

**INFLUENCE OF STRENGTHENING MATHEMATICS AND SCIENCES IN
SECONDARY EDUCATION (SMASSE) PROJECT ON STUDENTS PERFORMANCE
IN MATHEMATICS IN NYAKACH SUB – COUNTY, KISUMU KENYA**

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THIS RESEARCH PROJECT IS MY ORIGINAL WORK AND HAS NEVER BEEN
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DEDICATION

This work has been dedicated to my dear friend Rose Makunzo Mwangi who was my mentor and partly contributed to my financial expenses. Her support and encouragement has remained my source of inspiration and a symbol of perseverance during the economic turmoil of my study period.

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ACRONYMS AND ABBREVIATIONS

SMASSE	-	Strengthening of Mathematics and Science in Secondary Education.
PDSI	-	Plan, Do, See and Improve.
ASEI	-	Activity, Student, Experiment and Improvisations.
INSET	-	In Service, Education and Training
M.O.E	-	Ministry of Education
F.P.E	-	Free Primary Education
T.S.C	-	Teachers Service Commission
J.I.C.A	-	Japan International and Cooperation Agency
KNEC	-	Kenya national Examination Council
CEMASTE	-	Centre for mathematics Education Science and technology in Africa.
PEDAGOGY	-	Methods and principles of teaching
WESCA	-	West, East, Central, and South Africa.
SESEMAT	-	Secondary Science and Mathematics Teacher project-Uganda.
LSAY	-	Longitudinal Study of American Youth.
CGI	-	Cognitive Guided Instructions

ABSTRACT

The Kenya government through the ministry of education and in conjunction with JICA came up with strengthening of mathematics and science in secondary education (SMASSE) as a remedy to poor performance in mathematics and sciences in secondary schools. However, minimal studies have been carried out to establish the implementation of this project despite poor performance in mathematics over the years. Therefore, the purpose of the study was to identify the influence of SMASSE project on students' performance in mathematics in Nyakach sub-county in Kisumu county. The objectives of the study were: To determine the influence of SMASSE on students attitude towards mathematics and its performance in Nyakach Sub- County Kisumu county, Kenya;, Influence of SMASSE on teachers attitude towards the use of ASEI/PDSI in mathematics and its performance in Nyakach sub-county Kisumu county, Kenya; and the influence of SMASSE on principals and QUASO supervision towards mathematics and its performance in Nyakach Sub- County in Kisumu County, Kenya. Survey research design was used in the study and structured questionnaires - with open and closed ended questions - were employed to collect the data in attempt to answer the research questions. As well as interviews. The target population was 40 public secondary school. The study randomly sampled 20 principles, 51 mathematics teachers, 330 form four students and purposively sampled 3 SMASSE trainers and 1 QUASO. Census was employed on population of 40 public secondary schools from which 20 schools were randomly sampled. Expert judgment was used to determine validity while reliability of the instrument was determined through test and re-test where a pilot study was conducted in one public secondary school in upper Nyakach division. This was repeated after two weeks and the correlated results were $r=0.632$ and < 0.000 . The coded data was analyzed with aid of statistical package for social science version 16 (SPSS) and Microsoft excel. Descriptive statistics including means percentage, frequencies, standard deviations were used for continuous and frequency distribution of categorical data. Pearson's correlation was used to analyze the relationship between attendance of SMASSE and KCSE results mean score. The study found that, students had a positive attitude as shown by 176(57.9%) of students who enjoyed mathematics as result of influence of SMASSE project in schools, teachers' attitude towards teaching mathematics improved as they employed ASEI/PDSI strategies, principles and QUASO supervised and motivated the teachers and 15(88.2%)of the principals agreed with the project. The study concluded that students had demonstrated appositve attitude towards learning mathematics and their performance had supported this after introduction SMASSE. The study recommends that SMASSE should continue and all mathematics teachers should go through SMASSE in service and train others. School principals should continuously support, supervise and motivate mathematics teachers.

CHAPTER ONE.

INTRODUCTION.

1.1 Background of the Study.

The 2000 Dakar conference advocated for “Education for all” before the year 2015. This was key if most developing countries – majority being in Africa - were to be industrialized by 2030. However, looking at the performance in mathematics at the KCSE level, the industrialization vision looks quite doubtful. Improving the performance of students in mathematics is thus a great social need for Kenya, if it is to realize its industrialization agenda within the 2030 time frame. The perpetual poor performance in mathematics has always been attributed to the following issues: students having a negative attitude towards the subject; the selection of unsuitable types of textbooks to be used for the national curriculum; and an inappropriate type of pedagogy applied by teachers that has seen the poor utilization & mobilization of teaching & learning resources - primarily with regards to- the performance of little or no experiments, issuance of inadequate assignments, un interactive teachers, among others. Ministry of Education (2007).

Other factors that were also noted included: inadequate professional guidance by subject quality assurance and standards officers (QUASOs); non-completion of the syllabus or rather its belated completion; and lastly, a missing link between the syllabus covered in primary and secondary levels, Nui and Wahome (2006). The SMASSE project was introduced focusing on the ASEI and PDSI teaching approaches, so as to change the attitude and approaches of both teaching and learning sciences. This was as a result of a concerned Kenyan government that responded by reaching out to JICA which proposed the SMASSE project as a possible solution to the

predicament. The overall goal of SMASSE was to upgrade the capacity of young Kenyans when it came to mathematics, Mwangi (2004). Performance was to be improved primarily through training teachers in ways that were more advanced and progressive. The SMASSE programme had four basic phases. JICA on launching and completing the first four cycles, withdrew part of its funding. The Ministry of Education (MOEST) & the District Heads Association thus had to step in and sponsor the programme so as to see its continuity. Funds from JICA were used to train individuals who then became trainers of the SMASSE programme. This training was however only conducted in Japan. Also, training materials and science equipment were only provided to Kenya at the national level. This saw only a certain number of senior teachers per district trained (4 per subject for example) to become trainers. INSET activities were also carried out at the district level in various parts of the country. Despite all these efforts to correct on the low student achievement at the KCSE level, most students were still unable to handle questions in mathematics that required the application of construction skills, something that was to be corrected by the ASEI/PDSI hands on approach, KNEC (2010).

The various education reforms, trends and innovations were all aimed at improving: the quality of education; the access to relevant education; and the reduction of poverty, and as a result move the country's economic performance to an individual level. The Ministry of Education (2007) reported that, the government of Kenya continues to work towards improving the quality of education. This was primarily through cost sharing activities such as the provision of free primary education (FPE) & also free tuition for secondary education, together with funding in-service educational training (INSET) activities. Research studies as to how the quality of education in Kenya can be improved generally indicate that it is through improving the quality of teachers that this goal can be realized, Ewing (1995), World Bank (2006). In 1985, Kenya changed its education system from the 7-4-2-3 system to the 8-4-4 system, Mackey report (1981).

The 8-4-4 system aimed at inculcating self-reliance and all roundedness among graduates at every level, through emphasizing on subjects that were vocational. The 8-4-4 system changed the subject contents at both the primary level and the O level. For instance, Mathematics was made compulsory. The implementation of the 1981 Mackey report was accompanied by the revelation of how well equipped many schools were when it came to their capacity to teach mathematics. Policies when it came to the provision of teachers by the government changed from the scope of 659 schools that was existent nationwide prior to 1988, to a scope of 2126 schools.

Resource constraints became more of an issue and thus cost sharing in education was introduced and made official, (Republic of Kenya, 1988).

The SMASSE programme was launched in 1998 across the 72 districts in the country. The pilot was conducted in Muranga, Maragwa, Kisii, Gucha, Butere, Mumias, Kakamega, Lugari, Kajiado and Makueni. The aim was to upgrade capability of mathematics in the country through INSET activities. This was in response to poor performance and achievements witnessed in Kenya certificate of education (KCSE) results, KNEC (1998). A total of 108 INSET centers were established throughout the country before the conclusion of the SMASSE project, Center for mathematics, science and technology in Africa (CEMASTEA) strategic plan 2009 – 2015.

The in-service achieved its output successfully including establishing systems of trainers at the national in-set center in Nairobi, establishing a system of training in pilot district and strengthening the role of INSET. From results of this study, many problems were noted when it came to mathematics. Some were within the scope of the SMASSE programmed itself and others beyond its scope.

Nui and Wahome, (2006) noted that even in cases where qualified teachers were available - and in adequate numbers -or even cases in which teaching equipment & materials were adequate, the performance of students in mathematics was not necessarily good. Actually, surprisingly, a significant number of schools which were characterized by minimal facilities instructional materials, but with teachers who taught effectively had been observed to post good performance in mathematics. This revealed the possibility that the achievement of students from learning could primarily be determined by what went on in the classroom - that is –those approaches and methodologies that were used to deliver the contents of a subject, Republic of Kenya (2009).

Mwangi, (2004) indicated that one of the lessons that should also have been learnt from the 1998 survey on education conducted in Kenya, was that those factors that were greatly responsible for the poor performance in mathematics, with reference to the SMASSE project - were still not quite known – and this was particularly for mathematics.

1.2 Statement of the Problem.

The education system in Kenya is one which is both exam & grade oriented. Mathematics in Kenya is a core subject and is compulsory up to secondary school level. It also is a foundation for a number of fields such as medicine, engineering, architecture, agriculture and commerce. The attainment of vision 2030 requires that science and technology be the core of a country's education system. However, the performance in mathematics has been poor in Kenya at large, resulting to a national outcry by all education stakeholders.

The Kenya government through the Ministry of Education and in conjunction with JICA came up with SMASSE as a possible remedy to the problem. However, limited studies have been conducted to establish the nature of this project's implementation despite poor performance in mathematics over the years. Nui and Wahome (2006) pointed out that SMASSE'S purpose was to improve the performance of young Kenyan in mathematics

Isinya (2012) reported that teachers frequently stormed out of SMASSE INSET centers over issues such as poor accommodation facilities and meager daily allowances. Officials were also asking JICA to withdraw its sponsorship until these issues are addressed. As a result of those problems that were pointed out by Isinya, this study was conducted with the hope of finding out those contributions that the SMASSE project had so far had on the performance of students in mathematics at the KCSE level of examination in Nyakach sub-county, Kisumu County.

1.3 The Purpose of the Study.

This study's purpose was to assess those contributions the SMASSE project had so far had on the performance of students in mathematics, at the KCSE level of examination, with the main focus being Nyakach sub-county in Kisumu County.

1.4 Objectives of the study.

The overall objective of this study was to find out those impacts the SMASSE project had so far had on the performance of students in mathematics in Nyakach sub-county, Kisumu County.

The objectives of this study were to examine the:-

1. Influence the SMASSE project had so far had on the attitude of students towards mathematics and in turn its performance, in Nyakach sub-county, Kisumu County.
2. Influence the SMASSE project had so far had on the attitude teachers had towards applying the ASEI/PDSI approaches when teaching mathematics and in turn, its performance in Nyakach sub-county, Kisumu County.
3. Influence of the way in which those approaches associated with the SMASSE project being monitored- by both QUASO & head teachers- had on the performance in mathematics, in Nyakach sub-county, Kisumu County.

1.5 Research Questions.

1. How does the SMASSE project influence the attitude of students towards mathematics, in Nyakach sub-county, Kisumu County?
2. How do teachers apply the ASEI/PDSI teaching approach when teaching mathematics in Nyakach Sub–County, Kisumu County?
3. How do the supervision & motivation activities of the ASEI/PDSI teaching approaches by principals & QUASO, impact the performance in mathematics in Nyakach Sub–County, Kisumu County?

1.6 Significance of the Study.

Examinations at the national level are usually administered and overseen by the Ministry of Education. That being the case, this study hoped that its findings would be of use to the Ministry of Education, during the formulation of education and examination policies. This study also hoped to identify how effective the SMASSE programme had been when it came to improving the country's performance in mathematics, at the KCSE level.

The findings of this study were also hoped to help promote teaching and learning of mathematics among stake holders such as head teachers who were art based but could support mathematics teachers by providing teaching and learning resources.

The study also hopes that its findings would provide the planning committee of Nyakach sub-county with feedback that would help improve the performance of its schools in mathematics. It also hopes to motivate teachers in Nyakach sub-county to implement the ASEI/PDSI teaching approach with hope that it bring about change.

The study also hopes to spark a momentum for further research studies through establishing a foundation upon which other related studies could be anchored.

Finally, this study hopes to be credible enough to be referred upon by other researchers in the education world.

1.7 Basic Assumptions of the Study.

A number of assumptions were made pertaining to the nature of certain conditions. These were that: all the data that was required for this study was obtainable from the sampled respondents; all that data required by this study was obtainable within ascertain time period - this assumption was based on the belief that an agreement could be struck between the respondents & the researcher as to when the questionnaires should be returned following their completion - ; all those finances required for this study's activities were accessible and as a result finances were not a constraint, with regards to the scope to be covered; and finally, majority of the respondents targeted were transparent, honest and truthful when in came to their responses.

1.8 Limitation of the Study.

The limitation that was commonly faced when conducting this study was the lack of transparency in quite a number of schools. Transparency was a necessity if data that could be relied upon was to be collected. This problem was brought about by the wish of most head teachers to withhold certain information that would provide explanations as to why they performed the way they did.

Respondents were assured of utmost confidentiality so as to work around this predicament.

Some of the respondents delayed too much when it came to filling & returning questionnaires, way beyond that time frame the researcher considered adequate for a response. To minimize such delays, follow ups were done so as to improve on the response return rate.

The Nyakach sub-county has a very rocky terrain and this at times presented some difficulties with the most worrying one being time wastage when navigating the terrain. Alternative means of

transport such as motorcycles were thus at times opted for so as to work around that issue since giving up would result in a lower response rate than that targeted.

