STRENGTHENING OF MATHEMATICS AND SCIENCES IN SECONDARY SCHOOL EDUCATION (SMASSE) AND MATHEMATICS PERFORMANCE IN SELECTED SECONDARY SCHOOLS IN MAKUENI DISTRICT- KENYA

A Thesis
Presented to the School of
Postgraduate Studies and Research
Kampala International University
Kampala, Uganda

In Partial Fulfillment of the Requirements for the Degree
Master of Education in Educational
Management and Administration

By
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April, 2011

DECLARATION A

"This thesis is my original work and has not been presented for a Degree or any other academic award in any university or Institution of learning".

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Date

DECLARATION B

"I confirm that the work reported in this thesis was carried out by the candidate under my supervision".

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APPROVAL SHEET

This thesis entitled "Strengthening of Mathematics and Sciences in Secondary Education (SMASSE) and Mathematics Performance in K.C.S.E in Selected Public Secondary Schools in Makueni District –Kenya" prepared and submitted by **DOMITILA WAYUA MUIA** in partial fulfillment of the requirements for the degree of Master of education in educational management and administration has been examined and approved by the panel on oral examination with a grade of PASSED.

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DEDICATION

To my mother Wandia, brother Muthoka and late father Muia for their commitment and sacrifices made towards my early education and to my son Einstein.

ACKNOWLEDGEMENT

Through out the process of carrying out this research, numerous people have continuously supported me. I would like to thank the Almighty Lord for providing the opportunity for me to be with these people. I must thank my supervisor, Mr. Ochan Joseph who has unfailingly provided thoughtful instruction on and detailed consideration of all the steps in the process that led to this final paper. I must thank all the students, my classmates for their comraderie and fellowship in this intense, but often comical adventure called a master's degree.

In addition to those who provided academic support for this paper, I must also thank those of my family who have enabled this experience and showed me that all is possible. Lastly, I thank my son for making me laugh everyday and providing the perspective that helped me maintain my sanity.

ABSTRACT

The purpose of the study was to establish the relationship between Strengthening of Mathematics in Secondary school Education (SMASSE) and students' performance in mathematics in selected public secondary schools in Makueni district. The study was conducted utilizing a sample drawn from 15 public secondary in Makueni district. All the 50 mathematics teachers from the schools were used in the study. The study employed a descriptive correlational research design and used questionnaires, and observation schedule for data collection. The data collected was analyzed by use of; means, percentages and reported using frequency distribution tables. Further the relationship between the variables was analyzed by use of Pearson's correlation constant and Regression analysis. It was established that SMASSE methodologies and students mathematics performance were positively correlated. There after recommendations are made that, the Kenya government should ensure sustainability of the INSET, the universities and teacher training adopt the SMASSE INSET curriculum innovation in their teaching. Finally suggestions for further research were made, either a replica of this study to cover a larger sample, to find out the impact of SMASSE INSET in other parts of the country, an experimental research be done on districts which use SMASSE methodologies and those which do not use.

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CHAPTER ONE

THE PROBLEM AND ITS SCOPE

Background of the Study

Education provides the human resources needed for social and economic development and also contributes to poverty reduction through improving the capacity of individual people to make a living. In addition, when they fully develop their own abilities and capabilities through education and participate in various political, economic and social activities, their life choices widen allowing them to lead their lives with dignity (Narog 2007).

Many developing countries face the challenge of improving the 'quality' of education. The insufficient quality of education in developing countries has resulted in the fact that there are people who have graduated from primary school, but are unable to read, write or do simple calculations. As for primary causes for the low quality education, significant problems exist such as shortage of textbooks and educational materials, under developed curriculum as well as a shortage of trained teachers. With this in mind, Japan has helped 26 countries world wide for raising the 'quality' of education with Mathematics and Science education placed as apriority area. Mathematics and Science serve as the foundation for each and every person to live within their society, while being important for these countries to accomplish technological and scientific advancements and economic and social development. Teachers improve lessons in a concrete manner through teacher training for conducting practical lessons, allowing learners to better understand the lessons and derive pleasure from learning (Sugiyama 2007).

In Africa, Strengthening of Mathematics and Science Education in Western, Eastern, Central and Southern Africa (SMASSE-WESCA) was founded as an Intra-regional collaborative network centered on the SMASSE INSET that Japan has been supporting in Kenya since 1998. SMASSE-WESCA conducts activities to spread an approach of restructuring the lessons for secondary Mathematics and Science education established by SMASSE INSET to other countries. This approach introduces experiments and practical training and also promotes originality and ingenuity of teachers (SMASSE 2005).

The performance in mathematics and science subjects at secondary education level in Kenya has been very poor. For example in national form four examinations in the year 2001, over 60%(116 335 out of 192 589) students got grades D and E in Mathematics, over 40%(73 067 out of 180 372) students got grades D and E Chemistry, Over 18%(31 837 out of 175 975) got grades D and E in Biology and 32%(17458 out of 54 509) got grades D and E in Physics (Kenya National Examination Council 2002). Performances in mathematics have been unsatisfactory and have hindered progression into tertiary level institutions. This has been a major national concern as the performance in mathematics directly determines the progress that Kenya makes in becoming a middle level Industrial economy by 2030.

As far as poor performance is concerned, many stakeholders thought that teaching and learning materials provision was the answer to the poor performance. However, some schools which were considered well endowed in this regard were not performing as expected. The solution therefore went beyond facilities but included the quality of teachers. Secondary schools in Makueni district have also been performing poorly in mathematics in K.C.S.E creating worries among the parents, students and teachers. It was because of this abysmal performance that the government of Kenya in collaboration with the government of Japan through Japan International Co-operation Agency (J.I.CA) an initiative, known as Strengthening of Mathematics and Sciences in Secondary Education (SMASSE) was embarked upon.

