills and values that are appropriate for their work in teaching and in providing experiences in particular contexts through field experiences.

2.3 Mathematics and Science Education and Teacher Development in Japan

Since the Hiroshima and Nagasaki bombing, Munyao (2013) notes that Japan has transformed itself from a lowly country to one of the world's greatest economies through its emphasis on the utilization value of schooling and training of human resource. Natural sciences were introduced in Japanese education for the first time

after promulgation of school ordinance in 1872. Several revisions were made in the course contents and grade levels where science was taught. Some objectives of today's school science in Japan include; enhanced interest in nature through observation and experimenting, development of students abilities and attitude towards scientific enquiry, emphasizing the relationship between science and everyday life, emphasizing the mastery of scientific concepts and developing problem solving skills in learners.

Munyao (2013) notes that in-servicing of teachers in Japan is a continuous process. Teachers attend in- service courses at purpose built centers which are supported by the government. The teachers who attend are not given monetary incentives and attendance to in-service is voluntary however, it is a must for newly employed teachers who are then supposed to attend INSETs after every five years in their early initial services before ten years.

In Japan, notes Miheso (1999), there is plenty of teacher-pupil interaction, most teachers use inquiry approach in their teaching. Pupils plan and perform practical hands-on activities on the basis of their own experience. The teacher's role is that of a guide or a facilitator. Educational field trips are many and students experience science and mathematics outside their classrooms. Each science teacher is equipped with knowledge on how to use improvisation in the absence of conventional materials. This approach to teaching science and mathematics has led to industrialization of Japan. Strong scientific foundations are laid at school levels leading to generation of innovative concepts that are used in day to day life in Japan. The success of learner's-centered approach in Japan is what gave rise to the

SMASSE concept that has been adopted in Africa and other world nations such as Philippines to name a few.

2.4 SMASE (Strengthening Mathematics and Science Education) in Africa

According to CEMASTE (2008), the acronym SMASSE has been revised to SMASE with “single S” as opposed to “double S”. This has been done so as to reflect the current status because CEMASTE has slowly expanded beyond secondary schools.

SMASE – WECSA Association (Strengthening Mathematics and Science Education in Western, Eastern, Central and Southern Africa) was born out of a meeting held in Nairobi in 2001 in recognition of challenges facing mathematics and science teaching and learning in Africa. Workshops, exchange visits and INSETS have been used by SMASE-WECSA secretariat to sensitize members. Countries in this web are; Kenya, Malawi, Mozambique, Senegal, South Africa, Uganda, Zambia, Tanzania, Zimbabwe, Nigeria among others. SMASE-WECSA through JICA sponsorship sends personnel from the secretariat to member states to assist in capacity development for project management in planning, implementation and evaluation of INSETS.

SMASE-WECSA has partnered with ADEA (Association for Development of Education in Africa) to form a working group known as WGMSE (Working Group for Mathematics and Science Education) in sub-Saharan Africa. The main aim being to contribute through capacity development, networking advocacy, analytical work and dissemination of information for the improvement of mathematics and science education programmes in Africa.

2.5 Teacher Development in Kenya

The pre-independence Binns' Report (1953) emphasized the role of the teacher in effecting teaching methods with a view to improving education quality. The Binns' commission emphasized on learner-centred approach in learning than the teacher-centred style. The Head teachers Association of Kenya has noted that the problem of inadequate training and development of the public school teachers under TSC has always been there arising from pre-service to in-service training programmes.

ROK (2005) recommended that secondary school training programmes be restructured to require that teacher trainees attained basic qualifications in their respective subject areas. In so doing, the under graduate training in pedagogy was extended to four years. The sessional paper also recommended the in-servicing of teachers to improve the teaching of mathematics and science/sciences. It recommended that CEMASTEPA be upgraded into a fully fledged institution for in-service training for mathematics, science and technical teachers which is today the case plus its continued elevation into a state corporation to include in-servicing of all subjects in Kenya and also to cover the whole of Africa as a centre for in-servicing under the name of ICADETA; Institute for Capacity Development of Teachers in Africa Njoroge (2014).

Several organizations are involved in in-servicing training of teachers in Kenya. They include KICD (Kenya Institute of Curriculum Development) and KEMI (Kenya Education Management Institute). These offer formal training through courses and seminars.

Ojwang (2004), says that mathematics teaching has its own challenges; Teachers are inadequate, they are overwhelmed by workload and others teach more than one subject. They therefore cover the syllabus particularly without imparting necessary skills. Learners' interest in mathematics is dimmed right from primary school. It is with this understanding that this study was proposed so as to establish the effect of SMASE INSET implementation in the performance of mathematics.

For long, teachers have not relied on learner centered methods of teaching such as peer teaching. According to SMASSE 2004, mathematics which is a science and other sciences should be learner-centered hence, there is need for teachers to change their approach towards teaching and learning.

2.6 Effective Teaching

Flanders (1970), observes that efficiency of teaching behavior depends on quality of classroom verbal interactions, because learners in learner-centered classes participate more and have greater responsibilities for determination of content, purpose and procedure. The teacher should therefore encourage freer learner participation.

In SMASSE (2004) the ASEI ideology or approach considers the quality of classroom activities as important to achieving effective teaching and learning. The activities can be hands-on (psychomotor), minds-on (reasoning), hearts-on (affective) or mouths-on (communicative skills). These activities should increase the participation of the learner since they should be learner-centered. These activities should be well selected, directed and sequenced to give meaningful learning experience to the learner.

According to SMASSE, components of effective classroom communication skills include listening to understand, explaining logically, suggesting by listing possible solutions and ideas and occasionally giving experiences of daily life as well as demonstrating procedures step by step, reporting by recording observed phenomena, predicting accordingly and giving reports in form of data and ultimately discussing so as to come up with conclusions or inferences.

In SMASE's ASEI-PDSI approach, the teacher's role is solely that of a facilitator or guide. There must be as many activities during any lesson as possible. According to SMASSE (2006), ASEI-PDSI concept encourages a lot of improvisation from the immediate environment. Improvisation involves use of locally available materials within the financial capabilities of most learners/schools in the absence of conventional materials. The main reason for this as earlier stated was to arouse interest in learners and to demystify mathematics.

More time should therefore be spent on/in practical work to give learners the joy of doing mathematics. The importance of practical work is vast such as getting learners to be interested in the lesson, understanding concepts such as; I hear and I forget, I see and I remember, I do and I understand – a Confucius Chinese saying. Practicals help in verifying learner's hypothesis, solving complex problems, exploring concepts for application among others.

2.7 Learner-Centered Teaching/Learning

The teacher is thought to have very little direct control over what is taught because it is already prescribed in the curriculum which also suggests the approaches and methods to be used for teaching. However, it may be argued that the selection of the

methods of presentation to be used in class is solely the task of the teacher. Atsiaya (2007) notes that good teaching is largely a matter of personal attitude that requires thorough planning and selection of approaches and methods that will result in effective learning. Kahare (2011) indicates that the baseline report of 1999 established that inappropriate teaching methods and approaches were some of the major factors causing dismal performance in mathematics and science. Teachers did not seem to take into consideration what was more important in teaching ; the process or the content.

According to the report, they also did not take into account for whom they were carrying out the teaching process, they did not know that the learner was the most important person in the class so, most of them ended up using inappropriate teaching approaches and methods unknowingly. The teaching learning/learning process therefore became a teacher-centered affair, being mainly knowledge based “talk and chalk” thing with little or no active learner involvement.

According to SMASSE (2003), learners were made to accumulate a lot of unrelated facts, skills, formulas, laws and procedures without any attempt to relate them to their previous knowledge and experiences ie, the known to unknown approach. Activities and assignments were found to be few, apart and inadequate there by denying learners the opportunity to engage in mathematics. Students were not given the opportunity to reinforce and apply the concepts learnt during the lesson through practice and consolidation. Learners therefore became perceive recipients of knowledge with little or no participation. There was not enough effort by teachers to raise learner’s interest or curiosity levels in the learning of mathematics. Experiments were only done using conventional apparatus or were ignored all

together. Where conventional apparatus were unavailable, there was no improvisation.

Researchers have agreed to shift learning to inquiry based strategies so that learners can take on a more active role in their learning. Learner-centered teaching is an approach that focuses on the learners and all activities of the lesson are planned and executed so as to involve the learner fully. Akinibolola (2010) observes that learner-centered teaching gives learners an opportunity to think independently so as to obtain knowledge. This method helps the learner to discover for himself how knowledge becomes known and helps the learner to see for themselves how to formulate knowledge through collecting, organizing and manipulating data thus, knowledge is constructed by the learner. Learner-centered learning according to SMASSE (2005) promotes critical thinking skills such as analysis, synthesis and evaluation. The learning is made active, engaging and one that arouses curiosity in learning.

Realization of learner-centered teaching/learning requires that teachers are equipped with skills that will help them to select suitable activities that will engage learners meaningfully. It is with this in mind that SMASSE project championed the **ASEI-PDSI** movement. **ASEI** movement calls for the teaching/learning that is: **Activity** focused-that which involves activities aimed at helping learners to arrive at the learning outcome-that which involve activities aimed at helping learners arrive at the learning outcome by themselves-**Student-centered** where in the learning process the main focus is on the learner rather than the teacher. Activities should involve learner participation while the teacher becomes the facilitator: **Experiment oriented**-the experiments enhance learning by promoting curiosity and interest among

learners. Finally, **I**mprovisation-the use of locally available materials to improvise if there is a shortage of conventional resources. Improvisation may also be the use of local materials in the environment to help the learners to relate concepts learnt to the day to day aspects of life in addition to creating interest, curiosity and respect for the environment.

Effective practice of ASEI calls for good **P**lanning, **D**oing, **S**eeing and **I**mprovement hence the acronym **PDSI**. Planning tools such as lesson plans and schemes of work were according to SMASE (2004) not being made by teachers and when they were, it was only for school inspectors and QASOs rather than the teacher. Use of lesson plans was only done by a few teachers. To assist in planning, SMASE advocates for the ASEI-PDSI lesson plan where lesson notes are mixed with the plan of activities. During planning, teachers are supposed to take time to reflect on the most appropriate activities that will enhance effective learning. **P**lanning involves organization of activities in a systematic ways. **D**oing the planned activities is shared between the teacher and the learners where the teacher is simply the facilitator. The teacher arranges learners in groups to ensure instructiveness through group discussions that allow learners to recognize concepts from misconceptions. **S**eeing encourages the teacher to include feedback in the lesson. Lesson evaluation is seen as the key to **I**mprove lesson delivery. Evaluation according to SMASE (2004) can be done through asking learner's oral questions, self evaluation, quizzes, tests, etc. Errors are seen as constructive part of the learning process than as embarrassment. This study looked at teachers practice of learner-centered teaching and also looked at levels to which learners were involved during various stages of mathematic lessons.

2.8 Mastery of Content and Assessment/Evaluation

The baseline survey studies established that most young teachers seemed to have a problem in determining the level of content to be given to learners. On the other hand, experienced teachers looked unprepared and repeated the same mistakes yearly. Such insecurity with content could have bad effects on the learning of mathematics. Richard (2007) observes that effective pupil learning of science and mathematics depends on the teacher having adequate knowledge of it. He advises that teachers need sustained professional development in training and also while in service. Teachers with more content knowledge are more likely to teach in ways that help learners to construct knowledge. Such teachers pose more questions and are more likely to have learners consider alternative explanations or propose more investigations. Continuous study through in-service program can improve teacher's mastery of the subject matter.

During SMASE INSET cycles, teachers have had opportunities to discuss topics which they together with their learners encountered difficulties in such as; area of shapes, geometry, ratios, decimals, percentages, volume, surface area, fractions, graphs, scale drawings, operations and so on. During the SMASE INSET cycles, the teachers exchange ideas and also come up with innovative activities that they could engage the learners in. SMASE also advocates for team teaching where teachers continuously consult and encourage each other to try out problems and practical activities before assigning them to learners. This study sort to establish if teachers were now more confident in their teaching after attending SMASE INSETS.

Assessments or evaluations in form of assignments, tests, exams and such like are according to SMASE (2005) a pointer as to if concepts learnt have been understood. They provide learners with focus because they highlight their learning gaps and areas they can build on. However, although schools have policies on tests, exams, quizzes and home works, this is usually left to the individual teachers. This therefore, may at times lead to assignments being given rarely or not at all. SMASE program puts a lot of emphasis on the need to streamline evaluation/assessment so that teachers can get desired feedback early enough and take remedial action. This study was interested in the frequency of assessments/evaluations in sampled schools.

2.9 Studies done on SMASE Project

Nui and Nyachomba (2006), in the report at the 4th workshop on effective operation and management of SMASSE project in 2004 noted that more reforms are expected in reference to SMASSE INSET, such that learners were to become active in the learning process as the teachers guided the learning process. It was also recommended that the attitude of teachers and learners towards learning/teaching of mathematics be positive. In addition, teachers were to practice more effective teaching and learning methodologies and also possess content masterly to boost confidence in teacher/learner. This study attempted to establish whether this was the case with mathematics teachers in public primary schools in Embakasi District, Nairobi County.

In ADEA report of 2007, it was felt that some areas of SMASE INSET needed to be strengthened such as teacher capacity to learn from each other, teachers' willingness to attend SMASE INSET and how to dispose or express what they learn from SMASE inset cycles.

A study by Kagenyi (2007) in Kiamwangi Division, Muranga showed that 63% of teachers in the division did not like attending the SMASE INSET training. As such, teachers attitude to SMASE was negative, 43% of teachers, 40% of principals/headteachers and 100% of trainers agreed that SMASE had changed their attitude towards mathematics. The study showed that most teachers were not motivated to attend the SMASE INSETS.

Oirere (2008) found out that in Kenyena Division, Gusii, 70% of teachers attended the SMASE INSET voluntarily and so had a positive attitude towards SMASE INSET, in the desire to improve methodology, certification and promotion. These teachers were implementing the ASEI-PDSI lesson planning techniques although without physical lesson plans. Kamunyu (2011) notes that it would seem that teachers in diverse areas of Kenya have varied attitudes towards SMASE INSETS. It is for this reason that this study tried to find out the effects and perceptions held by mathematics teachers in public primary schools in Embakasi District, Nairobi County.

2.10 Summary of Literature Review

The literature above concerns the various effects that teacher in-servicing or development programmes have on the performance of mathematics, SMASE project being one such teacher in-service programme. This chapter starts by reviewing the importance of continuous teacher development, mathematics and science education as well as teacher education in Japan, SMASE in Africa, teacher development in Kenya and effective learning. This chapter also looks at learner-centred teaching/learning, mastery of content, assessments/evaluations and includes other studies done on SMASE. None of the above literature focuses on the effects of SMASE approaches on the performance of mathematics in Embakasi District of Nairobi County. The researcher intends to fill this gap.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Introduction

This chapter will describe the Research Design, The Location of The Study, The Target Population, Sampling Strategies, Research Instruments, Data Collection and Data Analysis.