SMASSE covers not only mathematics but also all the three sciences. That being the case, the decision to focus on only mathematics, due to resource constraints, created some form of distortion to those impacts that SMASSE had so far had. The study however decided to proceed based on the notion that all the four subjects had the same basic principles.

1.9 Delimitations of the Study.

This study was conducted in the west & lower divisions of Nyakach sub-county in Kisumu County, Kenya. The secondary schools selected were sampled in a manner that saw the formation of a true representative of those schools in the sub-county. The sample was made up of 20 head teachers, 51 mathematics teachers, 330 students, 3 SMASSE trainers and 1 QUASO. Most teachers had attended SMASSE, and the students targeted were in session making it possible to get that data required by the study.

1.10 Definition of Significant Terms

SMASSE -Strengthening of Mathematics and Sciences in Secondary Education.

PDSI -Plan, Do, See then Improve.

ASEI -Activity, Student, Experiment and Improvisation.

INSET -In-Service Education & Training.

JICA -Japan International and Cooperation Agency.

CEMASTEA-Centre for Mathematics, Science and Technology in Africa.

PEDAGOGY -The science & art of education, specifically, instructional theories which an instructor develops.

INFLUENCE -Capacity of something to be a compelling force or produce effect on the actions.

ATTITUDE -Having an inclined interest and thus emotion towards something.

APPROACH -A way of thinking and thus dealing with a situation.

PROJECT -An organized program of instructions.

RESOURCE -Any physical or even virtual entity that is limited in its availability, and that that needs to be consumed or used so as to obtain a desired output or requirement.

DEPENDENT VARIABLES -These are those factors that affect the outcome of a student's performance, relative to the population of students.

INDEPENT VARIABLES- These are those factors which affect all students equally. For instance, a difficult sum may be so for all students

INTERVENING VARIABLES–Those variables existing between two events or objects.

POOR PERFROMER –A student or learner who is not able to interpret, manipulate and apply mathematics concepts correctly. This is because the pass scores is determined by group ability in a common examination.

STAKE HOLDERS -Individuals or institutions with interest in education matters of a country.

PERFORMANCE -The fulfillment of a predetermined obligation.

MOTIVATION - Reasons why one behaves in a particular way.

1.11 Organization of the Study.

This study was organized into five chapters.

Chapter one introduced the study. That is, it first presented the Background of the study and then proceeded to present the Statement of the Problem, the Purpose of the Study, the Objectives of the Study, the Research Questions, the Significance of the Study, the Limitations of the Study, the Delimitations of the Study, the study's Basic Assumptions, the Definition of Significant Terms used in the study, and then concluded with the Organization of the Study. Followed by chapter two deals with the review of literature on the influence of SMASSE project on students' performance along the following themes; Students' attitude towards mathematics; teachers' attitude towards SMASSE ASEI/PDSI teaching approaches; and the views of head teachers & QUASO on monitoring and supervision of SMASSE's ASEI/PDSI teaching approaches. Then chapter three describes the methodology that was used while conducting the study including research design, target population, sample size and selection, research instruments and piloting. While chapter four entails data analysis of data that was collected by the researcher. This data is then interpreted, presented and discussed; And then the last chapter - chapter five - summarizes the findings, states conclusions, gives recommendations and suggestions for further studies. References and Appendices are also included

CHAPTER TWO.

LITERATURE REVIEW.

2.1 Introduction.

This chapter reviews various literatures that have looked at impacts SMASSE has had on the performance in mathematics, with focus being on Africa. Information is given on the following themes; the attitude of students towards the SMASSE's ASEI/PDSI teaching approaches; the attitude of teachers towards the SMASSE ASEI/PDSI way of teaching mathematics; and finally, the level of participation by head teachers & education officers when it comes to monitoring & supervising the implementation of the SMASSE ASEI/PDSI teaching approaches.

Background to the SMASSE project in Africa is the Jomtein declaration of education for ALL (EFA) in 1990 that marked a shift of Japan's focus from "hardware" type of projects - for example - the supply of buildings to schools, to "software" type of projects. Furthermore, at the United Nations general conference of trade and development (UNCTAD in 1996), Japan expressed her interest towards supporting education activities in Africa through a paper that was then presented during the 7th SMASSE-WESCA annual conference which was held in Lusaka, Zambia. JICA recognized Africa's need for assistance when it came to improving: the quality of education; the training of teachers; and the administration & management of schools. Japan is familiar with the concept of in-service training of teachers and further more is experienced in linking that which is taught in mathematics to that which is taught in science. This was so as to ensure that mathematical concepts learned, had an industrial applicability and also thus enhancing a graduate's employment ability. It had also been credited with the identification of that unique approach which saw industrial practices reformed through lesson studies. Within the same background, Africa's initiative - in which Japan plays an important role - , sought to not only strengthen mathematics but also to enhance the ability of students, but now through improving he

mastery of content by teachers and also their mastery of pedagogical skills. According to Hosstein,(2005),the initiatives of SMASSE-Kenya; SMASSE-Nigeria;SESEMAT-Uganda and SMASSE-Zambiaallinvolve the strengthening of mathematics at the secondary level of education.

The project was best suited for African countries, basically, developing countries,as it is such countries that were known toface severe resource constraints. The project was also suitable for such countries since they focused on strengthening mathematics, within those structures that were in existence. This thus saw emphasize on the need for effective mobilization of resources and as a result make people recognize the need for consensus building, on educational issues. The Ministry of Education Science and Technology thus needed policies that were capable of recognizing the need for change and thus be able: to welcome possible challenges &as a result set guidelines forguiding & effecting changes in KESSP; to acknowledge the need for professional development despite constrained resources; and finally, to come up with an outline for other policies but ones still dealing with the funding of various education initiatives.JICA, MOEST and the Sub-County Head Teachers Association were all supposed to sponsor the SMASSE project.

In Ethiopia, the reason behind JICA's cooperation in the education sector was so as to improve the accessibility of secondary educationby all students in the country,in addition to improving the quality of education. Capacity building was thus increased for both teachers and school directors.SMASSE in Ethiopia was started in 2011 and its focus was on building the capacity of those teachers who taught mathematics in grade 7 & 8, through a series of training activities. The trained teachers were then capable of engaging in teaching & learning activities that were more practical and proactive and this was hoped to improve the quality education received by students. Teachers were trained on how to use locally available resources as educational materials and also for experiments. The SMASSE programme in Ethiopia worked with the Ethiopian Ministry of

Education and also National Educational Trainers, so as to change the paradigm of education from the typical “chalk & talk” approach, to a more “studentcentered” approach. It was scheduled to end by 2014 having fully trained all mathematics teachers in the country who were thus better equipped with skills and knowledge that would allow them to conduct mathematics classes that were more interactive.

In Rwanda, the aim of the SMASSE programme was to achieve social & economic development, through the development of human resource, in science and technology, with the target being all mathematics teachers, and in close coordination with the Ministry of Education (MINEDUC). The SMASSE programme in Africa was thus basically rolled out with the aim of assisting in the establishment of in-service training that was institutionalized and mainly for mathematics teachers. African countries face common problems in mathematics namely: poor performance of students; and finally the necessity to transform the nature of lessons from being teacher-centered to being learner-centered. In addition, what had been learned in Kenya was to be shared with other African countries.

At the beginning of 2010, the SMASSE WESCA association had 11 member countries. However, by July 2010 the association had 33 member countries. The SMASSE programme was introduced with the overall goal of shedding more light on the importance of mathematics, in the changing world. (See figure 1 on appendix).

2.2 Students Attitude towards SMASSE's ASEI/PDSI Teaching Approach.

Students' attitude towards mathematics and the lack of a proper understanding of its relevance to future aspirations which affects the students.

The enthusiasm for studying mathematics usually plays a very important role in determining whether one will continue studying it at more advanced stages. One of the explanations as to why a few number of students take advanced courses in mathematics may be as a result of the thought that these courses are not necessary for their planned careers. Quite a number of students usually seem to have a proper understanding of that relationship between advanced mathematics and careers like engineering or even a health profession.

Data from the Longitudinal Study of American Youth (LSAY) showed that in 1990, 28% of young people who were not enrolled in mathematics courses, thought that they did not need advanced mathematics for what they planned to do in future. 39 % also said they did not need advanced science in terms of the same regards. Around, 30 % of the students had also been informed by their teachers and counselors that they did not need to pursue an advanced level of mathematics for their careers. Even among those students who expected to become scientists, the percentage that believed that advanced mathematics was key when it came to their careers, was below 75 %. The percentage that who knew they needed advanced mathematics was however slightly higher, for those students who planned to become engineers, relative to other career forms.

Between 1978 and 1990, the beliefs of students when it came to the relevance of mathematics in both their lives and careers, only saw a slight change. Also, the percentage of 17-year old students who indicated that they would like to take on more mathematics classes remained the same

during that period. This was also the case for that percentage of 17-year olds who felt they were good in mathematics.

Interestingly, among 13-year olds, the percentage that felt that they were good in mathematics increased by 6% (ETS 1991).The percentage of students indicating that they were taking mathematics “only because they had to” however remained the same for both of the age groups in the 1978-1990 period.

Data from the LSAY also indicated that most students just enjoyed studying mathematics as much as they did enjoy studying English or even Social Studies. It is also important to note that students across all levels of course work and found the mathematics courses to be much more challenging than both the English one and the Social Studies one .The data from NELS also showed that over half (57 % to be precise) of eighth grade students looked forward to attending the mathematics class. However, nearly 90 % of these eighth graders felt that mathematics was important to their future.

Classroom practice played a very important role in determining the way in which a learner performed. Lim (2006) & Zweak (2006) not noted for guiding principles but for defining good classroom practice pointed out that good practice could never be the same in the world over. It thus was to be developed at the school level and in addition to this aspect, models of good practices also needed to be valued across the: school; community; district; and national level so as to work effectively. Lim also stated that good practices entailed: listening to what learners had to say; designing curriculums that were learner-centered; the enjoyment of the learning process by students; a type of learning that was active and one in which there was doing so as to boost understanding; relating concepts being taught to the world of the learner; teachers staying learners too; and finally, the provision of regular professional development. Basically, good

classroom practices were shaped by all the parties involved. That is, students, teachers, schools and education officials.

Lim (2006) & Zweak (2006) made it easier to understand why a teaching strategy that had been effectively applied in a certain instructional session, did not necessarily work in another setting. More has to be done therefore, to assess the reality on the ground before introducing any classroom reforms.

Owiti (2011) observed the results of the Third International Mathematics & Sciences study (TIMES) of 1996 that had revealed the existence of a level of mediocrity when it came to teaching and learning mathematics that was simply intolerable. Teaching and learning mathematics basically entailed: the review of homework from the previous lesson; the issuance of more assignment; a quick delivery of a set of rules & the lesson in general; and finally, blowing away the remaining time with a set of exercises that teachers regarded to be for practice.

Owiti (ibid) argued that the methodology for teaching mathematics must be one that involves a scientific approach and also reveal how it was connected to the real world. Well organized lessons and presentations help students comprehend mathematical concepts and other major ideas. Research in Kenya has shown that: poor performance disillusionment; poor attitudes; and helplessness are what tend to be the case in most classrooms, when it comes to mathematics, Owiti (2011). In Kenya for instance, the performance in mathematics is perpetually dismal with an average of about 25% at the KCSE level of examination (Ayodo, 2009) Besides only about 19% of the students in Kenya schools like mathematics as compared to Singapore's 86%, (Owiti, 2008, Ayodo; 2009). Lack of creative teaching when it comes to mathematics whereby connections are made between: those cases commonly experienced by learners; the classroom work; and then the industry, has been observed to be the major contributing factor behind the variation. Many young Kenyans do not realize the value and application of mathematics in a

number of popular games across the world in addition to basic day to day living. Also, majorities think of mathematics as just isolated pieces of rules and ideas (Ayodo, 2009). This in part could contribute in future when it comes to the need to provide connections and experiences.

2.3 Teachers Attitude towards the SMASSE ASEI/PDSI Approaches.

The motivation of a learner to achieve in academics may either be enhanced or damaged by a teacher's attitude as he/she interacts with them. Flanders, (1970) and Franyo, (2007) argue that if the needs of students were responded to appropriately, it was possible for effective communication to take place between teachers and students.

There are those teachers who tend to intentionally ignore certain cues in the classroom and others who simply fail to notice these cues. These two incidences tend to influence the communication between teachers and students in a manner that is one sided. Also, despite the fact that the professional qualifications of teachers should be upheld in schools, teachers should also employ the use of their individual verbal communication skills. For instance, the recognition of a student's feelings and responding to them by encouraging him or her if they are weak. This breeds positive attitude towards learning and higher achievement by such a student.

According to a 1976 report by the national committee on education, objectives and policies by the Kenyan government, irrespective of how education is viewed, the role played by a teacher's quality must be given the most critical consideration. Teachers usually work within hierarchies in institutions that place highly visible constraint on that direction taken by their profession (Hawltorne, 1972). What teachers offer so as to make a difference in the achievements by students is usually greatly influenced by a school's administration. Anthony (2000) conducted a study on a number of factors that had an influence on success when it came to academics and strongly emphasized on the role of motivation. Both students and teachers agreed on the

importance of motivation. Their opinions, however, diverged when it came to factors such as how important active learning was and also on the issue of seeking help from students who were in residential high schools so as to assist in the process of determining how learning needs were perceived. Almost all students pointed out the need for teachers who cared and in addition, the preference of active learning. They further went ahead to mention the following needs: the need to feel emotionally safe; the need for high expectancy on the part of the school; and finally, the need for self-directed learning (learning by choice).