SMASSE INSET was started in 1998 in nine districts, these are; Butere Mumias, Gucha, Kajiado, Kakamega, Kisii, Lugari, Makueni, Maragua, and Muranga). In 2001, the INSET was expanded to other districts in the country. SMASSE INSET was implemented in Makueni district in 1998. The final stage of the INSET implementation (4^{th} cycle) ended in 2003

Statement of the Problem

The Common Wealth Survey findings of INSETS Africa INSET(1982) revealed that in-service activities are rarely followed and evaluated. Whilst a great deal of INSETS in African Common Wealth Countries is directed towards improving teacher competence in classroom teaching, it is difficult to establish how much training is provided and how effective the INSETS are. More over, the performance in mathematics in K.C.S.E examinations has been disastrous for Kenya.

It was on this basis that the researcher proposed to investigate whether there was any significant relationship between SMASSE and students performance in mathematics by examining the following:

1. Methods employed in teaching mathematics by teachers.
2. The instructional material employed in teaching mathematics.
3 .Students mathematics performances in Makueni district.

Purpose of the Study

The purpose of the study was to establish the relationship between SMASSE and students performance in mathematics.

Research Objectives

The study endeavored to:

1. To identify the demographic characteristics of the respondents in terms of Age, Gender, Qualification, Length of Stay and Position in the school.
2. To determine the extent of use of SMASSE methodologies in teaching by the mathematics teachers in Makueni district.
3. To assess the level of performance of students in mathematics in Makueni district.
4. To establish the relationship between SMASSE and students performance in mathematics in Makueni district.

Research Questions

The following questions guided the study:

1. What are the demographic characteristics of the respondents in terms of Age, Gender, Qualification, Length of Stay and Position in the School?
2. What is the extent of use of SMASSE methodologies in teaching mathematics by the teachers in Makueni district?
3. What is the level of performance of students in Mathematics in Makueni district?
4. Is there a relationship between SMASSE and students performance in mathematics in Makueni district?

Hypothesis

SMASSE teaching methodologies affects student's performance in mathematics.

Scope

The study was carried out in fifteen selected schools in Makueni district, Eastern province – Kenya. The area was chosen because it was one of the pilot SMASSE districts and it proximity made the school accessible to the researcher. The study intended to determine the relationship between SMASSE and students performance in mathematics.

Significance of the Study

The findings of this study are important to:

Policy Makers - to assess the effectiveness of SMASSE and come up with policies which would enhance mathematics performance, further technological advancement and catapult Kenya to middle level economy.

Educational Planners - to assess the cost- effectiveness of SMASSE and point out the areas that require improvement in terms of resources- Human, Material and financial.

Teachers - to serve as a motivating factor for them to use and practice the SMASSE methodologies towards improving performance in mathematics.

Students – to change their negative attitudes towards mathematics, use the SMASSE methodologies towards improving their performances in mathematics. This would make progression in tertiary education level possible.

Parents – to improve their confidence in the Kenyan education system and this would save them the extra cost of mathematics bridging courses once their children perform well in mathematics.

Operational Definitions of Key Terms

SMASSE Strengthening of Mathematics and Sciences in Secondary education

J.I.C.A Japan International Cooperation Agency

K.C.S.E Kenya Certificate of Secondary Education

INSET In-service Training

Bridging course lessons taken by a learner after they fail in a national examination (K.C.S.E) to improve their grade in the lesson failed.

CHAPTER TWO

REVIEW OF RELATED LITERATURE

Introduction

The chapter covers Concepts, Ideas, Opinions from Authors, Theoretical Perspectives and there after review of the related literature.

Concepts, Opinions, Ideas from Authors/Experts

SMASSE pursues In-service training (INSET) of serving mathematics and Science teachers with emphasis on changing the attitudes of teachers and students in classroom. Special emphasis is placed on shifting teacher-centered to student-centered classroom activities. It is argued that pedagogical changes in classroom activities should focus on **A**ctivities, **S**tudents, **E**xperiments and **I**mprovisation(ASEI) while the teaching and learning process can be in a cyclical manner using the **P**lan,**D**o,**S**ee and **I**mprove(SMASSE 2001).

ASEI/PDSI paradigm shift

For effective teaching, the teacher should have a shift

From	To
Content-based approach	**A**ctivity- Focused learning
Teacher-centered teaching	**S**tudent- Focused learning
Chalk and Talk	**E**xperiment-based teaching

Few demonstrations | Improvisation and small scale

Experiments

To achieve the ASEI, condition, the teacher should **P**lan, **D**o the activities before the lesson, **S**ee the strengths and weaknesses of the activity in order to **I**mprove and avoid earlier mistakes (PDSI). In the study, SMASSE methodologies are split into: ASEI activities, PDSI approach and attitude Approach.

Students' performance in mathematics

This refers to the ability of the learner to interpret mathematical concepts and apply them to solve real life problems (Eshiwani 2001).

The performance in mathematics in K.C.S.E has been, secondary schools in Makueni district not being exceptional.

Table: 2.1 Combined mean scores of Mathematics 2001-2007, in K.C.S.E in Makueni district.

Year	Mean	Grade
2001	2.76	D
2002	2.98	D
2003	2.96	D
2005	2.58	D
2006	3.07	D
2007	4.42	D

Source: Makueni District Exam Statistics 2008.

And those education psychologist who argue that if the teacher imparts to the learners a comprehensive mastery of the skills, chances will be high that the learner will be able to adopt the skills and apply them, hence high grades.

Figure 2.2 Summary of second argument after SMASSE INSET (input)-Teachers situation.

- Better methodologies
- Positive attitude
- High motivation
- Good resource utilization

↓

LEARNERS SITUATION (OUTPUT)

↑

- Positive attitude
- High motivation
- Improved performance

Okumbe (1998) pointed out that education can be equated to a production firm, where schools are manufacturing units and like in a plant where right ratios of raw materials, management skills and other right combination of production factors determine the quality of the product.

