

5000 |

**THE IMPACT OF SMASSE PROJECT ON TEACHING AND LEARNING OF
BIOLOGY IN GATANGA DISTRICT, MURANG'A COUNTY, KENYA**

MIGWI PETER WACHIRA

**A RESEARCH PROJECT SUBMITTED TO DEPARTMENT OF
EDUCATIONAL MANAGEMENT, POLICY AND CURRICULUM STUDIES,
SCHOOL OF EDUCATION, IN PARTIAL FULFILMENT FOR THE
REQUIREMENTS OF THE AWARD OF MASTER OF EDUCATION DEGREE.**

KENYATTA UNIVERSITY

KENYATTA UNIVERSITY LIBRARY

JUNE 2012

Migwi, Peter Wachira
*The impact of SMASSE
project teaching and*



2012/407522

DECLARATION

This research project is my original work and has not been presented for award of any degree in any other University.

.....*Peter Migwi*..... Date: *14/6/12*.....

MIGWI PETER WACHIRA

E55/CE/15558/08

This research project has been submitted for examination with our approval as the university supervisors.

.....*L.I. Libese*..... Date: *15/06/2012*.....

DR. LIBESE L. I.

Senior Lecturer,

Department of Educational Management,

Policy and Curriculum Studies,

Kenyatta University

.....*W. Itolondo*..... Date: *15/6/2012*.....

DR. (SISTER) ITOLONDO W.

Lecturer,

Department of Educational Management,

Policy and Curriculum Studies,

Kenyatta University

DEDICATION

I would like to dedicate this research project work to my family members for their moral and material support. I greatly appreciate their patience during my study.

ACKNOWLEDGEMENT

Special thanks to my supervisors Dr. Shiundu J. A, Dr. (Sister) Itolondo W. and Dr. Libese L.I. for their professional and technical guidance during the entire period of developing the research proposal and the project report.

I wish to acknowledge all my lecturers, from the department of Educational Management, Policy and Curriculum Studies, School of Education; especially Dr. Orodho J.A. for directing me on the fundamental principles in proposal writing and methodologies of carrying out research work.

I also wish to acknowledge the DEO Gatanga District for his support, my respondents, the Headteachers and staff members of all the secondary schools in Gatanga District who availed their time to fill the questionnaires.

My special thanks also go to the Ministry of Education and Kenyatta University for granting me this opportunity to pursue my Masters Degree.

God bless you all

ABSTRACT

This study was an assessment of the impact of SMASSE project on teaching and learning of Biology in Gatanga District, Kenya. Though SMASSE was aimed at improving teaching and learning of Mathematics, Chemistry, Biology and Physics evidence lacks to show that there is improvement on performance in these subjects. The purpose of this study was to assess the impact of SMASSE training in teaching and learning of Biology in secondary schools in Gatanga District. The objectives of the study were; to find out whether SMASSE has improved performance of students in Biology, to determine the attitude of students towards Biology since the implementation of SMASSE, identify the impact of SMASSE on teaching methodologies used by teachers of Biology and to determine the impact of school administration support on the success of SMASSE project in providing teaching and learning of Biology. Literature was reviewed on impact of SMASSE on Biology performance, preference of Biology subject by the learners after the implementation of SMASSE, the extent of adoption of SMASSE teaching methodologies by teachers and the extent to which the schools support SMASSE programme. The study adopted the survey design targeting 42 Biology teachers, 32 Science HoDs and 32 Headteachers from all the 32 secondary schools in Gatanga District. Simple random sampling was used to select six out the 32 secondary schools while purposive sampling was used to select 6 principals, 6 HoDs and 6 teachers to participate in the actual study. The study variables included attendance of SMASSE by teachers, performance of students in Biology, preference of Biology by students, adoption of SMASSE concepts in teaching Biology, school support to Biology teachers, as well as gender, experience of teachers and their status. The instruments employed for data collection included questionnaires for the headteachers and Biology teachers while an interview schedule was used for the Science HoDs. Before the actual data collection procedure, a pilot study was conducted to check the reliability and validity of instruments. Data collected was subjected to descriptive statistics, such as percentages, standard deviation, frequency and mean qualitative data was put under themes consistent with the research objectives. The study established that schools performed better in Biology after teachers attended SMASSE INSET programmes. The study also revealed that after the SMASSE programmes teachers had a good mastery of the subject contents which in turn improved their teaching skills and hence changed students' attitude toward the Biology subject. The study further found out that school administration support for the SMASSE programmes positively affect students' performances on science subjects and schools performance as whole. The study recommends that there should be intensification of seminars, workshops, refresher courses for Biology teachers to sensitize them on the benefits of group work, projects and practicals as assessment instruments in the teaching of Biology; the government should allocate more funds in schools to improve on teaching and learning resources in the laboratory; the Kenya Institute of Education (KIE) should revise the Biology syllabus and reduce its content leaving the most relevant topics to allow completion of the syllabus and adequate testing and revision; among other recommendations.

TABLE OF CONTENTS

Declaration.....	ii
Dedication.....	iii
Acknowledgements.....	iv
Abstract.....	v
Table of Contents.....	vi
List of Tables.....	ix
List of Figures.....	x
Abbreviations.....	xi

CHAPTER ONE: INTRODUCTION

1.1 Background to the Study.....	1
1.2 Statement of the Problem.....	5
1.3 Purpose of the Study.....	6
1.4 Objectives of the Study.....	6
1.5 Research Questions.....	7
1.6 Significance of the Study.....	7
1.7 Research Assumptions.....	8
1.8 Limitations of the Study.....	8
1.9 Delimitations of the Study.....	8
1.10 Theoretical Framework.....	9
1.11 Conceptual Framework.....	11
1.12 Definitions of Terms.....	13

CHAPTER TWO: REVIEW OF RELATED LITERATURE

2.0 Introduction.....	14
2.1 Impact of SMASSE on Biology Performance in Secondary Schools.....	14
2.2 Preference of Biology Subject by Learners after Implementation of SMASSE.....	15
2.3 Adoption of SMASSE Concepts in Teaching of Biology.....	17
2.4 Schools' Support for SMASSE Programme.....	23
2.5 Summary.....	25

CHAPTER THREE: METHODOLOGY

3.1 Introduction.....	27
3.2 Research Design	27
3.3 Study Locale	27
3.4 Target Population.....	28
3.5 Sample and Sampling Procedure	28
3.6 Research Instruments.....	29
3.7 Piloting of the Instruments.....	30
3.7.1 Reliability of the instrument	30
3.7.2 Validity of the instruments	32
3.8 Data Collection Procedure.....	32
3.9 Data Analysis Plan.....	32

CHAPTER FOUR: DATA ANALYSIS, RESULTS AND DISCUSSION

4.1 Introduction.....	34
4.2 Background data of the respondents.....	34
4.3 To find out whether SMASSE has improved performance of students in Biology	37
4.4 Preference of Biology subject by learners as perceived by teachers.....	41
4.5 Impact of SMASSE on teaching methodologies used by teachers of Biology.....	43
4.6 Impact of school administration support on the success of SMASSE project in providing teaching and learning of Biology.....	47

CHAPTER FIVE: SUMMARY, CONCLUSION AND RECOMMENDATIONS OF THE STUDY

5.1 Introduction.....	50
5.2 Summary of the study findings.....	50
5.3 Conclusion	52
5.4 Recommendations.....	53
5.5 Suggestions for further Studies.....	53
References.....	54

APPENDICES

Appendix One: Teachers' Questionnaire.....	60
Appendix Two: Heads of Departments Interview Schedule	63
Appendix Three: Head Teachers' Questionnaire.....	66
Appendix Four: Letter of Introduction	69
Appendix Five: Research Permit.....	70
Appendix Six: Sketch map showing Gatanga District	71

LIST OF TABLES

Table 3.1: Target Population and Sample Size.....	29
Table 3.2: Split Half Technique for Reliability Coefficient	31
Table 3.3: Summary of Data Analysis Plan.....	33
Table 4.1: Number of Biology teachers.....	35
Table 4.2: Work experience.....	36
Table 4.3: Teachers' experience in teaching	37
Table 4.4: Impact of SMASSE on Biology performance	39
Table 4.5: Students' preference of Biology subject.....	42
Table 4.6: Teachers' self assessment on the use of ASEI/PDSI	44
Table 4.7: Options taken to supplement teaching/ learning devices	45
Table 4.8: Adoption of ASEI/PDSI skills.....	46
Table 4.9: School support toward SMASSE programme.....	48

LIST OF FIGURES

Figure 1.1 Cascade System.....	2
Figure 1.2: Input – Process – Output System	10
Figure 1.3: Conceptual Framework	11
Figure 4.1: Number of cycles completed after SMASSE insets.....	36

ABBREVIATIONS

ADEA	Association for Development of Education in Africa
ASEI	Activity, Student Centred Experiment and Improvisation
CEMASTEА	Centre for Mathematics, Science and Technology Education in Africa
CP	Capacity Building
DEO	District Education officer
GoK	Government of Kenya
HODs	Heads of Departments
IEP	Individualized Education Programme
INSET	In-Service Education and Training
JICA	Japanese International Corporation Agency
KCSE	Kenya Certificate of Secondary Education
KNEC	Kenya National Examinations Council
KSSHA	Kenya Secondary Schools Heads Association
KSTC	Kenya Science Teachers' College
MoE	Ministry of Education
NEPAD	New Partnership for African Development
PDSI	Plan, Do, See and Improve
QASO	Quality Assurance and Standards Officer
SMASSE	Strengthening of Mathematics and Sciences in Secondary Education
TIVET	Technical Institutions for Vocational Educational and Training
TSC	Teachers Service Commission

CHAPTER ONE

INTRODUCTION

1.1 Background to the Study

According to the Ministry of Education (MOE, 2005) National Development Policy, Kenya is aiming to be an industrialized country by 2015 as articulated in the vision 2030. However, students performance in mathematics and science on which the industrialization and technological advancement will rely on, has been remarkably poor over the years. Annual reports from the Kenya National Examinations Council (KNEC) indicate that performance by students in the Kenya Certificate of Secondary Education (KCSE) in Mathematics, Biology, Physics and Chemistry has consistently been poor. Improvement of Mathematics and Science education was therefore considered a matter of urgency in Kenya.

As an intervention, Japanese International Corporation Agency (JICA) and the Government of Kenya, started an in service program for the Strengthening of Mathematics and Sciences in Secondary Education (SMASSE) Project (phase one) in 1998. The project is aimed at improvement of Mathematics and Science subjects through In-service Training (INSET) for teachers. It was started with an aim of equipping teachers with practical skills and knowledge to pass on to students in the curriculum implementation.

Initially, the Project covered nine districts namely, the former Kisii, Gucha, Kakamega, Butere – Mumias, Lugari, Kajiado, Makueni, Murang'a North and Maragua (as in the previous Kenyan constitution). The Districts are in five of the eight provinces in Kenya. Phase I was a pilot one, which took place between 1998 and 2003 (Report on the 4th workshop on Effective Operation and Management of the

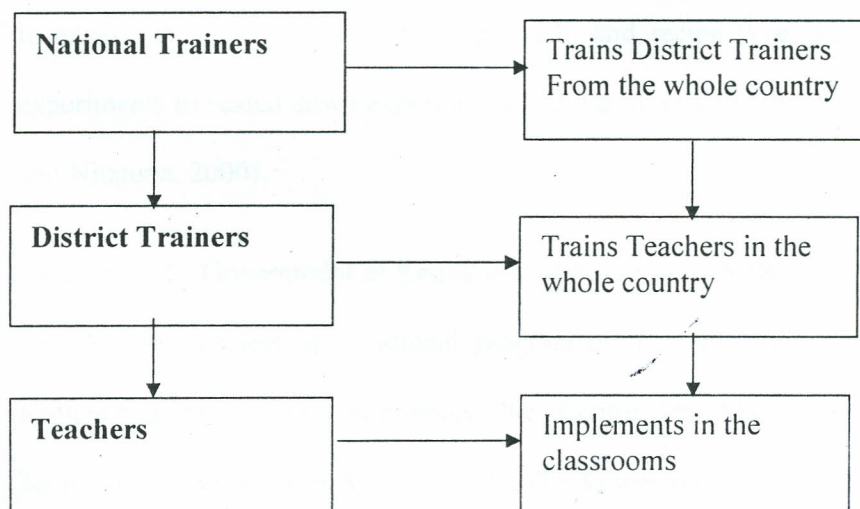
SMASSE Project held at Kenya Science Teachers' College (KSTC) on 13th and 14th May 2002) (SMASSE, 2002).

In October 2000, an extension to the Project was made to include six additional districts through the in-country training programme for SMASSE. This made it possible for the Project to cover seven provinces. The added districts were the former Kiambu, Baringo, Meru South, Kilifi, Taita-Taveta and Garissa (as in the previous Kenyan constitution).

Thus SMASSE Project is a joint venture between the Ministry of Education (MOE) and Japanese Government through Japanese International Co-operation Agency (JICA). The main benefactor is the Japanese government through JICA. Funds from this agency are used for training personnel, buying materials and for Capacity Building (CB) of all SMASSE training centers.

This system operates through the Cascade System as shown in the figure below:

***Figure 1.1 Cascade System**



*Source: Njuguna (1999) SMASSE Project Bulletin

The second financier is the MOE through allocation of annual budget to run national training centres and its training activities. The third and the last source of funds come from parents through District Education Boards (DEBs). Parents pay this money in form of school fees which appear as either activity or development fees on the fees structure. The money that is collected at district level through DEBs is meant to cater for traveling, food and accommodation expenses of teachers while on training. The focus of the project was to improve the quality of teaching in Mathematics and Science at secondary level through In-service Education and Training (INSET). In July 2003, after successful completion of the pilot phase of the project, SMASSE was expanded to cover all secondary school in Centre for Mathematics, Science and Technology Education in Africa (CEMASTEIA, 2007).

The SMASSE project started with a view of improving teachers' capabilities in terms of teaching methods, knowledge level and management of experimental equipment so that teachers are able to shift classroom practice from content based to activity oriented; teacher centred to student centred; lecture method and theoretical approach to experiment and research based approach; and recipe type, large scale textbook experiments to scaled down experiments and use of appropriate improvisation (Oyaya and Njuguna, 2000).