3.2 Research Design

The study employed a descriptive survey design to investigate the effects of SMASE INSET program in the teaching and learning of mathematics in public primary schools in Embakasi District, Nairobi County. Tromp and Kombo(2006) observes that the major purpose of descriptive survey research is to describe the state of affairs as they exist. Descriptive survey can be used when collecting information about people's attitudes, opinions, habits or any variety of educational or social issues. Mugenda and Mugenda (1999) observe that descriptive survey research can be used to collect data to answer questions concerning the current status of the subject of the study.

According to Orodho (2009) survey design allows the researcher to gather information, summarize, present and interpret it for the purpose of clarification.

3.3 Locale of the Study

The study was carried out in Embakasi District, Nairobi County this is because first and foremost, mathematics performance in KCPE has been low. Secondly, mathematics teachers from class 6-8 have attended SMASE INSET cycles and it

was important to find out if they are implementing SMASE INSET approaches. Thirdly, it was to assess how teachers perceive improvisation of teaching and learning resources as recommended by SMASE INSET approaches. Finally, no other study of this nature has been carried out in the district on how SMASE programme has affected mathematics performance in Embakasi District.

3.4 Target Population

The target population for this study was 30,000 learners in general, about 3000 standard 8 pupils, 60 standard eight mathematic teachers and 20 head teachers.

3.5 Sample and Sampling Procedure

The researcher employed convenient sampling technique to select public primary schools; non-probability technique was used to select 5 out of 20 schools which constituted about 25% of the population. Orodho (2009) defines a sample as a representative part of the whole population which will be studied and generalizations of the whole population made. Sekeran (2008), states that simple sampling is the best when a generalization of the findings to the whole population is the main objective of the study.

The sample was drawn from a population of 3000 standard eight learners, 60 standard eight mathematics teachers and 20 headteachers as shown below,

3.5.1 Sampling Table

Table 3.1: Sampling Table

Category	Population (N)	Sample	Percentage (%)
Headteachers	20	5	25
Mathematics teachers	60	20	25
Learners (STD 8)	3000	300	10
TOTAL	3080	325	

The sampling matrix was to yield 300 standard 8 learners, 20 standard eight mathematics teachers and 5 head teachers from sampled public primary schools. Gorard(2001) asserts that a sampling percentage/fraction of between 10-20% of the total population in descriptive research is acceptable. Therefore, 5 schools were selected for the study from a total of 20 schools representing 25% of the schools and headteachers. Standard 8 mathematics teachers selected were 33% of all class 8 teachers in Embakasi while the pupils selected represented 10% of all std. 8 pupils in Embakasi District.

3.6 Research Instruments

The data for this study was generated using questionnaires, interview schedules and observations guides. The researcher used interview schedules on administrators and questionnaires on mathematics teachers and learners. He used observational guides to collect information on the effects of SMASE INSETs towards enhancing the performance of mathematics from headteachers, mathematic teachers and learners. By involving many respondents, diverse answers to the same questions were

gathered. The independent variables were SMASE approaches to learning and teaching such as ASEI-PDSI concept and SMASE objectives.

3.6.1 Questionnaires

Sekeran (2006) defines a questionnaire as a pre-formulated set of questions to which respondents record their answers within closely defined alternatives. The teacher and the learner's questionnaires had both closed ended and open ended questions. A questionnaire according to Tromp and Kombo (2006) helps the researcher in getting information from a large sample in a diverse region and also upholds confidentiality.

3.6.2 Interview Schedule

An interview schedule according to Sekeran (2006) is more flexible and allows rapport and conducive atmosphere where truthful information can be got. Interview schedules for administrators were developed to seek their views on SMASE projects' effects on teaching and learning in their respective schools and also to establish the level of support given to the mathematic teachers.

3.6.3 Observation Guide

Direct observation provides information about actual behavior observes Sekeran (2006). A structured lesson observation guide was used to investigate teachers' use of SMASE approaches such as ASEI-PDSI concept among others in mathematics.

3.7 Piloting of Research Instruments

A pilot study was conducted independently before the main study in 2 public primary schools in Embakasi District. Orodho (2012) describes piloting as pre-testing the questionnaire in the field to a selected sample that is similar to the actual

sample to be used in actual study. Each instrument was piloted separately in the two randomly selected schools which were similar to the sample for the main study but were not included in the main study. Respondents consisted of 2 head teachers 4 mathematic teachers and 10 pupils, this was used to evaluate and improve the questionnaires appropriately.

3.7.1 Validity

Amin (2005) states that a research instrument is said to be valid if it actually measures what it is supposed to measure. Validity is the degree by which the sample of the test measures what it is designed to measure.

Orodho (2009) states that validity is the accuracy and meaningfulness of inference which is based on research results. Validity is thus the degree to which results obtained from analysis of data actually represent the phenomenon under investigation. It is therefore the degree to which an empirical measure of a concept accurately represents that concept.

The researcher ensured that the instruments had content validity which was determined through pre-testing/piloting. The content validity was to establish whether the instruments' content measured what they were supposed to measure. It was also to establish the accuracy of the instruments in obtaining anticipated data which met the research objectives of the study. The researcher went through the items in the instruments to ensure that they were clear and that they elicited the intended information from the respondents. The instruments were also scrutinized by research experts; the supervisors, to determine if they addressed all possible areas that they should. The supervisors reviewed the instruments for readability, clarity,

and comprehensiveness and together with the researcher came to some level of agreement as to items that were included in the final instruments.

3.7.2 Reliability

Orodho (2012) defines reliability as the extent to which a questionnaire, test, observation or any other test measurement produces the same results on repeated trials. To establish reliability of the instruments the researcher used the internal consistency index or homogeneity. This tested the extent to which items on the instruments were measuring the same thing. Orodho (2009) notes that if the individual item correlated highly with each other, then confidence about the reliability of the whole scale is created.

The researcher measured internal consistency using the split half reliability index. This involved dividing the test into two parts randomly or through even and odd numbering style then administering the two forms to the same group of individuals thereafter correlating the responses. If, above 80% of respondents give the same answers, the test was be deemed to be reliable. The researcher also used Cronbachs' coefficient alpha to test reliability of scale developed items that required several response options or those that had different possible answers each with a different weight on a scale.

The advantage of using the internal consistency index is that it is estimated after only one test administration. It therefore avoids problems associated with testing of instruments over multiple periods of time as noted by Orodho (2009). A correlation co-efficient of 0.8 and above would nonetheless prove reliable and override the disadvantages.

The disadvantage of the split half method according to Orodho (2009) is that, since half of the test scores are being correlated with the other half, the coefficient so computed does not reflect the reliability of the whole instrument. A correction factor is therefore applied to the computed correlation coefficient. Another disadvantage is the many ways the items that go into the test or measurement can be grouped into halves. Each splitting technique yields a different degree of correspondents between the two halves so, different reliability coefficients or estimates are got for the same test or instrument observes Orodho (2009).

3.9 Data Collection

The researcher sort permission and authority from the MOEST, he presented to the Director of County Education, a research permit from National Council for Science, Technology and Innovation (NACOSTI) authorizing him to conduct a research in the district and an introduction letter from Kenyatta University. The researcher also sort permission from the various school administrators, teachers and pupils who were involved in the research.

Questionnaires, interviews and observations schedules were used to collect primary data. The data collection was in phases; phase one, dealt on issuance of questionnaires, phase two involved interviewing and listening while the final phase involved observation. Questionnaires were distributed to the respondents who were given time to answer. They were then collected after response time was over. Confidentiality, anonymity and informants consent was observed. Questionnaires were not to bear respondents names but were instead encoded or numbered.

The researcher used the structured systematic interviewing technique that subjected each informant in the sample to the same stimuli of asking exact same questions. On questionnaires, the researcher used rating scale to measure perceptions, attitudes, values and behavior. The advantage of rating scales is that they are easy to administer however, Orodho (2009) observes that their disadvantage is that they may be sensitive to response bias.

The researcher also used structured observation technique where he observed as an on looker from the outside, here those being observed knew they were being observed but never knew the exact behavior being observed or recorded. It was only those behaviours appearing on a pre-defined observation list that were noticed and recorded for quantitative data production. The advantage of structured observation is that it provides precise numerical results that are amenable or complying to statistical analysis and can be repeated to monitor behavior change over item or the course of an intervention, however, structural observation has its share of weaknesses in that the pre-determined structure of observation limits the discovery of other relevant behaviors furthermore, data coding, entry, and analysis can be very time consuming observes Orodho (2009).

3.10 Data Analysis

Qualitative data collected was coded, analyzed and interpreted to show the relationship between SMASE approaches and mathematics performance. Descriptive statistics such as mean and standard deviation were used in the interpretation of data. Quantitative data collected from questionnaires and observation checklists was analyzed using Pearson Product Correlation Co-efficient (r) while qualitative data was analyzed through thematic approaches. Data was computed using SPSS data analysis programme, it was then presented using pie charts, bar graphs, text and tables. Generalizations were later be made.

CHAPTER FOUR

DATA ANALYSIS, PRESENTATION AND DISCUSSION

4.1 Introduction

This chapter presents data collected, results and discussions of the study findings on how SMASE approaches correlate to pupils' participations in mathematics lessons in public primary schools in Embakasi District, Nairobi County. Data was collected from head-teachers, mathematics teachers and standard eight pupils from 5 primary Schools in Embakasi District, Nairobi County. A total of 325 usable responses were obtained. Table 4.1 below describes the response rate.

The objectives of the study were to;

- i) Find out the effects of SMASE approaches on pupils participation in mathematics lessons.
- ii) Identify the effects of school managers on the management of SMASE project at the school and cluster level.
- iii) Identify challenges encountered by mathematics teachers while applying SMASE approaches in classroom practices.
- iv) Review the effects of SMASE project on the performance in mathematics in KCPE since 2009.

The presentation and discussions were in line with the objectives.

4.1.1 Response Rate

The results of the *table 4.1* below indicate the response rate of the total respondents. Three hundred and twenty five respondents participated in data collection; therefore the turn out rate was 325 final respondents making it 100% questionnaires return. This clearly indicated that the response was credible.

Table 4.1: Response Rate

	Sample used	Final respondents
Head teachers	5	5
Teachers	20	20
Pupils	300	300
Total	325	325

4.2 General Population Statistics

This section presents the demographic characteristics of the respondents with the aim of establishing the general background of the respondents who participated in the study. The areas that were to be discussed include;

4.2.1 General Class Population

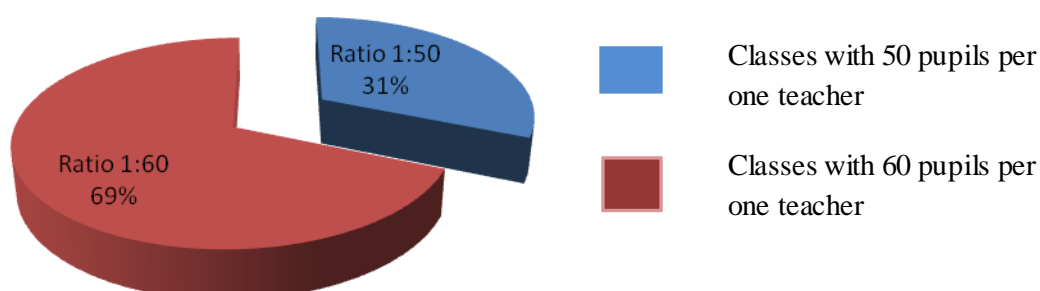


Figure 4.1: General Class Population Ratios

According to recommendations by the ministry of education science and technology, an average class should comprise of a total population of not more than 45 pupils. From the study findings that were carried out it was evident that in most schools class rooms were overloaded with pupils and 65% of the total population of learners taught were in classes that had more than 50 learners. As shown in *figure 4.1* above, an average class population in public primary schools in Embakasi District Nairobi County is more than 50 learners.

4.2.2 Pupil Textbook Ratio

For effective learning pupils should be provided with learning materials, especially in subjects like mathematics which require much practice for learners to master the taught concepts. From the research conducted most schools had few learning materials as compared to the general population of the school. It was found that the pupil-textbook ratio was 3:1 meaning that every three pupils were expected to share a textbook. Availability of enough reading materials for learners has a significant impact on their performance as well as their participation in learning activities.

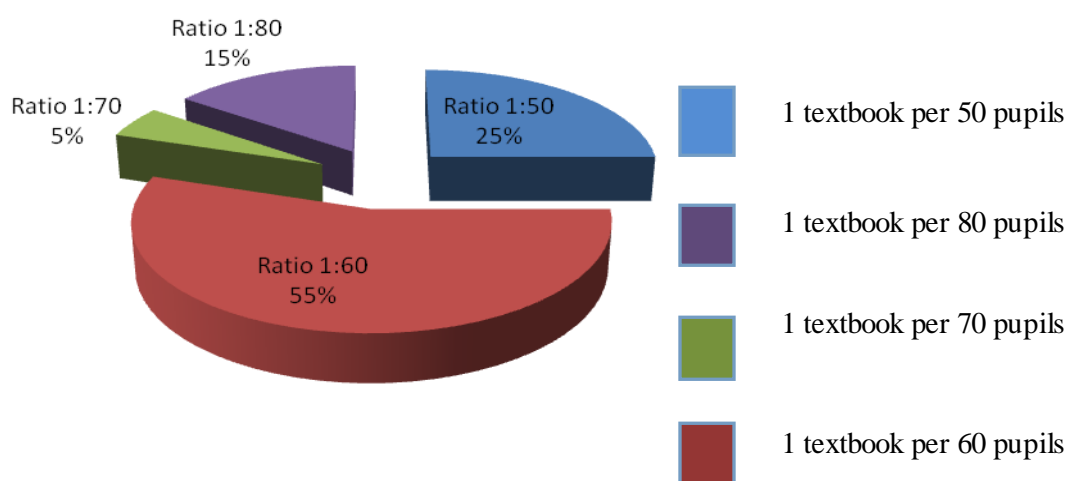


Figure 4.2: Pupil-Textbook Ratios

Most public schools lacked proper management to follow up the records of books in their inventories, some books were torn and some were lost since there was no proper follow-up for the return of the text books. Some learners were found to receive books and keep them for longer periods or never returning them at all either after losing them or transferring from the schools, this limited other learners from accessing the same text books with the aim of using them.