Therefore in the education sector, it is important to have the right combination and implementation of various factors such as;

Motivation and attitudes

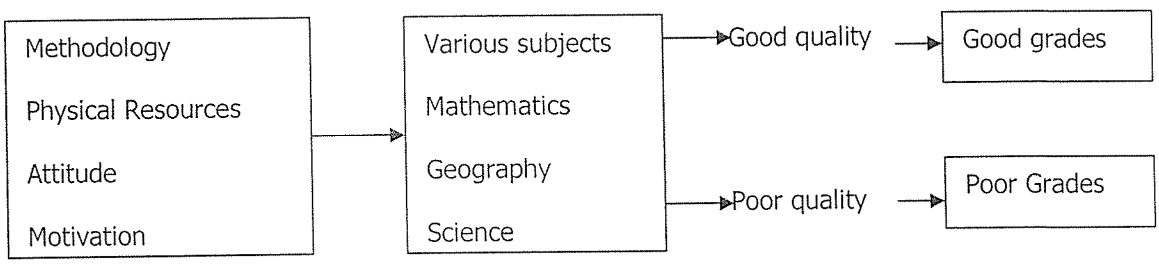
Financial management

Resource management for teaching and learning

Instructional methodologies and skills

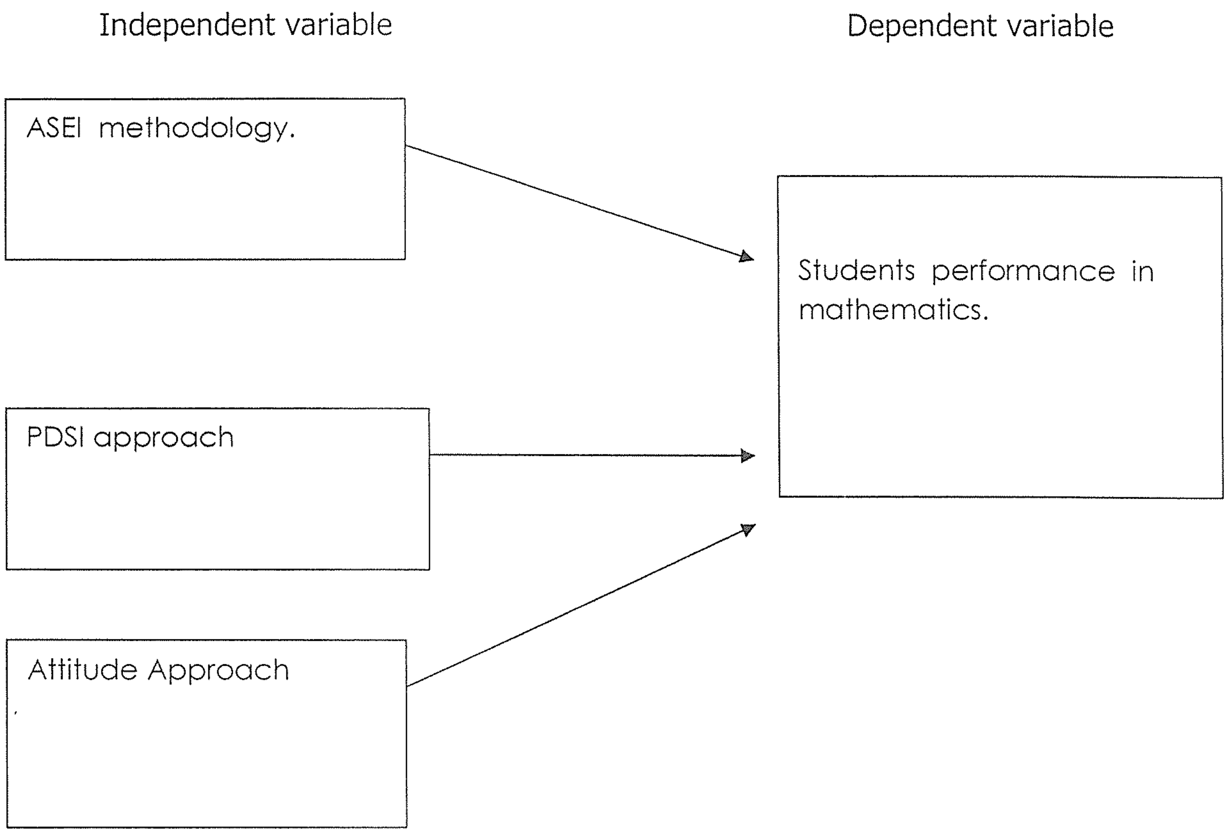
All the above applied on a fixed factor, the learner was expected to get good grades. Therefore educational stakeholders must come up with an education mixture of all inputs in order to bring the pre-determined objectives as indicated in figure 1.3 below.

Figure 2.3 Education Mixture



On fixed factor the learner plays a crucial role, therefore, skills for carrying out methodologies is very important. One should posses the right skills, attitudes and high level of motivation as an educationist to achieve both the school and subject objectives. The SMASSE INSET tries to make the mathematics teachers to investigate the variables given above to produce good fixed-factor learners, who will produce a competent student in Mathematics, able to obtain grade A in the subject.

Figure 2.4 Researchers Conceptual Framework



The above framework explains the interaction of independent and dependent variables.

Related Studies

The literature review emanate from various studies and works of the various educationists concerning performance of mathematics in K.C.S.E, for which, over the years has been poor and wanting causing hindrances in future career development in institutions of higher learning. In view of this grave situation, much research work has been done to identify the major causes of the declining performances in mathematics. Studies, reports and seminar presentations from different researchers and scholars attribute the poor performance in athematics in K.C.S.E to various reasons as discussed below.