When analyzing student generated solutions towards the enhancement of academic success in African-American youth, Tucker, Herman, Pedersen, Vogel and Reinke (2006) all found out that in addition to the academic preparation of a student, positive peer influence also enhanced the academic success. They further pointed out that praise & encouragement by teachers & parents was not necessarily needed to facilitate a student's work and achievement. They also agreed that a student's achievement also seemed to have a connection with his/her occupational aspirations. Wong, Wiest and Cusick (2002) also all pointed out that the manner in which students perceived the behaviors of their teachers also had the capability of boosting the development of a student's autonomy, self-work & competence and in addition to that, the manner in which parents decided to involve themselves in the education activities of their children. These factors mentioned above were also important due to the fact that they could be used as predictors of the motivation of a student and thus their achievement. They also went ahead to state that factors such as age and gender seemed to have a connection with those attitudes concerned with the achievement of students. Whitelaw, Milosovic & Daniels (2000), however, all cautioned to that association proposed by Wong, Wiest and Cusick (2002), saying that that relationship was one that was complex and thus required further research.

This study was designed to find out what attitudes students had towards mathematics as a subject, since this was one of the factors pertaining to student's characteristics that could affect the implementation of the ASEI/PDSI approach when it came to teaching the mathematics subject.

The ASEI/PDSI approach should have the following benefits if effectively implemented. It usually increases the opportunities teachers have when it comes to studying students – that is – how they learn and how they react. It also tends to make teachers better at anticipating the responses of students. As a result, it also improves motivation among students since there is an improved understanding of how they actually are, by their teachers. In the same light, it also usually, improves teachers ability when it comes to what they see when they to observe their students.

It also usually increases the knowledge base of teachers on not only their subject's dimensions, but also on how best to dispense that subject's contents. This is as a result of them working on lesson coverage in groups, thus allowing them to share resources and ideas. This further has the advantage of seeing an increase in collaboration between teachers. All in all, a form of continuous professional development for teachers is usually created and all these lead to an improved quality of education.

It is important to point out at this venture that the quality of teaching is the single most important factor in a student academic success, regardless of his/her social or economic status.

Nui and Wahome (2006) reported on the impacts of the SMASSE programme following their assessment survey of 2004. In general, they found out that students had become more actively involved in the learning process. However, they also noted that pretty much no teacher had a written work plan. However, despite that, they agreed that teachers knew what they intended to do, from judging the flow of their lesson. The findings of their study were further echoed by

Jangaa (2008) who also found out that teachers only prepared lesson plans just as a matter of requirement, and only did so when followed by administrators. This thus meant that mathematics teachers had not fully embraced ASEI lesson formation, an indication that something more needed to be done so as to encourage the teachers to do so. This was also however in contradiction with the SPIAS results of 2004 which claimed that teachers planned better and more consistently after attending a SMASSE INSET training programme.

Something that was also pointed out by all mathematics teachers was that an almost 100% implementation of ASEI was practically not possible due to a number of hindrance such as: an unbearable work load; lack of a way of successfully creating teamwork; and finally, inadequate physical facilities & resources, just to mention a few that were the most common ones.

According to Effand et al (2007), most teachers seemed to think that students lacked the skills of how to work in groups. Freeman (2007) agreed with that school of thought by pointing out that students usually learned better when they were directly involved in problem solving thus following their own lines of inquiry. He, however, went ahead to point out that achieving this type of learning was extremely difficult. This was unfortunate since it is what always continues to be central in the quest to achieve quality teaching.

Darling-Hammond (2009) also presented a very important point when he questioned the theory that the provision of facilities & resources, as well as amenities, without paying close attention to how they were to be used and that that would automatically guarantee a process of teaching that was of high quality was unrealistic. Clarke (1995) agreed with this opinion and even further added that quality can significantly be obtained through the combination of both efficiency & effectiveness in the classroom that saw students being provided with opportunities to interact with their teachers and other learning resources.

2.4 Support from Principals and QUASO in Monitoring the Implementation of SMASSE's Teaching Approaches.

According to Regan and Grayson (2003), an effective management when it comes to the implementation of a curriculum usually greatly depended on not only the availability of: human, financial; and physical resources, but also the manner in which they are controlled and monitored. Resources in this case were comprised of: students; staff-members; supplies; timetables; textbooks; teaching facilities among others and the head teacher was the one who played the management role. Earley and Bubb (2004) showed just how important adequate financial resources were by terming them as critical implementation indicators, when managing how a curriculum was managed.

Regan and Grayson (2003) also highlighted on the importance of managing physical resources, by pointing out that their nature & availability had a direct impact on the ability of both teachers and students, to engage in their respective activities. Carrying out classroom visits to observe lessons was another key role head teachers were meant to play. The manual of Heads of Secondary Schools in Kenya (1987) stressed on this role by noting that, in particular, headteachers must check the standards of teaching by referring to : schemes of work; lesson notes; students' exercise books; records of work done; and finally, conducting actual visits to the classroom to see how exactly individual teachers worked.

Rhodes, Stokes and Hampton (2004) also advocated for classroom observation, as a form of performance management. They, however, strongly believed that this should be done by trained mentors, who are actually capable of providing support to teachers when it came to issues such as teaching techniques and classroom management that could be employed by teachers. In this regard, Earley and Bubb (2004) stressed on the importance of feedback that was regular and also, one that was constructive to those parties that had been monitored and evaluated.

2.5 Theoretical Framework.

According to Jean Piaget's theory of intellectual development, knowledge is a construct of that interaction between heredity and environmental factors. Based on that theory, one's cognitive development could thus be significantly influenced by his/her environments, as well as their cognitive structure, which was usually determined by past experiences. The cognitive structure usually had a tendency of influencing the way in which a person –especially a child - perceived reality. As a result, a student's entry behavior was something very important. With regards to this, teachers were thus supposed to consider the fact that some learners were high achievers and others medium or low achievers, when planning for a lesson. However, it was also important to note that every student usually had at least some prior knowledge on a topic that was yet to be taught, which may have been acquired through: certain observed situations; knowledge that was previously acquired; or simply one's mental abilities.

The first principal this study drew from Piaget's theory was that learning was an active process. Knowledge was also according to the theory as a construction of a learner and his/her environment. As a child developed and continued to interact with the world around him/her, knowledge was continuously invented and reinvented. As far as education was concerned, a child's outcome, – at least according to Piaget's theory of intellectual development –was that a student should be allowed to do his/her own learning. Also, one could not understand a student, from simply talking to them.

Golby, Greenwald and West (1983) noted that good pedagogy involved presenting students with situations in which they experiment on their own. Basically, trying things out to see what happened, the manipulation of symbols, the posing of their own questions before proceeding to seek their own answers and finally the reconciliation of what one found one with what another student found. Such techniques saw one's mathematical abilities stressed. The abilities

considered were one's abstract & logical reasoning together with their generation of hypothesis which they organize their mental activities with structures that were more complex. In Piaget's theory, knowledge was assumed to have a specific role or purpose and that was the aid in a student in adapting to an environment. Piaget discovered that students thought and reasoned differently, at different periods in their lives. He believed that everyone passed through a variant sequence of four qualitative & distinct stages namely: from sensorimotor birth - 6 years; the pre-operational 2-7 years; the concrete operational 7-12 years; and finally, the formal the operational 12 years and above. Invariant – the opposite of the word variant that has just been used - means the stages cannot be skipped or re-organized, by anyone.

The central component of Piaget's theory was learning and thinking. Both the two required the participation of the learner. Knowledge was thus not merely transmitted verbally but needed to be constructed and reconstructed. Piaget also argued that for a child to know and construct the world, he/she child acted on objects and it is through such action that knowledge on those objects was acquired. The mind organized & re-organized reality and then proceeded to act upon that knowledge that was resultant. One was thus either active and if not, a vessel that was to be filled with knowledge.

A Piaget inspired curricula emphasized an educational philosophy that was learner centered. Such a curriculum was one that posed an active, discovery and learning environment in schools. Intelligence thus grew through a twin process of assimilation and accommodation. Assimilation involved the incorporation of new events into a pre-existing cognitive structure and accommodation on the other hand meant the change of that structure that was in existence so as to accommodate a new set of information. Learners were thus made to explore, manipulate, experiment, question and search for answers by themselves and all these traits were what characterized the ASEI/PDSI approach. Instructions were also individualized as much as possible

and in addition, students had a community in which communicated with one another and also, argued & debated on issues. A Piaget inspired curricula also saw teachers basically become facilitators of knowledge. That is, they primarily guided and stimulated students during their learning activities. This saw students being allowed to make mistakes but at the same time promoted to learn from them. Learning was actually more meaningful if student were allowed to experiment on their own rather than simply listening to lectures. The teacher were also learned how to better present students with materials, situations and occasions which allowed them to discover the art of learning. Virtual reality was seen to have the potential of moving education from the reliance on the board, to experimental learning in more naturalistic settings. This was generally the essence of SMASSE.

Mathematics was observed through the SMASSE approaches to provide opportunities that were capable of improving a person in totality. For instance, it could allow one obtain insight into the infinite land by explaining certain underlying mathematical principles that were behind some of the natural forms & patterns in the world and furthermore, those that were always around us. The approaches also helped students recognize how resources could be used in a more logical manner, through the determination of those consequences of certain decisions & choices. Generally, SMASSE's approaches helped students learn the values of mathematical truths. The ASEI/PDSI approaches also helped students to work together productively when it came to complex mathematical tasks and furthermore also made them realize that result were often better when problems were worked on collectively than individually. The approaches also helped students appreciate how mathematical thought contributed to the development of one's culture and through there cognition of mathematics from different cultures which had made contributions to the modern day mathematics.

SMASSE was an innovation and innovations are usually about change. Shiundu and Omulando (1992) pointed out that an innovation was an idea or practice that was perceived as being new but also an innovation could entail spreading something that was being imitated but unheard of in certain areas. Robbins and Decenzo (2008) considered change as being an alteration on an organization's: environment; structure, technology; or people. They further pointed out that changes in organization were a reality and were brought about by both external and internal forces. Technology was an external force while the composition of an organization's work force changed in terms of: age; education; and gender.

The SMASSE programme was about change. Change from the old teacher-centered learning approaches, to new learner-centered learning approaches. Basically, the change from old theoretical ways of learning to new the ASEI/PDSI approaches to learning. Bruner (1986) argued that teachers should build on those past experiences of learners, and assess those experiences and then proceed to incorporate them with new experiences. Learners selected & transformed information and almost always made decisions based on their cognitive structure, which was known to be responsible for providing meaning & organization to their experiences and allowed them to go beyond that information that was simply given to them. This idea was in line with the ASEI/PDSI approaches that were being proposed by the SMASSE programme, when it came to the teaching and learning of mathematics, as they were also founded on the basis of an individual's own interpretation, of the science world around them. Students were given opportunities to construct their own scientific methods. The SMASSE principles also called for learning environments that were filled with activities and also those in which learners' interests; understanding; and retention of knowledge were discovered.

According to Ileri (2004), those ASEI ideas that were appropriate were those which saw learning primarily become learner-centered and with learners being made more actively involved in most of

their learning activities. Teacher definitely corrected any misconceptions and inadequacies which learners acquired from their conceived perceptions of scientific knowledge. If ASEI ideas & approaches were effectively developed & executed, teachers almost always transmitted comprehensive mastery skills to learners in a better way and furthermore, chances of learners being able to not only adopt skills but also be capable of applying them were also higher. This thus brought about better grades. This has been an exhibit of the SMASSE INSET approach in secondary schools in Nyakach sub-county. It basically evaluated how teachers were being challenged by the ASEI/PDSI approach.

2.6 CONCEPTUAL FRAMEWORK.

Independent Variables.

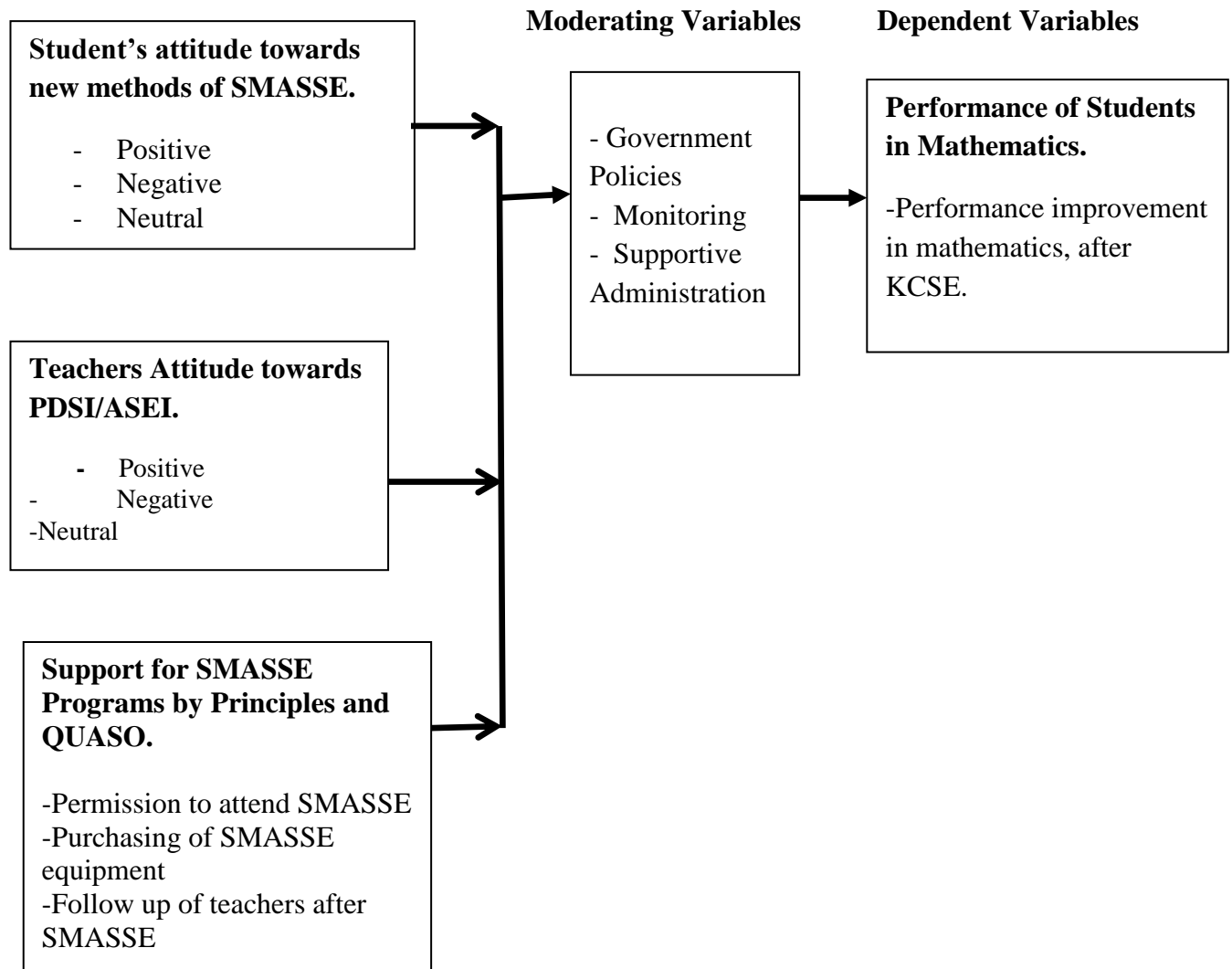


Figure 2.7 Conceptual Frame Work.