4.2.3 Teacher-Pupil Ratio

According to the findings, the teacher to pupil ratio was 1:60; in all sampled schools none was found to contain a teacher-learner population of less than 1:50. This indicates that teachers were overwhelmed by the many learners and they found it difficult to manage such huge populations. Most schools in Embakasi were found to be having shortage of teachers, especially mathematics teachers and despite the fact that the government employed a good number of teachers, the student population which was simultaneously increasing, outnumbered the teachers who had heavy workloads throughout the week.

It was found out that 18(90%) mathematics teachers were overloaded with many lessons per week making it impossible for them to manage the large pupil populations. Teachers were willing to practice SMASE gained ideas in class like, use of practicals, learner centered approaches to teaching as well as actively asking questions in class, the high class populations could not allow teachers to spend much time on practicals but to opt for theoretical covering of the syllabus before the end of the year. The *figure 4.3* below represents teacher-pupil ratios

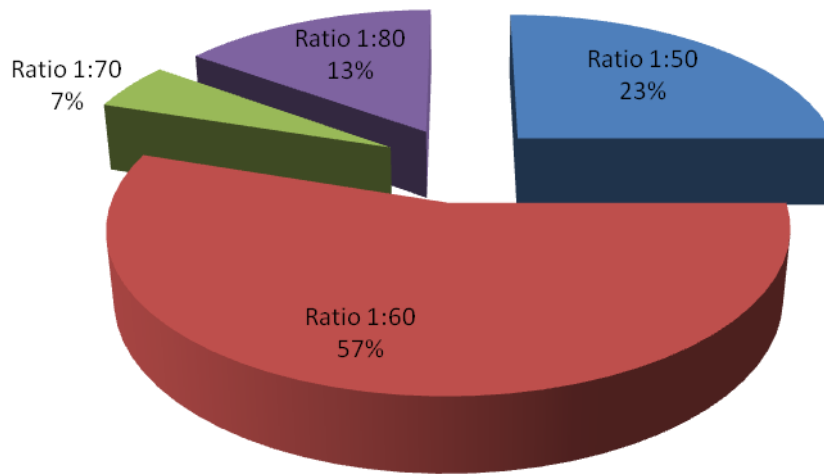


Figure 4.3: Teacher-Pupil Ratios

4.3 General information about pupils in five schools

4.3.1 Distribution of Pupils by Gender

The results represented in *figure 4.4* below shows that the majority of standard eight learners were male, representing 155(51.7%). The female learners were 145 (48.3%). This may be interpreted to mean that the majority of the children enrolled in primary schools and who managed to be in class eight were boys. There were several factors that were associated to this kind of turn out; mainly these were the ages where the girl child started to experience biological changes in her body. Secondly, most of these female pupils to some extent were left with a lot of domestic responsibilities at home by their working parents such as taking care of their younger siblings among other chores this, slightly pulled back the female pupils' school attendance.

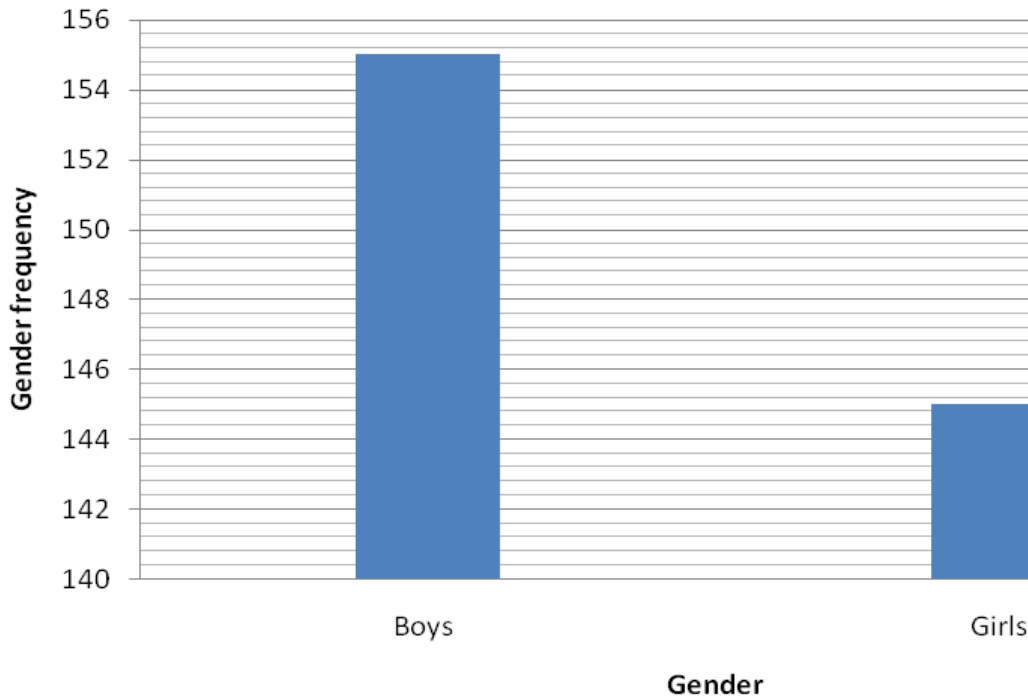


Figure 4.4: Pupil’s Gender Distribution

4.3.2 General Information on Pupil Attitude and Views on Mathematics lessons and Teachers

4.3.2.1 Pupils’ Point of view on Mathematics as a Subject

Majority of pupils have the perception that; “mathematics is not difficult,” a total of 229 (76.3%) of the responses gave; “agreed” and “strongly agreed” that mathematics was not difficult, although of the total sampled population 47 (12.4%) were undecided if mathematics is not difficult while 34(11.3%) perceived mathematics as difficult to them. There were many factors that were observed that proved to cause fear in pupils towards mathematics. These were; negative attitude towards mathematics as a subject, negative attitude towards mathematics teachers, lack of concentration while in mathematics lessons, lack of active participation in learning mathematics, lack of enough learning materials as well as lack of regular self-practice of mathematics tasks when the teacher was not in class. From personal

opinions given by pupils most suggested that they could develop better attitude towards mathematics and their mathematics teacher if he/she used better methods of teaching and talked politely with pupils mentioning that teachers canned them making it hard to learn mathematics concepts. *Figure 4.5* below graphically represents the pupils' response towards mathematics.

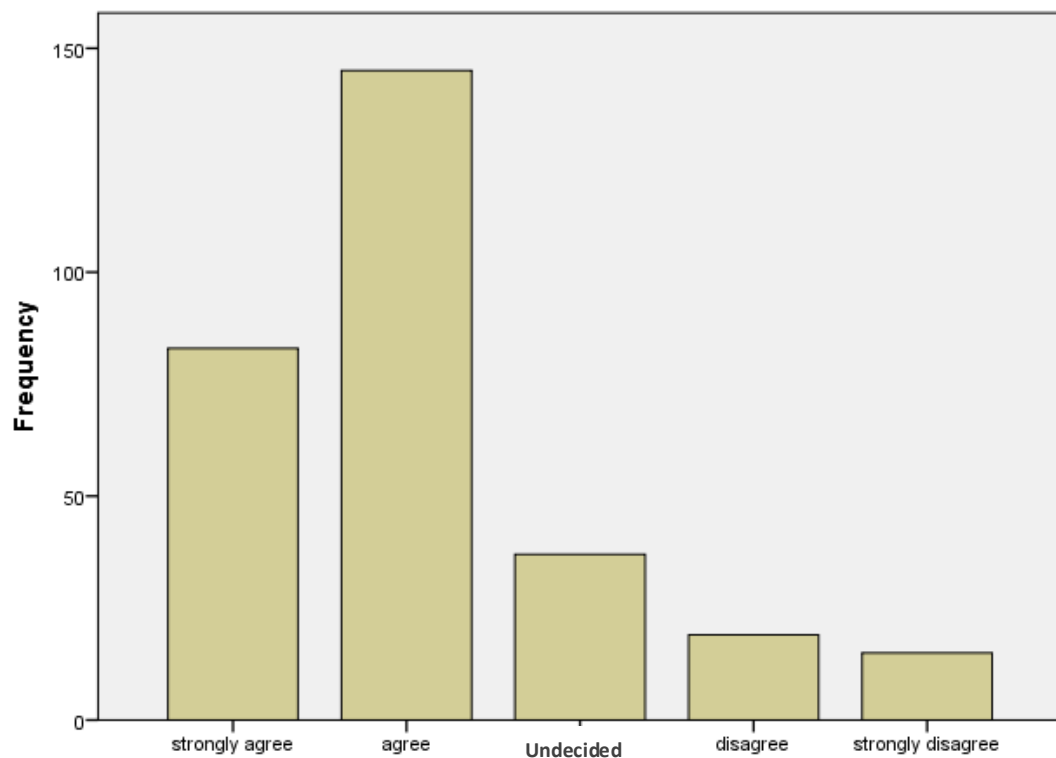


Figure 4.5: Learners Opinion towards Mathematics

4.3.2.2 Mathematics Study Confidence

Due to motivation from both teachers and parents/guardians pupils had developed confidence towards mathematics and usually enjoyed while learning and studying mathematics. According to the study findings, a larger population of pupils had confidence towards mathematics and found that it enjoyable to study the subject. A total of 265(88.3%) learners agreed (agreed/ strongly agreed) with the statement, “I enjoy studying mathematics” while 20(6.7%) learners fell in the undecided category

due to reasons they termed as personal i.e. the teacher was boring while teaching mathematics, the teacher used complex teaching language, the teacher did not allow them to participate in the lesson as well as that they felt that mathematics was generally hard to master.

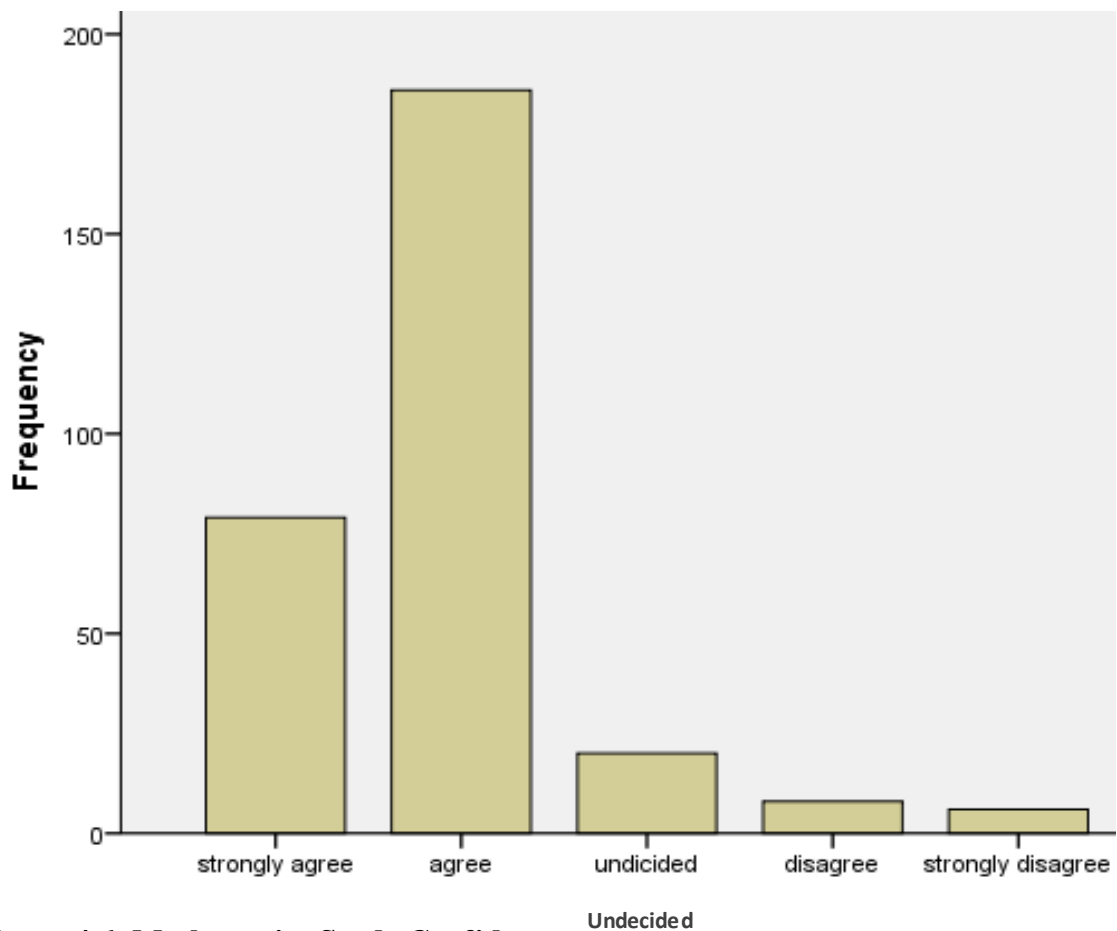


Figure 4.6: Mathematics Study Confidence

4.3.2.3 Application of Mathematics Concepts

Before the introduction of SMASE most pupils had problems in applying mathematics concepts in real life situations rendering them incapable of comprehending concepts taught in class. Through practical learning and learner participation in mathematics lesson 223(74.2%) of the learners felt that they had acquired mathematics concepts which they were positively applying in their daily lives. Though 38(12.7%) fell under the category of not exactly knowing if the

concepts they had acquired from class were applicable in life situations, a small percentage of pupils had the feeling of disagreeing that they totally did not apply mathematics concepts in their lives.