As a result the Government of Kenya in collaboration with JICA launched Phase II of the SMASSE project as a national program on 1st July 2003. To ensure effective implementation of the programme the Centre for Mathematics, Science and Technology Education in Africa (CEMASTEIA) was registered in 2004 under section 15 (2) of the Education Act Cap. 211 Laws of Kenya. A Board of Governors for the centre was instituted under legal notice No. 96 of June 23rd 2006, which was in line

with the Government's recognition of the relevance of in-service education and training (Republic of Kenya, 2006). The aim of the project was to strengthen the teaching and learning of mathematics and the three science subjects namely; Chemistry, Biology and Physics through INSET for teachers of these subjects.

INSET centres have been established at the district level throughout the country. In addition, INSET training has been expanded to include Headteachers, the Quality Assurance Officers, (QASO), Tutors of Mathematics and Science in Diploma Colleges and TIVET Tutors. The CEMASTEIA is also offering INSET courses for Educators from other African countries in collaboration with NEPAD and ADEA. Another aspect of INSET will target curriculum review for Diploma Teacher Training Colleges and technical subjects in Secondary Schools so as to ensure both adequate capacities and relevance of the content.

The vision of SMASSE is to contribute towards upgrading the capability of young Kenyans in the fields of Mathematics and Sciences through improved methodology and evaluation. The general objective of the project is to improve the quality of Mathematics and Science education in secondary schools in Kenya (SMASSE, 2008).

CEMASTEIA (2007) gives the specific objectives of SMASSE as:

- (a) To bring about positive attitude towards Mathematics and Science education.
- (b) Enhance participant's ability to plan and implement activity based lessons and to translate theoretical pedagogical issues into actual practice in the classroom.
- (c) To enable the participants to develop skills in areas of improvisation and scaling down and simplification of experiments.

Previous studies and SMASSE project evaluation reports indicate that SMASSE INSETs could be faced with challenges. For example, teachers complain of lack of

materials for use in conducting practicals and they rarely use the ASEI/PDSI approach in teaching, as established by Sifuna & Kaime (2007) and Oirere (2008). The evaluation report (CEMASTE, 2007) proposed that challenges and failure by teachers of mathematics and science to use ASEI/PDSI approaches were addressed through SMASSE INSET in the whole country.

The study therefore set out to assess the impact of SMASSE in teaching and learning of Biology in Gatanga district, Kenya. Many schools in Gatanga district in Central Province of Kenya have been performing poorly in K.C.S.E Biology examination over the years. Previous studies (Monk, 1994) have cited lack of learning facilities, poor attitude of learners towards science subjects and inadequate staffing as causes for poor performance. However, researchers have not investigated the impact that SMASSE project has had on teaching and learning of Biology.

1.2 Statement of the Problem

Implementation of any programme such as SMASSE requires development of relevant policies and capacity on continuous basis. Though SMASSE has been introduced to improve the teaching and learning of Mathematics and Sciences, including Biology, evidence lacks to show that there is improvement on performance in these subjects. Based on lack of concrete returns, it was the purpose of this study to establish the extent to which the project is viable. The success of any programme largely depends on the way in which those involved in the implementation of the programme embrace and strive to make it a success.

When the SMASSE project was initiated in Kenya in 1998, the main objectives were to improve the performance of mathematics and science in secondary schools. There is need to assess whether the programme is succeeding or failing by observing various

aspects that it was supposed to address. Success of a programme can however be evaluated on the impact it has on observable issues with those the programme is supposed to serve. According to Waititu (2007) the effectiveness of a training programme should be measured not by the level of performance reached at the end of training, but, rather, by assessing learners' performance in the post training tasks and real-world settings that are the target of the training.

Biology teachers in Kenya have undergone in-service training programme under SMASSE INSET, but it is not clear whether the training has translated into improved teaching and learning of the subject. The researcher aimed at finding out the impact of SMASSE in teaching and learning of Biology in Secondary Schools in Gatanga District, Murang'a county, Kenya.

1.3 Purpose of the Study

The purpose of the study was to determine the effect of SMASSE project on teaching and learning of Biology in Gatanga District, Kenya. This was in bit to propose further strategies that could be employed to improve effectiveness of SMASSE in meeting the set objectives.

1.4 Objectives of the Study

The study attempted to look into the following:-

- i. To find out whether SMASSE has improved performance of students in Biology.
- ii. To identify the attitude of students towards Biology since the implementation of SMASSE.
- iii. To identify the impact of SMASSE on teaching methodologies used by teachers of Biology.

- iv. To determine the impact of school administration support on the success of SMASSE project in providing teaching and learning of Biology.

1.5 Research Questions

The study sought to answer the following questions:-

- i. How has SMASSE improved performance of students in Biology?
- ii. What has been the attitude of students towards Biology since the implementation of SMASSE?
- iii. What is the impact of SMASSE on teaching methodologies used by teachers of Biology?
- iv. What is the impact of school administration support on the success of SMASSE project in providing teaching and learning of Biology?

1.6 Significance of the Study

Once complete, the study may benefit; the SMASSE district organizers and trainers of teachers in Gatanga and other districts to plan ahead in order to make the future INSET a success; The Ministry of Education in order to assess the impact of the programme on teaching and learning of sciences especially Biology. This may form the basis of capacity building for science teachers and initiation of any other relevant measure; Biology teachers in the country could find the research quite valuable for self assessment purposes especially on the aspect of offering possible solutions, where obstacles have been identified in the teaching of Biology.

Further, headteachers of secondary schools could use the study findings to understand the need to support teachers of Biology by providing the necessary resources; the sponsor of the programme - JICA, MOE and KSSHA may too use the report for their internal evaluation purposes; the study may also contribute to the body of knowledge

on Biology education at the secondary school level. Other scholars and researchers may benefit from the literature that the study may generate.

1.7 Research Assumptions

The proposed study made the following assumptions:

- i) There were teachers in Gatanga District who were teaching before and after the SMASSE project.
- ii) There would be observable impact in teaching of Biology.

1.8 Limitations of the Study

- i) Lack of adequate time since the researcher is an Institutional-Based student.
- ii) The schools in Gatanga District are scattered in an expansive district some in areas with poor road network, which may require a lot of time for data collection.

1.9 Delimitations of the Study

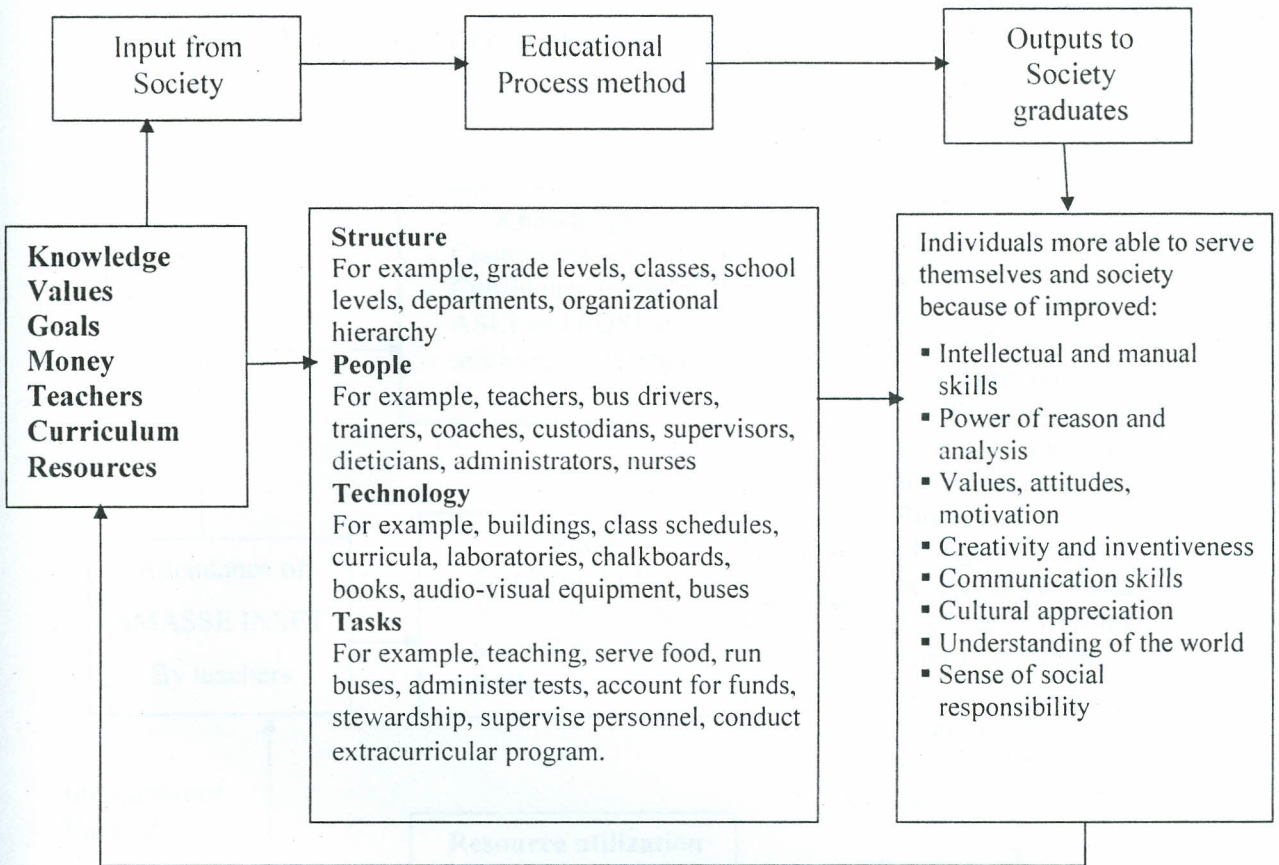
- i) The literature review was only based on the SMASSE Programme implementation in Kenya
- ii) The proposed study confined itself to students and teachers in public secondary schools who are the direct beneficiaries of the SMASSE programme and not the other stakeholders.
- iii) The students and teachers included in the sample were only those in session in the respective secondary schools by the time of study.
- iv) Although there are other factors affecting performance, the study confined itself to SMASSE.

1.10 Theoretical Framework

The study was based on the Systems Theory advanced by Dixon (1991). The theory explains and predicts behaviour of the complete organization: its people, structure, environment and technology. Shermerhorn (1993), further explains that a system is a collection of interrelated parts that function together to achieve a common purpose.

In addition, Owens (1981) holds the view that an educational institution is an open system that receives resources (inputs) from the environment and transforms them into products (outputs). As an open system, the educational institution receives inputs from its environment in form of people, finances and raw materials, which it utilizes in order to produce products, which are then released back into the larger society. The products or outputs are in this case the beneficiaries of the educational institution and the skills they have attained while the environment is the larger society. Figure 1.1 is a diagrammatic representation of the systems theory. The independent variable of the study is attendance of SMASSE cycles. The dependent variables include attitude of students towards Biology, teaching methodologies and school administration support.

***Figure 1.2: Input – Process – Output System**

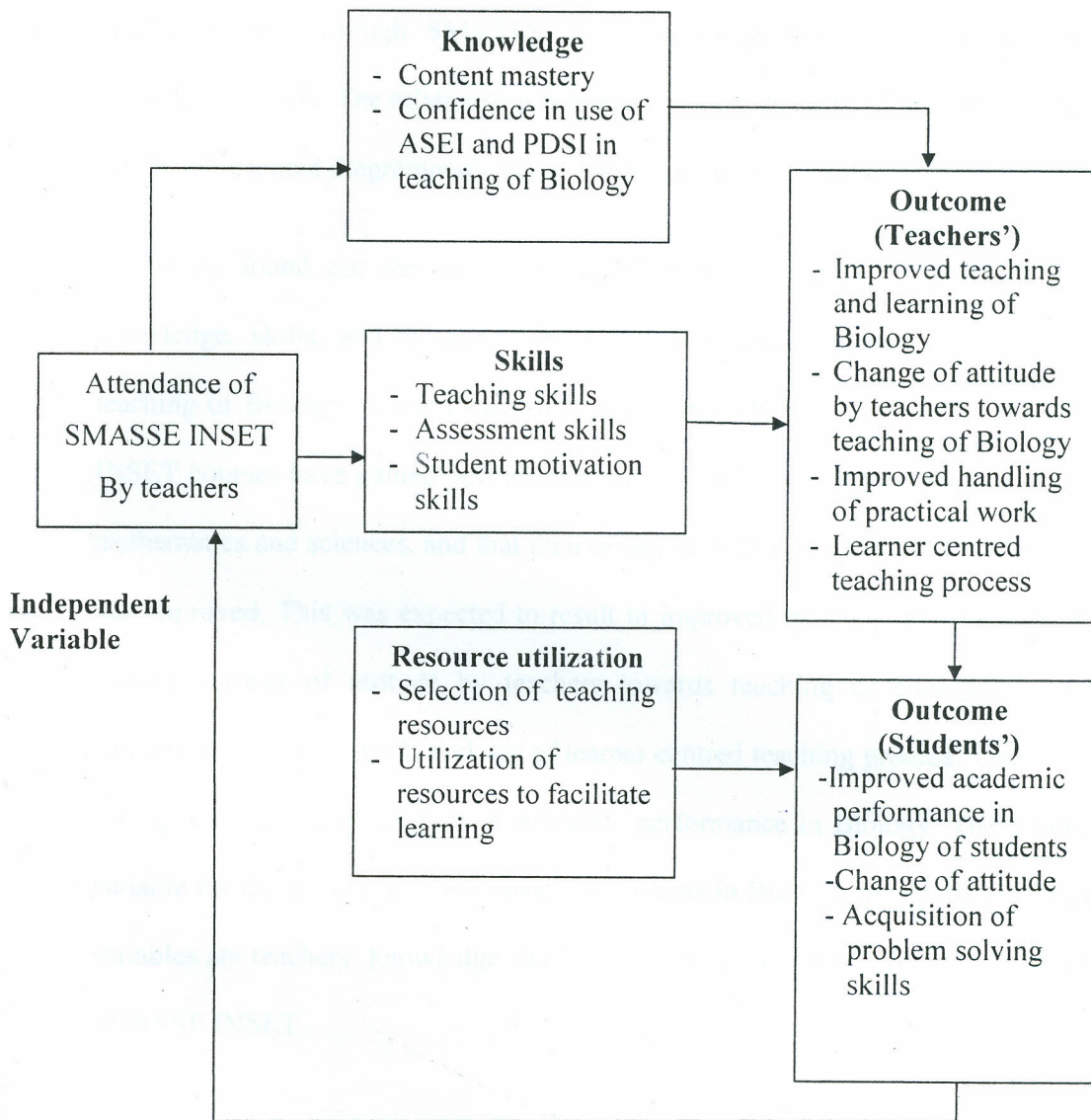


***Source:** *Organizational Behaviour in Education* by Owens, (1981, p64)

Inputs from society are transformed through the educational process to outputs in form of educated graduates who should be absorbed in the job market. A system is composed of sub-systems or sub-units that work together in a division of labour so that the entire organization can achieve its goals. The ultimate goal is for all sub-systems to perform in ways that facilitate high productivity for the whole organization. According to the systems theory, if one sub-system fails, the whole system is put in jeopardy. In this study, the teachers' abilities coupled with investment in education (the input) through teacher training and SMASSE INSET (the process) result in acquisition of new knowledge and skills leading to use of appropriate classroom practices such as ASEI/PDSI (the output).