Source: Researcher generated

Infigure 2.7, the conceptual frame work explained three independent variables which were: theattitude of student in which learners were motivated in group discussions to achieve their set targets; the attitudes of teachers in which teachers were motivated by being sponsored for the

SMASSE programme together with the provision of materials required to support the new approaches so as to enable them employ the PDSI and ASEI approaches; and finally, the support by principals and QUASO through supervision, motivation and follow ups after the attendance of the SMASSE programme.

2.7 Knowledge Gap.

In world governments that are increasingly independent & information rich, policy makers and citizens were noted to face problems associated with: bringing expert knowledge to weigh in on decision making activities; the basic information policy makers have on that society they governed; the manner in which current policies are working; and finally, on those costs and consequences that are possible in the future. Many communities world wide have also increasingly demanded for the same. SMASSE as a result grew to be an integral part of those responses for that increased demand for information. Despite: secondary school head teachers; quality assurance officers; and teachers continued attendance of SMASSE's INSET activities year in year out, KCSE results in mathematics indicate a very minimal improvement.

SMASSE was also noted to so far not be able to establish how: the different entry behaviors of students; the large number of student intake; the wide content to be covered; the limited amount of time available; and finally, the ambitious expectations of the administration, the management, the parents & the community impacted the SMASSE programme. This study found out that when it came to mathematics, that knowledge from a student's way of thinking primarily originated from their CGI. That is, instructions that were guided by reasoning. Also, statements from a number of teachers were seen to indicate that knowledge based research was needed for better teaching techniques.

This study's findings also showed how the knowledge on students' thinking had an influence curriculum reforms (Fennema and France 1992 and Terry et al., 1991).

It was also observed that most times, positive attitudes by teachers towards the ASEI/PDSI approaches, lead to their successful implementation in the classroom. However when teachers had negative attitudes, they with time became frustrated when implementing the ASEI/PDSI approaches and as time progressed, failed to employ to the SMASSE approaches. There was thus need for SMASSE to find a way of addressing the attitude issue, since it is a major inhibiting factor. This study therefore address and concluded that's so far, SMASSE has not managed to quite achieve its overall objective of improving the performance in mathematics.

2.8 Summary of Literature Review.

This chapter dealt with the review of literature related to the influence the SMASSE program had so far had, on the performance in mathematics, by secondary schools students. It gave a great amount of focus on those attitudes students and teachers had towards the SMASSE approaches of ASEI/PDSI. It also looked into that interest students had when it came to performing mathematical problems on their own. It as well showed how poor performance in mathematics was greatly brought about by negative attitudes carried by students, teachers and other significant parties. The chapter then proceeded to look at those views & opinions mathematics teachers and the management had on the applicability of the ASEI/PDSI approaches when it came to the classroom. It additionally looked at those common & external sources of great pressure that students faced with regards to performing well in mathematics, and the impacts they had on students.

This chapter then proceeded to look at how important teaching and learning resources were when it came to mathematics. It likewise showed how the manipulation of physical objects for learning purpose helped students make abstract ideas more concrete. It then added to that by pointing out how the use of anything tangible or visible helped students draw connections more easily and further made lessons learnt more memorable. In addition, the study called attention to the reasons as to why the progress of students when it came to mathematics needed to be monitored and how doing that had a great impact on the manner in which teaching was conducted.

The chapter also mentioned the roles played by mathematics in an individual's life and in addition, the reasons behind the emphasis on mastering mathematics by all, irrespective of whether they planned on pursuing a technical career or not. That emphasis was due to the fact in the new world, there were very high chances that one would in future have to work with people who work with numbers. A number of mathematical skills that students needed to acquire, so as to increase their chances of being successful in the current very competitive world were also pointed out. This chapter also delved into how mathematics brought about development that was all rounded. It in addition got into reasons as to why good performance in mathematics was important in the current fast changing societies. It also explained how mathematics played an important role in not only the scientific community, but also in cultural communities. A number of those key challenges faced by the SMASSE program were then looked at, before then proceeding to state the theoretical & conceptual frameworks and finally concluding with the existent knowledge gap.

CHAPTER THREE.

RESEARCH METHODOLOGY.

3.1 Introduction.

This chapter described those methods that were used when conducting the study. They included: the research's design; the targeted population; the sample size and sampling procedures used; the research instruments employed; the validity & reliability of those research instruments; and finally, the procedure of data collection & data analysis.

3.2 The Research Design.

The study employed a descriptive survey research design, which is a method of collecting information by administering questionnaires and interviewing a sample of individuals. The decision to adopt a descriptive research design was guided by Mugenda (2008) observations which described those research designs commonly used when examining social issues in the community. Mugenda favored descriptive studies which due to their exploratory nature, were relatively easier and simpler to conduct, yet quite effective when it came to providing a foundation upon which correctional and experimental studies could be built. According to Kombo and Tromp (2006), descriptive research was a process of explaining a state of affairs, when it still existed. Descriptive research was however not restricted to fact finding as it also most times resulted into the formulation of important principles of knowledge and thus solution to significant problems (Kerlinger, 1969).

This study used quantitative techniques to collect and analyze its data. The method was adequate for this study because it generalized from a sample to a population. Inferences were also made about certain characteristics, attitude or behaviour of the targeted population (Babbie, 1990). This method was also used as the procedure for data collection not only because it was economical but

also its rapid turnaround when it came to data collection (Babbie, 1994-1998). Questionnaires were administered to all parties of interest to the study – these were – students; teachers; head teachers; quality assurance & standards officers; and lastly, trainers. For teachers, they were used to assess that impact the SMASSE ASEI/PDSI approaches had so far had, on the performance of students in mathematics, at the KCSE level. For students, they were used to establish whether teachers were applying the ASEI/PDSI approaches, when teaching mathematics. For head teachers, trainers, and quality assurance officers they were used to establish the manner to which the implementation of the SMASSE approaches by mathematics teachers was being supervised.

3.3 Target Population.

This study targeted public secondary schools in Nyakach sub-county, together with the associated quality assurance officers and lastly, the region's SMASSE trainers. The lower Nyakach sub-county and the west Nyakach sub-county have a population of 40 public secondary schools when combined, thus (N=40). This study involved five mathematics teachers from each of the 40 schools, thus (N=200). Also, each and every head teacher in all the 40 public schools targeted were involved in the study' thus (N=40) and finally, from the 40 public schools targeted, 330 form four students took part in the study. The value of N was 40 public school. The sample was thus well above 10% in cases of large populations. Sample sizes were also at least 20% as the population, as stipulated by Gay (1992) in the case of a descriptive studies. 3 district SMASSE trainers and 1, also district, quality assurance & standard officer also took part in the study.

Head teachers gave insight on the provision and availability of teaching & learning resources. Mathematics teachers provided information on the teaching methods they applied when teaching mathematics and the extent of their use of teaching & learning resources when teaching. Trainers provided information on challenges the SMASSE project had been observed to meet and how those challenges impeded the achievement of the targeted objectives. Quality assurance & service

officers provided information on the manner in which the implementation of the SMASSE approaches of were supervised and monitored. Finally, students in their fourth form gave information about their attitude towards mathematics and how they viewed those reasons that were pointed out when it came to why one should properly master the subject.

3.4 Sample Size and Sampling Procedure.

The sample size and the sampling procedures that were adopted are discussed under this section.

3.4.1 Sample Size.

The sample comprised 405 individuals segmented into 51 mathematics teachers who had received the SMASSE training, 20 principals, 3 district trainers, 1 quality assurance officer and 330 form four students from schools in Nyakach sub-county. The selection of the sample was based on the Krejcie & Morgan (1990) modern tables. As indicated below According to Krejcie and Morgan(1990),if the targeted population is made up of less than a hundred elements, then the entire population can be the sample. The model of Krejcie & Morgan described how this study's sample size was arrived at. Orodho(2002) noted that in any educational or social science study, a sample should be selected in such a way that assurance is quite certain when it comes to the resultant group's participation and in addition, the population's representation by the sample, is one which is proportional to its size.

Appendix 11:

Table for determining sample size from a given population.

N	S	N	S	N	S
10	10	220	140	1,200	291
15	14	230	144	1,300	297
20	19	240	148	1,400	302
25	24	250	152	1,500	306
30	28	260	155	1,600	310
35	32	270	159	1,700	313
40	36	280	162	1,800	317
45	40	290	165	1,900	320
50	44	300	169	2,000	322
55	48	320	175	2,200	327
60	52	340	181	2,400	331
65	56	360	186	2,600	335
70	59	380	191	2,800	338
75	63	420	196	3,000	341
80	66	440	201	3,500	346
85	70	440	205	4,000	351
90	73	460	210	4,500	354
95	76	480	214	5,000	357
100	80	500	217	6,000	361
110	86	550	226	7,000	364
120	97	600	234	8,000	367
130	97	650	242	9,000	368
140	103	700	248	10,000	370
150	108	750	254	15,000	375
160	113	800	260	20,000	377
170	118	850	265	30,000	379
180	123	900	269	40,000	380
190	127	950	274	50,000	381
200	132	1000	278	75,000	382
210	136	1100	285	1,000,000	384

Note – N + S Population Size

S is Sample Size

Small – Sample Techniques. The NEA Research Bulletin, Vol. 38 (December, 190)

3.4.2 Sampling Procedure.

The study adopted a four multistage sampling approach. This was simply because that approach enabled: sub-counties; divisions; and locations to be used as sampling units, but at various levels, thus allowing the study to be concentrated and at the same time, to cover a wide area. In addition, the multistage sampling approach allowed for flexibility - where simple random sampling approach was used - at various stages of sampling. This was pointed out by (Gupta, 2008) as one of the main advantages of the multistage sampling approach.

In the 1st stage of this study's multistage sampling procedure, 1 sub-county was selected from the 7 different sub-counties in Kisumu County. Nyakach sub-county happened to be the one selected from the 7. In the 2nd stage, the researcher proceeded to randomly select 2 divisions from the three existing in the selected sub-county. In the 3rd stage, schools were randomly selected from all the 40 public schools that were present in the chosen Nyakach sub-County. In the 4th stage, respondents were randomly selected to participate in the study.

Table 3.1 shows population samples used by the researcher.

Table 3.1: Population and Samples.

TYPE OF SUBJECT	POPULATION	SAMPLE	PERCENTAGE (%)
Head Teachers	40	20	50 %
Trainers	5	3	60 %
Mathematics Teachers	200	150	75 %
Quality Assurance Officer	1	1	100 %
Form Four Students	440	330	75%
Total	686	504	100 %

3.5 Research Instruments.

The primary data was obtained using questionnaires and structured interviews. Questionnaires were adopted for the form four students, mathematics teachers and principals. Three sets of questionnaires were in accordance thus developed. There was a questionnaire for students (Appendix 3), another one for mathematics teachers who had at some point gone through the SMASSE program (Appendix 4) and finally, one for head teachers (Appendix 5). Structured interviews were personally administered by the researcher to two key informants of the study. That is, the only quality assurance and standards officer (Appendix 6) and the three SMASSE trainers (Appendix 7).

3.5.1. Pilot testing of the Instruments.

A pilot study was conducted in only one secondary school located in the Upper Nyakach division in Nyakach sub-county, Kisumu County. The pilot was carried out so as to test the suitability of those research instruments that were to be used by the study were. This was with regards to: the ease of administering those instruments; and also the errors that could likely be made when interpreting those various items on a research instrument. The other reason as to why the pilot study was conducted was so as to determine how suitable those methods of data collection & analysis that were to be used by the study were. A number of challenges that were observed when conducting the pilot study –for instance –the clarity of those items on the research instruments, when it came to their interpretation, were what guided that process of improving the efficiency of this study's research instruments and as a result enhance the validity of the actual study's data.