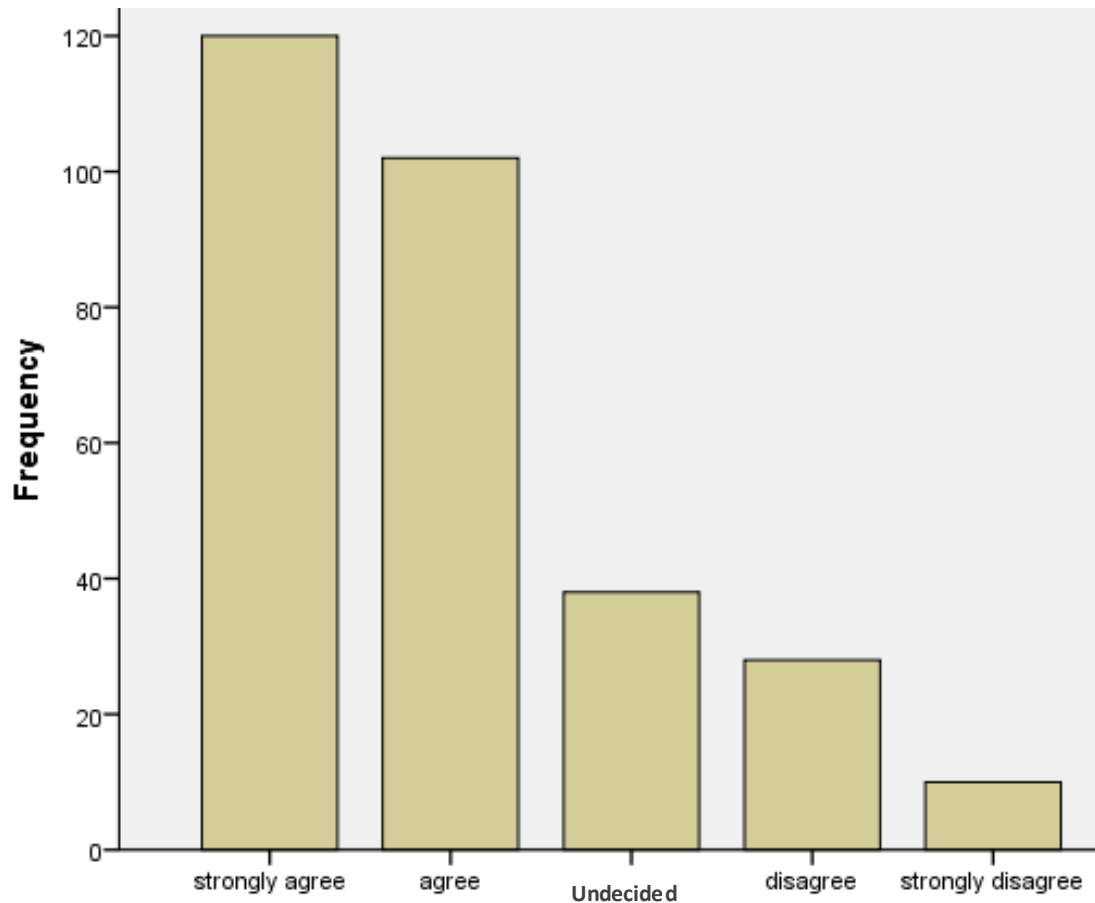


Figure 4.7: Application of Mathematics Concepts

4.3.2.4 Mastery of Mathematics Concepts

According to the study findings, the mastery of mathematics concepts had improved significantly and 216(72%) of the pupil population acknowledged the fact that they could easily grasp concepts which were taught by their teacher other than getting additional help from their parents, guardians, elder siblings, tutors (through tuition that was organized privately by their parents) or any other persons with basic knowledge in mathematics. 38(12.7%) were doubtful of mastering contents as the

teacher was explaining to them while 56(15.3%) of the whole population had the problem of grasping the content taught in class by their teacher. This was possible since they might have developed a negative attitude toward mathematics as a subject or towards their mathematic teachers.

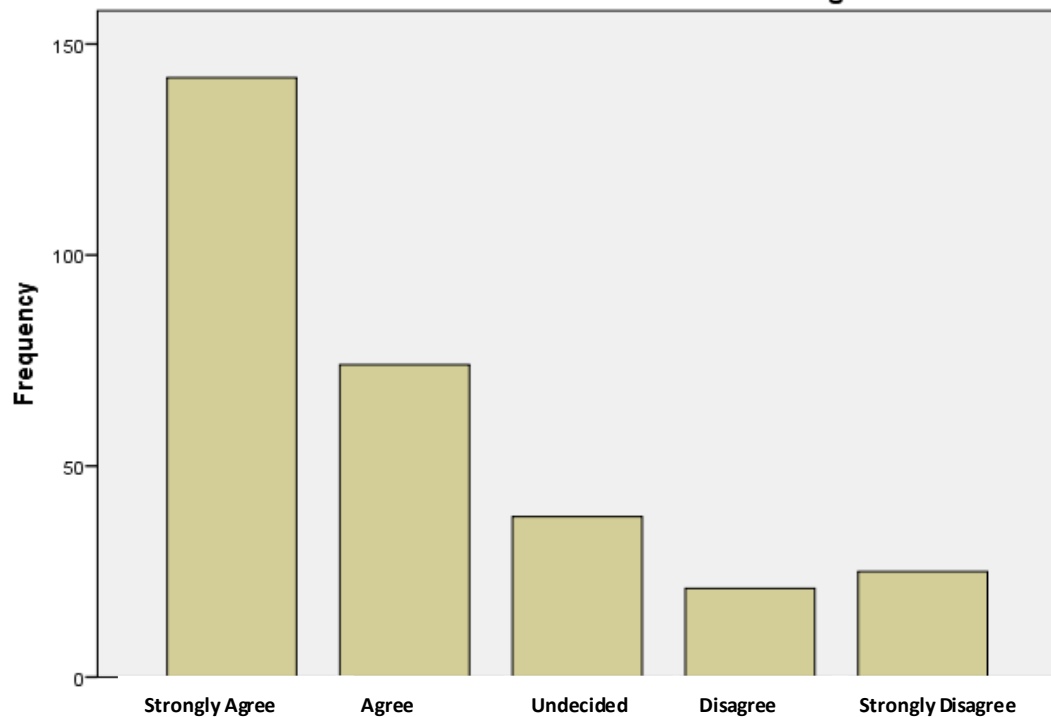


Figure 4.8: Learner Mastery of Mathematics Concepts

The fact that motivation significantly affects the outcome of any action, learning more especially in mathematics greatly relies on motivation for better performance. When teachers motivate their learners to work hard, they promote the learners' mastery of content. Motivated learners tend to develop positive attitude towards the subject taught as well as to their teacher since they feel closer to the teacher and view the content to master as easy 254 (84.6%) of the learners felt that their teachers motivated them in class and that they had achieved better grades through motivation while only 24(8.1%) had a negative feeling, 22(7.3%) were undecided and had mixed feelings for the same.

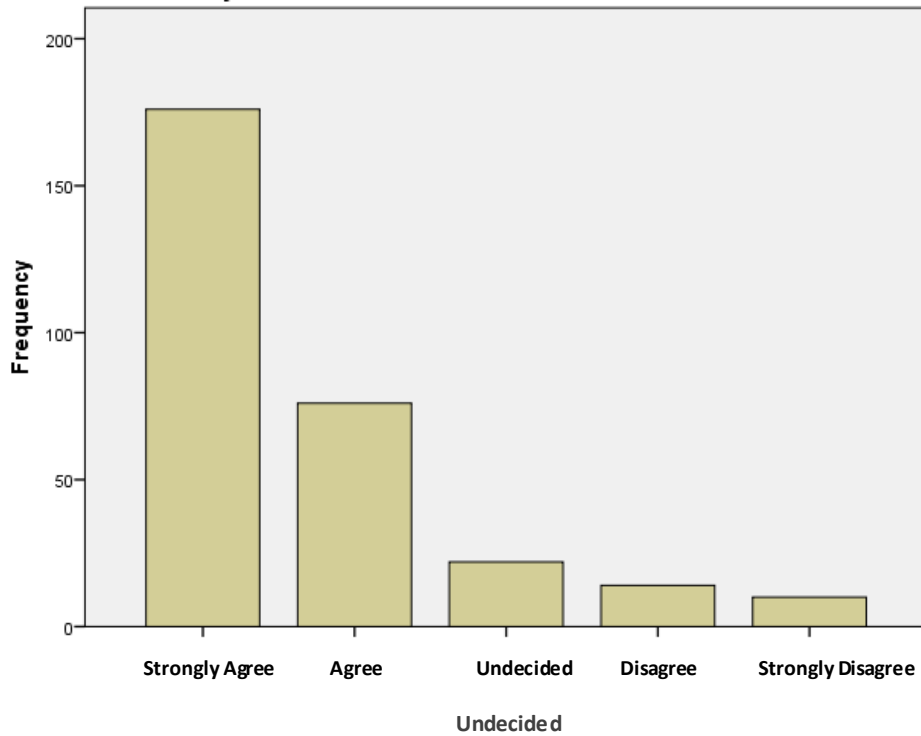


Figure 4.9: Teacher Motivation on Learners

4.4 General Information of Class 8 Mathematics Teachers

4.4.1 Distribution of Teachers by Gender

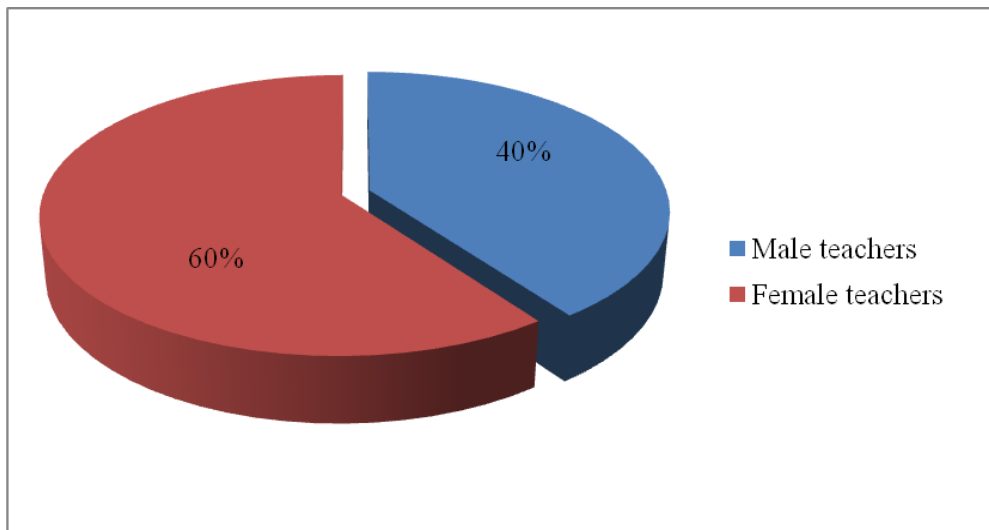


Figure 4.10: Gender Statistics for Teachers

According to the study 12(60%) of the teacher population was dominated by female teachers while the male teachers were only 8(40%) out of the total population.

4.4.2 Distribution of Teachers based on their Professional Qualification and Carrier Choice

As shown in the chart below, the majority of teachers 11(55%) were bachelor of education (B.ED) degree holders; while 9(45%) were diploma holders. This indicated that intellectually, teachers were well qualified to handle primary school pupils. Despite the fact that most teachers were degree holders, they were initially P-1 or diploma teachers in their first career training. They later furthered their education to make it degree standard.

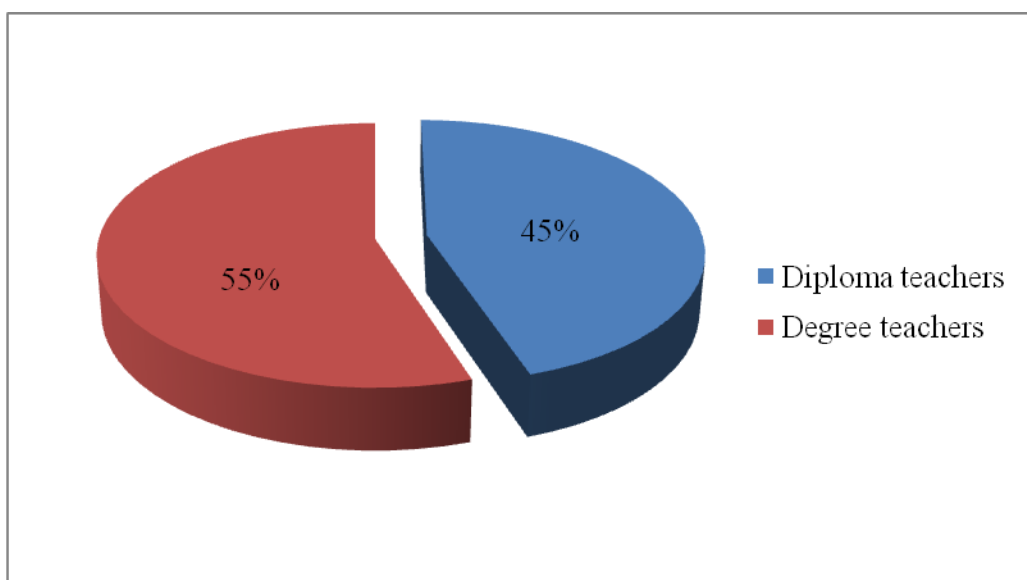


Figure 4.11: Professional Qualifications for Mathematics Teachers

Although most of the teachers were well equipped with high professional qualifications, majority of them never had passion to be teachers. The highest percentage of teachers 42(70%), who were mainly degree holders had other carrier choices other than teaching but settled on teaching since they had no other carrier options. The *figure 4.11* below shows teacher response on career choice.

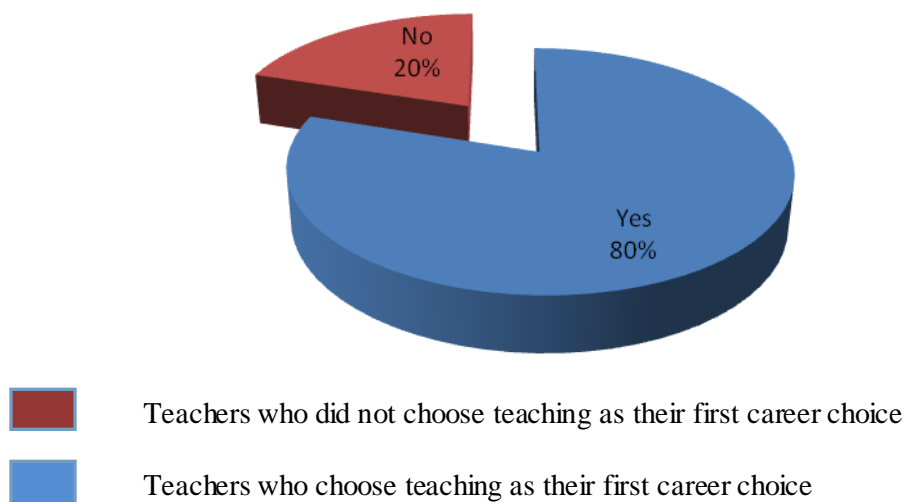


Figure 4.12: Teacher’s first career of choice

4.4.3 Teaching Experience

According to the study results, 54(90%) of the teachers were well experienced and had practiced teaching for quite a long time. Most of them had taught for at least 11 years either in their current schools or in other schools.