Paucity in Resource Availability, Utilization and Students' Performance

Corkcroft (1981) finds it necessary for teachers to have adequate reference books related to teaching of mathematics. This should include professional publications on the subjects, copies of teachers guide with related text books. The use of teaching aids help to facilitate teaching and learning of concept, increase the efficiency of information processing, give meaning to words help to focus on students interest and assist the teacher to relate the abstractness to concreteness.

Konchhar (1996), in his writing reveals that classrooms, laboratories and subject rooms should be suitable and convenient for work, well equipped with adequate furniture. In absence of such facilities, students will not have the opportunity to practice what they learn in classroom theory. Such a factor has been responsible for the poor performance of students in science subjects.

It is a well known fact that an object handled impresses itself more firmly on the mind than the object merely seen from a distance or in an illustration. Thus practical work forms an important feature in any mathematics course.

Teaching Methods and Students' Performance

The process of content delivery affects the performances of the students in the subject. Many teachers do not prepare for mathematics lessons. They develop the lesson poorly. This demoralizes the learners. Many researchers have come up with the following observations.

Miheso (1999) noted that if in mathematics class the teacher fills his time with drilling students' routine operation, he kills the interest hampers their intellectual development and misuses their opportunities.

Owour (1995) points out that poor performance is as a result of teachers not being dedicated to their duties. Some of them are traders while others are drunkards. They devote most of their time to their businesses giving little time to their students. This worsens when it comes to performance of students in science subjects since such subjects require much more time to be devoted to them by both teachers and students.

Dewey, as cited in Venkateswarna S.(1997) contends; "we violate the learners nature and render difficult the best ethical results by introducing the learner abruptly to a number of special studies, of reading, writing and biology" it is that the current subject centered curriculum, teachers focus their efforts and attention on making students learn the topics in the subjects and courses of study according to a fixed syllabi in a rigid set of pattern to enable them to pass a set of examinations.

The present needs of the child are hardly kept in mind and at sometimes the learners loose interest in what is being taught. This in the end contributes to the poor performance in such subjects like mathematics.

Githiari (2005) adds that in teaching, there are various methods which a teacher can use. It is therefore upon the teacher to vary the methods to achieve the desired results. He adds that in order to develop practical skills in mathematics subjects, students should be made to keep on practicing what is done in classroom theory by putting it into practical skills.

He also noted that at examination time, many students are lost as they do not have the necessary concepts and skills. They therefore end up performing poorly and unless the government addresses the cause of poor performances in mathematics, nothing would change soon.

Teachers' / Students' Attitude and Students' Performance

According to Robson (1993), the attitude through out the society is "don't tell me what I don't want but show me and tell me what I want" in relation to the topic is important that the learner cultivates the positive attitude towards the subjects. The learners should be also involved both practically and orally during the learning sessions for them to develop skills and attitudes.

Muthini (1997) noted that some mathematics teachers contribute towards demoralizing students towards mathematics. This is by not marking assignments promptly and giving positive remarks. He also noted that teachers make students lose interest by not giving them very easy questions to improve the student's basic skills to create interest in the students. He further notes that lack of interest in students as they enter secondary schools is due to lack of proper counseling by the mathematics

CHAPTER THREE

METHODOLOGY

Research Design

The study employed a descriptive correlational design. Descriptive studies, according to Koul (1984) are concerned with gathering the facts rather than manipulation of variables. They attain information concerning the current status of phenomena and describe what exists with respect to variables or conditions in a given situation (Best and Kahn 1993). Descriptive correlational research was found appropriate as it was interested in describing the relationship between SMASSE and students performance in mathematics.

Research Population

The target population of the study constituted 15 public secondary schools in Makueni district, which has 57 mathematics teachers.

Sample size

Out of the 58 mathematics teachers in the selected schools, a sample of 50 teachers was selected using the Slovene's formula,

$$n = \frac{N}{1+N(e^2)}$$

Where n=required sample size, N=known population size

ẹ=significance level (0.05).

Sampling Procedures

The researcher used purposive sampling technique to select all the 15 public secondary schools which had presented candidates for K.C.S.E examinations since 2003. The researcher found the method appropriate because it dealt with the useful respondents only.

Instruments

Researcher made questionnaires were developed and used to gather information from the mathematics teachers as the respondents were literate and the information could easily be described in writing. The questionnaire had 3 sessions, one on the demographic characteristics of the respondents, another on the level of use of SMASSE methodologies and the last on students' performance in mathematics. All the questioners in section 1 and 2 where closed ended and respondents were required to tick as appropriate all questions on the extent on the use of SMASSE methodology were Likert scaled ranging from: 1-Never, 2-Rarely, 3-Frequently,4-Very Frequently. The questionnaire on students performance in mathematics were closed ended and required the respondents to fill the number of students who passed in each grade in the range provided.

Validity and Reliability

The researcher developed the instrument with the guidelines of the research supervisor and a pretest was administered as a pilot study to the respondents who were not included in the study. This was to test the reliability of the instrument. Inconsistencies discovered were corrected with the guidance from the supervisor and the instrument was finally was accepted as consistent. Content Validity was determined using a Content validity Index (CVI) from the judgment of experts, computed using the following formula:

$$CVI = \frac{\text{Number of valid items}}{\text{Total number of items}}$$

A minimum validity index of 0.7 was used to declare the instrument content valid. The content validity of the study was 0.78.

Data Gathering Procedures

The researcher made the corrections on the proposal after successfully defending it and obtained a transmittal letter from the School of Post Graduate Studies Director. The transmittal letter was delivered to the concerned authorities in the schools before administering the instrument to the respondents so as to seek official appointment and book appointment. After the official permission, questioners were administered by the Researcher, data collected, coded into the computer and analyzed by use of statistical Package for Social Sciences (SPSS) through a statistician. Results from the analyzed data were then interpreted and final report was prepared for viva defense.