1.11 Conceptual Framework

*Figure 1.3: Conceptual Framework



Source: Researchers (2011)

Dependent Variable

The ultimate goal of any training program is to successfully translate the knowledge, skills, abilities, or attitudes acquired in the training environment into improved performance on the job. This research is concentrated on the impact of teachers' in-service training through SMASSE on the teaching and learning of Biology in secondary schools. The relationship between the independent and dependent variables can be represented diagrammatically as shown in Figure 1.2 (above).

The study found out the role of SMASSE INSET training in shaping teachers' knowledge, skills, and teacher's ability to utilize available teaching resources in teaching of Biology. It was expected that teachers who have attended the SMASSE INSET courses have gained new knowledge and skills on teaching methodologies in mathematics and sciences, and that their ability to utilize available teaching resources has improved. This was expected to result in improved teaching and learning of the subject, change of attitude by teachers towards teaching of Biology, improved handling of practical work, and use of learner centred teaching process. These in turn are expected to lead to improved academic performance in Biology. The dependent variable for the study was performance of students in Biology, while the independent variables are teachers' knowledge, skills, and utilization of resources as influenced by SMASSE INSET.

1.12 Definitions of Terms

Some of the terms in this study and in the context of this study are defined as follows:-

Academic performance: Refers to the knowledge obtained and skills developed in the school subjects usually designated by test scores.

Impact: What can be observed after the implementation of the project.

In-service training: Training undertaken by teachers who have already graduated and are working.

Motivation: Refers to the desire to excel. It is the propelling force that drives the students and teachers to do well in teaching/learning and in examinations.

Pedagogy: Refers to the teaching methods and approaches used in the teaching of Biology.

Performance: Refers to an act of working well as a school teacher and doing all the tasks of a teacher as required by MoE and supervisors leading to good academic performance.

Pilot Study: A small proportion of the whole project taken for the purpose of assessing whether the project will succeed or not.

Training: Refers to any learning activity which is directed towards the acquisition of specific knowledge and skills for purposes of occupation or task.

CHAPTER TWO

REVIEW OF RELATED LITERATURE

2.0 Introduction

The literature review on this study focused on the following areas; impact of SMASSE on Biology performance, preference of Biology subject by the learners after the implementation of SMASSE, the extent of adoption of SMASSE teaching methodologies by teachers, and the extent to which the schools support SMASSE programme.

2.1 Impact of SMASSE on Biology Performance in Secondary Schools

The terminal indicators of upgrading of the abilities are the results of the National Examination. However, MoE (2007) observes that only a fraction of the students aspire for higher education and the KCSE examination serves as a screening device, disqualifying a large majority and selecting a small minority of graduates for tertiary education. Even though the purpose is for selecting those to transcend to higher education one of the potential benefits of alternate assessment is that the process may be used to improve educational programmes (Browder, Spooner & Algozzine 2003). Dustmann, Rajah, & Soest, (1998) advocated that “teachers must learn to use alternate assessment not only to document what the student has learnt but also to enhance and extend that learning”.

In contrast, few researchers have focused on the relationship between the students' educational programme and alternate assessment outcomes. In their review of the research on alternate assessment, (Browder, et al 2003) found only two studies that considered the relationship between programme quality and outcome scores and both were based on the Kentucky alternate assessment.

Hoxby (1998) found a Correlation between alternate assessment scores and best practice indicators from the Kentucky systems change project, but only a moderate correlation with Individualized Education Programme (IEP) quality. Kelly, William and Eric (1999) found a relationship between instructional variables and alternate assessment scores. Specifically, involving students in the portfolio evaluation and embedding the alternate assessment in ongoing instructions were correlated with students' scores. Although these studies suggest that the quality of both educational programmes and alternate assessment scores are linked, no studies to date have determined if there is a casual relationship between training teachers and student scores.

2.2 Preference of Biology Subject by Learners after Implementation of SMASSE

One of the main objectives of SMASSE INSET courses is to bring about positive attitude towards Mathematics and Science education (CEMASTE, 2007). This is based on previous studies that show that learners generally have negative attitudes towards mathematics and sciences. Chesire, Odindo, Oduor, & Muriithi (2004). Chesire, et al (2004) mentioned the fact that there was a general attitude among students that mathematics and sciences are difficult subjects. The feeling had been noted to be greater in girls than boys.

A number of factors have been cited as the causes that had led to the feeling. The first is poor performance during national examinations. Students consider it a waste of time to concentrate on subjects they will not pass. A study by two psychologists Bich and Verof cited in Chesire et al (2004) confirmed that anticipation of positive outcome enhances the tendency to action while anticipation of negative outcome blocks or inhibits the action. Another factor contributing to negative attitudes is too

much theoretical teaching of science, which makes the subject appear too abstract and boring. Teachers have also been accused of having contributed to instilling the negative attitude. This had been especially so in mixed schools where teachers expect boys to perform better in science than girls (Cheshire et al, 2004). Finally, social-cultural attitudes contribute to negative attitudes, whereby traditionally difficult tasks were seen as male domain. Girls were associated with lighter household chores. This leads to girls giving up in any subject viewed as more challenging at the very beginning.

Understanding of students' preferences of a subject is important in supporting their achievement and interest toward a particular discipline. Students' attitudes toward Science have been extensively studied (Osborne, Simon, & Collins, 2003), but research was initially focussed greatly on science in general (Dawson, 2000) and less attention was addressed to particular disciplines like Biology, Physics or Chemistry (Salta & Tzougraki, 2004). This can partly camouflage students' attitudes because science is not viewed as homogeneous subject (Spall et al., 2003).

In general, students' attitudes toward science decrease with age (Osborne, Simon, & Collins, 2003), boys show more positive attitudes toward Science than girls (Francis & Greer, 1999) and more negative attitudes are associated with the Physical Sciences rather than Biological Sciences (Spall, Barrett, Stanisstreet, Dickson & Boyes, 2003; Spall, Stanisstreet, Dickson & Boyes 2004). Jones, Howe and Rua (2000) showed that, unlike Chemistry or Physics, girls showed more positive attitudes toward biology than boys. Dawson (2000), after comparing changes in Australian students' interests and attitudes over 20 years, established that, girls' preferences in Biology lead in Human Biology and General Biology, but boys were greatly interested in earth sciences. A study by Baram-Tsabari & Yarden (2005) using method of children's

spontaneous questions found that children's interest in human Biology increases with age relative to the interest in Zoology which showed opposite tendency. Except gender differences, research on UK students' (aged 11 – 16 years) attitudes showed that attitudes towards Biology exhibit different age-related patterns than attitudes toward Physics (Spall et al., 2004). Attitudes towards Physics became more negative as age of students increases, relative to more positive attitudes toward Biology (Spall et al., 2004). In contrast, Stark & Gray (1999) in a large sample of Scottish students found that boys' preferences for science topics shifted from biologically oriented to physics as the age of students increases, while girls' preference for biological topics were less affected by age and relative high. This means that research in Biology would explore different patterns in attitudes related with gender and/or age than other science courses. All factors reported above including basic factors such as such as effects of teacher, parents or environment (George & Kaplan, 1998) would affect students' attitudes toward Biology. However, the effect of teacher is disputable; while Gardner (1975) reported evidence that curriculum and teacher effects on attitudes were slight, other studies suggest that students' attitudes are quite malleable, and that individual teachers can have a major effect on both overall science interests and on more specific topic related ones (Bottomley & Ormerod, 1981; Kelly, 1988). This area, however, still received less attention. Of concern for this study was the impact that SMASSE INSET courses have had on students' attitudes toward Biology.

2.3 Adoption of SMASSE Concepts in Teaching of Biology

Rivkin, Hanushek & Kain, (2005) say in schools variables such as how well students like their teachers, the science curricular or the science climate have an effect on attitude towards science. This is further emphasized by Bradley & Taylor (1998) who says that how well a student gets along with his or her teacher affects his/her

performance. Maaja & Aidla (2006) noted that schools with stable, experienced and qualified teachers usually have better school facilities in terms of school buildings, books and equipments than those schools which have difficulty in attracting experienced and qualified staff. Numerous investigations have also been carried out to find the effects of instructional resources on students' academic achievement. Eminent scholars have also contributed immensely to report the effect of one variable on the other. Consequently, there have been many reports from these studies which had served as useful guides to the present one.

Monk (1994) says, apart from the qualifications of the teacher dedication is of utmost importance if students are to excel in academics. Kathryn and Margaret, (2003) says teacher's characteristics in particular contributes to academic performance of the subject. He says that, better trained and more experienced teachers produce better results. INSET is one of the approaches employed to upgrade teachers' skills and competence the world over.

Karega (2008) is in conformity with world wide consensus that improving quality of education depends on improvement of quality of classroom practices. Kibe, Odhiambo and Ogwel (2008), on the contrary, observes that there were poorly endowed schools in terms of facilities and scholarly material, yet they posted relatively better examination results owing to effective teaching and management of learning environment. This study will seek to get views of those teachers who were teaching before the SMASSE project began and who are still teaching today. This will help to understand the impact the SMASSE has had on the improvement of the teaching methods of the teacher.

In the process of developing ways of improving the practical work, a pedagogical paradigm of “ASEI” movement by application of “PDSI” approach was constructed. This paradigm, around which the training was to rally the teachers, espouses Learner-Centred Methods where learners are actively involved in the learning process rather than passive receivers of knowledge, with the teacher guiding the learning process. The curriculum enhances teachers’ attitudes, pedagogical knowledge and skills. Content mastery and skills of making and utilizing teaching/learning aid and materials.

Orodho (2005) says the uniqueness of the laboratory is principally in providing students with an opportunity to engage in the process investigation and inquiry. The acronym, ASEI stands for Activity, Student Centred Experiment and Improvisation. Activity involves practical work discussion presentation and so on. Student-centred make use of interactive learning strategies like, group discussion, academic tour, project work and others. In this approach of teaching/learning, learners are engaged in experiment which makes the lesson objectives more effective. Improvisation/Innovativeness enhances curiosity and supplement conventional resources for promoting participation of as many students in the lessons as possible. (CEMESTEA, 2007)

The PDSI stands for Plan (of the lesson activities and flow based on learners needs and abilities), Do the lesson activities systematically, See learners’ growth in knowledge, skills and attitudes at all stages of lessons and Improve instructional process based on evaluation results. By application of this paradigm, there has been quite some improvement in the teaching and learning of Mathematics and Sciences in Kenyan Classrooms (CEMASTEA, 2007).

Hoxby (1998) describes practical work as a method in which course effect and nature of feeling and learning are determined by actual experience or experiment order in a controlled condition. Bradley and Taylor (1998) illustrates this essentiality of practical work by saying that Science is a practical activity which takes place in the laboratory. They further declare that Science simply belongs there naturally as cooking belongs to the kitchen and gardening to garden.

The effect of application of ASEI and PDSI pedagogical paradigm in the teaching practices has made mathematics and science subjects to become more relevant to learners, more practical and therefore more interesting, inexpensive, and more accessible. Teachers improve their skills in work planning, monitoring learning achievement, self and collegial follow-through and follow up lesson evaluation and utilization of feed back to improve subsequent lessons (CEMASTEVA, 2007).

Students like practical work, Cecilia (1998) give an insight into this and says that learners from beginning of secondary school through to higher education justify the use of practical working science on the ground of interest and motivation. The author argues that students come to the science laboratory with the expectation that they would be doing practical work.

Cecilia (1998) says, it is not just enough for students to do something in the laboratory but rather laboratory experiences need to be designed so that they focus attention. Angrist and Lavy (1999) say in a laboratory, numerous experiences may be provided in which students manipulate materials; gather data, make inferences and communicate the results in a variety of ways. Joshua and Victor (1999) also argue that most convectional practical tests are done and reported individually. Candidate

performs and reports or records on paper for the examiner can only assume that the skills were utilized during the practical work to give the production on paper.

Cecilia (1998) however, argues that teachers lack experiences in assessment methods for students to test understanding and enhance performance in the science laboratory. The trend in Science teaching has been that there is an increasing demand for more student participation in the learning process.

Akerhielm (1995) reports that teachers need to interact with learners during the classroom instruction to encourage the learner to participate in the learning process. Bradley and Taylor (1998) reported that different teachers' method produce some specific pupil outcomes. For example, warm supportive rewarding behaviour appear not only to help concept learning but also to help create a democratic class where each member has equal learning opportunities.

McVicar (2000) found out that only 18 percent of teachers adopt enquiry approach teaching. This observation is contrary to the letters and spirit of SMASSE which emphasizes learner based teaching/learning methods. Simon, Brendon, Carol & Deborah (2004) reports that quality and quantity of pupil interaction is an indication of effective classroom teaching. The study found out that students who mostly interact with teachers made significant achievements.

Vignoles, Levacic, Machin, Reynolds & Walker (2000) say there is a need for improvement of the awareness of their behaviour in learning situation. This helps teachers guide students in learning science by nurturing the spirit of inquiry and logical thought. Training of teachers enlightens them on their teaching style, how to handle their own questions and responses of their learners.