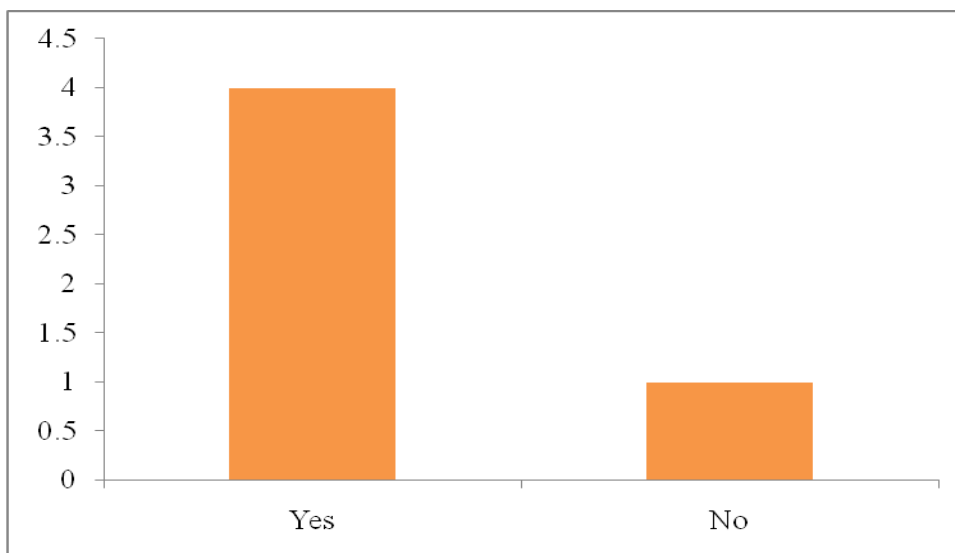


Figure 4.13: Teaching Experience for Mathematics Teachers

4.4.4 Lesson Workload per Week

Despite the fact that teachers were working hard to cover the syllabus, they were faced with the challenge of having heavy workloads throughout the week which rendered them incapable of monitoring the progress of learners closely, some teachers due to these heavy workloads and other commitments found it even difficult to interrogate their learners to ensure that they had all understood what was taught in class. With heavy workloads throughout the week and high pupil population some teachers found it difficult to issue homework and even though some did give out homework, they did not follow up to ensure that the homework was well done and if any corrections were needed and if all learners had understood what was required to be done in order to arrive at the right answers. A cumulative percentage of about (75%) of teachers had a lesson workload of 26 lessons and above per week which was very much tiresome relative to the big pupil population that they handled.

Table 4.2: Teacher Lesson Load per Week

		Frequency	Percent
Valid	15 - 20 lessons	1	5.0
	21 - 25 lessons	4	20.0
	26 -30 lessons	7	35.0
	over 30 lessons	8	40.0
	Total	20	100.0

4.4.5 Teacher Attendance in SMASE INSET Programmes

According to the study, majority of teachers 48 (80%) had attended SMASE INSET training not once but frequently. This indicated that teacher experience in applying SMASE knowledge in teaching mathematics was good. According to the responses and the evidence from mathematics performance records during K.C.P.E examinations there had been marginal improvement. This is despite the fact that teachers were overloaded with lessons throughout the week as well as having to manage highly populated classes.

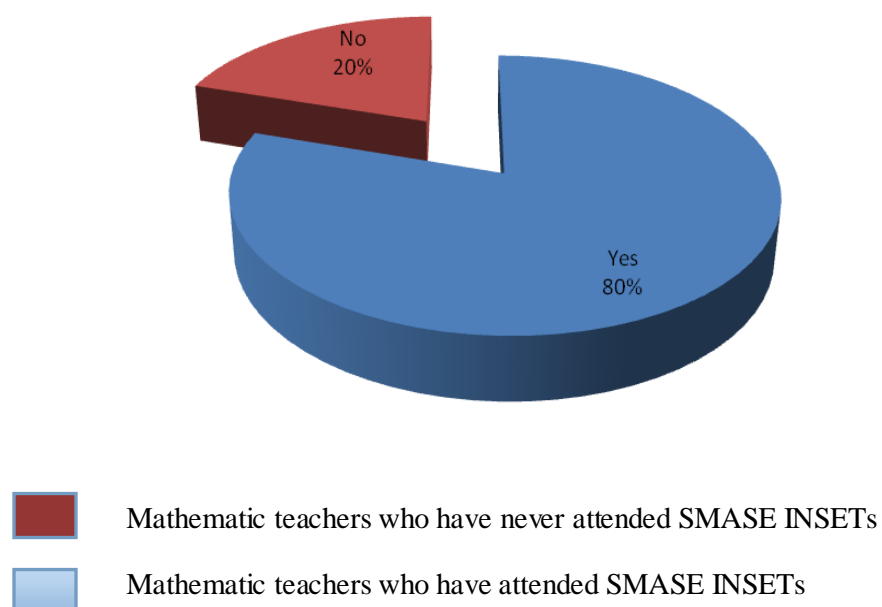


Figure 4.14: SMASE INSET Attendances for Mathematics Teachers

4.5 General Headteachers Information

A total of five headteachers were involved in the study from the selected five schools in Embakasi District and according to the study, 4(80%) of the headteachers had been involving themselves in SMASE projects and they felt that mathematics performance had slightly improved through the SMASE programme. They gave

5(100%) responses on their schools involvement in SMASE projects as well as in sending their mathematic teachers for SMASE training.

4.5.1 Headteachers' Experience and Academic Achievements

The study findings indicated that 4(80%) of the headteachers were aged between 40 – 49 years while the rest were above 50 years of age. Academically, 3(60%) were diploma holders while 2(40%) were bachelor of education and master of education degree holders. Likewise, 3(60%) of them fell between 6 – 10 years of experience while 2(40%) headteachers had an experience of 11 and above years. This clearly indicated that schools in Embakasi District had well-educated administrators who were capable of leading using their vast knowledge and experience.

Table 4.3: Professional Qualifications for Headteachers

		Frequency	Percent
Valid	Diploma	3	60.0
	B.ED	1	20.0
	M.ED	1	20.0
Total		5	100.0

4.5.2 School Forums for SMASE Trained Teachers and its Facilitation

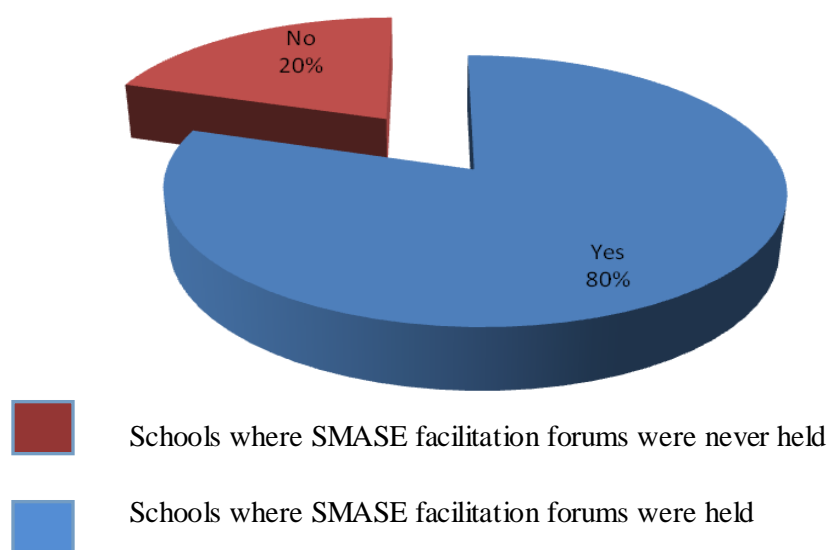


Figure 4.15: SMASE Programme Concept Facilitation

The schools have developed forums where SMASE trained teachers gather and share ideas on how to enhance mathematics performance. According to the findings, the confidence of teachers in teaching mathematics had significantly improved and they had developed better and positive attitudes towards mathematics.

As shown in the *figure 4.15* below, school managers had developed various ways of facilitating and ensuring that SMASE earned knowledge was shared among teachers to enhance learning. These was achieved through; subject panels and staff meetings where teachers shared knowledge and proposed new techniques of imparting mathematics knowledge to learners. Subject panels were the most effective and commonly applied methods since they directly involved teachers and learners at the same time, teachers were capable of identifying problems from learners as they aired them out. Later, teachers were able to sit in staff meetings and come up with ways of

solving those problems they also worked towards achieving better performance for learners in their schools.

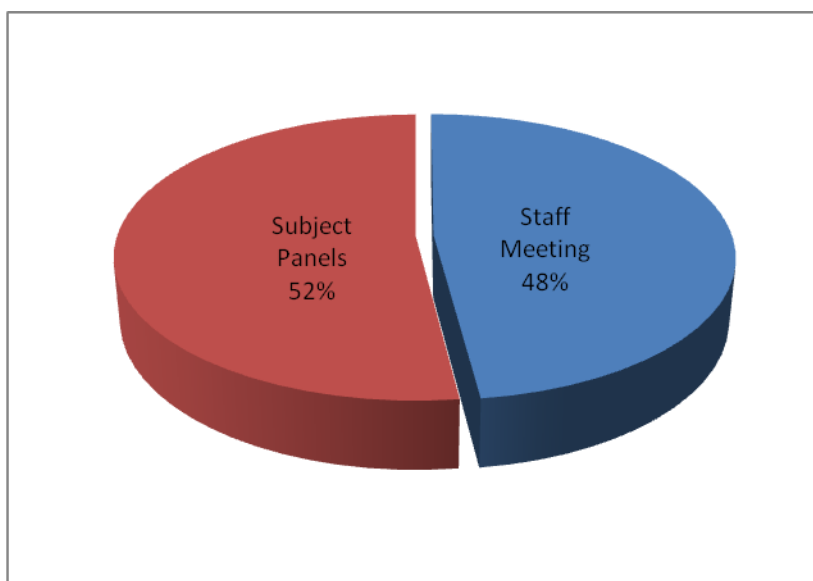


Figure 4.16: Facilitation Methods

4.5.3 Learner and Teacher Motivation Techniques

Both learners and teachers were motivated for better performance in mathematics termly and yearly. Teachers were usually motivated through purchase of more reference materials as well as gifts and vouchers. Learners' motivation on the other hand was usually done verbally, by clapping as well as through awarding of gifts and prizes to the best performers. This was done termly to ensure that learners worked hard. Presents such as exercise books, pens/pencils, geometrical sets, rulers and mathematics textbooks were usually awarded to overall best performers and also to those who had significantly improved in their performance. *Figure 4.16* below shows the commonly used methods for teacher and pupil motivation in Embakasi District, Nairobi County.

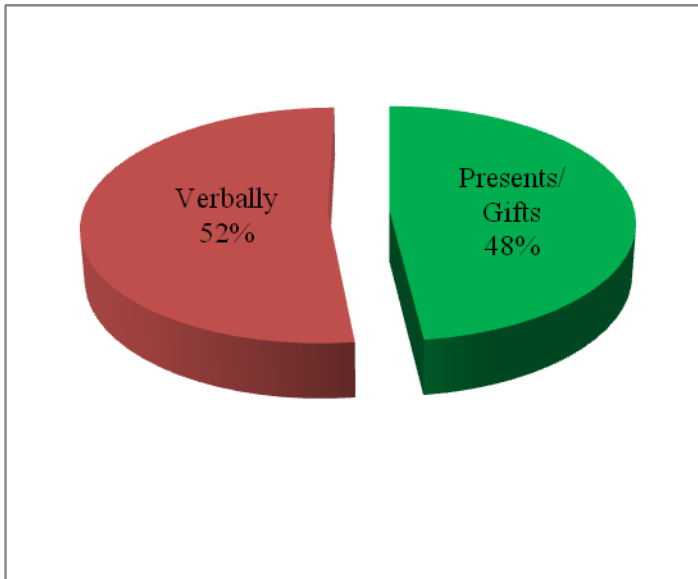


Figure 4.17: Motivation Techniques

4.6 Challenges Facing SMASE INSET Programme

There were quite a number of problems and challenges that faced SMASE INSET programme that were discovered from the research findings. The several challenges that were listed by teachers concerning the proper implementation of the programme were;

- i. Teachers had limited time to attend SMASE training since they had other commitments; heavy workloads and other personal commitments to attend to.
- ii. High learner population made it almost impossible for teachers to effectively practice practical and learner centered approaches of teaching mathematics. The high population of learners was not compatible to the readily available materials and time.
- iii. Most teachers did not implement/make use of SMASE gained ideas in teaching mathematics in classrooms. This made the programme sound useless as the knowledge acquired from trainings and seminars was not effectively practiced in teaching mathematics.

- iv. There was lack of proper and regular follow-up by SMASE officers to ensure that what was learned from the seminars and trainings was put into practice and that it promoted better performance in mathematics.
- v. Inadequate materials posed great danger for the full implementation of SMASE ideas since schools had few textbooks and lacked capital to finance the purchase of equipment that could be used in practicals during mathematics lessons.

4.7 ASEI-PDSI Lesson Planning and Its Effectiveness in Schools

Activity, Student, Experiment Improvisation (ASEI) and Plan, Do, See, Improve (PDSI) are very important lesson planning strategies that all teachers should practice to attain the best in class most especially in mathematics classes. From the study it was discovered that ASEI-PDSI lesson planning techniques were very effective as they promoted learner participation and performance in mathematics. Teachers agreed that ASEI-PDSI had positively affected mathematics and through it, they had been able to achieve interactive mathematics classrooms they had also improvised practical apparatus for learners to intellectualize mathematics ideas. Through doing and seeing, mathematics had improved significantly. The *figure 4.17* below shows teachers' responses towards ASEI-PDSI lesson planning methods.

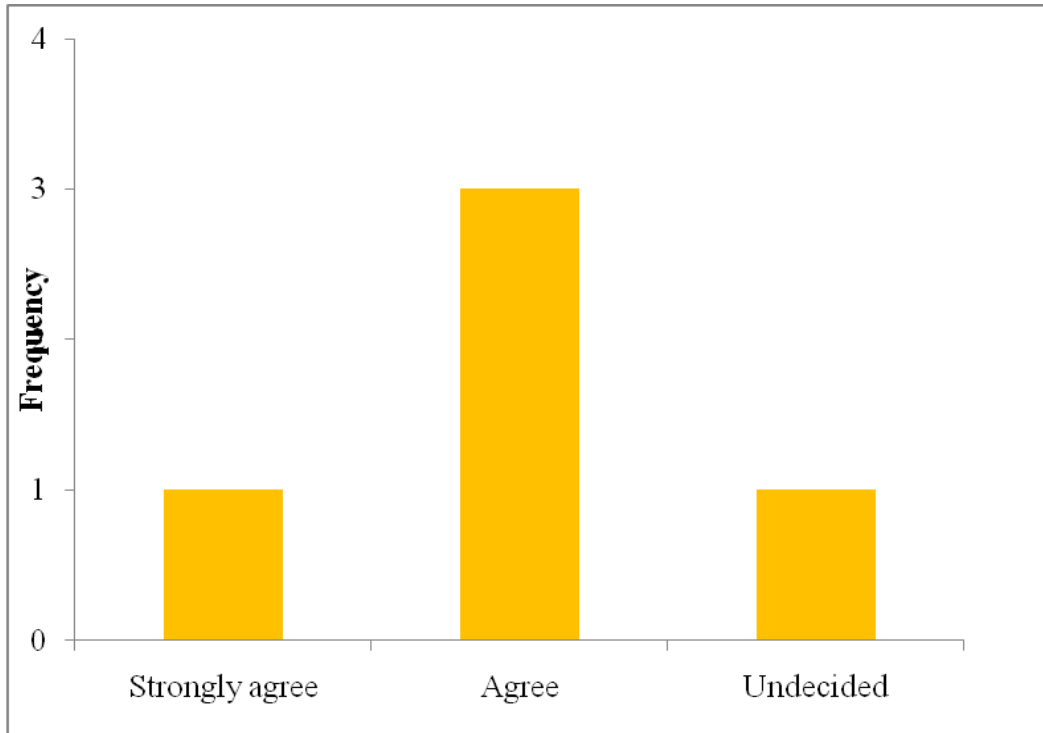


Figure 4.18: ASEI-PDSI lesson planning effectiveness in schools

4.8 Mathematics Performance and Pupil Enrolment since the year 2009

The table below shows pupil enrollment and mean score for mathematics since the year 2006. The study findings indicate that these schools enrolled large numbers of pupils while the number of teachers was very low. According to figures obtained from the study it was observed that an average of 172 learners were enrolled into class eight in public primary schools in Embakasi District every year. It was observed that the number of enrollments each year since the year 2006 had significantly increased. Since the advent of the SMASE programme and the significant improvement in mathematics and science, parents had developed positive attitudes towards the performance in public primary schools and most especially in the performance of mathematics.