Data Analysis

Data collected on the respondents profile was analyzed by use of frequency counts and percentage distributions. The extent of use of SMASSE methodologies and Students performance was analyzed by use of . Pearson's Co relational Coefficient and Regression Analysis was used to analyze the relationship between SMASSE and students performance in mathematics and test the hypothesis of the study

Ethical Considerations

The researcher started by seeking permission from the respondents before carrying out research this means that respondents were not compelled to participate in the study. An introductory letter from the School of Postgraduate Studies was availed Extreme confidentiality to the respondents was promised and practiced .Responses were coded to ensure anonymity.

Limitations

Home factors were not considered in the study, an assumption that all the students came from the same home setting was made.

Extraneous variable, which were beyond researchers control such as respondents' biasness and honesty and control of the study setting.

Instrumentation- the research instrument was not standardized thus validity and reliability tests were done to improve the credibility of the research variable.

CHAPTER FOUR

PRESENTATION, ANALYSIS AND INTERPRETATION OF DATA

Introduction

This chapter contains the data analysis method used to arrive at the conclusions for the study. The analysis procedures and major findings of the study are discussed below as per each research question.

Demographic Characteristics of Respondents

The demographic characteristics included Age, Gender, Qualification, Length of stay in School and Position in School. Table 4.1 shows the frequency and percentage distribution of the profile.

Table: 4.1 Demographic Characteristic of Respondents (n= 50)

Main Categories	Sub Categories	Frequency	Percentage
Age	26-30 Yrs	10	20
	31-35 Yrs	30	60
	36-40 Yr	08	16
	Above 40 Yrs	02	04
	Total	**50**	**100**
Gender	Male	16	32
	Female	34	68
	Total	**50**	**100**
Qualification	Diploma	10	20
	Degree	38	76
	Masters	02	04

	Total	**50**	**100**
Teaching Experience	Less than 2 yrs	00	00
	2-4 Yrs	02	04
	Above 4 Yrs	48	96
	Total	**50**	**100**
Position in School	Head Teacher	02	04
	H.O.D	05	10
	Senior Teacher	09	18
	Assistant Teacher	34	68
	Total	**50**	**100**

Table 4.1 indicates that majority of the respondents were aged between 30-35 years (60%) while those above 40 taking only 4%. Most of the mathematics teachers aged above 40 years had advanced in job group and were schools heads.

The men dominated in teaching of mathematics as men had 68% and females constituted 32%. 76% were degree holders, 20% had diploma qualifications and only 4% had attained a master's level of education.

Most mathematics teachers (96%) had worked in the schools/station for over 4 years since 2003 meaning they had attended SMASSE In-service course.

On qualification, Assistant teachers dominated with 68%, while head teachers had 4%. This implies that most of the teachers in the selected schools are assistant teachers.

Extent of Use of SMASSE Methodologies

The second research question of the study was; what is the extent of use of SMASSE methodologies in teaching mathematics by the teachers? In answering this question, the mathematics teachers were asked a set of questions capturing the use of: ASEI methodology, PDSI approach and attitude approach of teaching and learning. On ASEI and PDSI approach, the scale used was 4- Very Frequently. 3- Frequently, 2- Rarely 1- Never. For interpretation of the mean, the following was used;

1.0 - 1.4 **Never**

1.50 – 2.4 **Rarely**

2.5 - 3.4 **Frequently**

3.5 – 4.0 **Very Frequently**

Their responses are as summarized below:

Table: 4.2.1. Showing Extent of Use of ASEI Methodologies

As a teacher, i		4		3		2		1		Mean
		F	%	F	%	F	%	F	%	
ASEI Methodologies										
1	Assign questions for discussion during the lesson	30	**60**	19	**38**	01	**02**	-	-	**3.60**
2	Let students report practical results during the lesson	15	**30**	32	**64**	03	**06**	-	-	**3.24**
3	Assign students project work	20	**40**	20	**40**	10	**20**	-	-	**3.20**
4	Encourage students to participate in science congress	31	**62**	15	**30**	04	**08**	-	-	**3.54**
5	Present students for mathematics context	32	**64**	16	**32**	02	**04**	-	-	**3.60**
6	Lets students perform experiments during practical sessions	29	**58**	19	**38**	02	**04**	-	-	**3.56**
8	Use locally available materials to explain concepts	30	**60**	19	**38**	01	**02**	-	-	**3.60**
9	Improvise in absence of conventional materials	31	**62**	17	**34**	02	**04**	-	-	**3.58**
	Overall Mean									**3.49**

From table 4.2.1 it can be noted that most mathematics teachers assigned discussion questions to learners very frequently(mean=3.60), they frequently let students report practical results during the lesson(mean=3.24) and assigned the students project work(mean=3.20). This meant that their teaching was **A**ctivity- focused as opposed to Content – based. Very frequently the teachers encouraged students to participate in Science congress (mean=3.54), presented students for mathematics contexts (mean=3.60) and let students perform experiments during practical sessions (mean=3.56). This was further confirmed by many teachers rarely preferring demonstrations (mean =1.50). The overall mean (3.49), showed that ASEI methodology was very frequently used. This meant that the respondents used the **S**tudent-centered and **E**xperiment –based learning approach. Use of locally available materials to explain concepts and **i**mprovisation in absence of conventional materials was supported by most teachers as they very frequently improvised (mean=3.60 and 3.58). This meant that most teachers had shifted from few demonstrations to **I**mprovisation and small scale experiments.