Campbell, Corbally and Nystrand, (1983) reports that the approach of the teacher to the classroom has both practical and theoretical aspects. The practical aspect required that the teacher quenches the student in their understanding of the subject matter. Gibbons, (2002) asserts that quality of teacher student interaction correlates positively and significantly with student performance. Hanushek and Eric (2006) reported that teacher talk dominates classroom interaction in both high performing and low performing schools. This shows that the methods employed by teachers to their science and Biology particularly is basically similar. This study will therefore seek to look into improvement on the teaching methods used by the teachers before and after SMASSE project that emphasizes learner centred approach to learning.

In a Kenyan study, Sifuna and Kaime (2007) established that school teachers who had attended SMASSE, School-based Teacher Development (SBTD) programmes were not able to apply student-centred approach in the classroom. They attributed this to large class sizes, use of English which is a second language in Kenya, and pressure to cover the syllabuses in preparation for national examinations. Sifuna and Kaime (2007) however established that teachers evaluated the two INSET programmes as having been effective in exposing them to a student-centred approach. In another Kenyan study, Oirere (2008) established that there was only partial implementation of the ASEI/PDSI concepts in class by teachers, and noted that the major hindrances to the adoption of the concepts were lack of time management skills, delays in receiving learning materials, large class sizes, heavy workload and pressure to complete the syllabus.

When professional approach is embraced in teaching process the use of indirect verbal behaviour for instance acceptance of students' feelings, praises or encouragement is enhanced and this is associated with a more positive attitude towards learning and

higher achievement by the students (SMASSE 2000). Some teachers subject learners to the traditional telling or the narration marathon which leads to ineffective learning of knowledge, concepts and skills required in biology as a practical subject (SMASSE, 2000). The ways the teachers deliver the content of their lesson affect the achievement of the learners in Biology (Dustmann, Rajah & Soest, 1998) According to SMASSE project (2000), teachers plunge into the activity of teaching armed with text books. Johnes, Bradley & Millington (1999) assert that lower ability students perform better in small group approach and higher achievers also benefited. Co-operative learning generally works equally well for all types of students (Kathryn & Margaret, 2003). For these reasons the study thus sought to look into the teaching methods employed by the biology teachers in regard to whether some impact has been realized due to SMASSE project.

2.4 Schools' Support for SMASSE Programme

School headteachers and other leaders need to offer support to Biology teachers for the SMASSE programme to have significant impacts on academic performance. Of particular importance is the role played by headteachers as school leaders. As pointed out by Hill (2006), with the emergence of the knowledge society it is likely that schools will come under constant pressure to find ways of improving learning outcomes for all students, and headteachers will be expected to provide the leadership required to bring about the needed transformation. According to SMASSE report finding of 2000 headteachers must take a more responsible role in initiating and monitoring both administrative and academic activities in the schools. Kathryn & Margaret (2003) state that the basic reason why some schools perform better than others in examinations is that while some school Headteachers organize the learning process for their students others leave it to chance.

A prime task of school Headteachers is to exercise leadership of the kind that results in a shared vision of the directions to be pursued by the school, and to manage change in ways that ensure that the school is successful in realising the vision. Murphy (1999) argues that school leadership should adopt school improvement as its centre of gravity. Placing school improvement at the centre of the profession ensures that the job of the headteacher is pedagogically and educationally grounded, and tied directly to the core business of schooling. It requires headteachers who have a solid knowledge of the learning process and of the conditions under which students learn in the school setting. It also places a premium on knowledge about educational change and school improvement. In short, it emphasises the role of the headteacher as a knowledge manager with respect to the core business of the school, namely teaching and learning, in a context of change and the ongoing imperative for improvement (Hill, 2006).

Upon implementation of SMASSE programme, it was expected that school leadership would provide all the necessary resources needed to support implementation of SMASSE teaching methodologies. Among the many areas the SMASSE sought to address was the teaching materials in science. Gibbons (2002) says availability of resources determines performance. The issue of resources was the most emphasized in the ASEI/PDSI where the learner is the most active in the development of the lesson. Figlio (1999) says that visual aids affect performance. This means that proper use of the teaching aids will affect performance in Science teaching in general and will seek to look into the impact SMASSE had on the improvement of teaching/learning resources, for Biology subject.

SMASSE programme principles were also embedded on the assumption that school leadership would be committed to motivating and effective management of the

science teachers. There is overwhelming evidence from the literature on school effectiveness and improvement regarding the significance of the Headteacher in establishing a culture within the school that promotes and values learning and that embodies realistic but high expectations of all students and teachers (Lezotte, 2010). This implies a commitment to organisational learning (that is, learning within the specific context of the school and its school improvement agenda). Headteachers must therefore be knowledgeable about ways of promoting organisational learning that enhance simultaneously the motivation of staff, and their competence and capacity to engage in a process of ongoing development and improvement. They must provide staff with opportunities that extend well beyond traditional models of, and approaches to, professional development and in-service training. Effective professional learning involves intensive, sustained, theoretically-based yet practically-situated learning, with opportunities to observe good practice, to be involved in coaching and mentoring processes, and to take time for reflection (Hargreaves & Fullan, 1991). One of the key objectives of this study was to find out the extent to which the schools support the SMASSE programme.

2.5 Summary

The literature reviewed in this chapter shows the impact of SMASSE on Biology performance, preference of Biology subject by the learners after the implementation of SMASSE, the extent of adoption of SMASSE teaching methodologies by teachers, and the extent to which the schools support SMASSE programme. The review shows that INSET programmes such as SMASSE can have impact on academic achievement. It also emerged from the review that one of the main aims of SMASSE was to change the negative attitudes of students' towards mathematics and sciences, which was caused by persistent poor performance, lack of encouragement by teachers,

and socio-cultural attitudes. The reviewed literature shows that failure by teachers to adopt the SMASSE concepts of ASEI and PDSI are mainly due to lack of resources and time for practical work, which point to lack of support by school leadership. Local literature shows that SMASSE INSET could be faced with challenges. For example, teachers complain of lack of materials for use in conducting practicals and they rarely use the ASEI/PDSI approach in teaching, as established by Sifuna and Kaime (2007) and Oirere (2008). However, previous studies have not looked into how SMASSE project influences performance in Biology. Poor performance in Biology at secondary school level is a major concern to researchers, teachers and teacher trainers. Biology teachers in Kenya have undergone in-service training programme under SMASSE INSET, but it is not clear whether the training has translated into improved teaching and learning of the subject. This is the reason the researcher sought to look into the impact of SMASSE in teaching and learning of Biology in Secondary Schools in Gatanga District, Kenya.

CHAPTER THREE

METHODOLOGY

3.1 Introduction

The research methodology section entails the description of the research design, study locale, target population, sample and sample selection procedure, instrumentation, pilot study and data analysis methods.

3.2 Research Design

The study adopted a survey design to assess the impact of SMASSE in the teaching of Biology in Secondary Schools in Gatanga District in which a sample survey of selected schools will be carried out. According to Orodho (2005), survey design involves collection of data, facts or statistics about an event, describes its nature and examines actions as they are or as they happen rather than manipulation of variables. Survey design thus describes or explains collected data about aspects of education that interests policy makers, educators and other stakeholders. The rationale behind use of a survey design is that it enables the researcher to gather data and study a large population in a short time, by using sampling techniques and survey data collection tools such as questionnaires. The design also allowed the researcher to study a given phenomenon without manipulating variables. It is on this strength that the researcher chooses this design to enable the use of questionnaire, to collect data in regard to the impact of SMASSE in teaching/learning of Biology in secondary schools in Gatanga District for processing and finally drawing conclusions.

3.3 Study Locale

The locale of the study was Gatanga District, Murang'a County, Kenya. This district was carved out of the larger Murang'a District which was one of the districts where

the SMASSE project was introduced in 1998. Gatanga is one of the Districts which has not recorded success/failure of SMASSE. It is for this reason that the area was preferred for the study.

3.4 Target Population

Gatanga district has 32 secondary schools as per the data at Gatanga D.E.O's office. Despite having several categories of secondary schools, the study will target the day secondary schools since they are the majority and many of them are not adequately equipped with science apparatus for practical teaching/learning of Biology. It is in such schools that the knowledge and skills acquired in SMASSE are applicable, especially in improvisation of the teaching materials and equipment. The 32 secondary schools constituted the target population for the study. The study targeted 42 Biology teachers, 32 Science HoDs and 32 Headteachers.

3.5 Sample and Sampling Procedure

Sampling is a procedure in which a fraction of a group known as a sample is chosen to represent the total population about which generalizations are made (Robert and Barbara, 1995). According to Mugenda & Mugenda (1999) the purpose of sampling is to secure a representative group (sample) which will enable the researcher to gain information about a population. Due to limitations of time and funds to cover the entire population, a study can be carried out from a carefully selected sample to represent the entire population. Gay (1992) observes that a sample of at least 20% of the population is a group representation for descriptive survey research. On this strength, the researcher randomly selected (20%) of the schools which is six schools. Two more schools were randomly picked, before the actual data collection exercise, for piloting. Table 3.1 shows the target population and sample size.

***Table 3.1: Target population and sample size**

Category	Target Population	Sample size	Percentage
Schools	32	6	18.6
Principals	32	6	18.6
HoDs	32	6	18.6
Biology teachers	42	30	71.4

***Source:** Gatanga DEOs Office (2011) statistics

To get the specific schools for the study from each zone, a list of schools was made out of which the desired number was purposively selected by the researcher to include day secondary schools only. The rationale for using purposive selection was to obtain the desired sample. This consisted of those teachers who had taught before and after the start of the SMASSE project.

3.6 Research Instruments

Data was collected using questionnaires and interview guides. Questionnaires were developed for the headteachers and biology teachers. Interview schedules were used to collect data from the Heads of Departments. The researcher developed these instruments with the assistance and guidance of the supervisors.

Interviews provide in-depth data, which is not possible to get using questionnaires and it also makes it possible to obtain data required to meet specific objectives of the study (Mugenda & Mugenda, 1999). Interviews also guard against confusing questions, thereby help the respondent to give relevant responses. Furthermore, the researcher is able to seek immediate clarification of issues from the respondents as it is a two way communication channel.

The heads of department interview schedule were used to get data from the Science H.O.Ds touching on the attitudes of the Biology teachers towards SMASSE and the impact of SMASSE Project on teaching and learning of Biology.

3.7 Piloting of the Instruments

Piloting of the instruments involved the pre-testing of data collection instruments to the two randomly selected schools which were excluded from the actual study. The purpose of pilot study was to determine the reliability and validity of the instruments by identifying any items in the questionnaire that were unclear to the respondents and iron out any ambiguity. The pilot study also enabled the researcher to familiarize himself with administration of the instrument. Piloting was done once an introductory letter from the University and a research permit from the National Council for Science and Technology, were been obtained.

3.7.1 Reliability of the instrument

Reliability refers to the consistency of an instrument in measuring what it intends to measure. It is therefore the consistency in which an instrument produces reliable results.

In this study, the technique for establishing reliability involved the split-half technique. Split-half technique is a method of reliability testing whereby the instrument being tested is administered only once to the pilot study respondents and then the responses are divided into two equal halves, which are then subjected to reliability testing (Borg & Gall, 1989). Split-Half technique of reliability testing was employed, whereby the pilot questionnaires from the sample schools were divided into two equivalent halves (SH-1 and SH-2) and then a correlation coefficient for the

two halves were computed. Table 3.2 shows a sample for Split Half technique procedure.

***Table 3.2: Split Half Technique for Reliability Coefficient**

Respondents	SH-1	Respondents	SH-2	D (A - B)	D ²
1	3	2	2	1	1
3	5	4	5	0	0
5	4	6	4	0	0
7	1	8	1	0	0
9	4	10	5	-1	1
					$\sum(D)^2 = 2$

*Source: Researcher

Procedure for Split Half is as follows:

$$(i) \quad r = 1 - \frac{6\sum(D)^2}{N(N^2 - 1)}$$

Where:

r = Correlation coefficient

N = Sample,

\sum = Summation of scores,

D = Deviation

$$(ii) \quad SH = \frac{2r}{1 + r} \quad \begin{array}{l} \text{(Where Items are doubled)} \\ \text{(Spearman Brown Prophecy)} \end{array}$$

Using the above formula for the sample data in Table 3.1 we obtain: -

$$r = 1 - \frac{6(2)}{5(25-1)} = 0.9$$

$$SH = \frac{2(0.9)}{1 + 0.9} = 0.9474$$

A reliability coefficient of 0.7 or above was accepted as recommended by Gay (1992).

3.7.2 Validity of the instruments

Validity is the degree to which an instrument accurately measures what it purports to measure (Gay, 1992). In this study, face validity and content validity of the instruments was considered. To improve face validity of the instrument, a pilot study was conducted in two public secondary schools, which were not included in the final study. The piloted questionnaire was scrutinized to identify items that seemed to be unclear or ambiguous to the respondents. Such items were reviewed and recorded, thereby improving the face validity of the instrument. According to Borg and Gall (1989), content validity of an instrument is improved through expert judgment. As such, the researcher sought assistance of his supervisors, who, as experts in research, helped to improve content validity of the instruments.

3.8 Data Collection Procedure

The researcher personally administered the questionnaires in both the pilot and main study. A research permit was obtained from the Ministry of Education Headquarters at Jogoo House, Nairobi. The researcher sought clearance from the District Education officer (DEO) Gatanga after which he contacted the principals of the participating schools and visit them later for the administration of the questionnaires. All the respondents were assured of the confidentiality of the information provided. The filled questionnaires were collected two weeks later. The researcher carried the interview schedule reports after interviewing the HoDs.

3.9 Data Analysis Plan

Before the actual data analysis, the gathered data from the various instruments, transcripts and schedules were validated, edited, coded and them entered in the

computer for analysis using the Statistical Package for Social Sciences (SPSS), version 17. In the validation process, the collected questionnaires were checked to determine whether an accurate or acceptable sample has been obtained in terms of proportion of the issued instruments. They were also checked for completeness.

Interview schedules were transcribed and then arranged as per the items and responses in thematic manner, relating these themes to the research questions. Data analysis was then performed using both quantitative and qualitative techniques. Quantitative data was subjected to descriptive statistics that yielded mean scores, frequencies and percentages. Percentages are the most widely used and understood standard proportions (Best and Kahn 1993). To facilitate the making of recommendations of the study, the findings were presented using tables, graphs and charts. Besides that, a qualitative analysis of personal views and opinions were presented as direct quotations and incorporated into recommendations of the study. Given below is a summary of the study variables and analysis procedures used.