The research instruments were administered twice. After the first administration, the researcher waited for two weeks and then re-administered the same instruments, and to the same respondents, so as to obtain the second set of data. The researcher decided to re-administer the research instruments to the pilot's respondents after two weeks because Kumar (2005) noted in cases when the interval between the 1st and 2nd administration was too short, test-retests were usually affected by recall of responses by respondents. Also, when the time span between the 1st and 2nd administration was too long, the maturation factor issue came into play thus affecting its reliability. The study thus opted for a time span of two weeks so as to take into consideration both of the issues –that is -recall of responses by respondents and the maturation factor.

Data from the 1st and 2nd administrations on collection were analyzed before being used to compute for the correlation coefficient and as a result, determine how reliable the study research instruments were. Pearson's correlation coefficient revealed a high correlation ($r = 0.632$, $p < 0.000$)

and thus the conclusion that the chosen instruments were highly reliable. This high reliability was also brought about by the ability of the various research instrument administered per a category of respondents to be easily compared among the different respondents that made up a category. This thus had the advantage of eliminating those type of problems that were known to arise if instance where instrument comparisons were being made to different ones.

Reliability of entire test= $\frac{\text{reliability of 0.5}(r)}{1 + \text{reliability of 0.5 test (r)}}$

1 + reliability of 0.5 test (r)

Where r is the coefficient of correlation and also the quantitative measure of reliability on a 0-1 scale, such that as (r) leads to 1, the reliability of the concerned research instrument increases, Salemi(2003). A reliability of 0.632 was achieved thus showing that research instruments were reliable.

3.5.2 Validity of Research Instruments.

The quality -validity & reliability - of a research study to a large extent usually depends on the accuracy of the data collection procedure. This is because the validity and reliability of a study usually are a measure of its relevance (Barbie and Mouton, 2010 & Mugenda and Mugenda, 2008). Data collection procedures should thus yield data that is both relevant and correct to the concerned research questions or objectives. According to Kothari (2010), validity when it comes to a study usually indicates the degree to which an instrument measures what it is supposed to measure. Validity can also be looked at in terms of utility, that is, the extent to which differences found in measuring instruments used in a study reflect those differences -true differences -that exist among those subjects being tested (Mugenda and Mugenda, 2008), or even the extent to which an empirical measure of something adequately reflects its true meaning (Barbie and Mouton, 2010). Validity generally has to do with how accurate the data in a study represents that study's variable.

The study determined the validity of its content - that is -that extent to which the various measuring instruments provided a satisfactory coverage for the variables under study (Kothari, 2010, Barbie ad Mouton, 2010). This was done partly because content validity involved an analysis by experts who judged how well the measuring instruments employed in a study meet the standards discussed above. The judgment expert of a number of experts was also used through the seeking of assistance and opinions of the supervisors, researchers and other research experts in the University of Nairobi. The decision to use expert judgment as a method of determining the validity of this study was guided by Kothari(2010) who observed that content validity tended to be good if the instruments contained a sample that was a true representative and that the determination was one that was primarily intuitive & judgmental and had been determined by a panel of persons who judged how well the research instrument meets the concerned standard. The suggestions that were obtained from those experts consulted were also used to improve on those items on the study's research instruments.

3.5.3 Reliability of Research Instruments.

Reliability in this study was defined as a measure of that degree to which a research instrument yields consistent results or data after repeated trials Mugenda & Mugenda, (2003). Sekares (2006) stated that reliability measured- without bias – the consistency across not only time but also various items. What this meant was that if a measure was developed and said to be reliable, it would always produce the same results when measuring a phenomenon(Gatara, 2010).The research also ensured that the questions in its research instruments were designed using simple language and also one that was easy to understand by its respondents. Krumar, (2008) defined reliability as the measure of an instrument consistency, stability, predictability and accuracy. Nachmias & Nachimias (1996) had earlier defined reliability as that extent to which a measuring instrument contained variable errors - that is - those errors that appeared but in an inconsistent

manner from observation to observation, when conducting any one measurement attempt, or even varied ones that appeared each time a given unit was measured using the same instrument. Kumar, (2005) also noted that the greater the consistency and stability of an instrument, the greater its reliability.

3.6 Data Collection Procedures.

Prior to the actual administration of research instruments, permission to carry out the research from the University of Nairobi was sought and this was issued with an introductory letter. Thereafter, permission to collect data from was then sought from the National Council of Science and Technology. Following a successful application, the area to be covered by the study was then visited for familiarization. It was then ensured that the study's questionnaires and cover letters were clearly printed. Respondents were then either contacted through meetings, direct contact or telephone calls within the study's data collection time frame. The researcher handed the questionnaires with cover letters to the respondents, introduced questionnaires and collected them back after being filled. Secondary data was collected from the: Ministry of Education office; the library's staff reference book; scholars, journals, the internet, publications, dissertations & thesis, indexes & abstracts, research reports; among others.

3.7 Data Analysis Techniques.

The data obtained from the field was organized according to the study's objectives and analyzed by descriptive statistical techniques. Data obtained from the field was organized on the basis of its source and the serial numbers of the data pieces. It was then inspected for completeness and also edited for errors. Before the data was coded, all those data pieces from the various research instruments were identified and a list made. The researcher then read through the list compiled in which the responses by the respondents also featured. The researcher was as a result in a position

to identify the most common responses- in terms of categories - which were then later listed and assigned: an item number; a name; a response category name; and a number code to form a coding frame.

The coding frame not only made it possible for all respondents to be accounted for but also for the same to be done for all items in each data piece. The two were further displayed in one display sheet which could simply be read at a glance making its analysis easy. After the data was presented into a display sheet, descriptive statistics such as means, percentages and standard deviations were all computed for using the SPSS version 16. Descriptive statistics was also used to draw and present results in tables. Findings were finally reported by the use of frequency tables and percentages.

3.8 Ethical Considerations.

Care was taken to ensure strict observance of ethical standards during the study, every participant in the study was notified of the: aims; methods; & benefits of the study, and his/her rights to refuse to take part in the study or simply to terminate their participation at any time. Furthermore, there was no pressure or inducement of any kind applied to encourage an individual to participate in this study. The identities of participants were also strictly confidential. On conclusion of the study, it was also ensured that any information that could reveal the identities of participants was destroyed. The study also avoided the inclusion of information revealing the identity of any participant, in the final report. In order to minimize the possibility of any harmful psychological consequences on respondents by the study, those items that were highly intensive, offensive and immoral were avoided. For instance, the administration of questionnaires was done in confidence. In addition, any other information that was obtained from other sources or authors to support this study's relevance was also adequately acknowledged in the form of references. Finally, when

conducting this study, considerations were made to avoid any form of plagiarism by making sure that other people's work was duly acknowledged and situations properly documented.

CHAPTER FOUR.

DATA ANALYSIS, PRESENTATION, INTERPRETATION AND DISCUSSION.

4.1 Introduction.

This chapter presented those findings of the study which had been analyzed, interpreted and discussed. The purpose of this study was to assess contributions the SMASSE project had so far had on the performance of students in mathematics at the KCSE level of examination in Nyakach sub-county, Kisumu County. It basically presented the results of the study, beginning with the response return rate, and concluded with its objectives. Its objectives were: to analyze contributionsthe SMASSE project had had towards students having a more positive attitude towards mathematics; to study the attitude teachers had towards SMASSE ASEI/PDSI approaches of teaching mathematics; to evaluate the motivation& supervision from principals and QUASO towards the SMASSE project

Respondents included: principals; trainers; mathematics teachers; quality assurance& supervision officers; and from four students. A record of the response return was also taken after the data collection process so as to determine whether the data collection process had achieved its desired target. The results were presented in frequency counts and percentages in table 4.1.

4.2 Response Return Rate.

Table 4.1: Response Return Rate.

Respondents	Sample	Percentage
Principals	17	85%
Trainers	3	100%
Mathematics Teachers	41	82%
Quality Assurance Service Officer	1	100%
<u>Form Four Students</u>	<u>303</u>	<u>91.8%</u>
Total	365	91.8%

From the research findings, table 4.1 shows a good percentage of the sample response return rate. Out of the expected 20 school principals, 17, that is(85%), gave a full feedback. The research was also able to get feedback from all the 3 trainers and the 1 quality assurance officer. Out of the 50 teachers sampled, 41 of them, that is(82%), gave feedback. Feedback from the form four students was also a good one as well. The entire sample response return was well achieved, 365, that is (91.8%).

4.3. Contribution of the SMASSE Project towards Students Attitude.

To assess the contribution of the SMASSE project had towards the attitude of students in mathematics in Nyakach sub county, students were asked to share their views towards the subject.

Table 4.2: Students Attitude towards Mathematics

<u>Attitude</u>	<u>SA</u>	<u>A</u>	<u>U</u>	<u>D</u>	<u>SD</u>
Mathematics lesson are interesting.	176 (57.9%)	106 (34.9%)	13 (4.3%)	6 (2.0%)	3 (1.0%)
<u>Students have a more positive attitude.</u>	<u>97 (31.9%)</u>	<u>134 (44.1%)</u>	<u>30 (9.9%)</u>	<u>27 (8.9%)</u>	<u>16 (5.3%)</u>

KEY:

S.A – Strongly Agree; A - Agree; U – Undecided; D – Disagree; S.D - Strongly Disagree.

The results from table 4.2 above indicate that the attitude of students towards mathematics is more positive. Majority, that is, 176(57.9%) strongly agreed [SA] that they enjoyed mathematics, 106(34.9%) agreed [A] that they found mathematics lessons interesting and very few disagreed [D]. Concerning attitude, 97(29.4%) strongly agreed [SA] that they had a positive attitude towards mathematics, 134(44.1%) agreed [A] that they had a positive attitude while very few, 16 (5.3%) strongly disagreed [SD] and 27 (8.9%) disagreed [D]. 30(9.9%) were undecided [U]. It can thus be concluded that the SMASSE project had a great contribution towards improving the attitude of students when it comes to mathematics.

These findings were actually in agreement with Lim (2006) and Zweak (2006) who pointed out that guiding principles are what defined good classroom practices. In the same study Lim and Zweak also noted that good practices were not the same in the world over and as a result had to be developed at the school level. Models of good practices also need to be valued at not only the school but also the district, national and community level.

Lim(2006) also proposed a practice of these results. Good practices involved:listening to the voices of learners; designing learner-centered curriculums; students enjoying the learning process; active learning where there is doing in order to promote understanding;relating learning to thelearner’s world; teachers becoming learners too; and finally, providing regular professional development. Basically, good classroom practices – especially when it comes to mathematics – are usually shaped by all those parties involved in the learning process, with students; teachers; and education officials being key, since teaching mathematics is actually an artistic activity. Owiti(2011)argued that methodology for teaching mathematics must involve scientific approaches and be connected to the real world. Ayodo,(2009) points outs that there is need to provide connection and experiences so as to improved the student attitude.

4.4 .Teachers Attitude towards the SMASSE ASEI/PDSI Approachin Teaching Mathematics.

To establish the attitude of teachers towards the SMASSE ASEI/PDSI approaches with regards to teaching mathematics and its influence on performance in Nyakach sub-county, Kisumu County, students were asked to indicate some of the ways teachers taught mathematical concepts in class.

Table 4.3: Teachers Attitude towards mathematics.

Mathematics Teachers	Mean	Std. Dev.
Start lessons by reviewing the previous class .	1.4	0.76
Encourage us to form groups.	1.5	0.66
Always use prepared notes when teaching.	2.1	1.13
Usually allow us to present activities in class.	2.0	1.05
Provide guidance during practical mathematical lessons.	1.7	0.84
Enjoy teaching mathematics.	1.5	0.69
Are friendly in class.	1.6	0.85
Give assignments quite often.	1.9	1.12
Summarize the concepts taught at the end of lessons.	1.7	0.77
Use objects that are readily available to illustrate concepts.	1.9	0.98
Overall Mean.	1.7	0.87

From the results in table 4.3, most of the students pointed out that their mathematics teachers usually start lessons by reviewing that which was covered in the last class - (M=1.4, SD= 0.76). They also mentioned that their mathematics teachers encouraged them to form group - (M=1.5, SD= 0.66). A good number of students also indicated that their mathematics teachers usually use prepared notes when teaching - (M=1.5, SD=1.13).The response in this case was, however, quite varied and this is indicated by the standard deviation that's greater than 1. A large number of students also agreed that their mathematics teachers enjoyed and liked teaching mathematics - (M=1.5, SD= 0.69). On the issue of the use of locally available objects to illustrate mathematical concepts an adequately large number of students pointed out that their mathematics teachers did

apply such resources - ($M=1.98$, $SD= 0.98$). The overall mean was ($M=1.7$) and the concurrent standard deviation was ($SD= 0.87$). This revealed that students believed that their mathematics teachers had a positive attitude towards teaching the subject.

The findings were actually in agreement with those of Nui and Wahome (2006) who had also earlier reported on impacts of the SMASSE project's during a 2004 survey that had mainly focused on assessing whether students had become more actively involved in the learning process. SPIAS results of 2004 also claimed that teachers planned better and more consistently after attending a SMASSE INSET, further supporting this study's results.

It thus is appropriate to make the conclusion that SMASSE had greatly contributed to the attitudes of mathematics teachers drifting towards a more positive nature. Lim (2006) and Zweak (2006) had also noted that guiding principles for defining good classroom practices were not the same in the world but on the contrary, were developed at the: school; community; district; and national levels.