Table: 4.2.2 .Showing Extent of Use of PDSI Approach

PDSI Approach		**4**		**3**		**2**		**1**		**Mean**
		F	%	F	%	F	%	F	%	
1	Prefer demonstrations	02	**04**	-	**-**	19			**58**	**1.5**
2	Make lesson plans	29	**58**	17	**34**	04	**08**	-	**-**	**3.50**
3	Use lesson notes only while teaching	06	**12**	01	**02**	19	**38**	24	**48**	**1.78**
4	Use both lesson plan and lesson notes while teaching	19	**38**	24	**48**	06	**12**	01	**02**	**3.22**
5	Try out experiments before practical sessions	29	**58**	19	**38**	01	**02**	01	**02**	**3.54**
6	Invite other teachers evaluate me while teaching	20	**40**	15	**30**	11	**22**	04	**08**	**3.02**
7	Invite questions in and outside class	31	**62**	17	**34**	02	**04**	-	**-**	**3.58**
8	Consult other teachers on the lesson before and after the lesson	20	**40**	19	**38**	08	**16**	03	**06**	**3.14**
	Overall Mean									**3.12**

On the **PDSI** Approach the mathematics teachers reported that they made lesson plans very frequently (mean=3.50), rarely used lesson notes alone while teaching (mean=1.78), frequently used both lesson plan and notes while teaching (mean=3.22). This meant that they took time to **P**lan for the content and the lesson. The teachers very frequently (mean=3.54) tried out experiments before practical sessions meaning they **D**id or tried the experiments before the lesson and they frequently invited other teachers to evaluate them as they taught(mean=3.58) and consulted others on the lesson before and after the lesson(mean=3.14). An overall mean of 3.12 indicated use of PDSI approach frequently. These translate to employment of **S**ee or evaluate in order to **I**mprove to avoid earlier mistakes.

Attitude Approach

For the sake of interpretation, ranking was done as:-

Strongly Agree (SA)	3.5 –4.0	Agree (A)	2.5-3.4
Disagree (D)	1.5 - 2.4	Strongly Disagree (SD)	1.0-1.4

Table: 4.2.3. Showing the Attitude Approach

As a teacher		SA		A		D		SD		
		F	%	F	%	F	%	F	%	**mean**
1	Teaching is a fulfilling profession	21	**42**	29	**58**	-	-	-	-	**3.42**
2	Teaching Mathematics and Science is interesting	21	**42**	29	**58**	-	-	-	-	**3.42**
3	Practical activities can be carried	19	**38**	25	**50**	05	**10**	01	**02**	**3.42**

	out even without laboratories									
4	A lesson plan enables a teacher to teach more effectively	21	**42**	25	**50**	04	**08**	-	-	**3.34**
5	I improvise in absence of convectional materials	31	**62**	17	**34**	02	**04**	-	-	**3.34**
6	All students can learn if taught effectively	21	**42**	20	**40**	07	**14**	02	**04**	**3.20**
7	SMASSE has addressed challenges I have been facing while teaching	17	**34**	32	**64**	01	**02**	-	-	**3.32**
8	I am a more effective teacher after SMASSE INSETS.	15	**30**	33	**66**	02	**04**	-	-	**3.26**
9	I voluntarily attend SMASSE INSET	17	**34**	33	**66**	-	-	-	-	**3.34**
10	What I learnt from SMASSE is practical	17	**34**	33	**66**	-	-	-	-	**3.34**
	Overall									**3.32**

From Table 4.2.2 it can be noted that teaching was a fulfilling profession and that teaching mathematics and Science was interesting as the mean =3.34. This signified a positive attitude.

A mean of 3.24 indicated that practical activities could be carried out even without laboratories, and that lesson plans enabled effective teaching (mean =3.34). Many confirmed that they improvised in absence of conventional materials (mean =3.34) and that all learners are capable of learning if taught effectively (mean = 3.20)

A mean of 3.32 and 3.26 respectively indicated that SMASSE addressed some challenges they had been facing while teaching and that they had become more effective teachers after attending SMASSE in-service training. Further, most respondents attended SMASSE voluntarily (mean = 3.35) and what they learnt was practical (mean = 3.35).

It can therefore be concluded that the attitude of the respondents was positive, both about the SMASSE in-service training and towards mathematics. This was shown by their willingness to attend the in-service training, to improvise teaching materials and plan for their lessons.

Level of Students Performance.

The dependent variable in the study was students performance, measured in terms of students scores ranked as: (Below 24) - Very Poor, (25-39) - Poor, (40-49) - Fair, (50-69) - Good, (70 -79) – Very Good and (above 80)-Excellent. The respondents were requested to indicate their mathematics scores in K.C.S.E of students who passed in each rank in mathematics using the above scale. The responses were summarized as below;

Table: 4.3 Level of Students' Performance in Mathematics

Marks (%)	Description	Mean
Below 24	Very Poor	29 .21
25 - 39	Poor	16.17
40-49	Fair	38.02
50-69	Good	26.42
70-79	Very Good	14.61
Above 80	Excellent	12.42

Results in Table 4.3 indicate that most students in the sampled school performed fairly. On average, 38 students from each school scored between 40% and 49%, 29 scored below 24%, 26 scored between 50% and 69% and 12 attained excellent grades. Further 53 students from each school could be ranked above average (scored 50% and above) with 45 students scoring below 39%. This indicates the mathematics performance was fairly good hence the cause needed to be identified.

Relationship between SMASSE Methodologies and Mathematics Performance.

The purpose of the study was to establish whether there was a significant relationship between the extent of use of SMASSE methodologies and students performance in mathematics. The SMASSE methodologies were categorized into 3 types: ASEI, PDSI and Attitude Approach. in order to determine whether there was a significant relationship between the two variables the Researcher used the Pearson's Correlation Coefficient and Regression Analysis to correlate the two. Results of the test are shown in Table 4.4.1 and Table 4.4.2.

Table: 4.4 .1: Correlating SMASSE and Students' Performance

Variables Correlated	r-value	Sig-value	Interpretation	Decision on Ho
ASEI Vs Performance	0.276	0.006	Positive and significant	Rejected
PDSI Vs Performance	0.709	0.000	Positive and significant	Rejected
Attitude Vs Performance	0.430	0.024	Positive and significant	Rejected

Legend

SMASSE Strengthening of Mathematics and Sciences in Secondary Education

ASEI **A**ctivity-focused, **S**tudent-centered, **E**xperiments-focused and **I**mprovisation.