***Table 3.3: Summary of Data Analysis Plan**

Research Question	Independent Variable	Dependent Variable	Mode of Analysis
To what extent has the performance of Biology in K.C.S.E improved or not since the introduction of SMASSE?	SMASSE INSET attendance	Performance in Biology	Mean, frequencies, and percentages.
To what extent has the number of students choosing Biology in Form 3 increased or not?	SMASSE INSET attendance	Number of students choosing Biology	Mean, frequencies, and percentages.
To what extent has Biology teachers adopted the SMASSE methodologies?	SMASSE INSET attendance	Adoption of SMASSE methodologies	Mean, frequencies, and percentages.
To what extent do the schools support the SMASSE program financially?	SMASSE INSET attendance	Support for SMASSE	Mean, frequencies, and percentages.

* **Source:** Researcher's own (2011)

CHAPTER FOUR

DATA ANALYSIS, PRESENTATION OF RESULTS AND DISCUSSION

4.1 Introduction

This chapter presents data analysis and discussion of the study findings. The general objective of the study was to assess the impact of SMASSE project on teaching and learning of Biology in Gatanga District, Kenya. The findings of the research are presented based on the four research objectives:

- i. To find out whether SMASSE has improved performance of students in Biology.
- ii. To identify the attitude of students towards Biology since the implementation of SMASSE.
- iii. To identify the impact of SMASSE on teaching methodologies used by teachers of Biology.
- iv. To determine the impact of school administration support on the success of SMASSE project in providing teaching and learning of Biology.

The background data of the respondents is given first, followed by the analysis and discussion of each of the four research objectives.

4.2 Background data of the respondents

The participants comprised 6 principals, 6 HODs and 30 teachers from 6 secondary schools in Gatanga District, Kenya. All the 42 questionnaires were returned and this represented a 100% questionnaire return rate. Table 4.1 shows the number of Biology teachers from the sampled schools.

Table 4.1: Number of Biology teachers

No. of Biology teachers	Designation		Total
	Principals	HODs	
None	0	0	0
One	3	3	6
Two	1	2	3
Three	2	1	3
Total	6	6	12

Table 4.1 shows that 3 principals reported that they had one Biology teacher in their schools, 1 reported they had two teachers while 2 indicated they had three teachers. On the other hand, 3 HODs indicated that their schools had one Biology teacher, 2 indicated two while 1 indicated they had three Biology teachers. This is an indication that schools were adequately staffed with Biology teachers. A previous study by Asyago (2005) established that in schools where teachers are not adequate, teachers have heavy workloads and do not get adequate time to attend to students' needs satisfactorily.

Figure 4.1 shows number of cycles teachers had undergone since the introduction of SMASSE insets.

KENYATTA UNIVERSITY LIBRARY

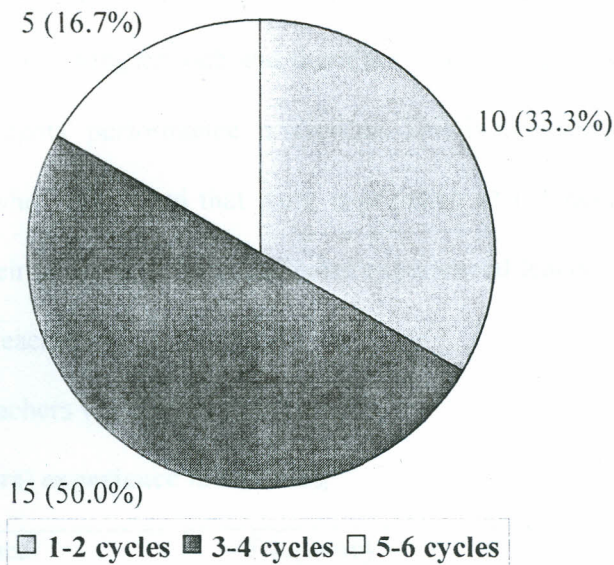


Figure 4.1: Number of cycles completed after SMASSE insets

As shown in Figure 4.1, 50.0% of the teachers indicated that they had completed 3-4 cycles since the SMASSE insets began, 10 (33.3%) reported 1-2 cycles while the remaining 5 (16.7%) indicated 5-6 cycles. Completion of cycles is expected to equip teachers with good mastery of subject contents which would improve their teaching skills. This concurs with a previous study by Inyega (2002) revealed that attendance of all the SMASSE cycles promoted positive attitudes towards the subjects among teachers and improved their effectiveness in teaching.

Table 4.2 shows the principals and HODs working experience.

Table 4.2: Work experience

Years of experience	Designation		Total
	Principals	HODs	
4 - 7 years	1	4	5
8 - 11 years	1	0	1
12 and above	4	2	6
Total	6	6	12

The table shows that 2 principals had worked for 4-11 years while 4 of them had 12 years and above of experience. However, 4 HODs had worked for 4-7 years while 2

had a working experience of 12 years and above. This implies that majority of the respondents had worked long enough and therefore were conversant with the impact of SMASSE on students' performance in sciences. This is in agreement with a study by Moini (2009) who established that work experience of teachers influences their attitude towards their teaching subject and more experienced teachers tend to perform better than novice teachers.

Table 4.3 shows teachers working experiences

Table 4.3: Teachers' experience in teaching

Working experience	Frequency	Percent
0 - 3 years	5	16.7
4 - 7 years	5	16.7
8 - 11 years	10	33.3
12 years and over	10	33.3
Total	30	100.0

As shown in Table 4.3, 10 (33.4%) teachers reported that they had taught for 0-7 years whereas 20 (66.6%) indicated that they had over 8 years teaching experience. This implies that most of the teachers had adequate experience to make them efficient and effective in their profession. They could also give factors that lead to poor performance in Biology and other science subjects in schools since they have taught for a long time.

4.3 To find out whether SMASSE has improved performance of students in Biology.

The first objective of the study sought to find out whether SMASSE has improved performance of students in Biology. To address this objective, the study first

established students' performance in Biology after teachers went through the SMASSE project.

All study respondents (principals, HODs and teachers) reported that there was an improvement in the result after teachers went through the programme.

The school heads and HODs also reported that in order to assess the effectiveness of the SMASSE inset after teachers attend the programmes they: Check students' performances on Biology subject; visit laboratories during practical lessons; check students' marked scripts and the assignment books and also enquire information from teachers about SMASSE to assess their attitude towards the programme.

To determine whether SMASSE had impact on Biology, principals, HODs and teachers were presented with a number of statements showing the impact of SMASSE on Biology performance. They were required to state their agreement levels on a four-point Likert scale ranging from strongly agree to strongly disagree. Table 4.4 shows the mean scores and standard deviations obtained by the respondents.

Table 4.4: Impact of SMASSE on Biology performance

Impact of SMASSE on Biology performance	Principals		HODs		Teachers		Total	
	M	SD	M	SD	M	SD	M	SD
Teachers who have attended SMASSE record better performance in Biology for their students	3.67	0.516	3.00	0.000	3.33	0.711	3.33	0.650
In general, SMASSE has led to improved performances in Biology	3.33	0.516	3.00	0.000	2.90	0.712	2.98	6.43
Teaching methods in Biology has improved due to teachers' attendance of SMASSE	3.33	0.516	3.33	0.816	3.03	0.765	3.12	0.739
SMASSE has improved the overall school performance	3.00	1.095	2.67	0.516	3.07	0.785	3.00	0.796
The number of students pursuing further studies in Biology related courses has increased due to SMASSE	2.67	0.516	2.83	0.950	2.83	0.950	2.81	0.833

Table 4.4 shows that the mean scores obtained by the respondents on impact of SMASSE on Biology performance ranged between 3.67 and 2.67. The mean scores above 3.00 denoted that the respondents were in agreement with the statements while the mean score below 3.00 denoted that the respondents disagreed with the statements. The respondents obtained high mean scores on the following statements: teachers who have attended SMASSE record better performance in Biology for their students and teaching methods in Biology has improved due to teachers' attendance of SMASSE. All the study respondents (principals, HODs and teachers) obtained low mean scores on the following statement: the number of students pursuing further studies in Biology related courses has increased due to SMASSE. This implies that

most of the respondents were in agreement that SMASSE programmes had a positive impact on students' performance in Biology subject.

In agreement to this finding, Hoxby (1998), based on data from Massachusetts, Illinois, found a Correlation between alternate assessment scores and best practice indicators from the Kentucky systems change project, but only a moderate correlation with Individualized Education Programme (IEP) quality. In another study conducted in California by Kelly, William and Eric (1999) found a relationship between instructional variables and alternate assessment scores. Specifically, involving students in the portfolio evaluation and embedding the alternate assessment in ongoing instructions were correlated with students' scores. Although these studies suggest that the quality of both educational programmes and alternate assessment scores are linked, no studies to date have determined if there is a casual relationship between training teachers and student scores.

The study respondents further gave suggestions on what needs to be done to improve performance of Biology in schools. The following were their responses;

- (i) There should be intensification of seminars, workshops, refresher courses for Biology teachers to sensitize them on the benefits of group work, projects and practicals as assessment instruments in the teaching of Biology.
- (ii) The government should allocate more funds in schools to improve on teaching and learning resources in the laboratory.
- (iii) The Ministry of Education should revise the Biology syllabus and reduce its content leaving the most relevant topics to allow completion of the syllabus and adequate testing and revision.
- (iv) The attitude of the teachers need to be worked on further, so that they can be fully compliant to ASEI /PDSI approach.

(v) The government should employ more teachers in order to reduce workload for Biology teachers to enable them concentrate fully on teaching and testing in Biology.

(vi) Students should be motivated to have a positive attitude towards science subjects by making learning interesting and rewarding those who perform well. Those who lag behind should also be encouraged to work harder.

Commenting on the suggestions given by the respondents, the researcher feels that some of these challenges facing the schools are being addressed, for example, the Ministry of Education has been organizing workshops for Biology teachers, providing funds for improving teaching and learning resources in the laboratories through Free Secondary Education. In addition the government is recruiting more Biology teachers every year.

4.4 Preference of Biology subject by learners as perceived by teachers

The second objective of the study was to find out the attitude of students towards Biology since the implementation of SMASSE. In a review of literature from Britain, Osborne, Simon, & Collins (2003), argued that understanding of students' preferences of a subject is important in supporting their achievement and interest towards a particular discipline. In reference to this objective, the respondents were given five items measuring students' preference of Biology subject. They rated the items on the extent to which they agreed or disagreed with each statement on a four-point Likert scale, ranging from Strongly Agree to Strongly Disagree.

Table 4.5 shows the means and standard deviation obtained by the respondents on each of the 5 items.

Table 4.5: Students' preference of Biology subject

Preference of Biology by students	Principals		HODs		Teachers		Total	
	M	SD	M	SD	M	SD	M	SD
Through SMASSE teachers have been able to show students that Biology is not as difficulty as earlier thought	3.50	0.548	3.17	0.408	3.57	0.679	3.50	0.634
SMASSE has helped improve students' attitude towards Biology	3.33	0.516	3.67	0.516	3.13	0.681	3.24	0.656
More still needs to be done to improve students' preference of Biology	3.33	0.816	3.50	0.548	2.60	0.498	2.83	0.660
Since inception of SMASSE, students' preference of Biology has improved	3.17	0.753	2.50	0.548	3.00	0.983	2.95	0.909
Despite the SMASSE project, most students in the school still prefer other science subjects not Biology.	2.00	0.894	2.17	0.408	1.57	0.568	1.71	0.636

As shown in Table 4.5, the mean scores obtained by the respondents on preference of Biology by students ranged between 3.67 and 1.57. All the respondents obtained high mean scores on the following statements: SMASSE teachers have been able to show students that Biology is not as difficulty as earlier thought and SMASSE has helped improve students' attitude towards Biology. This shows that they were in agreement with the above stated statements. However, teachers obtained low mean scores on the statement which stated that more still needs to be done to improve students' preference of Biology. In addition, all the respondents (Principals, HODs and teachers) obtained low mean scores on the statement which stated that despite the SMASSE project, most students in the school still prefer other science subjects not

Biology. This shows that the respondents were in disagreed with the statements. The findings presented above imply that after the SMASSE programmes teachers were well equipped with the subject contents which in turn improved their teaching skills and hence changed students' attitude toward the Biology subject.

Basic factors such as such as effects of teacher, parents or environment (George & Kaplan, 1998) would affect students' attitudes toward Biology. However, the effect of teacher is disputable; while Gardner (1975) reported evidence that curriculum and teacher effects on attitudes were slight. Other studies carried out by Bottomley & Ormerod (1981) and Kelly (1988) suggest that students' attitudes are quite malleable, and that individual teachers can have a major effect on both overall Science interests and on more specific topic related ones.

To confirm the above results principals, HODs and teachers were requested to comment about students' attitude after the implementation of SMASSE. Majority reported that students had a positive attitude towards Biology and hence improvement in performance. Monk (1994) says, apart from the qualifications of the teacher dedication is of utmost importance if students are to excel in academics. Kathryn & Margaret (2003) says teacher's characteristics in particular contributes to academic performance of the subject. He says that, better trained and more experienced teachers produce better results. INSET is one of the approaches employed to upgrade teachers' skills and competence the world over.

4.5 To find out the impact of SMASSE on teaching methodologies used by teachers of Biology.

The third objective of the study was to find out the impact of SMASSE on teaching methodologies used by teachers of Biology. To address this objective, teachers were

given a self assessment question which they were requested to comment on their ability to handle practical work before and after SMASSE insets. All teachers (100.0%) reported that they had an improvement in their ability to perform and handle practical work. Additionally, they assessed themselves on the use of ASEI/PDSI in teaching and learning of Biology as shown in Table 4.6.