Lim (2006) also argued that good practices involved: listening to the voices of learners; and making curriculums more student-centered, so as to make learning a more interesting activity since students are made more involved in the classroom. Lim also added that teachers were also made learners in cases where they provided regular professional development. Basically, good classroom practices were shaped by all those parties that were involved – particularly: teachers; student; the school environment; the home environment; and education officers, since teaching mathematics was an artistic activity. HAWL TORNE, (1972) argues that what teachers offer so as to make a difference in their achievement by student is greatly influenced by school administration. Anthony (2006) strongly emphasizes on the role of motivation to both teachers and students to improve on attitude. Pedereen, Vogel and Reink (2006) stress that apart from students' preparedness positive peer influence enhances academic success .

Table 4.4: SMASSE Training, Continuity and Attendance.

	SA	A	U	D	SD
Are SMASSE INSET trainers competent?	6 (14.6%)	10 (24.4%)	13 (31.7%)	11 (26.85)	1 (2.4%)
Should SMASSE INSET be continuous?	9 (21.95)	5 (12.2%)	12 (29.3%)	12 (29.3%)	3 (9.3%)
<u>Do Principals sponsor INSET activities?</u>	<u>11(26.8%)</u>	<u>13(31.7%)</u>	<u>10 (24.4%)</u>	<u>6 (14.6%)</u>	<u>1(2.4%)</u>

As indicated in table 4.4, 10 (24.4%) teachers agreed [A] that the SMASSE INSET trainers were competent. However, and rather surprisingly, 12(29.3%) teachers were undecided [U] when asked whether SMASSE should be continuous. On the question of whether principals sponsored all SMASSE training activities, 11(26.8%) teachers strongly agreed [SA] and 13(31.7%) agreed [A]. These numbers may be interpreted to mean that teachers were either unhappy with the accommodation facilities provided when attending SMASSE training courses or the fact that the training period was always during the holidays and in addition, the provision of no allowances when attending SMASSE training courses. There were also no promotions by the ministry following the conclusion of the SMASSE training course.

On the issue of school principals sponsoring teachers who decided to attend SMASSE training courses, the manual for heads of secondary schools in Kenya (1997) actually states that that should be the case. Earley & Bubb (2004) argued from the perspective that head teachers should send their teachers to INSET courses and also stressed on the issue that this would only be successfully achieved, if they head teachers to sponsor their teachers. The above actually agree with a report by Isinya (2012) who through the Daily Nation noted that teachers were increasingly storming out of SMASSE training centers and in addition, that there had been increased recommendations by SMASSE officials to JICA for the withdrawal of its sponsorship, due to the ever poor accommodation facilities and the lack of allowances.

Table 4.5: Use of the PDSI/ASEI Approach.

The teachers were asked how often they used PDSI/ASEI approach when teaching. The results obtained were tabulated in table 4.5.

	Very often	Often	Rear	Very Rea	Not at All
How often do you use the ASEI approach?	2 (4.9%)	27(65.9%)	9 (22%)	1(2.4%)	2(4.9%)
How often do you use the PDSI approach?	2 (4.9%)	28(68.3%)	8 (19.5%)	1(2.4%)	2(4.9%)

The results from the above table indicate that teachers use ASEI/PDSI quite often - that is - 27(65.9%) and 28(68.3%) respectively. These findings echo those of Janga (2008). Janga observed that teachers prepare lesson plans only as a matter of requirement and only started doing so after the SMASSE project began. SPIAS results of 2004 also pointed out those teachers planned better and more consistently after undergoing a SMASSE INSET course. This also offered support to this study's findings. Very rare, 1(2.4%) and not at all, 2(4.9%) had the least percentages and this was interpreted to mean that the SMASSE project was effective.

Table 4.6: Teachers attitude in Teaching Mathematics.

		Frequency	Percent (%)
Valid	Yes	40	97.6%
	No	1	2.4%
Total		41	100%

The results in table 4.6 indicate that teachers had a positive attitude towards teaching mathematics.

Mathematics teachers were asked whether they enjoyed teaching the subject. 40(97.6%) responded by saying ‘yes’ meaning that they enjoyed teaching mathematics, while 1(2.4%) responded by saying ‘no’ meaning that they never enjoyed teaching it. These results were interpreted to mean that teachers enjoyed teaching mathematics.

Table 4.7: Students Preparedness.

Table 4.7 shows the views of mathematics teachers concerning the issue of how prepared they believed their students were for their mathematics exams.

		Frequency	Percent (%)
Valid	Yes	29	70.7%
	No	12	29.3%
Total		41	100%

29 (70.7%) of the teachers believed that their students were prepared while 12(29.3%) believed the opposite. The large difference between the percentages was an indication that most mathematics teachers had confidence that their students had been well prepared for their mathematics examinations.

Table 4.8 Students’ Preparedness at the Primary Level.

The mathematics teachers were also asked if they engaged their students in: marking; revision; and giving feedback so as to establish how prepared students were at the primary level. Their responses were indicated in table 4.8 below.

		Frequency	Percentage (%)	Valid Percentage (%)	Cumulative Percentage (%)
Valid	Yes	12	29.3 %	29.3 %	29.3%
	No	29	70.7 %	70.7 %	100 %
Total		41	100 %	100 %	100 %

Table 4.8 was interpreted to mean that students were engaged and thus well prepared in Mathematics at the primary level.

Table 4.9: Teachers Marking, Revision and Feedback

		Frequency	Percentage (%)	Valid Percentage (%)	Cumulative Percentage (%)
Valid		1	2.4 %	2.4 %	2.4 %
	Yes	32	78 %	78 %	80.5 %
	No	8	19.5 %	19.5 %	100 %
Total		41	100 %	100%	100 %

Table 4.9 can be interpreted to mean that teachers frequently mark, revise and give feedback to their students. This had a contribution to the change in students' interest and attitude when it came to mathematics.

4.5 Supervision and Motivation of Mathematics Teachers by Head Teachers & QUASOs.

To assess the supervision and motivation of the teaching and learning of mathematics by principals and QUASOs and its resultant impacts in Nyakach sub-county, head teachers were asked to indicate their perception of their school when it came to motivational speakers.

Table 4.10: Acceptance of Schools on Motivational Speakers Role.

Schools Embrace Motivational Speakers		Frequency	Percent (%)
Valid	Yes	15	88.2 %
	No	2	11.8 %
Total		17	100 %

From the frequency results in table 4.10, most of the head teachers, 15(88.2%) believed that their school embraced the role of motivational speakers in enhancing mathematics performance in schools.

The two groups of respondents were, further, asked to state the general number of mathematics teachers that attended the SMASSE INSET courses. Pearson correlation coefficient was used to identify the relationship between the overall SMASSE attendance and performance in mathematics. The results are presented in table 4.11

Table 4.11: Correlation between SMASSE Attendance and Performance.

SMASSE/PERFORMANCE.		SMASSE Attendance.Performance of Schools.	
SMASSE Attendance.	Pearson	1	0.632
	Correlation.		
	Sig. (2 - tailed).		0.000
	N.	17	17
Performance of Schools.	Pearson	0.632	1
	Correlation.		
	Sign. (2 - tailed).	0.000	
	N.	17	17

Pearson correlation coefficient revealed a high positive correlation between SMASSE attendance and the performance of schools, ($r=0.632$), ($p < 0.000$). The correlation was significant. This thus meant that head teachers were being successful when it came to inducing a higher performance in schools, as a result of supporting and encouraging teachers to attend SMASSE INSET courses. The results were actually in agreement with those of other previously conducted studies. For instance, according to Oluoch (1982), implementation means taking an innovation to schools, once try-out have been completed. It amongst other things involves: convincing a variety of people to accept the innovation; informing the general public of the innovation & keeping them

informed; training of teachers; provision of necessary facilities; the supply of associated equipment & materials; actually implementing the innovation; and the provision of a continuous supply of teachers. In the case of SMASSE, there has been the implementation of the ASEI/PDSI teaching approaches that teachers are taught during SMASSE INSET courses thus improving the mathematics performance of students.

4.6 Contributions of the SMASSE Project on Student's Performance in Mathematics.

To find out those influences the SMASSE project had so far had on the performance of mathematics at the KCSE level of examination, head teachers were asked whether they thought that SMASSE had brought about an improved performance in mathematics at the KCSE level of examination. The results were presented in table 4.12.

Table 4.12: Contribution of the SMASSE project has had on the Performance in mathematics at the KCSE Level of Examination.

Response	Frequency	Percentage (%)
Valid		
Strongly Agree	3	17.6 %
Agree	10	58.8 %
Undecided	3	17.6 %
Strongly Disagree	1	5.9 %
Total	17	100.0 %

Only 1 (5.9 %) teacher disagreed when the question as to whether the SMASSE project had led to an improved performance in mathematics was presented.

It thus was logical to conclude that majority of teachers the SMASSE project had led to an improved performance in mathematics. This was because 10 (58.8 %) teachers agreed [A] that the performance in mathematics had improved. A further 3 (17.6 %) also strongly agreed [SA].

School performance was also increased since the inception of SMASSE projects.

The head teachers were also asked to reveal the mean score of their schools in mathematics, between the years 2006 & 2009 - that is - before SMASSE was implemented and also the mean score between the years 2010 & 2013, following SMASSE's implementation. The average figures were then computed for and presented in table 4.13.

Table 4.13: SMASSE Implementation and Performance in Mathematics at KCSE Level.

Before SMASSE was Implemented.

Year.	2006	2007	2008	2009
Mean Grade in Mathematics.	2.93	2.99	3.02	3.19

After SMASSE was implemented.

Year.	2010	2011	2012	2013
Mean Grade in Mathematics.	3.8	4.14	4.03	5.13

The comparison revealed that there had been an improved performance in mathematics between the year 2006 and 2013. Mathematics' mean score has steadily increased from an average of 2.9 to one of 5.1. This was simply interpreted to mean that the SMASSE project had brought about new teaching techniques with regards to mathematics.

4.6.1 Number of Mathematics Teachers per School.

The researcher sought to know the number of the teachers in the sampled schools. Head teachers were thus requested to reveal the number of mathematics teachers in their respective schools. The figures obtained were then tabulated and presented in table 4.14.

Table 4.14: Number of Mathematics Teachers in a School.

Valid	Frequency	Percentage (%)
2 Teachers	5	29.4 %
3 Teachers	5	29.4 %
4 Teachers	4	23.5 %
5 Teachers	2	11.8 %
Above 6 Teachers	1	5.9 %
Total	17	100.0 %

The results revealed that most of the schools - according to the school principals - had either 2 or 3 mathematics teachers. That is, the numbers 2 & 3 both shared a frequency of 5 (29.4%) and that was the highest when it came to the number of schools involved. This was interpreted to mean that most schools in Nyakach sub-county had an inadequate number of mathematics teachers. However, with that being said, it is also important to note that an increase in the supervisory efforts of head teachers in the county have actually brought about an improvement in the performance in mathematics, at the KCSE level.

Table 4.15: Adequacy of Teachers.

The head teachers were asked whether they found the number of mathematics teachers in their respective schools adequate or not. Their responses were tabulated in table 4.15 below.

		Frequency	Percentage (%)
Valid	Yes	5	29.4 %
	No	12	70.6 %
Total		17	100.0 %

Most head teachers, 12(70.6%) pointed out that the number of mathematics teachers in their respective schools were inadequate. A few head teachers 5(29.4 %), however, stated the opposite. The findings were the basis for this study's conclusion that teachers are not adequate in these schools. That being the case SMASSE ASEI/PDSI approaches towards teaching could make a big contribution towards improving the performance in mathematics.

CHAPTER FIVE.

SUMMARY OF THE FINDINGS, CONCLUSIONS AND RECOMMENDATIONS.

5.1 Introduction.

The chapter summarized the findings of this study which were looked at in chapter four. In addition, the chapter made: conclusions; contributions to the body of knowledge; recommendations; and, finally, suggestions for further studies in the same topic.

5.2 Summary of the Findings.

The researcher was out to establish that influence the SMASSE project had so far had on the performance of secondary students in mathematics at the KCSE level of examination. Various objectives were used to achieve the research topic and were discussed per the sub-theme, starting with: the attitude of students; the attitude of teachers; the supervision of teachers by principal&QUASO with regards to implementing the ASEI/PDSI approaches of teaching. The results indicated that students generally had a positive attitude when it came to the ASEI/PDSI approaches of teaching which actually made up the basic structure of the SMASSE project.

There also was a noticeable increase in the mean score of mathematics - that is - from 2 to 5, an indication of progress that was positive. According to the findings obtained, there also was a high percentage, 57.9 %(176)of students who enjoyed mathematics, following the introduction of the SMASSE project.

The attitude of students towards mathematics was in general also noticed to have improved, contrary to those findings of studies earlier analyzed in the literature review. 134(44.1%) students that were sampled stated that theirattitude towards mathematics had improved following the introduction of the ASEI/PDSI teaching approaches. This definitely was an indication that the SMASSE project had made a positive contribution when it came to the nature of student's

performance in mathematics, at the KCSE level of examination. Students were asked about the methods their mathematics teachers used in class to present mathematical concepts. The researcher used this approach so as to gauge that attitude teachers had when it came to teaching mathematics, following the introduction of the SMASSE project. Their responses revealed very good strategies employed by mathematics teachers, a factor that led to an improvement in the attitude towards not only teaching but also learning mathematics. Responses from students as to whether previous lessons were reviewed by mathematics teachers before proceeding to teach a new concept had a mean [M] of 1.4 and a standard deviation [SD] of 0.76. This was an indication that teachers were now more concerned with ensuring that students fully understood mathematical concepts. In addition, it also reflected a more positive attitude by the teachers towards teaching mathematics, an outcome that was credited to SMASSE's INSET courses.

Mathematics teachers also revealed to be speaking more on the subject of formation of discussion groups (M=1.5, SD= 0.66). The standard deviation implied that the view was not a varied response, almost all the teachers strongly agreed on this. More teachers also used prepared notes when teaching mathematics, a finding that was in agreement with the findings of Jangaa (2008).