PDSI **P**lan, **D**o, **S**ee and **I**mprove

From table 4.3.1, the r-values are positive indicating a positive relationship performance in mathematics (r-values >0), suggesting the higher the extent of use of SMASSE methodologies the better the performance and vice versa. The significant values of all the methodologies are less than 0.05 (0.006 ≤ 0.05, 0.000< 0.05, 0.024< 0.05) thus all the null hypotheses are rejected, leading to the conclusion that SMASSE methodologies significantly affect students performance in mathematics. This further implies the more frequently the SMASSE methodologies are used in teaching and learning mathematics, the better the students' performance.

Table: 4.4.2: Regression Analysis Results

Variables Regressed	Beta	R Square	F value	Sig	Interpretation	Decision on Ho
Performance Vs ASEI	0.346	0.669	25.701	0.001	significant effect	Rejected
Performance Vs PDSI	0.248					
Performance Vs Attitude	0.691					

From 4.3.2 the sig.< o.05 indicating a significant a significant relationship between SMASSE methodologies and students performance in mathematics. R-Square is 0.669 meaning the SMASSE methodologies contributes almost 70% of student's performance in mathematics. The remaining 30% is contributed by factors outside the study. The beta factor 0.346 shows that ASEI contributes approximately 35% of the students' performance in mathematics, with PDSI contributing 35% and Attitude approach 60%

CHAPTER FIVE

FINDINGS, CONCLUSIONS AND RECOMMENDATIONS

Introduction

This chapter contains a brief discussion of the study findings as compared with other research work done in the country on the performances of mathematics. There after is a conclusion and recommendations to various stakeholders in education sector concerning more interventions and pulling of resources towards enhancing improvements of mathematics performances in secondary schools

Findings

As earlier stated the data was collected from questionnaires administered to 50 mathematics teachers from the district. The study intended to examine the relationship between SMASSE methodologies and students mathematics performance. It was guided by four research objectives which included determining the:

(i) Demographic characteristics of the respondents

(ii) Extent of use of SMASSE methodologies

(iii) Level of students performance

(iv) Relationship between SMASSE methodologies and students performance in mathematics

The following is the findings obtained as per each research question and what other researchers found in connection with mathematics performances.

Demographic Characteristics of the Respondents

Analysis using frequencies and percentage distributions showed majority of the respondents were aged between 30-35 years (60%) while those above 40 taking only 4%. The men dominated in teaching of mathematics as men had 68% and females constituted 32%. 76% were degree holders, 20% had diploma qualifications and only 4% had attained a master's level of education. Most mathematics teachers (96%) had worked in the schools/station for over 4 years since 2003 meaning they had attended SMASSE In-service course. On qualification, Assistant teachers dominated with 68%, while head teachers had 4%.

Extent of Use of SMASSE Methodologies

Descriptive analysis using means indicated that the respondents used the ASEI methodology frequently (overall mean=3.49), PDSI approach frequently (overall mean 3.12) and had a positive attitude approach (overall mean = 3.32). Most mathematics teachers assigned discussion questions to learners very frequently (mean is 3.6 =), they frequently let students report practical results during the lesson and assigned the students project work. This meant that their teaching was Activity-focused as opposed to Content – based. Very frequently (mean = 3.20) the teachers encouraged students to participate in Science congress, presented students for mathematics contexts and let students perform experiments during practical sessions. This was further confirmed by many teachers rarely preferring demonstrations (mean =1.5)

This meant that the respondents used the **S**tudent-centered and **E**xperiment –based learning approach. Use of locally available materials to explain concepts and **i**mprovisation in absence of conventional materials was supported by most teachers as they very frequently improvised. This meant that most teachers had shifted from few demonstrations to **I**mprovisation and small scale experiments.

On the **PDSI** Approach the mathematics teachers reported that they made lesson plans very frequently, rarely used lesson notes alone while teaching frequently used both lesson plan and notes while teaching. This meant that they took time to **P**lan for the content and the lesson. The teachers very frequently (mean=3.54) tried out experiments before practical sessions meaning they **D**id or tried the experiments before the lesson and they frequently invited other teachers to evaluate them as they taught and consulted others on the lesson before and after the lesson. These translate to employment of **S**ee or evaluate in order to **I**mprove to avoid earlier mistakes. From the above responses, it can be concluded that most mathematics teachers used the SMASSE methodologies in their teaching.

Level of Students Performance

Analysis of mathematics scores indicated that most students in the sampled school performed fairly good(between 40% and 49%).On average 26 students from each of the sampled school scored between 50% and 69% and 12 attained excellent grades. 53 students from each school could be ranked above average (scored 50% and above) with 45 students scoring below 39%. This indicated a fairly good mathematics performance.

Relationship between SMASSE Methodologies and Mathematics Performance

Analysis using Pearson's Correlation Coefficient and Regression showed a positive significant relationship between SMASSE methodologies and students mathematics performance. Students performance in mathematics was positively correlated with ASEI (r=0.276 ,Sig =0.006), PDSI approach (r=0.430 sig.=0.000) and Positive Attitude approach (r=0.430 , sig= 0.24)

Analysis using the Regression analysis showed that the SMASSE methodologies contribute almost 70% of student's performance in mathematics. The remaining 30% is contributed by factors outside the study. The beta factor 0.346 shows that ASEI contributes approximately 35% of the students' performance in mathematics, with PDSI contributing 35% and Attitude approach 60%

Conclusions

The following conclusions are made based on the findings;

Majority of mathematics teachers in Makueni district are youth, aged between 30 – 35 years many of them being men. Further majority are graduates with over four years experience and serving as assistant teachers. The use of SMASSE methodology is frequent and students' performance in mathematics is good as most of students score above average.