Despite the fact that SMASE programme had a significant impact on learner performance, the pupil population had significantly affected mathematics performance over the years since the workload for the teacher per week was very heavy and learning materials (textbooks) were insufficient to cater for the learners' needs in learning process.

The table below shows mathematics performance means score and student enrolment populations every year since the year 2006 – 2013.

Table 4.4: Learners' Enrollment and Performance Relationships in Pre and Post SMASE Period

YEAR	Total Enrolments	Average Enrolments	Mean Score During K.C.P.E
2006 - 2009	3094	154.7	49.4995
2009 - 2013	3771	188.55	48.408
differences	677	33.85	-1.0915

Mathematics performance has significantly improved since the advent of SMASE INSET primary programmes in the year 2009 and onwards as compared to earlier years despite of the very high pupil populations. From the *table 4.4* above it is clearly indicated that the means score of the year 2010 – 2013 have dropped by 1.0915 but considering the conditions prevailing in the schools such as high pupil population, lack of enough learning material, minimal teacher motivation in the schools, lack of proper evaluation and assessment methods by educational officers and low or no follow-up activities on SMASE by relevant authorities, the performance seems to slightly remain constant. Hence, this can be termed as a significant improvement given the above prevailing circumstances.

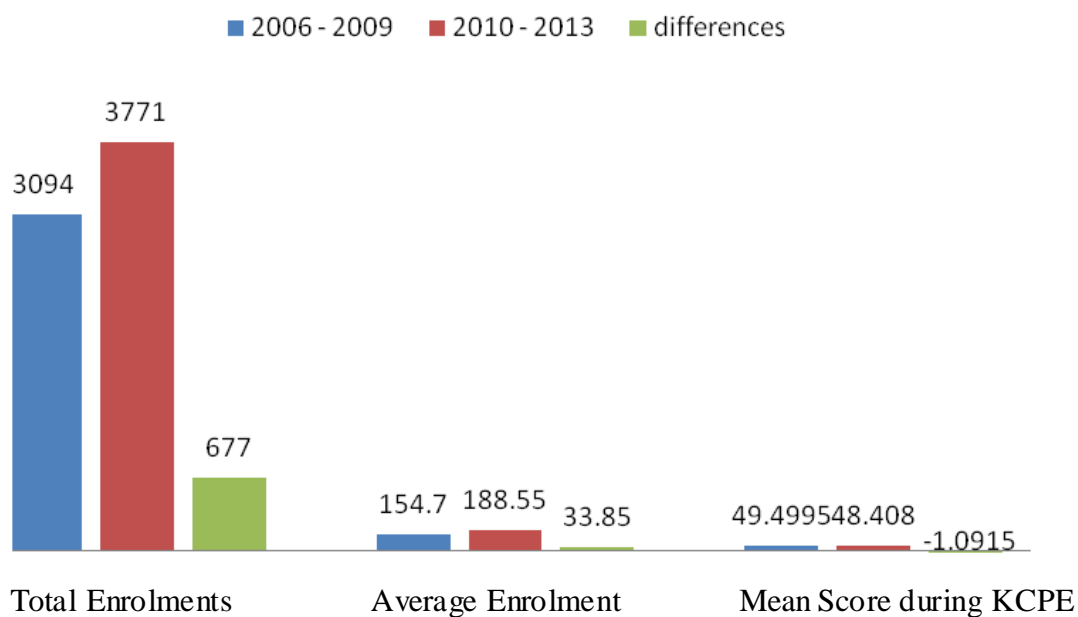


Figure 4.19: Learners' Enrollment and Performance Relationships in Pre and Post SMASE period

4.9 Mean Scores and Standard Deviation

Table 4.5: Learners' Opinion about Mathematics (N=300)

	Mean	Std. Deviation
Mathematics is not difficult	2.12	1.047
I enjoy studying mathematics	1.98	1.399
I apply mathematics that I learn in my daily life	2.19	3.255
I understand better when the teacher uses teaching aids	2.04	1.278
My teachers motivates me to do well in mathematics	1.68	1.027
My teacher makes me feel that I can improve in mathematics	1.56	0.947
I have improved in mathematics performance	2.29	1.209
I like the way my teacher teaches mathematics practically	1.80	1.043
Sum of means/std. Deviation	15.66	11.205

As reflected in the above table, the total mean score for academic achievement motivation was $M = 15.66$. Based on the participation and performance of pupils, the item with the highest mean score was “I have improved in mathematics performance.” ($M = 2.29$). the item “Mathematics is not difficult” ($M=2.12$) was the third item in terms of means, this implied that even though majority of the pupils perceive Mathematics as a difficult task, they still encouraged themselves and worked hard to meet their academic achievements. On the other hand, the item with the lowest score was “My teacher makes me feel that I can improve in mathematics” ($M=1.56$). This implied that mathematics performance was highly influenced by learners’ motivation and their positive attitude towards mathematics and the mathematic teachers.

4.10 Mean Scores and Standard Deviation for “Learner Participation during Mathematics Lessons” as Reported by Learners (N=300)

Table 4.6: Learner Participation during Mathematics Lessons

	Mean	Std. Deviation
Ask questions	1.55	0.961
Answering questions	1.95	0.970
Suggesting possible Outcomes of practical activities	1.75	1.054
Make observations and give presentations	1.21	1.173
Make conclusions from practical activities	1.84	0.931
Taking part in group work and group discussions	2.10	1.019
Asking clarification on areas not well understood	1.74	0.932
Give presentations on findings	1.34	0.971
Finishing my mathematics homework/assignments	2.19	1.036
Take my mathematics exercise book for marking	2.35	0.843
What is taught is hard to understand	1.91	0.293
Language used is above my understanding	1.85	0.354
Teachers speak very fast/unclearly	1.84	0.367
I cannot speak well in English so I cannot ask or answer a question	1.93	0.256
Sum of means/std. Deviation	29.19	13.291

As shown in the **table 4.6** below, the total mean score for learners participation in mathematics lessons was $M = 29.19$. Based on the participation and performance of pupils, the item with the highest mean score was “I take my mathematics exercise book for marking.” ($M = 2.35$). This is due to the fact that most learners preferred “Finishing mathematics homework/assignments” ($M=2.19$). Although most learners had the feeling that; what was taught was hard to understand (‘what is taught is hard to understand’ $M=1.91$), they still worked hard to ensure that they practiced what was taught in class by their teachers through taking homework/assignments and handing them over to the teachers for marking. This implied that mathematics performance was highly influenced by learner centered approaches of teaching as opposed to teacher centered approaches.

4.11 Mean Scores and Standard Deviation

Table 4.7: Teacher Response towards SMASE INSETs and Related Trainings (N=20)

	Mean	Std. Deviation
Have you ever attended SMASE INSET cycle?	2.40	4.639
Pay individual attention to learners in mathematics class	2.05	0.999
Always set positive and realistic goals	1.50	0.513
Practical activities are performed in each mathematics topic	3.10	4.506
Reflect on how to improve a lesson after teaching it	1.55	0.510
Teaching mathematics is interesting	1.75	1.070
Allow learners to report results of practical work	2.90	0.788
Assign learners practical work	2.80	0.696
Give learners discussion work	2.55	0.686
Engage learners in group work	2.45	0.605
Sum of means/std. Deviation	23.05	15.012

From the above table, the total mean score for teachers response towards SMASE INSET acquired knowledge was; $M = 23.05$. Based on the teachers SMASE acquired knowledge, the item with the highest mean score was “Practical activities are performed in each mathematics topic.” ($M = 3.10$). It was noted that the teachers assigned as well as allowed learners to report on the results of the practical activities assigned.

4.12 Regression Analysis

Table 4.8: Regression table

Model	Unstandardized Coefficients		Standardized Coefficients Beta	t	Sig.
	B	Std. Error			
(Constant)	1.110	0.796		1.394	0.164
Mathematics is not difficult	0.153	0.061	0.133	2.509	0.013
I enjoy studying mathematics	0.076	0.045	0.089	1.703	0.090
I apply the mathematics that I learn in my daily life	0.004	0.019	0.012	0.234	0.815
I understand better when the teacher teaches practically	0.312	0.053	0.328	5.932	0.000
Answering questions	0.007	0.090	0.005	0.074	0.941
Suggesting possible outcomes to practical activities	0.079	0.066	0.069	1.189	0.235
Make conclusions from practical activities	0.035	0.078	0.027	0.447	0.655
Improvising materials for doing practical activities	0.042	0.076	0.034	0.555	0.579
Taking part in group work and group discussions	0.021	0.070	0.018	0.301	0.764
Asking for clarifications on areas not well understood	0.060	0.086	0.046	0.698	0.486
Finishing my mathematics homework/assignments	0.136	0.077	0.116	1.769	0.078
Taking my mathematics exercise book for making	0.004	0.105	0.003	0.037	0.971

Dependent Variable: I have improved in mathematics performance. From the above regression *table 4.9* it was revealed that the items; “Mathematics is not difficult, I enjoy studying mathematics, I apply mathematics that I learn to my daily life, I understand better when the teacher is teaching practically, Answering questions, suggesting possible outcomes to practical activities, Making conclusions from practical activities, Improvising materials for doing practical activities, Taking part in group work and group discussions, Asking clarifications on areas not well understood, Finishing my mathematics homework/assignments and I take my mathematics exercise book for marking”, to a constant zero, individual learner performance “I have improved in mathematics” would be at 1.110, a unit increase in; “Mathematics is not difficult” would lead to an increase in mathematics performance by a factor of 0.153, “I enjoy studying mathematics” would lead to an increase of mathematics performance by a factor of 0.076, “I apply mathematics that I learn to my daily life” would lead to an increase in mathematics performance by a factor of 0.004, “I understand better when the teacher is teaching mathematics practically” would lead to an increase in mathematics performance by a factor of 0.312, “Answering questions” would lead to an increase in mathematics performance by a factor of 0.007, “Suggesting possible outcomes to practical activities” would lead to an increase in mathematics performance by a factor of 0.079, “Making conclusions from practical activities”, would lead to an increase in mathematics performance by a factor of 0.035, “Improvising materials for doing practical activities” would lead to an increase of mathematics performance by a factor of 0.042, “Taking part in group work and group discussions” would lead to an increase in mathematics performance by a factor of 0.021, “Asking for clarifications on areas not well understood” would lead to an increase in

mathematics performance by a factor of 0.060, “Finishing my mathematics homework/assignments” would lead to an increase in mathematics performance by a factor of 0.136 and “I take my mathematics exercise book for marking”, would lead to an increase in mathematics performance by a factor of 0.004.

This clearly shows that there was a strong positive relationship between individual learner improvement in mathematics and the above mentioned factors. It was also revealed that such variables mentioned above were significant since their p-values were less than 0.05 indicating that the entire variables were statistically significant.

Table 4.9: Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	R Square Change	F Change
1	0.597	0.357	0.302	1.013	0.357	6.529

From the findings in the above table, the value of adjusted R squared (coefficient of determination) was 0.302, an indication that there was a variation of 30.2% on SMASE programme effectiveness on mathematics improvement and learners’ participation in mathematic lessons, at 95% confidence interval. The study also established that there was a strong positive relationship between the SMASE programme, school managers, teachers and learners as shown above by the correlation coefficient of 0.597.

Table 4.10: Anova

Model		Sum of	Df	Mean	F	Sig.
		Squares		Square		
1	Regression	154.207	23	6.705	6.529	.000 ^b
	Residual	278.301	271	1.027		
	Total	432.508	294			

From the ANOVA statistics in table above, the processed data, which is the population parameters, had a significance level of 5% which shows that the data was ideal for making a conclusion on the population's parameter as the value of significance (p-value=0.579) was less than 5%. It also indicated that the model was statistically insignificant.

It is clear that despite the fact that SMASE programmes are working towards enhancing mathematics performance in public primary schools in Embakasi District and Kenya at large, there were still calls for allocation of more resources and time towards SMASE INSETS and the enhancement of mathematics performance for the attainment of SMASE vision and mission for sustainable development in education.

CHAPTER FIVE

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

This chapter gives a summary of the study, draws conclusions and makes recommendations and suggestions for further research.

5.2 Summary of Findings

The study obtained information from 5 primary school headteachers, 20 primary school teachers and 300 pupils from STD 8, making a total of 325 respondents. Questionnaires were used on head teachers, teachers and pupils while interview schedules were used on headteachers. The researcher also used class room observation schedules on SMASE trained teachers he also checked their schemes of work and lesson plans.

The main objective of the study was to examine the effects of SMASE approaches on pupils' participation in mathematics lessons in public primary schools in Embakasi District, Nairobi County.

The following is a summary of the major findings:

5.2.1 Effects of SMASE Approaches on Pupils Participation in Mathematic Lessons

Based on the findings, it was clear that the SMASE programme has had significant effects on learner participation during mathematics lessons. Through SMASE INSETS, teachers had gained knowledge essential for mathematics practicals and learners had learned to develop self-motivation to practice and learn more

mathematics concepts without developing negative attitude neither towards their teachers nor to mathematics as a subject.

Through the introduction of learner centered approaches of teaching, teachers had found it easier to monitor pupil progress and content mastery during and after mathematics lessons. Teachers had gained more courage and had also developed positive attitudes towards mathematics.