This was revealed by the mean [M] of 2.1 and also a standard deviation [SD] of 1.13 as per the responses of students when asked about the issue. Teachers were also: more friendly in class, (M=1.6, SD= 0.85); and in addition seemed to enjoy teaching mathematics more, (M=1.5, SD= 0.69). The overall mean [M] of 1.7 and standard deviation [SD] of 0.87 generally was an indication that teachers had developed a more positive attitude with regards to teaching mathematics.

Using questionnaires, the researcher sought out the views of school principals on the SMASSE project in general and the manner in which they supervised the implementation of the SMASSE ASEI/PDSI teaching approaches.

This study's main objective was to find the influence these approaches had so far had towards student's performance in mathematics. Since the performance of students in mathematics to a significant extent depended on administrative governance, the sampled principals were asked to share their views as to whether their schools had embraced the role of motivational speakers when it came to the performance of students in mathematics. Most of the principals, 15 (88.2%), agreed. Very few, 2 (11.8%), were in contradiction and this was an insignificant number.

Finally, the Pearson correlation coefficient had likewise also revealed a high & positive relationship between teachers attendance of SMASSE INSET courses and an improved performance in mathematics, ($r=0.632$), ($p < 0.000$). Most research findings such as that of Oluoch (1982) had earlier also presented similar findings.

5.3 Conclusions.

The main purpose of this study was to assess those contributions the SMASSE project had so far had on the performance in mathematics at the KCSE level of examination in Nyakach sub-county. The study then proceeded to make three main conclusions which were based on its findings:

With regards to the first objective of this study - that is - to assess those contributions the SMASSE project had so far had towards the attitude of students when it came to learning mathematics, the study concluded that following the introduction of SMASSE, students had demonstrated a positive attitude towards learning mathematics and their performance further supported this. This mainly was because there had been a noticeable increase in the performance in mathematics since SMASSE begun and most students had also pointed out that they seemed to enjoy mathematics more in class. From these findings, it is clear that the SMASSE project has had a positive influence on student's performance in mathematics. This actually promises a

continued improvement in the performance in mathematics by students before SMASSE's expiration.

With regards to the second objective - that is -to establish the attitude of mathematics teachers towards the SMASSE ASEI/PDSI teaching approaches together with those effects they had so far had on students' performance in Nyakach sub-county, this study concluded that, the approaches had highly improved the attitude of mathematics teachers towards teaching the subject. There had also been an improvement in the methods applied by mathematics teachers thus advancing content delivery. This was brought about by the increased motivation among students since they recognized an improvement in the methods employed by teachers and as a result, more persistence among the students.

With regards to the third objective - that is - to examine the manner in which head teachers & QUASOs supervised and also supported SMASSE's ASEI/PDSI teaching approaches, this study came to the conclusion that the two parties employed good motivational techniques towards mathematics teachers and also always allowed them to attend further SMASSE INSET courses. As a result, there had been a high and positive relationship between the attendance SMASSE INSET courses, and the performance of students in mathematics.

5.4 Recommendations.

Since this study revealed through its findings that the SMASSE project was achieving its set objectives, the researcher recommends for the continuation of the SMASSE project, beyond the initially selected 2015 termination date. This is because of the fact that a number of the set objectives will still not have been achieved by then. The researcher also recommends for the allocation of more funds to the SMASSE project by the government. The researcher also recommended for the improvement of supervision and motivation activities associated with the implementation of SMASSE's ASEI/PDSI teaching approaches. The researcher also concluded by stating that the government should strive to ensure that all mathematics teachers in its public schools attend SMASSE INSET.

Table 5.1: Contribution to the Body of Knowledge.

<p>To assess effects the SMASSE project had so far had towards the attitude of students when it came to learning mathematics in Nyakach sub-County, Kisumu Kenya</p>	<p>The study found out that there had been a significant improvement in the attitude of students towards mathematics following the implementation of ASEI/PDSI teaching approaches. The improved attitude among students saw an improvement in the performance of mathematics in Nyakach sub-county.</p>
<p>To establish the attitudes mathematics teachers had towards SMASSE ASEI/PDSI teaching approach and the influence that had so far had on students' performance in the subject in Nyakach sub-county, Kisumu county.</p>	<p>Findings showed that most mathematics teachers have embraced the ASEI/PDSI teaching approach and this has seen the performance of students' in mathematics at the K.C.S.E level of examination improve. It was also established that there is a positive correlation between attendance of SMASSE INSET courses and K.C.S.E performance ($r = 0.632, p > 000$).</p>
<p>To examine whether principals and QUASOs supervised the implementation of the SMASSE ASEI/PDSI teaching approaches and also whether they supported teachers to attend SMASSE INSET courses.</p>	<p>This study established that principals and QUASOs supervised the implementation of the ASEI/PDSI teaching approaches. It also established that head teachers supported their mathematics teachers attend SMASSE INSET courses. Head teachers also supported the ASEI/PDSI teaching approaches by purchasing equipment that were supplementaries.</p>

5.6 Suggestions for Further Research.

Based on the findings, conclusions and recommendation made, the researcher suggests that further research should be carried out on:

1. The lack of interest in SMASSE INSET courses, among a significant number of teachers.
2. The lack of peer training on the ASEI/PDSI teaching approaches, among teachers who are colleagues.
3. The efficiency of SMASSE INSET courses at the sub-county level. This is so as to identify the different difficulties that were faced in the various sub-counties, and thus enable the enactment of solutions that were sub-county specific.
4. How the significant others of students and also their peers usually influence how they perform in their academics.

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Appendix 1: Letter of Transmittal



UNIVERSITY OF NAIROBI
COLLEGE OF EDUCATION AND EXTERNAL STUDIES
SCHOOL OF CONTINUING AND DISTANCE EDUCATION
KISUMU CAMPUS

Our Ref: UON/CEES/KSM/4/13

Your Ref:

Telephone: 057-2021534 Ext. 28626

University of Nairobi Plaza
Oginga Odinga Street,
P.O. Box 825,
KISUMU, Kenya.

08th August, 2014

TO WHOM IT MAY CONCERN

RE: MBATI ROSELYN - REG NO: L50/61460/2013

This is to confirm to you that the above named **Mbati Roselyn** is a student of the University of Nairobi, College of Education and External Studies, School of Continuing and Distance Education undertaking Masters in Project Planning and Management in Kisumu Campus and she has successfully completed her course work and examinations as required.

In partial fulfilment of the requirements for the Masters in Project Planning and Management, **Roselyn** is undertaking research for her Masters Project. We therefore request you to allow her access the data/information she may need for the purpose of her study. Any assistance, information or data collected is needed for academic purposes only and will therefore be treated in strict confidence.

We would appreciate any assistance that may be given to her to enable her carry out the study.

Thank you.

08 AUG 2014

Dr. Raphael O. Nyonje, PhD
RESIDENT LECTURER
KISUMU CAMPUS

ISO 9001: 2008 CERTIFIED

The Fountain of Knowledge Providing Leadership in Academic Excellence

Appendix 2:Letter of Introduction

ROSELYNE MBATI,

P.O BOX 119,

MASENO.

THE PRINCIPAL NYAKACH SUB COUNTY.

Dear Sir/Madam,

RE: RESEARCH ON SMASSE.

Hello,

My name is Roselyn Mbatl, a master's student, university of Nairobi. I am pursuing a master's degree in project planning and management. The main purpose of writing this letter is to seek permission to issue: your office; mathematics teachers; and form four students with questionnaires for my research. I am carrying out a research on influence of SMASSE project on performance in mathematics in K.C.S.E examinations and your school has been selected to aid in the study. The study is done to investigate whether use of resources in teaching promotes learning and if SMASSE project was able to change attitude of teachers and learners towards mathematic.

This study is entirely for academic purposes. The information provided by the interviewee will be treated highly confidential and will no way be disclosed to any third party. I request you to feel free and provide honest answers without fearing any persecution or disclosure. I will be looking at the collective feedback for all responses but not individual response.

Your assistance will be highly appreciated.

Thank you.

Yours sincerely,

Roselyn Mbatl

Appendix 3

Questionnaire for students on their performance in Mathematics, before and after implementation of SMASSE Project

Instructions

Answer all the questions below as honest as possible by ticking that which applies to you.

Key:

SA- Strongly Agree	5
A - Agree	4
U - Undecided	3
D -Disagree	2
SD - Strongly disagree	1

1. Name of your school.....

Contribution of SMASSE Project towards Mathematics.

2. Our mathematicsteacher usually starts each lesson by reviewing the previous lesson.

SA. [] A.[] U. [] D. [] SD. []

3. Our mathematics teacherusually teaches using lecture methods and notengaging ones.

SA. [] A.[] U. [] D. [] SD. []

4. Our mathematics teacher usually encourages us to form study groups.

SA. [] A.[] U. [] D. [] SD. []

5. Our mathematics teacher usually uses prepared notes when teaching.

SA. [] A.[] U. [] D. [] SD.[]

6. Our mathematics teacher usually allows us to present activities in class

SA. [] A.[] U. [] D. [] SD.[]

7. Our mathematics teacher usually guides us during practical mathematical lessons.

SA. [] A.[] U. [] D. [] SD.[]

8. Our mathematics teacher likes and enjoys teaching mathematics.

SA. [] A.[] U. [] D. [] SD. []

9. Our mathematics teacher is often friendly when teaching.

SA. [] A.[] U. [] D. [] SD. []

10. I usually enjoy mathematics lessons.

SA. [] A.[] U. [] D. [] SD. []

11. Students have enough mathematical text books.

SA. [] A.[] U. [] D. [] SD. []

12. Our mathematics teachers usually complete the mathematics syllabus on time.

SA. [] A.[] U. [] D. [] SD. []

13. Our mathematics teachers usually give remedial lessons and these help us improve our performance.

SA. [] A.[] U. [] D. [] SD. []

14. Mathematics teachers often involve us in class when teaching.

SA [] A.[] U. [] D. [] SD []

15. Our mathematics teacher give us assignments very often.

SA. [] A.[] U. [] D. [] SD. []

16. My classmates have a very positive attitude towards mathematics.

SA. [] A.[] U. [] D. [] SD. []

17. Our mathematics teacher usually summarize what has been taught at the end of the lesson.

SA. [] A.[] U. [] D. [] SD. []

18. Our mathematics teachers use locally available materials as illustrations when teaching.

SA. [] A.[] U. [] D. [] SD. []

19. Our mathematics teachers often give us class activities.

SA. [] A.[] U. [] D. [] SD. []

20. What steps are you putting in place to improve your mathematics performance?
Comment briefly.

.....
.....
.....

Appendix 4

Questionnaire for Mathematics Teachers on performance in Mathematics before and after implementation of SMASSE Project

Dear Sir/Madam

Kindly answer the following questions.

The information gathered will be kept confidential and will be used for research purposes only. The usefulness of the information will depend on you honesty.

Thank you.

Instructions.

Answer all the questions below as honestly as possible by ticking which ever applies to you.

Key:

SA - Strongly Agree	5
A - Agree	4
U - Undecided	3
D - Disagree	2
SD - Strongly disagree	1

1. Name of your school.....

2. Current grade

S1	[]
Diploma	[]
B.A, B.S.C with PGDE	[]
Masters	[]
P.H.D.	[]

3. Type of school

Boys boarding	[]
Girls boarding	[]
Mixed day	[]
Mixed boarding	[]

4. Position held at school level.

H.O.D [] Subject Teacher [] Classroom Teacher []

A. ACADEMICS.

1. How many lessons do you teach per week?

12 – 19 lessons [] 20 – 29 lessons [] 30 and above []

2. Comment briefly how your teaching load affect your performance in teaching mathematics.....

.....

.....

3. On average what is the student enrolment in your classes?

10 – 25 [] 26 – 45 [] 40 and above []

B. Good Performance in mathematics

1. Do you take time to emphasize the importance of learning mathematics?

If yes/No, explain briefly giving reasons.

.....

.....

2. Do you manage to cover your syllabus on time?

If no give reasons

.....

.....

C. Resources

1. Do you use teaching/learning guide in teaching mathematics?

.....
.....
.....

2. Comment briefly how the use of learning/teaching aids promotes teaching and learning mathematics.

.....
.....
.....

3. State briefly how you engage learners in making some of the teaching/learning aids.

.....
.....
.....

4. Briefly comment how the school administration supports in provision of teaching /learning aids.

.....
.....
.....

D. Teaching methods

Key

SA - Strongly Agree	5
A - Agree	4
U - Undecided	3
D - Disagree	2
SD - Strongly disagree	1

i. Do you enjoy attending SMASSE in set?

S.A [] A.[] U. [] D. [] S.D []

ii. SMASSE in set trainers are competent

S.A [] A.[] U. [] D. [] S.D []

iii. SMASSE insets should be continuous

S.A [] A.[] U. [] D. [] S.D []

iv. How often do you use PDSI?

Very Often [] Often [] Rare [] Very rare [] Not at al []

v. How often do you use ASEI?

Very often [] Often [] Rare [] Very rare [] Not at al []

E. Others

i. Do you enjoy teaching mathematics?

Yes [] No []

ii. State briefly some of the problems you encounter in the process of teaching mathematics?.....
.....
.....
.....

iii. Do you consider your students well prepared in primary schools in mathematics?

Yes [] No []

Tick the right reason

Broad syllabus []

Exam centered []

Wrong methodology []

Ineffective teaching []

Less teaching time []

Any other? []

iv. Do you sometimes punish your students in process of teaching mathematics?

Yes [] No. []

v. What affects you actions in reference to student performance?

Good [] Bad [] Don't know []

vi. How often do you test your students?