Table 4.6: Teachers' self assessment on the use of ASEI/PDSI

Use of ASEI/PDSI in teaching /learning of Biology	Yes		No	
	f	%	f	%
I sometimes use ASEI/PDSI approach to teaching of Biology	18	60.0	12	40.0
I always use ASEI/PDSI approach to teaching of Biology	10	33.3	20	66.7
I do not use ASEI/PDSI approach to teach Biology	0	0.0	30	100.0
I rarely use ASEI/PDSI approach to teaching of Biology	0	0.0	30	100.0

As shown in Table 4.6, 60.0% of the teachers reported that sometimes they use ASEI/PDSI approach to teaching of Biology while 33.3% of them reported that they always use ASEI/PDSI approach. However, no respondents indicated that they never or rarely apply ASEI/PDSI approach when teaching Biology. This implies that teachers were occasionally engaging students in performing experiments and also in lesson discussions and hence creating an interactive learning environment. This enables teachers to draw students' attention in classroom therefore leading to easy understanding of the subject.

According to CEMASTE (2007) effect of application of ASEI and PDSI pedagogical paradigm in the teaching practices has made mathematics and science

subjects to become more relevant to learners, more practical and therefore more interesting, expensive, and more accessible. Teachers improve their skills in work planning, monitoring learning achievement, self and collegial follow-through and follow up lesson evaluation and utilization of feed back to improve subsequent lessons.

Teachers were also asked to indicate what they do whenever they do not have a certain apparatus that is required in teaching a topic /subtopic. Table 4.7 shows their responses.

Table 4.7: Options taken to supplement teaching/ learning devices

Options taken	Yes		No	
	f	%	f	%
I improvise on locally available materials	30	100.0	0	0.0
I teach theoretically	5	16.7	25	83.3
Overlook the topic/subtopic	0	0.0	30	100.0
I postpone it until I get the equipment	0	0.0	30	100.0

Table 4.7 shows that all teachers (100.0%) reported that they improvise on locally available materials whenever they have no device for teaching a certain topic whereas 16.7% indicate that they teach theoretically. All the respondents were in disagreement that they overlook the topic or postpone it until they get the equipments.

To confirm teachers' responses, the schools heads and HODs reported that all teachers in their schools improvise on the locally available materials in case of inadequacy of teaching and learning resources. This implies that teachers were committed in their work though challenges such as inadequacy of teaching resources were hindrances in their activities.

Similarly, a study by Oirere (2008) established that there was only partial implementation of the ASEI/PDSI concepts in class by teachers, and noted that the major hindrances to the adoption of the concepts were lack of time management skills, delays in receiving learning materials, large class sizes, heavy workload and pressure to complete the syllabus.

The study further sought to find out whether ASEI/PDSI skills had any impact on teaching performance. To establish this, Principals, HODs and teachers were presented with five statements based on adoption of ASEI/PDSI skills. They were required to state their agreement levels on a four-point Likert scale ranging from strongly agree to strongly disagree. Table 4.8 shows the means and standard deviation obtained by the respondents on each of the 5 statements.

Table 4.8: Adoption of ASEI/PDSI skills

Adoption of ASEI/PDSI skills	Principals		HODs		Teachers		Total	
	M	SD	M	SD	M	SD	M	SD
SMASSE attendance has improved how teachers conduct experiments in Biology	3.50	0.548	3.67	0.516	3.33	0.922	3.40	0.828
Teachers of Biology are able to use PDSI skills during lessons due to attendance of SMASSE	3.50	0.548	3.00	0.632	3.43	0.568	3.38	0.582
Teachers of Biology are able to improvise teaching aids due to attendance of SMASSE	3.50	0.548	3.67	0.516	3.33	0.922	3.40	0.828
SMASSE attendance has promoted use of student-centered methods in Biology lessons	3.33	0.516	3.17	0.408	3.47	0.730	3.40	0.665
Teachers of Biology are able to use ASEI skills during lessons due to attendance of SMASSE	3.33	0.516	3.17	0.408	3.40	0.621	3.36	0.577

Table 4.8 shows that the mean scores obtained by the respondents on various aspects on adoption of ASEI/PDSI skills ranged between 3.50 and 3.33. The respondents obtained high mean scores on the following statements; SMASSE attendance has improved how teachers conduct experiments in Biology; teachers of Biology are able to use PDSI skills during lessons and also they are able to improvise teaching aids .The table shows that all the respondents obtained mean scores above 3.00 denoting that they agreed with all statements. This implies that SMASSE programme had a positive impact on teaching performances and therefore students' performance in Biology improved.

Contrary to these findings, in a Kenyan study, Sifuna & Kaime (2007) established that school teachers who had attended SMASSE, School-based Teacher Development (SBTD) programmes were not able to apply student-centred approach in the classroom. They attributed this to large class sizes, use of English which is a second language in Kenya, and pressure to cover the syllabuses in preparation for national examinations. Sifuna & Kaime (2007) however established that teachers evaluated the two INSET programmes as having been effective in exposing them to a student-centred approach.

4.6 Impact of school administration support on the success of SMASSE project in providing teaching and learning of Biology.

The fourth research objective of the study was to determine the impact of school administration support on the success of SMASSE project in providing support for teaching and learning of Biology. SMASSE programme principles were embedded on the assumption that school leadership would be committed to motivating and effective management of the science teachers (Lezotte, 2010). To address this research objective, teachers reported that their schools principals were supportive as far as

SMASSE attendance and implementation of the program is concerned. They also added that laboratories are well equipped since inception of the SMASSE project.

According to SMASSE report finding of 2000 headteachers must take a more responsible role in initiating and monitoring both administrative and academic activities in the schools. Kathryn and Margaret (2003) state that the basic reason why some schools perform better than others in examinations is that while some school Headteachers organize the learning process for their students others leave it to chance. The study respondents (principals, HODs and teachers) were given five items based on school support towards SMASSE programme. They were required to state their agreement levels on a four-point Likert scale ranging from strongly agree to strongly disagree. Table 4.9 shows the means and standard deviation obtained by the respondents on each of the 5 items.

Table 4.9: School support toward SMASSE programme

School support for SMASSE	Principals		HODs		Teachers		Total	
	M	SD	M	SD	M	SD	M	SD
The schools administration shows commitment to improved performance in Biology	4.00	0.000	3.50	0.548	3.50	0.777	3.57	0.703
The school administration sponsors science and Maths teachers for SMASSE training	3.83	0.408	3.67	0.516	3.60	0.563	3.64	0.533
The school provides all needed resources to enable Biology teachers implement SMASSE concepts	3.67	0.516	3.33	0.816	3.30	0.535	3.36	0.577
Even after attending SMASSE training, the conditions in the school do not support implementation of SMASSE concepts	1.83	0.753	1.67	0.816	1.73	0.785	1.74	0.767
The school administration has not given adequate support to promote Biology teaching in the school	1.50	0.548	1.50	0.837	1.17	0.379	1.26	0.497

As shown in Table 4.9, principals, HODs and teachers obtained high mean scores on the following statements: The schools administration shows commitment to improved performance in Biology, the school administration sponsors science and Maths teachers for SMASSE training and the school provides all needed resources to enable Biology teachers implement SMASSE concepts. However, all the respondents obtained low mean scores on the following statements: even after attending SMASSE training, the conditions in the school do not support implementation of SMASSE concepts and the school administration has not given adequate support to promote Biology teaching in the school. This implies that the schools administration were supporting the SMASSE programme and hence positively affecting performances of science subjects in schools.

Upon implementation of SMASSE programme, it was expected that school leadership would provide all the necessary resources needed to support implementation of SMASSE teaching methodologies. Among the many areas the SMASSE sought to address was the teaching materials in science. Gibbons, (2002) says availability of resources determines performance. The issue of resources was the most emphasized in the ASEI/PDSI where the learner is the most active in the development of the lesson. Figlio (1999) says that visual aids affect performance. This means that proper use of the teaching aids will affect performance in Science teaching in general and will seek to look into the impact SMASSE had on the improvement of teaching/learning resources, for Biology subject.

CHAPTER FIVE

SUMMARY, CONCLUSION AND RECOMMENDATIONS OF THE STUDY

5.1 Introduction

This chapter presents the summary of the study, conclusions and recommendations arrived at. It also gives suggestions for further studies.

5.2 Summary of the study findings

The purpose of this study was to assess the impact of SMASSE project on teaching and learning of Biology in Gatanga District, Kenya. The study participants were 6 principals, 6 HODs and 30 teachers. Given below is the summary of study findings.

5.2.1 Impact of SMASSE on Biology performance in Secondary Schools in Gatanga District

In relation to the first objective the study established that there was an improvement in the result after teachers went through the programme. In order to assess the effectiveness of the SMASSE inset after teachers attend the programmes the school heads and HODs: Check students' performances on Biology subject; visit laboratories during practical lessons; check students' marked scripts and the assignment books and also enquire information from teachers about SMASSE to assess their attitude towards the programme. The study also established that teachers who had attended SMASSE recorded better performance in Biology for their students. Teaching methods in Performance in Biology had also improved. This implies that most of the respondents were in agreement that SMASSE programme had a positive impact on students' performance in Biology subject.

5.2.2 Preference of Biology subject by the learners as compared to other Science subjects, after the implementation of SMASSE.

Regarding student preference of Biology subject, the study established that SMASSE teachers have been able to show students that Biology is not as difficult as earlier thought. The SMASSE programme had helped improve students' attitude towards Biology which in turn led to improved performance. This is an implication that after attending SMASSE programmes teachers were well equipped with the subject contents which in turn improved their teaching skills and hence changed students' attitude toward the Biology.

5.2.3 To assess to what extent the teachers have adopted the SMASSE teaching of Biology after INSET and PDSI training

Sixty percent of the teachers reported that sometimes they use ASEI/PDSI approach to teaching of Biology while 33.3% of them reported that they always use ASEI/PDSI approach. This shows that teachers occasionally engaged students in performing experiments and in lesson discussions hence creating an interactive learning environment leading to easy understanding of the subject. All teachers (100.0%) reported that they improvise on locally available materials whenever they have no device for teaching a certain topics. To confirm teachers' responses, the schools heads and HODs reported that all teachers in their schools improvised on the locally available materials in case of inadequacy of teaching and learning resources.

The study established that SMASSE attendance had improved the way teachers conduct experiments in Biology; teachers are able to use PDSI skills during lessons and also improvise teaching aids. The result findings were in line with CEMASTE (2007) report which says that through application of ASEI/PDSI, there has been quite

some improvement in the teaching and learning of Mathematics and Sciences in Kenyan Classrooms. Teachers also improve their skills in work planning, monitoring learning achievement, self and collegial follow-through and follow up lesson evaluation and utilization of feed back to improve subsequent lessons.

5.2.4 Schools support towards SMASSE programme

According to teachers responses the study found out that school principals were supportive as far as SMASSE attendance and implementation is concerned. They also added that laboratories are well equipped since inception of the SMASSE project.

The study further revealed that principals, HODs and teachers obtained high mean scores on the following statements: The schools administration shows commitment to improved performance in Biology, the school administration sponsors science and Maths teachers for SMASSE training and the school provides all needed resources to enable Biology teachers implement SMASSE concepts. This implies that the school administration were in full support of the SMASSE programme leading to improved performance in Biology.

5.3 Conclusion

Based on the findings of the study as summarized above, it can be concluded that schools performed better in Biology after attending SMASSE INSET programmes. SMASSE programmes had positive impact on teaching and learning of Biology subject. The study established that after the SMASSE programmes teachers had a good mastery of the subject contents which in turn improved their teaching skills and hence changed students' attitude toward the Biology subject. After adopting the ASEI and PDSI approaches teachers have been able to make the teaching and learning of Biology more interesting and easy to understand. Finally the study concludes that

schools administration support for the SMASSE programmes had a positive impact on students' performances on science subjects and schools performance as whole.

5.4 Recommendations

- (i) There should be intensification and regular seminars, workshops, refresher courses for Biology teachers to sensitize them on the benefits of group work, projects and practicals as assessment instruments in the teaching of Biology.
- (ii) The BoG, parents and other stakeholders should support the school by raising funds to improve on teaching and learning resources in the laboratory.
- (iii) The Kenya Institute of Education should revise the Biology syllabus and reduce its content leaving the most relevant topics to allow completion of the syllabus and adequate testing and revision.
- (iv) The Teachers Service Commission (TSC) should employ more teachers in order to reduce workload for Biology teachers to enable them concentrate fully on teaching and testing in Biology.

5.5 Suggestions for further Studies

1. A study should be carried out on the relationship between frequency of testing and KCSE performance in Biology.
2. A study should be conducted to determine the administrative factors that influence students' performance in Biology.

REFERENCES

- Baram, T. A. & Yarden, A. (2005). *Characterizing children's spontaneous interests in science and technology*. International Journal of Science Education, 27(3), 803-826.
- Akerhielm, K. (1995). *Does class size matter?*, Economics of Education Review, Elsevier, vol. 14(3), pages 229-241, September.
- Angrist, J. D., & Victor L(1999), *Using Maimonides' Rule to Estimate the Effect of Class Size on Scholastic Achievement*, Quarterly Journal of Economics 114
- Asyago, B. (2005). *An Investigation into the Challenges Facing the Free Primary Education Management: The Case of Machakos District*. Kenya. Unpublished MEd Thesis, Kenyatta University.
- Best, J. W. & Kahn, J. V. (1993). *Research in Education*. New York: Prentice-Hall Inc.
- Borg, R. W. & Gall, D. M. (1989): *Educational Research: An Introduction*, New York: Longman Inc.
- Bottomley, J. & Ormerod, M. (1981). *Stability and ability in science interest from middle school to the age of science choices (14+)*. European Journal of Science Education, 3, 329-338.
- Bradley, S. & Taylor, J. (1998). "The Effect of School Size on Exam Performance in Secondary Schools," Oxford Bulletin of Economics and Statistics, Department of Economics, University of Oxford, vol. 60(3), pages 291-324, August.
- Bradley, Steve, Geraint J. & Jim M.. (2001). "School Choice, Competition, and the Efficiency of Secondary Schools in England." *European Journal of Operational Research* 135: 527-44.
- Browder, D.M., Spooner, F., Algozzine, R., Ahlgrim-DeLzell, L., Flowers, C., & Karvonen, M. (2003). *What we know and need to know about alternate assessment*. *Exceptional Children*, 70, 45-61. National Bureau of Economic Research, Inc.
- Campbell, R. F. Corbally, J. E. & Nystrand, R. O. (1983): *Introduction to Education Administration*, 6th Edition, Massachusetts: Allyn and Bacon.
- Cecilia, E. R. (1998). "Private School Vouchers and Student Achievement: an Evaluation of the Milwaukee Parental Choice Program," The Quarterly Journal of Economics, MIT Press, vol. 113(2), pages 553-602, May.
- CEMASTEА, (2007). *Progress Report for Secondary INSET (SMASSE)*, Nairobi: CEMASTEА.