The focus of SMASE programme was on changing learner attitude towards mathematics, increasing pupil participation in mathematics lessons, and enhancing the perception of the role of work-planning for effective classroom practices as advocated by the ASEI-PDSI concept. The programme also targeted teachers' mastery of content and ability to incorporate new- emerging and cross-cutting issues in education.

Observations based on Monitoring and Evaluation instruments: ASEI-PDSI checklists and lesson observation instruments showed that lessons by teachers who had participated in SMASE INSETs were of higher quality than those implemented by teachers who had not participated in SMASE INSETs. It was observed that mathematics lessons were better for SMASE-trained teachers and those who frequently attended the trainings and seriously took and utilised the knowledge gained. It was observed that pupils' participation was higher in classes of SMASE INSET exposed teachers.

5.2.2 Effects of School Managers on the Management of SMASE Project at the School and Cluster Level

Based on the second objective, the findings revealed that school managers significantly affected the management of SMASE projects both at school and cluster level. It was found that school managers played a very important role towards positive achievement of SMASE INSET since the managers were to oversee how teachers attended SMASE seminars as well as ensuring that they practiced the acquired knowledge in class. School managers also played an important role of ensuring that resources were availed when needed by mathematics teachers and also ensuring that SMASE follow-up activities were done by the concerned authorities such as CEMASTEAs, QASOs and TAC officials. Finally, school managers ensured that teachers who had attended SMASE INSETS also inducted the rest of the teachers through mathematics panel meetings or during staff meetings.

5.2.3 Challenges Encountered by Mathematics Teachers while Applying SMASE Approaches in Classroom Practices.

According to the study findings teachers faced several challenges as they delivered SMASE gained knowledge to the learners. Some of these challenges were perpetuated by the fact that the student population was very high and teachers were left with huge workloads thorough out the week in addition to having to practice learner centered, practical methods in teaching mathematics, this left the teachers with no option but to toil harder as they had to meet goals set by their administrators through schemes of work of completing the syllabus by the end of the year.

Another challenge was on learning materials being few due to the rising number of pupils. Other factors such as loss/misplacement of textbooks by pupils, non-replacement and not repairing worn out textbooks presented these problems as almost impossible to solve since the schools did not set aside funds to only purchase textbooks, but to also cater for other activities as well. The resulting effect was a higher pupil-textbook ratio, thus forcing most learners to rely on teachers for information and as a result, they could not freely practice mathematical problem solving skills by themselves.

Pupils' performance evaluation was another major problem in the schools. As stated by teachers, they found it difficult to evaluate performance for every pupil since the population was too high and time was limited. SMASE field officers themselves hardly visited schools to monitor progress and when they visited, they did not evaluate learners well nor assess SMASE trained teachers.

The negative attitude developed by learners towards mathematics as a subject or to mathematics teachers was a big challenge for teachers to manage since they were not sure what the initial cause for the negative attitude was.

According to the responses given by the headteachers of the primary schools, there were several challenges facing the implementation of ideas learned from SMASE INSETS in the schools. These were;

- i) Lack of follow up by QASOs and other field officers on SMASE activities that were going on in schools.
- ii) A big number of teachers were reluctant to attend SMASE seminars due to other commitments.

- iii) There was no pay, salary increase or prompt award of certificates for teachers who had attended the seminars, which demoralized them and encouraged them to develop negative attitude towards attending the SMASE INSETs.
- iv) At school level, there was lack of promotion after training in SMASE cycles.
- v) Inadequate materials for learning i.e. textbooks.
- vi) Some teachers were forced to attend SMASE trainings.
- vii) Some teachers did not utilize the knowledge acquired from the SMASE trainings in class.

According to the response from teachers and school administrators, SMASE programme was faced with several challenges in its quest to deliver effective training to teachers in order to enhance the performance of mathematics in schools.

Table 5.1 below shows factors that SMASE had effectively addressed and those that were beyond its reach and which proved challenging to address.

Table 5.1: Achievable and Non-achievable factors for SMASE

Factors that SMASE can handle	Factors that SMASE cannot handle'
a. Attitude by headteachers, teachers and subsequently pupils and parents.	a. Lack of staff houses and other facilities such as equipments, textbooks, water and electricity.
b. Lack of appropriate teaching methodology/Pedagogical issues/ teacher-centeredness.	b. Poor communication and funding of school activities and programmes.
c. Mastery of Subject content	c. Parents and communities' attitude.
d. Inadequate assignments to students.	d. Interrupted school programmes due to activity fees collection.
e. Few or non-existent interactive forums for teachers.	e. Food, child labour, and other family problems.
f. Infrequent supervision from senior educational administrators.	f. Teachers' poor working conditions and terms of service including incentives.
g. Missing link between primary and secondary school (syllabuses) content levels.	g. Overloaded syllabus and timetables-work load.
h. Lack of information about schools by local communities.	h. Unfair teacher transfers.
	i. Stagnation in one job group.
	j. Provision of infrastructure and instructional material and equipment to schools

5.2.4 Review the effects of SMASE project on the performance in mathematics in KCPE since 2009.

Mathematics performance has significantly improved since the year 2009 and onwards when SMASE project started in primary schools in Kenya as compared to earlier years despite the high pupil population in public primary schools in Embakasi District.

The activities of the SMASE programme were aimed at changing the traditional teacher-centered teaching methods and equipping teachers with necessary skills for classroom practices that put emphasis on activity-oriented ways of teaching and learning. Through the project the following have been achieved;

- i. More opportunities have been created for learners to take responsibility for their own learning;
- ii. Employment of inquiry-based approaches as opposed to recipe-type activities/practicals;
- iii. Encouraging improvisation not only to enhance conventional equipments and apparatus/materials but also to arouse interest and curiosity among learners;
- iv. Encouraging teachers to draw content and examples from the learners' real life experiences in order to capture their interest and imagination;
- v. Fostering teachers' ability and appreciation for work planning;
- vi. Systematic execution of the learner-centered teaching/learning process;
- vii. Evaluation of the teaching-learning process against lesson objectives and outcomes;

5.3 Conclusions

In conclusion, it can be said that SMASE programmes have significantly affected pupil participation in class as well as mathematics performance since the year 2009. It is therefore very important for school managers and mathematics teachers to embrace the SMASE concept that calls for the strengthening of mathematics and science education both in public and private primary schools for the achievement of better performance/grades in mathematics as well as in sciences.

Various factors are responsible for poor performance in mathematics in primary schools in Embakasi namely; students' negative attitude towards mathematics as a subject and to mathematic teachers, lack of motivation to both teachers and pupils, lack of enough textbooks for learning and high student populations against that of teachers. Though teachers attend SMASE programmes, they lack entrenched forums to facilitate sharing of the acquired knowledge to the rest of staff members in the same field, it is important for teachers and administrators to identify these factors and purpose to mitigate their influence on pupils and their performance in mathematics.

It is notable that most schools had established forums where SMASE trained teachers shared their knowledge to the rest of the staff members and exchanged ideas on how better to impart mathematics knowledge on pupils so as to achieve better performance using SMASE approaches.

In all schools, pupil-textbook ratio was high and according to the findings of the study, school managers had not established better ways of replacing worn/lost textbooks. According to the information provided by the headteachers, purchase of new books was done termly but from the information that was provided by mathematics teachers on pupil-textbook ratio, it was evident that even though textbooks were purchased termly, they were not enough to cater for pupils needs in the schools. There was no alternative method that was stated by the headteachers of replacing lost textbooks. This might be the main cause making the schools to lack enough mathematic textbooks.

In all the schools, SMASE approaches had not been fully implemented for the better teaching of mathematics, though teachers were SMASE trained and school managers supported the programme, practical teaching and learner centered approaches of teaching were not very effective since the students population was very high hence not all students got chances to participate during the lesson, the workload for teachers per week also could not allow teachers to handle such great pupil populations individually. Though the methods are essential for better performance of mathematics, they were not given much emphasis due to time limits and lack of facilities/learning materials, all of which were critical variables in the implementation of the key SMASE INSET approaches.

5.4 Recommendations

Based on the findings of this study, the following recommendations were made;

- i. Since this study has implications on the work of the teachers, school managers, SMASE project, researchers as well as curriculum planners, there is need to develop a greater awareness and understanding of the various interactions involving variables that predict the academic performance of students. For the fact that SMASE approaches are strong predictors of pupils' participation in Mathematics lessons, it is necessary for the curriculum developers to integrate SMASE programme into the schools and make it a requirement that teachers attend the programmes.
- ii. Based on the findings from this study, school administrators should encourage the development of a strong relationship between mathematics teachers and SMASE programme and ensure that knowledge acquired from these seminars in put into practice.

- iii. This present study indicates that the academic environment in Embakasi District should encourage learner centered approach of imparting knowledge to pupils as the central scheme to academic success.

5.5 Suggestions for Further Research

The present study has not addressed a wide scope. It is recommended that more extensive studies that would cover a larger sample be conducted. This will assist in the promotion of education that is learner centered and hence improvement in mathematics performance in Kenyan primary schools through prioritizing on the strengthening of SMASE programme throughout the country.

The following research studies were suggested:

- i. Further studies should be done to determine whether the results of this study are representative. In the current study a correlation research design was used to measure SMASE effectiveness on enhancing mathematics performance by pupils in public primary schools. Since pupils may have answered the questions with socially desirable responses and mixed attitudes, perhaps interviews with pupils would have allowed for more contextual and thus more honest responses.
- ii. The study focused on pupils' participation and performance in mathematics in their final year of study. Feedback from the teachers or the teachers' instructional strategies might have influenced the higher performance and participation in mathematic lessons. These and other issues need to be studied further to clearly point out the importance of SMASE programme in uplifting mathematics performance in primary schools.

- iii. Further study is needed to look into the connections between learner centered approaches of imparting knowledge, practical teaching and academic performance in more complex academic domains in the country such as Physics, Chemistry, Biology and Economics.
- iv. A comparative study should be carried out between public primary schools and private primary schools in Embakasi District, Nairobi County to see whether similar findings are obtainable.
- v. A similar study should be carried out in other counties to find out whether similar findings are obtained.

REFERENCES

- ADEA Report (2007) Adea Regional Meeting www.adeanet.org
- Akinibolola A.O (2010) *Enhancing Student Attitude Towards Nigerian Secondary Schools*. Journal of Teacher Education Vol 34. www.ecu.edu/aj/te
- American Federation of Teachers (2006) *Teacher Quality in Professional Development of teacher*. <http://www.eft.org>.
- Amin M (2005) *Social Science Research, Conceptual, Methodology and Analysis*. Kampala
- Atsiaya R M (2007) *Trends in Teaching and learning of Mathematics and Science; A paper on INSET mop up cycle one*, Kiambu, unpublished
- Banilower, E. R., Heck D.J and Rosenberg, SL, Weiss, I. R.. (2008). *Studying the effects of professional development: The case of the NSF's Local Systemic Change through the Teacher Enhancement Initiative*. *Journal of Research in Mathematics Education*, 39(2), 113-152.
- Binns Commission (1953), *The African Education: A Study of Policy and Practice in Tropical British*, Nuffield.
- Bruner J (1966) *Towards a Theory of Instruction*, Cambridge MA, Harvard University
- CEMASTE A (2008) Newsletter, November/December 2008
- CEMASTE A (2011) *Monitoring and Evaluation SMASE* Nairobi unpublished.
- CEMASTE A (2012) *Monitoring and Evaluation SMASE* Nairobi unpublished.
- Daily Nation, 5th Feb 2014: Handing Over and Opening of the New Complex of CEMASTE A,
- Flanders N.A (1970) *Analyzing Teachers' Behaviour*, Massachusetts, Addison Wesley

- Gorard S (2001) *Education Research for Modern Scholars*. Enugu, Fourth Dimension publishers
- JICA (2009) *Partners in Development*, JICA Newsletter, Nairobi.
- JICA (2007) Overview of Terminal Evaluation A Survey results of Sept 2007.
- Kagenyi D.M (2007) *Cost Effectiveness of SMASSE Programme in Thika District; A Case of Kiamwangi Division*, un-published, Masters of Education Project, K.U.
- Kahare M.W (2011) *Impact of SMASSE in Teaching and Learning of Physics in mixed Day Secondary Schools in Lari Division, Central Province, Kenya*, K.U.
- Kaimenyi J.T (2014) Opening of CEMASTE A complex, DN 5th Feb 2014, pg 40-41.
- Kamunyu W. (2011) *Effectiveness of SMASE as perceived by Chemistry Teachers in Gatundu South District*, Kenyatta University unpublished K.U, Nairobi
- KESSP (2005) Kenya Education support sector program Report July 2005
- Kipsang B and Kaimenyi J. (2014) MOEST DN 5th February, pg 40-41
- Kombo DK and Tromp DL (2006) *Proposal and Thesis Writing: An instruction* Nairobi. Makerere University Press
- Malala G (2012) *A Review of extend of Sustainability of Education projects: A Case of SMASSE Project in Kenya. Bondo, Bondo University*
- MOEST (2004) Development of Education in Kenya: www.ibe.unesco
- Miheso M (1999) *Individual Training In Japan; Implications For Kenya. Unpublished SMASE project Report*, Nairobi KU press
- Mugenda D.M and Mugenda A.G (1999) *Research Methods; Qualitative and Quantitative Approaches*. Act Press, Nairobi.

- Munyao H.T (2013) *Impacts of SMASE project on teaching Mathematics in Secondary Schools in Mwingi West District, Unpublished Masters Project*, Nairobi KU Press
- Njoroge N.M (2014) *Director, DN 5th Feb 2014, pg 40-41*
- Nui N. and Nyachomba I (2006) *SMASSE Project: Mathematics Report on the 4th Workshop on Effective Operations and Management of SMASE Project*. Unpublished, Nairobi. KU.
- Oirere D.I (2008) *An Evaluation of Effectiveness of SMASSE INSET Project in Secondary Education. A Case of Kenya Division, Gucha District, Kenya – unpublished, KU*
- Ojwang J (2004) *Steps taken on In-Servicing Nairobi Microde Education consult*
- Okumbe H (2007) *Educational Management: Theory and Practice*, Nairobi, NAIROBI University Press
- Olembo J, Karagu N and Wanga P (1992) *Management in Education*, Nairobi Educational Research and publication, Nairobi EARP
- Ombalo D (2008) *A study of the Impact of SMASSE INSET Project in upgrading capability* Pauline's Publications and Africa.
- Orodho J.A (2009) *Elements of Education and Social Science Research Methods*, Masola Publishers; Nairobi
- Orodho JA (2012) *Techniques of Writing research Proposals and Report in Education and Social Sciences* Nairobi, Kanezja HP enterprises.
- Richards A.D (2007) *Taking Science To Schools*, Washington DC, National Academic Press
- ROK (2005) *Kenya Education Sector Support Programme*, M.O.E Nairobi, July 2005

- ROK, (2005) Sessional Paper No. 1; *A Policy Framework Training and Research meeting the Challenge of Education Training and Research in Kenya in the 21st Century*, Nairobi, Government Press
- Sekeran U. (2006) *Research Methods for Business, A Skill Building Approach*, John Wiley
- SMASSE INSET (2003) Facilitation Materials, Kikuyu, Thogoto TTC
- SMASSE INSET (2004) Materials on Facilitation, Kikuyu, Thogoto TTC
- SMASSE INSET (2006) Materials on Facilitation, Kikuyu, Thogoto TTC
- SMASSE INSET (2009) Facilitation Materials by Facilitators; Gachoka P, Mugo P, Simiyu B, Magu B, Thogoto TTC, Nairobi
- Townshed T. and Bates E (2007), *A Hand Book of Teachers' Education Globalization Standards and Professionalism in Times of Change*, Netherlands, Springer
- Tromp and Kombo D.K; (2006) *Proposal and Thesis Writing: An Introduction*, Nairobi Washington.