Weekly [] Monthly [] Termly []

vii. Do you mark students work regularly?

Yes [] No []

Comment briefly giving reasons

.....
.....
.....
.....

viii. Are you able to mark, give feedback and revise your tests on time?

Yes [] No []

ix. How would you rate yourself as a mathematics teacher? Briefly explain.

.....
.....

Appendix 5

Principals Questionnaire for principals, on the performance in Mathematics, before and after the implementation of the SMASSE Project.

Dear Sir/Madam

Kindly answer the following questions. The information gathered will be kept confidential and will be used for research purposes only. Usefulness of the information will depend on your honesty. Your assistance will be highly appreciated.

Thank in advance.

Instructions.

Answer all the questions below as honestly as possible by ticking which ever applies to you.

Key:

- S.A – Strongly agree 5
A - Agree 4
U - Undecided 3
D - Disagree 2
S.D - Strongly disagree 1

A. Background information

1. Name of your school.....

2. Current grade

S1 Diploma B.A, B.S.C with PGDE

Masters P.H.D

3. Type of school

Boys boarding

Girls boarding

Mixed day

Mixed boarding

4. Students enrolment per sex

Male Female Total

B. Academics

1. Fill in the table below indicating the mean grades and mean score for mathematics for indicated years.

Table 1 years	2006	2007	2008	2009
Mean score				
Mean grade				

Table 2 years	2010	2011	2012	2013
Mean score				
Mean grade				

2. In your own opinion, how do the results in the two tables (1) and (20). Compare?

.....
.....
.....
.....

Give brief comments.....
.....
.....
.....

3. Has the school registered improved mean score over the years?

.....
.....

Give brief reason.
.....
.....
.....
.....

C. RESOURCES

1. How many mathematics teachers does your school have?
2. Are mathematics teachers in your school adequate?

D. ATTITUDE

1. Does your school embrace the role of motivation speakers in enhancing students attitude towards learning mathematics.

.....
.....
.....

E. TEACHING METHODS

1. Have all mathematics teachers in your school have attended SMASSE in-set?
 - i. If yes to what level?
 - ii. If no give reasons
2. Does you school sponsor mathematics teachers for seminars, workshops and other exchange programmes to enhance content delivery?
If no, give reasons

.....
.....
.....

OTHERS

Key

S.A – Strongly agree	5
A - Agree	4
U - Undecided	3
D - Disagree	2
S.D - Strongly disagree	1

- i. Performance in mathematics has improved since inception of SMASSE in set.

S.A [] A.[] U.[] D. [] S.D []

- ii. SMASSE in-sets are a waste of school funds

S.A [] A.[] U.[] D. [] S.D []

- iii. SMASSE in-sets should be terminated.

S.A [] A.[] U.[] D. [] S.D []

- iv. Our science laboratories are well equipped.

S.A [] A.[] U.[] D. [] S.D []

Appendix 6

Questionnaire for Quality Assurance and Standards Officer

Instructions

Answer all the questions below as honestly as possible by ticking which ever applies to you.

Key:

S.A – Strongly agree 5

A - Agree 4

U - Undecided 3

D - Disagree 2

S.D - Strongly disagree 1

1. Teachers attend in service training willingly without coercion

S.A [] A.[] U. [] D. [] S.D []

2. Teachers are active during inset services

S.A [] A.[] U. [] D. [] S.D []

3. SMASSE in –set should be terminated

S.A [] A.[] U. [] D. [] S.D []

4. The SMASSE in-set curriculum need some motivation

S.A [] A.[] U. [] D. [] S.D []

5. The training centre in the district is well equipped with SMASSE related teaching and learning materials.

S.A [] A.[] U. [] D. [] S.D []

6. We provide attendance certificate at the end of each cycle

S.A [] A.[] U. [] D. [] S.D []

7. As supervisor of the SMASSE project do you think SMASSE has been successful or not? Explain briefly.

.....
.....

8. Do you share you observations with your principals and teachers concerned, explain briefly.

.....
.....
.....

9. What input is needed to make SMASSE successful?

.....
.....
.....

10. Is it worth investing in SMASSE heavily, explain shortly.

.....
.....
.....

11. ASEI/PDSI pedagogy and hand on methods. Do you think you have been known by teacher. Explain briefly

.....
.....
.....

12. Were all stakeholders involved in the programme so that they own it? Explain briefly.

.....
.....
.....

Appendix 7

Questionnaire for SMASSE Trainers on success of the inset

Instructions

Answer all the questions below as honestly possible by ticking which ever applies to you.

Key:

S.A – Strongly agree	5
A - Agree	4
U - Undecided	3
D - Disagree	2
S.D - Strongly disagree	1

1. The management of SMASSE in – set training is efficient and effective.

S.A [] A.[] U. [] D. [] S.D []

2. Teachers are coerced to attend in-set training

S.A [] A.[] U. [] D. [] S.D []

3. The SMASSE in – set is success

S.A [] A.[] U. [] D. [] S.D []

4. The training materials are relevant

S.A [] A.[] U. [] D. [] S.D []

5. I give feedback about challenges facing the National body

S.A [] A.[] U. [] D. [] S.D []

6. Explain briefly challenges that you meet as a SMASSE trainer?

.....
.....
.....

7. Give some possible solutions to the SMASSE challenges

.....
.....
.....

8. What can be done to improve SMASSE training? Comment briefly.

.....
.....
.....

Appendix 8: Letter for Permit



UNIVERSITY OF NAIROBI
COLLEGE OF EDUCATION AND EXTERNAL STUDIES
SCHOOL OF CONTINUING AND DISTANCE EDUCATION
KISUMU CAMPUS

The Secretary
National Council for Science and Technology
P.O Box 30623-00100
NAIROBI, KENYA

08th August, 2014

Dear Sir/Madam,

RE: MBATI ROSELYN - REG NO: L50/61460/2013

This is to inform you that **Mbati Roselyn** named above is a student in the University of Nairobi, College of Education and External Studies, School of Continuing and Distance Education, Kisumu Campus.

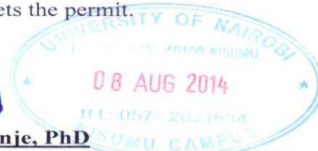
The purpose of this letter is to inform you that **Roselyn** has successfully completed her course work and Examinations in the programme, has developed Research Project Proposal and submitted before the School Board of Examiners which she successfully defended and made corrections as required by the School Board of Examiners.

The research title approved by the School Board of Examiners is: *"Influence of Strengthening Mathematics and Science in Secondary Education (SMASSE) Project on Students Performance in Mathematics in Nyakach Sub-County, Kisumu Kenya"*. The research project is part of the pre-requisite of the course and therefore, we would appreciate if the student is issued with a research permit to enable her collect data and write a report. Research project reflect integration of practice and demonstrate writing skills and publishing ability. It also demonstrates the learners' readiness to advance knowledge and practice in the world of business.

We hope to receive positive response so that the student can move to the field to collect data as soon as she gets the permit.

Yours Faithfully

Dr. Raphael O. Nyonje, PhD
SENIOR LECTURER & RESIDENT LECTURER
DEPARTMENT OF EXTRA-MURAL STUDIES
KISUMU CAMPUS



Appendix 9: Letter of Authorization



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 November, 2014

NACOSTI/P/14/9289/4062

Roselyn Mbatia
University of Nairobi
P.O. Box 30197-00100
NAIROBI.

RE: RESEARCH AUTHORIZATION

Following your application for authority to carry out research on *"Influence of Strengthening Mathematics and Science in Secondary Education (SMASSE) Project on student performance in mathematics in Nyakach Sub County, Kisumu, Kenya,"* I am pleased to inform you that you have been authorized to undertake research in **Kisumu County** for a period ending **5th December, 2014.**

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

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


DR. S. K. LANGAT, OGW
FOR: SECRETARY/CEO

Copy to:

The County Commissioner
Kisumu County.

The County Director of Education
Kisumu County.

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

Appendix 10: Permit


THIS IS TO CERTIFY THAT:
MS. ROSELYN MBATI
of UNIVERSITY OF NAIROBI, 0-40105
Maseno, has been permitted to conduct
research in Kisumu County

on the topic: INFLUENCE OF
STRENGTHENING MATHEMATICS AND
SCIENCE IN SECONDARY EDUCATION
(SMASSE)PROJECT ON STUDENT
PERFORMANCE IN MATHEMATICS IN
NYAKACH SUB- COUNTY, KISUMU
KENYA.

for the period ending:
5th December,2014

Rmbati
Applicant's
Signature

Permit No : NACOSTI/P/14/9289/4062
Date Of Issue : 18th November,2014
Fee Received :Ksh. 1000




[Signature]
Fee Secretary
National Commission for Science,
Technology & Innovation

CONDITIONS

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

REPUBLIC OF KENYA



National Commission for Science, Technology and Innovation

RESEARCH CLEARANCE PERMIT

Serial No. A 3669

CONDITIONS: see back page

Appendix 11:

Table for determining sample size from a given population.

N	S	N	S	N	S
10	10	220	140	1,200	291
15	14	230	144	1,300	297
20	19	240	148	1,400	302
25	24	250	152	1,500	306
30	28	260	155	1,600	310
35	32	270	159	1,700	313
40	36	280	162	1,800	317
45	40	290	165	1,900	320
50	44	300	169	2,000	322
55	48	320	175	2,200	327
60	52	340	181	2,400	331
65	56	360	186	2,600	335
70	59	380	191	2,800	338
75	63	420	196	3,000	341
80	66	440	201	3,500	346
85	70	440	205	4,000	351
90	73	460	210	4,500	354
95	76	480	214	5,000	357
100	80	500	217	6,000	361
110	86	550	226	7,000	364
120	97	600	234	8,000	367
130	97	650	242	9,000	368
140	103	700	248	10,000	370
150	108	750	254	15,000	375
160	113	800	260	20,000	377
170	118	850	265	30,000	379
180	123	900	269	40,000	380
190	127	950	274	50,000	381
200	132	1000	278	75,000	382
210	136	1100	285	1,000,000	384

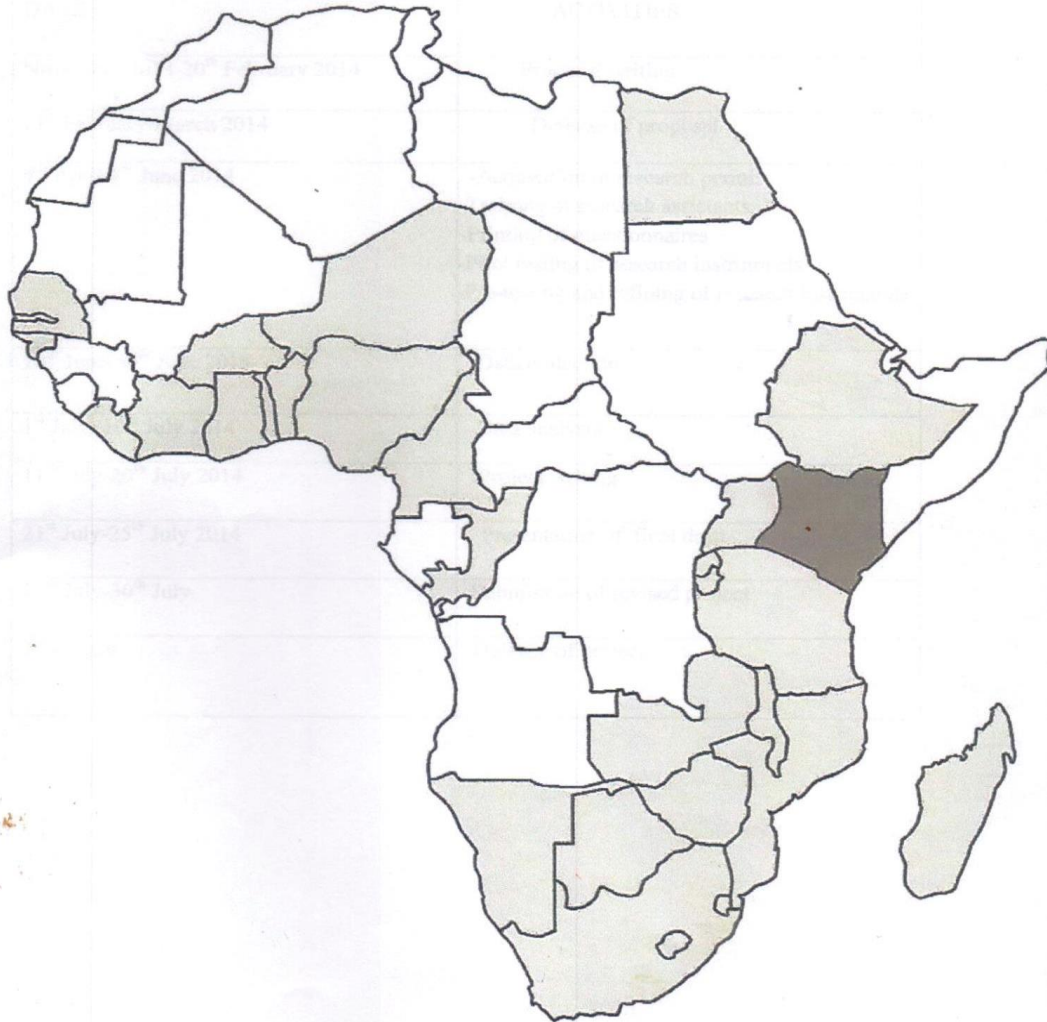
Note – N + S Population Size

S is Sample Size

Small – Sample Techniques. The NEA Research Bulletin, Vol. 38 (December, 190)

Appendix 12

SMASSE-WECSA Member Countries



Source: SMASSE Project (2005)