- Chesire, C. B, Odindo, F. G., Oduor, S.E & Muriithi L.N. (2004). *Attitudes towards Mathematics*. A paper presented during cycle 1 Uasin Gishu district INSET.
- Dawson, C. (2000). *Upper primary boys' and girls' interests in science: have they changed since 1980?* International Journal of Science Education, 22(6), 557-570.
- Dixon, R. (1991). *Management Theory and Practice*. Oxford: Butterworth - Heinemann Ltd.
- Dustmann, C. & Rajah, N. & Van, S. A. (1998). "School Quality, Exam Performance, and Career Choice," Economics Working Papers eco 98/14, European University Institute.
- Figlio, D. N. (1999). "Functional form and the estimated effects of school resources," Economics of Education Review, Elsevier, vol. 18(2), pages 241-252, April.
- Francis, L. J. & Greer, J. E. (1999). *Attitude toward science among secondary school pupils in Northern Ireland: relationship with sex, age and religion*. Research in Science and Technological Education, 17(1), 67-74.
- Gardner, P. L. (1975). Attitudes to science: a review. *Studies in Science Education*, 2, 1-41.
- Gay, L.R. (1992). *Education Research; Competences for Analysis and Application*. (4th Edition). New York: Macmillan Publishers.
- George, R. & Kaplan, D. (1998). *A structural model of parent and teacher influences on science attitudes of eighth graders: evidence from NELS: 88*. Science Education, 82(1), 93-109.
- Geraint, J. & Steve, B. & Jim, M. (1999). "School choice, competition and the efficiency of secondary schools in England," Working Papers 000021, Lancaster University Management School, Economics Department.
- Gibbons, S. & Stephen M. (2002). "Valuing Primary Schools." London School of Economics, unpublished paper.
- Gonzales, P., Guzman, J., Jocelyn, L. & Gonzales, P. (2004). *Highlights From the Trends in International Mathematics and Science Study (TIMSS) 2003*, U.S. Department of Education.
- Hanushek, E. A. (2006). "School Resources," *Handbook of the Economics of Education*, Elsevier.
- Hargreaves, A. & Fullan, M. (1991). *Understanding teacher development*, London: Cassell.
- Hill, P. W. (2006). *What heads need to know about teaching and learning*, National Melbourne, AU: College for School Leadership.

- Hoxby C.M, (1998). *"The Effects of Class Size and Composition on Student Achievement: New Evidence from Natural Population Variation,"* NBER Working Papers 6869, National Bureau of Economic Research, Inc.
- Hoxby, C. M, (1998). *How Much Does School Spending Depend on Family Income? The Historical Origins of the Current School Finance Dilemma,* *American Economic Review*, American Economic Association, vol. 88(2), pages 309-14, May.
- Inyega, J. (2002). Change in Attitudes towards Teaching Strategies in Secondary School Teachers in Kenya Following In-service Professional Development. Paper presented at annual conference of SAETS, 2002, Kennesaw, GA.
- Jones, M. G., Howe, A., & Rua, M. J. (2000). *Gender differences in students' experiences, interests, and attitudes toward science and scientists.* *Science Education*, 84(2), 180-192.
- Joshua, D. A. & Victor L. (1999). *"Using Maimonides' Rule To Estimate The Effect Of Class Size On Scholastic Achievement,"* *The Quarterly Journal of Economics*, MIT Press, vol. 114(2), pages 533-575, May.
- Karega, M. (2008). Increasing Effectiveness of South-South Cooperation: the Case of SMASSE Kenya and SMASE-WECSA, A paper Presented at the Workshop for Practitioners of South-South and Triangular Cooperation During the Fifth Annual United Nations Day for South-South Cooperation And the Launch of the Global South-South Development Expo on 18 December 2008 at U.N. Headquarters/New York).
- Karega, M. (2008). *Increasing Effectiveness of South-South Cooperation: the Case of SMASSE Kenya and SMASE-WECSA,* A paper Presented at the Workshop for Practitioners of South-South and Triangular Cooperation U.N. Headquarters, New York.
- Kathryn, G. & Margaret, S. (2003). *"The Impact of School Inputs on Student Performance: An Empirical Study of Private Schools in the United Kingdom,"* University of Oxford, Department of Economics.London
- Kelly, A. (1988). The customer is always right: Girls' and boys' reactions to science lessons. *School Science Review*, 69(249), 662-676.
- Kelly, B., William, O. B. & Eric, H. (1999). *"School Size and the Distribution of Test Scores,"* *Claremont Colleges Working Papers*, Claremont Colleges.
- Kenya National Examination Council, (2005). *Regulations and Syllabuses 2006-2007,* KNEC, Nairobi.
- Kibe, S., Odhiambo, J. & Ogwel, J.C. (2008). *Impact of SMASSE INSET on students' capacity through improved teaching and learning in the classrooms, a paper presented at the 8th Regional conference for SMASSE WECSA,* Nairobi, Kenya.

- Lezotte, L. W. (2010). *What effective schools do: Re-envisioning the correlates*. Indianapolis, IN: Solution Tree.
- Maaja, V. & Aidla, A. (2006). "Relationships between organizational culture and performance in Estonian schools with regard to their size and location," *University of Tartu - Faculty of Economics and Business Administration, in: National and international aspects of organizational culture*, volume 24, chapter 6, pages 147-171 Faculty of Economics and Business Administration, University of Tartu (Estonia)
- McVicar, D. (2000). "Are Secondary Schools In Northern Ireland Too Small? A Microeconomic Analysis Of School Size And Career Choice At Sixteen," ERSA conference papers149, European Regional Science Association.,LONDON
- Ministry of Education (2005). *Kenya Education Sector Support Programme (KESSP)*. MoE, Nairobi.
- Ministry of Education (2005). *Kenya Education Sector Support Programme (KESSP)*. MoE, Nairobi.
- Ministry of Education (2005). *Policy Framework on Education, Training and Research: Meeting the Challenges of Education, Training and Research in Kenya in the 21 Century*: Nairobi: Government Printer.
- Ministry of Education (2007), *Secondary Education Strategy*, Nairobi, Africa.
- Ministry of Education (2007). *Kenya Education Sector Support Programme: School Infrastructure Technical Handbook*. Nairobi: Ministry of Education.
- Moini, R. (2009). *The impact of EFL teachers' cognition on teaching foreign language grammar*: Special issue English, No. 49 pp 141 – 164.
- Monk, D. H. (1994). "Subject area preparation of secondary mathematics and science teachers and student achievement," *Economics of Education Review*, Elsevier, vol. 13(2)
- Mugenda, O.M. & Mugenda, A.G. (1999). *Research Methods Quantitative and qualitative approaches*. Nairobi; Acts Press.
- Murphy, J. (1999). *The quest for a center: Notes on the state of the profession of educational leadership*. Paper presented at the annual meeting of the American Educational Research Association, Montreal, April 1999.
- Njuguna, B. M. (1999). *The findings from baseline studies by SMASSE Project Bulletin*, unpublished.
- Oirere, O. D. (2008). *An Evaluation of the Effectiveness of SMASSE INSET Project in Secondary Education: A Case of Kenya Division Gucha District, Kenya*. Unpublished M.Ed Project, Kenyatta University.

- Orodho, J. A. (2005). *Elements of Education and Social Science Research Methods*. Nairobi; Masola Publishers.
- Osborne, J., Simon S., & Collins, S. (2003). *Attitudes towards science: a review of the literature and its implications*. *International Journal of Science Education*, 25(9), 1049-1079.
- Owens, A. R. (1981). *Organizational Behaviour in Education*, Inglewood Cliffs, Prentice Hall, New Jersey.
- Oyaya, E. & Njuguna, B. (2000). *Strengthening of Mathematics and Science at Secondary School Education (SMASSE Project)*. An unpublished paper presented at the Annual Conference of the Kenya National Secondary School Head' Association.
- Republic of Kenya (2006). *CEMASTEIA order; Legal notice No. 96 of June 2006* Nairobi: Government Printer.
- Rivkin, S.G., Hanushek, E.A. & Kain, J. F. (2005). *Teachers, Schools, and Academic Achievement*. *Econometrica*, 73, 417-458.
- Robert, H. & Barbara W. (1995). *"The Determinants of Children's Attainments: A Review of Methods and Findings,"* *Journal of Economic Literature*, American Economic Association, vol. 33(4), pages 1829-1878, December.
- Rosalind, L., Stephen M., David R., Anna V. & James W. (2000). *"The Relationship between Resource Allocation and Pupil Attainment: A Review,"* Centre for the Economics of Education, LSE.London
- Salta, K. & Tzougraki, C. (2004). Attitudes toward chemistry among 11th grade students in high schools in Greece. *Science Education*, 88(4), 535-547.
- Shermerhorn, J. R. (1993). *Management for Productivity*, 4th Edition, New York: John Wiley and Sons.
- Sifuna, D. N. & Kaime, J. G. (2007). *The Effect of In-Service Education and Training (INSET) Programmes in Mathematics and Science on Classroom Interaction: A Case Study of Primary and Secondary Schools in Kenya*, *Africa Education Review*, 4 (1), 104-126.
- Simon, B., Brendon, M., Carol, P. & Deborah W. (2004). *"Sorting and Choice in English Secondary Schools,"* *The Centre for Market and Public Organisation 04/111*, Department of Economics, University of Bristol, UK.
- SMASSE (2002). *Effective Operation and Management of SMASSE project*. Unpublished stakeholders report.
- SMASSE (2008). Principal's workshop report. Unpublished stakeholders report.

- Spall, K., Barrett, S., Stanistreet, M., Dickson, D., & Boyes, E. (2003). Undergraduates views' about biology and physics. *Research in Science and Technological Education*, 21(2), 193-208.
- Spall, K., Stanisstreet, M., Dickson, D., & Boyes, E. (2004). Development of school students' constructions of biology and physics. *International Journal of Science Education*, 26(7), 787-803.
- Stark, R., & Gray, D. (1999). Gender preferences in learning science. *International Journal of Science Education*, 21(6), 633-643.
- Steve, B. & Jim, T. (1998). "The effect of school size on exam performance in secondary schools." Working Papers 000002, Lancaster University Management School, Economics Department.
- Steve, G. (2002). *Geography, Resources and Primary School Performance*, CEE Discussion Papers 0025, Centre for the Economics of Education, LSE., London.
- Vignoles, A., Levacic, R., Machin, S. Reynolds, D., & Walker, J. (2000). *The Relationship Between Resource Allocation and Pupil Attainment: A review*. DfEE Research Report No. 228, London: DfEE.
- Waititu, M.M.(2007). *Monitoring and Evaluation Report on District INSET-Monitoring and Evaluation Task Force*; CEMASTE.A.

KENYATTA UNIVERSITY LIBRARY

APPENDICES

Appendix One: Teachers' Questionnaire

The aim of asking you the following questions and suggestions is to help me assess the impact of SMASSE in the teaching and learning of Biology in secondary schools in Gatanga District. The information you will give will be used for the purpose of the project only. You can be assured that the information is confidential between you and the researcher. Do not write your name on any part of this questionnaire.

1. How many schools have you taught so far? []
2. Have you attended the SMASSE insets? Yes [] No []
3. How many cycles have you completed? []
4. What is your teaching experience? Please tick one
 - 0 – 3 years [] 4 – 7 years []
 - 8 – 11 years [] 12 years and over []
5. Has SMASSE helped you in improving your teaching methods of biology?
 - Yes [] No []
6. Has there been an improvement in the results after you went through the SMASSE project? Yes [] No []
7. Do you get support from your head teacher as far as SMASSE attendance and implementation of the program is concerned? Yes [] No []
8. Do you have better ability to handle practical work than you had before the SMASSE Insets? Yes [] No []
9. Assess your own practice in the use of ASEI/PDSI in teaching and learning of Biology by ticking on the relevant column.

Statement	Yes	No
I do not use ASEI/PDSI approach to teach Biology		
I rarely use ASEI/PDSI approach to teaching of Biology.		
I sometimes use ASEI/PDSI approach to teaching of Biology		
I always use ASEI/PDSI approach to teaching of Biology.		

10. Comment on the resources in your laboratory before and after the start of the SMASSE project.

.....

.....

.....

.....

11. Whenever you do not have a certain device that is required in teaching of a topic/subtopic what do you do? Please tick the answer that best suits you.

- i. I teach theoretically []
- ii. Overlook the topic/subtopic []
- iii. I postpone it until I get the equipment []
- iv. I improvise on the locally available materials. []

12. In the table below, indicate the extent to which you agree or disagree with the statements provided. Use the following scale while responding.

SA-Strongly Agree A – Agree D- Disagree SD – Strongly Disagree

Impact of SMASSE on Biology performance	SA	A	D	SD
Teachers who have attended SMASSE record better performance in Biology for their students				
In general, SMASSE has led to improved performance in Biology				
Teaching methods in Biology has improved due to teachers' attendance of SMASSE				
SMASSE has improved the overall school performance				
The number of students pursuing further studies in Biology related courses has increased due to SMASSE				
Preference of Biology by students	SA	A	D	SD
Since inception of SMASSE, students' preference of Biology has improved				
Despite the SMASSE project, most students in the school still prefer other science subjects not Biology				
SMASSE has helped improve students' attitude towards Biology				
Though SMASSE teachers have been able to show students that Biology is not as difficult as earlier thought				
More still needs to be done to improve students' preference of Biology				
Adoption of ASEI/PDSI skills	SA	A	D	SD

SMASSE attendance has promoted use of student-centered teaching methods in Biology lessons				
SMASSE attendance has improved how teachers conduct experiments in Biology				
	SA	A	D	SD
Teachers of Biology are able to use ASEI skills during lessons due to attendance of SMASSE				
Teachers of Biology are able to use PDSI skills during lessons due to attendance of SMASSE				
Teachers of Biology are able to improvise teaching aids due to attendance of SMASSE				
School support for SMASSE	SA	A	D	SD
The school administration sponsors science and maths teachers for SMASSE training				
The school provides all needed resources to enable Biology teachers implement SMASSE concepts				
Even after attending SMASSE training, the conditions in the school do not support implementation of SMASSE concepts				
The school administration shows commitment to improved performance in Biology				
The school administration has not given adequate support to promote Biology teaching in the school				

13. Comment on the results of biology before and after the SMASSE project.

.....