SMASSE methodologies contribute almost 70% of student's performance in mathematics. The remaining 30% is contributed by factors outside the study. The beta factor 0.346 shows that ASEI contributes approximately 35% of the students' performance in mathematics, with PDSI contributing 35% and Attitude approach 60%.

Recommendations

Since this study has found that the SMASSE methodologies INSET initiatives and interventions have made some contribution in the improvement of mathematics performance in Makueni district, the researcher makes the following recommendations:

1. The Kenyan government should be able to sustain the programme for the newly employed and long serving teachers for in-servicing purposes on the trends in their areas of specialization.
2. The ministry of Education should attach a motivational factor example like pay rise to teachers who successively attend the SMASSE in=service training his is because the attitude approach contributed 60% of the students performance in mathematics.
2. Universities and teachers training colleges should adopt the SMASSE training curriculum when training Mathematics and Science teachers in their institutions.
3. Education stakeholders i.e. government, parents and other partners in education should come up with other education INSETs on other subjects to in-service teachers not only in secondary but also in primary schools.

Suggestions for further Study

Results of the study are not conclusive;

A replica of the study can be carried to cover a larger sample.

Further research should be carried out in other districts where SMASSE INSET is being implemented to find out the impact of the in-service training on the mathematics and science performances in those districts and the results of this study.

An experimental research should be carried out using schools that have not used SMASSE methodologies and that use the methodologies SMASSE methodologies.

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APPENDICES

APPENDIX I: Transmittal Letter

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COLLEGE OF OPEN EDUCATION AND DISTANCE LEARNING
OFFICE OF THE DIRECTOR

Date: 08th December, 2010

TO WHOM IT MAY CONCERN

Letter of Introduction.

This is to introduce **Domitila Muia** Reg. No. **MED/20074/72/DF** a student pursuing a Master's Degree in Educational Management Administration of Kampala International University from **April 2008** in the Institute of Open Education and Distance Learning Programme. She is writing her research on **'Strengthening of Mathematics and Sciences in Secondary Education (SMASSE) and Mathematics Performance in K.C.S.E in Selected Public Schools in Makueni District, Kenya.'** She is at the data collection stage and your Institution/ Organization has been chosen for her research study.

It will be appreciated if you can accord her the necessary assistance.

Thank you,

KAMPALA INTERNATIONAL UNIVERSITY
08 DEC 2010

J.S. Owoeye, Ph.D
Director-IODL

"Exploring the Heights"

APPENDIX IV

Questionnaire to determine the demographic characteristics of the respondents, extend of use of SMASSE methodologies and level of students performance in mathematics.

Please kindly spare your valuable time. Respond to the following questions. The information is solely for academic purposes. You are assured that the information/ answers given shall be treated with utmost confidentiality, therefore do not disclose or write your name on the questionnaire.

Demographic characteristics

1 Age

a) 26-30 ☐ b) 30-35 ☐ c) 36-40 ☐

d) Above 40 ☐

2 Sex

a) Male ☐ b) Female ☐

3 Qualification

a) Diploma ☐ b) Degree ☐ c) Masters Degree ☐

4 Position in School

a) Head teacher ☐ b) H.O.D ☐

c) Senior teacher ☐ d) Asst. teacher ☐

5. Length of stay in school since 2003

a) Less than two years ☐ b) 2-4 years ☐

c) Above 4 years ☐

Extent of use SMASSE Methodologies in teaching

Please tick the rate that is appropriate to you on your situation on the right side boxes, using the rates given below

Very Frequently	Frequently	Rarely	Never
4	3	2	1

	As a teacher, i	4	3	2	1
	ASEI Methodologies				
1	Assign questions for discussion during the lesson				
2	Let students report practical results during the lesson				
3	Assign students project work				
4	Encourage students to participate in science congress				
5	Present students for mathematics context				
6	Lets students perform experiments during practical sessions				
7	Use locally available materials to explain concepts				

8	Present students for mathematics context				
9	Improvise in absence of conventional materials				

PDSI Approach					
1	Prefer demonstrations				
2	Make lesson plans				
3	Use lesson notes only while teaching				
4	Use both lesson plan and lesson notes while teaching				
5	Try out experiments before practical sessions				
6	Invite other teachers evaluate me while teaching				
7	Invite questions in and outside class				
8	Consult other teachers on the lesson before and after the lesson				

Attitude Approach

Please tick the rate that is appropriate to you on your situation on the right side boxes, using the rates given below.

Strongly Agree	Agree	Disagree	Strongly Agree
SA	A	D	SD

As a teacher		SA	A	D	SD
1	Teaching is a fulfilling profession				
2	Teaching Mathematics and Science is interesting				
3	Practical activities can be carried out even without laboratories				
4	A lesson plan enables a teacher to teach more effectively				
5	I improvise in absence of convectional materials				
6	All students can learn if taught effectively				
7	SMASSE has addressed challenges I have been facing while teaching				
8	I am a more effective teacher after SMASSE INSETS.				
9	I voluntarily attend SMASSE INSET				
10	What I learnt from SMASSE is practical				

Level of students' performance

Please rate your students in terms of performance in class as below

Class mark	Number of students
Below 24	
25-39	
40-49	
50-69	
70-79	
Above 80	

RESEARCHER'S CURRICULUM VITAE

Personal profile

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Sex	Female
Date of birth	1979
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EDUCATION BACKGROUND

Year	Institution	Achievement
2008-2009	Kampala International University	MED
1996-2000	Kenyatta University	BED
1991-1994	St Josephs Girls Kibwezi	K.C.S.E
1982-1990	Kiambani primary	K.C.P.E

WORKING EXPERIENCE

2010- To date	Teachers-Ngara Girls S.S	Nairobi
2002-2010	Teacher-Ngakaa S.S	Makindu