APPENDICE

APPENDIX I: HEADTEACHERS INTERVIEW SCHEDULE

School:

Gender: Male () Female ()

1. Age: 30 – 39 () 40 – 49 () 50-60 ()

2. What is your highest professional Qualification?

P-1 () Diploma () PGDE ()

B.ED () M.ED () PH.D ()

3. How many years have you been a head teacher in this school?

1-5 () 6-10 () 11-15 () over 16years ()

4. Have you ever been involved in SMASE INSET Organization?

Yes () No ()

5. Has your school ever sent teachers for SMASE INSET program?

Yes () No ()

6. Have you ever attended a meeting about SMASE?

Yes () No ()

7. In your school, do you have a forum where SMASE trained teachers share their experiences with other teachers?

Yes () No ()

If yes, how is this facilitated? Through;

Subject Panels () Staff Meetings () Others ()

8. Respond to these **statements** on the effect of SMASE INSET on mathematics in your school.

Key: SA – Strongly Agree; A – Agree; U – Undecided; D – Disagree;

SD – Strongly Disagree. *Please tick \surd where appropriate*

	Statement	SA	A	U	D	SD
I	KCPE Performance has improved					
II	Teachers are more confident in teaching					
III	Teachers attitude towards mathematics is now positive					
IV	There is increased use of improvisation by teachers					
V	Mathematics lessons are now more learner-centered					
VI	ASEI – PDSI lesson planning is effective in the school					
VII	Mathematics lessons are more hands- on now					

9. Do you motivate your learners?

Yes () No ()

If yes, how? Presents () Verbally ()

Money () Clapping ()

10. Do you motivate teachers to post good results?

Yes () No ()

11. How often do you buy text books/reference materials for your school?

Termly () Yearly () Monthly ()

12. How often do you purchase exercise books for learners?

Termly () Yearly () Monthly ()

13. Do you have enough mathematics teachers in std 8?

Yes () No ()

14. Do you have a policy of replacing lost/worn out text books?

Yes () No ()

15. Were teachers forced to attend SMASE INSETs?

Yes () No ()

16. What challenges have you generally faced in SMASE project/programme?

.....

.....

.....

APPENDIX II: STD 8 MATHEMATICS TEACHERS'

QUESTIONNAIRE

Please read the questions below and provide the appropriate responses by either ticking or giving further information in the space provided. Do not write your name on the questionnaire since the information you give will be treated confidentially, this study is purely for research purpose. Kindly write your honest response to each question.

SECTION A: PERSONAL INFORMATION (Tick where appropriate)

1. Gender Male () Female ()
2. What are your highest professional qualifications?
P1 () Diploma () PGDE ()
B.ED () M.ED/MA () PH.D ()
3. How long have you been teaching?
1 – 5 years () 6 – 10 years () 11 – 20 years ()
Above 20 years ()

SECTION B

TEACHING MATHEMATICS

4. Was teaching your first choice career?
Yes () No ()
5. What is your lesson teaching load per week?
Below 14 () 15 – 20 () 21 – 25 ()
26 – 30 () Over 30 ()
6. Have you ever attended any mathematics SMASE INSET cycle?
Yes () No ()
If yes, how many
7. What is the teacher- student ratio in your school? About,
1:50 () 1:60 () 1:70 () 1:80 ()

8. What is the average classroom population in Mathematics lesson?

30 learners & below () 31 – 40 learners ()

41 – 49 learners () 50 and above ()

9. What is the average learner to text book ratio in mathematics?

1:1 () 2:1 () 3:1 () 4:1 () 5:1 ()

10. What is your opinion on these statements? Please tick [] in the appropriate box (es).

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

No		SA	A	U	D	SD
11.	Effective teaching can be achieved through improvisation					
12.	Planning makes the teacher more effective in class					
13.	I pay individual attention to learners in mathematics class					
14.	Other duties cannot hinder effective teaching of mathematics					
15.	I always set positive and realistic goals for my learners					
16.	Practical activities can be performed for each mathematics topic					
17.	Teaching mathematics is interesting					
18.	I reflect on how to improve a lesson after teaching it					
19.	Lesson plans are not necessary for effective teaching					
20.	Activities help learners to understand concepts better					
21.	I sometimes repeat a lesson that was not well understood					
22.	Teaching aids do not assist in effective learning/teaching					

SECTION C:

How often do you do these activities? Please tick [✓] the appropriate box

No		Every lesson	Most lessons	Some lessons	Rarely	Never
23.	Engage learners in group work					
24.	Give learners discussion work					
25.	Assign learners practical work					
26.	Allow learners to report results of practical work					
27.	Make lesson plans (ASEI-PDSI lesson plans)					
28.	Trying out experiments before going to class					
29.	Give home work					
30.	Invite a colleague to observe you in class					
31.	Use local improvised materials in practical lessons					
32.	Build on what learners already know					
33.	Supervise group work					
34.	Assist pupils to relate learnt concepts to daily life					
35.	Perform demonstrations for learners					
36.	Use schemes of work to make lesson plans					
37.	Mark pupils exercise books to check grasp of ideas					
38.	Build on pupils ideas/suggestions during teaching					
39.	Use charts and other teaching aids					
40.	Summarize the lesson					

SECTION D:

41. How do you find the performance of mathematics since the introduction of SMASE project?

Very Good () Good () Poor () Very Poor ()

42. Please fill the table below on mathematics performance in KCPE from 2006 – 2013 in your school.

YEAR	ENROLMENT	MEAN
2006		
2007		
2008		
2009		
2010		
2011		
2012		
2013		

43. In your opinion, what challenges hinder implementation of SMASE approaches in your teaching /school?

.....

44. What are the effects of SMASE approaches on the attitude and participation of learners in mathematics lessons?

Positive () Negative ()

.....

Thank you for participating

APENDIX III: LEARNERS' QUESTIONNAIRE

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

SECTION A

1. Which class are you in?
2. State your gender; Girl () Boy ()

Read the following statements and give your honest opinion by ticking in the appropriate box

NO	Statement	Strongly Agree	Agree	Undecided	Disagree	Strongly Disagree
3.	Mathematics is not difficult					
4.	I enjoy studying mathematics					
5.	I apply the mathematics am taught to my daily life					
6.	I understand better when teacher uses teaching aids					
7.	My teacher motivates me to do well in mathematics					
8.	My teacher has made me feel that I can improve in mathematics					
9.	I have improved in mathematics performance					
10.	I like the way the teacher teaches mathematics practically					

SECTION B

The following **statements** refer to your participation in a mathematic lesson. Read each statement and evaluate your level of participation by ticking [\surd] in the appropriate box

KEY:-

No participation	0
Little participation.....	1
Average participation.....	2
A lot of participation.....	3

	Statement	0	1	2	3
11.	Asking questions				
12.	Answering questions				
13.	Suggesting possible outcomes of practical activities				
14.	Make observations and give presentations				
15.	Record measurements				
16.	Make conclusions from practical activities				
17.	Improvising materials for doing practical activities				
18.	Taking part in group work and group discussions				
19.	Asking for clarifications on areas not well understood				
20.	Give presentations on findings				
21.	Finishing my mathematics homework/assignments				
22.	Taking my mathematics exercise book for marking				

SECTION C:

PERTINENT ISSUES

23. What is taught is hard to understand.

True () False ()

24. The language used in teaching is above my understanding.

True () False ()

25. The teacher speaks very fast / unclearly.

True () False ()

26. I cannot speak well in English so I cannot ask or answer a question.

True () False ()

27. What suggestions would you give that would help to improve teaching and learning of mathematics?

.....

28. How has the increased use of practical activities in mathematics been of help to you? It has given me;

Positive Attitude () Negative Attitude ()

Thank you for participating

APPENDIX IV: OBSERVATION SCHEDULE FOR SMASE

APPROACHES

School: No. of Students

Class: Date

Topic: Sub-Topic

Please evaluate each of the following aspects of the lesson on the scale of 0 – 4

Key: 0 – Poor: 1 – Fair: 2 –Satisfactory: 3 – Good: 4 – Very Good

	PLAN	0	1	2	3	4
1	The Work plan accounts for learner’s background and previous experience.					
2	Work plan is appropriate to lesson interns of content and learner’s ability.					
3	Materials are appropriate and adequate.					
	INTRODUCTION	0	1	2	3	4
1	Previous knowledge linked to new topic.					
2	Introduction is clear and interesting.					
3	Introduction arouses curiosity and interest.					
	DEVELOPMENT	0	1	2	3	4
1	Learners are able to express prior experiences based on the content learned					
2	The teacher is able to demonstrate activities.					
3	Learners are able to give their own observations in practical lessons.					
4	Lesson allows learners to practice skills like observation, measuring identifying variables.					
5	Teacher is able to deal with learners questions and reinforces learning in steps					
6	Lesson encourages active learner participation.					
7	Learners are able to give their own forecasts/predictions					
8	The lesson is focused more on activities than on					

	content (i.e is learner-centred)					
9	The lesson is teacher- centred					
	CONCLUSION	0	1	2	3	4
1	Lesson encourages learner to make conclusions.					
2	Teacher is able to summarize lesson and give assignments.					
3	The lesson assists learners to relate content taught to daily activities.					
4	The teacher utilizes time well					
	CLASS MANAGEMENT	0	1	2	3	4
1	Teacher is able to conduct lesson considering different learner abilities					
2	Teacher is able to make efficient use of teaching aids.					
	SEE/EVALUATE	0	1	2	3	4
1	Teacher able to supervise class work					
2	Teacher attentive to needs of the learners diverse abilities.					
3	Teacher able to keep eye contact with learners.					
4	Teacher allows questions from learners and builds on feedback.					
5	Teacher able to pose questions to evaluate learners' understanding.					
	IMPROVE	0	1	2	3	4
1	Teacher able to spot inattentive learners					
2	Teacher able to do rehearsals on content taught.					
3	Teacher able to discuss and correct pupils misconceptions					
4	Teacher builds on pupils feedback					

The teaching aids used in the class are mostly?

Conventional/Bought () Improvised () Additional comments

Thank you for participating

APPENDIX V: KENYATTA UNIVERSITY RESEARCH

ATHORIZATION LETTER



**KENYATTA UNIVERSITY
GRADUATE SCHOOL**

E-mail: dean-graduate@ku.ac.ke

Website: www.ku.ac.ke

P.O. Box 43844, 00100
NAIROBI, KENYA
Tel. 8710901 Ext. 57530

Our Ref: E55/CE/24322/2012

DATE: 9th December, 2014

The Principal Secretary,
Higher Education, Science & Technology,
P.O. Box 30040,
NAIROBI

Dear Sir/Madam,

RE: RESEARCH AUTHORIZATION MICHAEL KARURI- REG. NO. E55/CE/24322/2012

I write to introduce Mr. Michael Karuri who is a Postgraduate Student of this University. He is registered for M.Ed degree programme in the Department of Educational Management, Policy & Curriculum Studies.

Mr. Karuri intends to conduct research for a M.Ed. Proposal entitled, "Effectiveness of Smase Programme Towards Enhancement of Mathematics Performance in Public Primary Schools in Embakasi District, Nairobi County, Kenya".

Any assistance given will be highly appreciated.

Yours faithfully,



MR. LUCY N. MBAABU
FOR: DEAN, GRADUATE SCHOOL

RM/mn

APPENDIX VI: NACOSTI AUTHORIZATION PERMIT



NATIONAL COMMISSION FOR SCIENCE, TECHNOLOGY AND INNOVATION

Telephone: +254-20-2213471,
2241349, 310571, 2219420
Fax: +254-20-318245, 318249
Email: secretary@nacosti.go.ke
Website: www.nacosti.go.ke
When replying please quote

9th Floor, Utalii House
Uhuru Highway
P.O. Box 30623-00100
NAIROBI-KENYA

Ref: No.

Date:

18th February, 2015

NACOSTI/P/15/8365/4527

Michael Karuri
Kenyatta University
P.O. Box 43844-00100
NAIROBI.

RE: RESEARCH AUTHORIZATION

Following your application for authority to carry out research on "*Effectiveness of SMASE Programme towards enhancement of mathematics performance in public primary schools in Embakasi District, Nairobi County, Kenya*" I am pleased to inform you that you have been authorized to undertake research in **Nairobi County** for a period ending **17th April, 2015**.

You are advised to report to **the County Commissioner and the County Director of Education, Nairobi County** before embarking on the research project.

On completion of the research, you are required to submit **two hard copies and one soft copy in pdf** of the research report/thesis to our office.


SAID HUSSEIN
FOR: DIRECTOR GENERAL/CEO

Copy to:

The County Commissioner
Nairobi County.

The County Director of Education
Nairobi County.

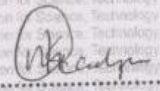
National Commission for Science, Technology and Innovation is ISO 9001:2008 Certified

APPENDIX VII: RESEARCH PERMIT


THIS IS TO CERTIFY THAT:
MR. MICHAEL KARURI
of KENYATTA UNIVERSITY, 462780-100
NAIROBI, has been permitted to conduct
research in Nairobi County

on the topic: EFFECTIVENESS OF SMASE
PROGRAMME TOWARDS ENHANCEMENT
OF MATHEMATICS PERFORMANCE IN
PUBLIC PRIMARY SCHOOLS IN EMBAKASI
DISTRICT, NAIROBI COUNTY, KENYA.

for the period ending:
17th April, 2015


Applicant's
Signature

Permit No : NACOSTI/P/15/8365/4527
Date Of Issue : 18th February, 2015
Fee Received :Ksh 1,000



Secretary
National Commission for Science,
Technology & Innovation