14. What would say about the attitude of the biology students now?

.....

15. Briefly comment on what you believe needs to be done to improve the performance of biology in you school specifically and Kenya in general

.....

.....

Thank you very much for your co-operation.

Appendix Two: Heads of Departments Interview Schedule

1. How many biology teachers does your school have? []
2. Do they attend the SMASSE insets? Yes [] No []
3. Is there one who has attended all the cycles offered so far? Yes [] No []
4. What is his/her teaching experience? Please tick one.
0 – 3 years [] 4 – 7 years []
8 – 11 years [] 12 years and over []
5. Has SMASSE helped them in improving their teaching methods of biology as far as they comment? Yes [] No []
6. Has there been an improvement in the results after he/she went through the SMASSE project? Yes [] No []
7. Do you give support to them as far as SMASSE attendance and implementation of the program is concerned?
Yes [] No []
8. How do you assess the effectiveness of the SMASSE inset after teachers attend them?
.....
.....
9. The SMASSE project emphasizes the use of ASEI/PDSI in teaching and learning of science in general and biology in particular. Assess the practice of the same by your biology teachers?
.....
.....
.....
.....
10. Comment on resources in your biology/science laboratory before and after the start of the SMASSE project
.....
.....
.....

11. What in your opinion do teachers of biology do whenever they do not have a certain device that is required in teaching a topic/subtopic? Please tick the answers(s) that best suits.

- a. They teach theoretically []
- b. They overlook the topic/subtopic []
- c. They postpone it until I get the equipment []
- d. They improvise on the locally available materials. []

12. In the table below, indicate the extent to which you agree or disagree with the statements provided. Use the following scale while responding.

SA-Strongly Agree A – Agree D- Disagree SD – Strongly Disagree

Impact of SMASSE on Biology performance	SA	A	D	SD
Teachers who have attended SMASSE record better performance in Biology for their students				
In general, SMASSE has led to improved performance in Biology				
Teaching methods in Biology has improved due to teachers' attendance of SMASSE				
SMASSE has improved the overall school performance				
The number of students pursuing further studies in Biology related courses has increased due to SMASSE				
Preference of Biology by students	SA	A	D	SD
Since inception of SMASSE, students' preference of Biology has improved				
Despite the SMASSE project, most students in the school still prefer other science subjects not Biology				
SMASSE has helped improve students' attitude towards Biology				
Though SMASSE teachers have been able to show students that Biology is not as difficult as earlier thought				
More still needs to be done to improve students' preference of Biology				
Adoption of ASEI/PDSI skills	SA	A	D	SD
SMASSE attendance has promoted use of student-centered teaching methods in Biology lessons				
SMASSE attendance has improved how teachers conduct experiments in Biology				
Teachers of Biology are able to use ASEI skills during lessons due to attendance of SMASSE				
Teachers of Biology are able to use PDSI skills during lessons due to attendance of SMASSE				
Teachers of Biology are able to improvise teaching aids due to attendance of SMASSE				

School support for SMASSE	SA	A	D	SD
The school administration sponsors science and maths teachers for SMASSE training				
The school provides all needed resources to enable Biology teachers implement SMASSE concepts				
Even after attending SMASSE training, the conditions in the school do not support implementation of SMASSE concepts				
The school administration shows commitment to improved performance in Biology				
The school administration has not given adequate support to promote Biology teaching in the school				

12. Comment on the results of biology before and after the SMASSE project.

.....

.....

.....

.....

13. What would you say about the attitude of the biology students now?

.....

.....

.....

.....

14. Briefly comment on what you believe needs to be done to improve the performance of biology in your school specifically and Kenya in general.

.....

.....

.....

.....

Thank you very much for your co-operation.

Appendix Three: Head Teachers' Questionnaire

The aim of asking you the following questions and suggestions is to help me assess the impact of SMASSE in the teaching and learning of Biology in Secondary school in Gatanga district. The information you will give will be used for the purpose of the project only. You can be assured that the information is confidential between you and the researcher. Do not write your name on any part of this questionnaire.

1. How many biology teachers does your school have? []
2. Do they attend the SMASSE INSETS? []
3. Is there one who has attended all the cycles offered so far? Yes [] No []
4. What is his/her teaching experience? Please tick one.
0 – 3 years [] 4 – 7 years []
8 – 11 years [] 12 years and over []
5. Has SMASSE helped them in improving their teaching methods of biology as far as they comment? Yes [] No []
6. Has there been an improvement in the results after he/she went through the SMASSE project? Yes [] No []
7. Do you give support to them as far as SMASSE attendance and implementation of the program is concerned? Yes [] No []
8. How do you assess the effectiveness of the SMASSE inset after teachers attend them? Briefly comment

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

9. The SMASSE project emphasizes on the use of ASEI/PDSI in teaching and learning of science in general and biology in particular. Assess the practice of the same by your biology teacher(s).

.....
.....

10. Comment on resources in your biology/science laboratory before and after the start of the SMASSE project

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

11. What in your opinion do teachers of biology do whenever they do not have a certain device that is required in teaching a topic/subtopic? Please tick the answers(s) that best suits.

- a. They teach theoretically []
- b. They overlook the topic/subtopic []
- c. They postpone it until I get the equipment []
- d. They improvise on the locally available materials. []

12. In the table below, indicate the extent to which you agree or disagree with the statements provided. Use the following scale while responding.

SA-Strongly Agree **A** – Agree **D**- Disagree **SD** – Strongly Disagree

Impact of SMASSE on Biology performance	SA	A	D	SD
Teachers who have attended SMASSE record better performance in Biology for their students				
In general, SMASSE has led to improved performance in Biology				
Teaching methods in Biology has improved due to teachers' attendance of SMASSE				
SMASSE has improved the overall school performance				
The number of students pursuing further studies in Biology related courses has increased due to SMASSE				
Preference of Biology by students	SA	A	D	SD
Since inception of SMASSE, students' preference of Biology has improved				
Despite the SMASSE project, most students in the school still prefer other science subjects not Biology				
SMASSE has helped improve students' attitude towards Biology				
Though SMASSE teachers have been able to show students that Biology is not as difficult as earlier thought				
More still needs to be done to improve students' preference of Biology				
Adoption of ASEI/PDSI skills	SA	A	D	SD
SMASSE attendance has promoted use of student-centered teaching methods in Biology lessons				
SMASSE attendance has improved how teachers conduct experiments in Biology				
Teachers of Biology are able to use ASEI skills during lessons due to attendance of SMASSE				
Teachers of Biology are able to use PDSI skills during lessons due to attendance of SMASSE				
Teachers of Biology are able to improvise teaching				

aids due to attendance of SMASSE				
School support for SMASSE	SA	A	D	SD
The school administration sponsors science and maths teachers for SMASSE training				
The school provides all needed resources to enable Biology teachers implement SMASSE concepts				
Even after attending SMASSE training, the conditions in the school do not support implementation of SMASSE concepts				
The school administration shows commitment to improved performance in Biology				
The school administration has not given adequate support to promote Biology teaching in the school				

13. Comment on the results of biology before and after the SMASSE project.

.....

.....

.....

14. What would you say about the attitude of the biology students now?

.....

.....

.....

.....

15. Briefly comment on what you believe needs to be done to improve the performance of biology in your school specifically and Kenya in general.

.....

.....

.....

.....

Thank you very much for your co-operation.

Appendix Four: Letter of Introduction

Peter Migwi

P.O. Box 880,

Thika.

Dear Respondent,

RE: QUESTIONNAIRE

I am a post graduate student in the School of Education at Kenyatta University, Department of Educational Management, Policy and Curriculum Studies. I am required to undertake a research study whose title is 'The impact of SMASSE project on teaching and learning of Biology in Gatanga District, Murang'a County, Kenya'.

This letter is aimed at requesting you to truthfully fill the attached questionnaire. The data you provide will enable the researcher to assess the impact of SMASSE project on teaching and learning of Biology in secondary schools in Gatanga. I would also like to assure you that any information given will be treated with utmost confidentiality and used for academic purpose only.

Your assistance is highly appreciated.

Thank you.

Yours sincerely,

Peter Migwi

Appendix Five: Research Permit

REPUBLIC OF KENYA



NATIONAL COUNCIL FOR SCIENCE AND TECHNOLOGY

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

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

Our Ref: NCST/RRI/12/1/SS-011/1469/4

Date:
21st October, 2011

Peter Wachira Migwi
Kenyatta University
P. O. Box 43844
NAIROBI

RE: RESEARCH AUTHORIZATION

Following your application for authority to carry out research on "*The impact of SMASSE project on teaching & learning of Biology in Gatanga district, Murangá County, Kenya*" I am pleased to inform you that you have been authorized to undertake research in Gatanga District for a period ending 31st December 2011.

You are advised to report to the District Commissioner & the District Education Officer, Gatanga District before embarking on the research project.

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

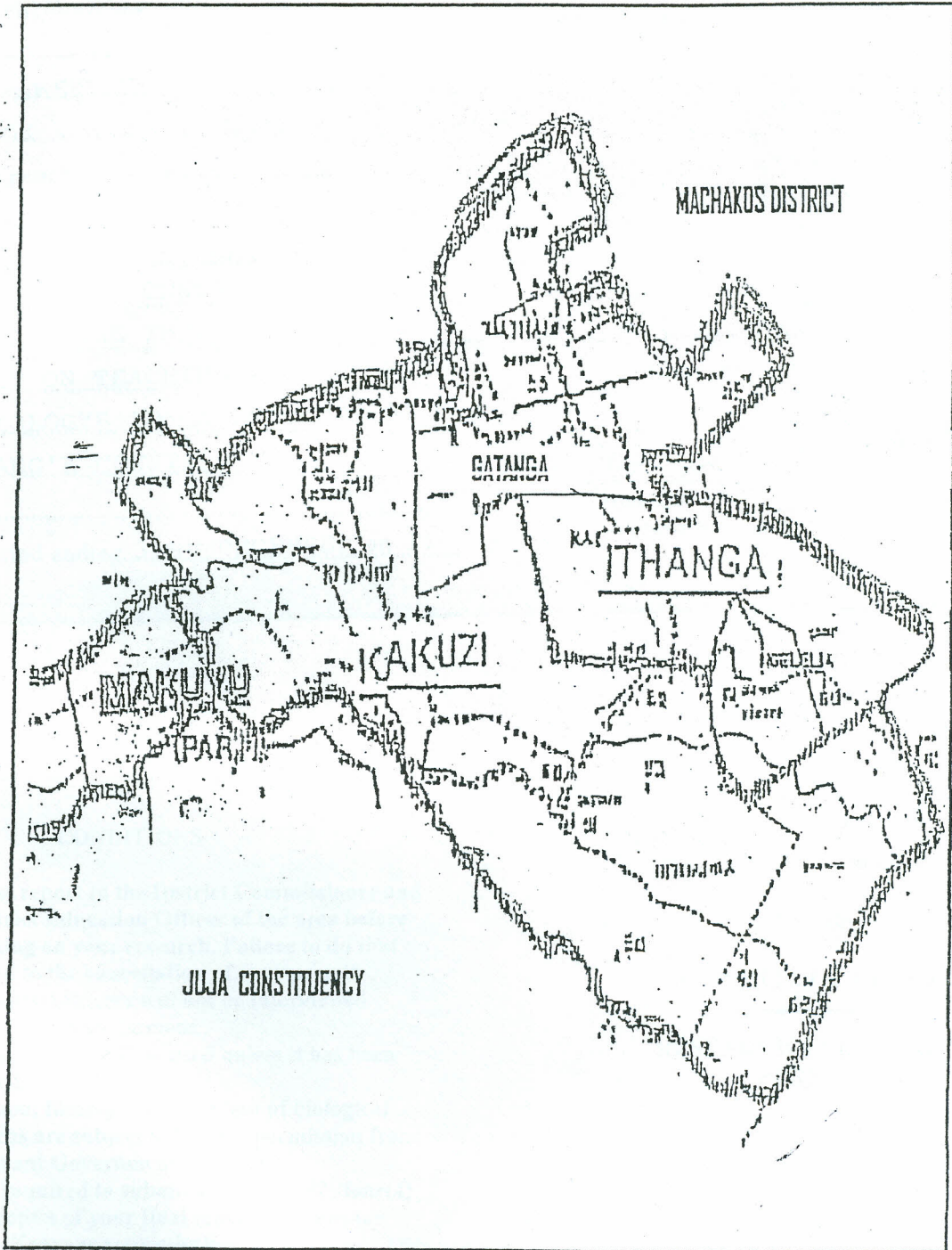
A handwritten signature in black ink, appearing to read 'P. N. Nyakundi'.

P. N. NYAKUNDI
FOR: SECRETARY/CEO.

Copy to:
The District Commissioner
Gatanga District

The District Education Officer
Gatanga District

Appendix Six: Sketch Map showing Gatanga District



THIS IS TO CERTIFY THAT:

Prof./Dr./Mr./Mrs./Miss... PETER WACHIRA

MIGWI

of (Address) KENYATTA UNIVERSITY

P.O. BOX 43844, NAIROBI

has been permitted to conduct research in

Location,

GATANGA District,

CENTRAL Province,

on the topic THE IMPACT OF SMASSE

PROJECT ON TEACHING AND LEARNING

OF BIOLOGY IN GATANGA DISTRICT,

MURANG'A COUNTY, KENYA

for a period ending 31st DECEMBER 2011

Research Permit No. NCST/RRI/12/1/SS011

Date of issue 21st OCTOBER 2011

Fee received KSHS. 1000



[Signature]
Applicant's
Signature

[Signature]
Secretary
National Council for
Science and Technology

CONDITIONS

1. You must report to the District Commissioner and the District 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)/four(4) bound copies of your final report for Kenyans and non-Kenyans respectively.
6. The Government of Kenya reserves the right to modify the conditions of this permit including its cancellation without notice



REPUBLIC OF KENYA

RESEARCH CLEARANCE
PERMIT

KENYATTA UNIVERSITY LIBRARY