

**EFFECTS OF SMASSE INSET ON STUDENTS' ATTITUDE, TEACHING
APPROACHES AND PERFORMANCE IN BIOLOGY IN
SECONDARY SCHOOLS IN BOMET DISTRICT**

BY

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ABSTRACT

Performance in Biology KCSE has remained consistently low over the years. The purpose of the study was to investigate whether SMASSE INSET has effects on students' attitude, teaching approaches and performance in Biology. The theoretical Framework was based on Lewin theory of planned change (1947) which focuses on unfreezing, moving and refreezing stages of implementing change successfully. The study was conducted in Bomet district. The respondents were selected from the form three students. A sample of 360 students, 24 science HOD, 24 Biology SMASSE teachers and 24 public secondary schools were selected using both stratified and simple random sampling. The study adopted descriptive survey design. Data were collected using questionnaires and analyzed using both descriptive and inferential statistics. For descriptive statistics, frequency tables, percentages and means of respondents' scores were used while chi-square and analysis of variance (ANOVA) were employed to establish relationships and test the hypotheses. The study established that both students' attitude and teaching approaches have significantly improved as a result of SMASSE INSET. The study also found out that performance in Biology KCSE has improved in Bomet district. The study revealed that performance in Biology has been below average (50%) for the last six years in Bomet district. To sustain SMASSE project, school administrators should regularly supervise teachers on the implementation of ASEI- PDSI approach. Teacher training programme should be revised to meet the emerging teaching approaches.

DEDICATION

To my beloved wife, Merceline and our wonderful children, Glaudia Dorothy, Frank Laban, Cris Caleb and Nack Noeline, thanks for your support and encouragements.

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LIST OF ABBREVIATIONS

ANOVA	Analysis of Variance
ASEI	Activity Students Experiment and Improvisation
DPC	District Planning Committee
G.O.K	Government of Kenya
HOD	Head of Department
INSET	In-Service Education and Training
KCSE	Kenya Certificate of Secondary Education
KNEC	Kenya National Examination Council
MOE	Ministry of Education
PDSI	Planning, Doing, Seeing and Improving
QASOS	Quality Assurance and Standard Officers
SMASSE WECSA	Strengthening of Mathematics and Science in Secondary Education in Western Central and Southern Africa
SMASSE	Strengthening of Mathematics and Science in Secondary Education

CHAPTER ONE

INTRODUCTION TO THE STUDY

1.0 OVERVIEW

This chapter presents an overview of the study. It examines the background information to the study, the statement of the problem, the purpose and the objectives of the study, the research questions, the research hypotheses and the assumptions of the study. It also presents the significance, the scope and limitation of the study, the theoretical framework and the operational definition of terms.

1.1 Background to the study

SMASSE project (1998) found out that student overall performance in science subjects has been consistently poor over the years. It was argued that one way of addressing the difficulties students experience in the science classrooms is through appropriate teaching interventions that can be realized through professional development of science teachers, hence the birth of SMASSE project in 1998.

It was hoped that the start of a professional development programs for science teachers will equip teachers with appropriate teaching skills and instructional strategies that are necessary to effectively implement science curricula in schools.

The government of Kenya with the assistance from the government of Japan through Japanese International co-operation Agency (JAICA), began the program of strengthening the teaching and learning of mathematics and science education in public

Secondary schools through a pilot project known as “strengthening mathematics and science in secondary Education (SMASSE)”.

The SMASSE project was implemented in July 1998 and was run up to July 2003 as Phase one. The project was based on a cascade system.

This means that four senior teachers in each subject (mathematics, physics, chemistry and biology) were selected from the 9 pilot districts in 5 pilot provinces through interviews and trained at the national level. Those trained at the national level were to train their colleagues at the district level in their respective areas, a system called cascade system (SMASSE PROJECT, 1998).

The outcomes of the 5 years SMASSE project (1998 to 2003) were to be used in seeing possibility of starting all year round national in- service teacher’s education course for science and mathematic teachers by the end of the project period in July 2003. SMASSE project phase II was implemented since July 2003 as a five year project to cover the whole country.

SMASSE project (1998) targeted teachers because they spend more time with students and their attitude impacts negatively on students.

The negative attitude among students is manifested in untidy, incomplete homework, frequent absenteeism, lack of attention in class, poor performance and low enrolment in optional science subjects (Wambui, 2006).

The change of education oriented curriculum to practical oriented curriculum requires in- service training if the new curriculum is to be effectively and efficiently implemented.

INSET would therefore provide the necessary forum where the policy makers and teachers would share experiences and deliberate on matters pertaining to curriculum objectives, content, sequencing and modalities of implementation (Kamunge Report, 1988).

The Gachathi report also known as the report on the National education objectives and policies (1976), Lay emphasis on improving science and mathematics teaching in the secondary school curriculum. The persistent state of low performance in Biology KCSE examination is a major concern to parents, government and other stakeholders in education. In order to address this situation change has to occur in the classroom. SMASSE project (1998) was therefore conceived as an intervention measure to upgrade the capability of young Kenyans in science and mathematics. It is an initiative aimed at strengthening mathematics and science in secondary education through institutionalization and regularization of in-service training of serving teachers.

A baseline survey was carried out in 1998 to identify the root causes of poor performance in science and mathematics in KCSE examinations.

The main problem areas that the project identified were as follows: Poor attitude of the learners, inappropriate teaching approaches, poor content mastery by the teachers, poor utilization and mobilization of teaching and learning resources.

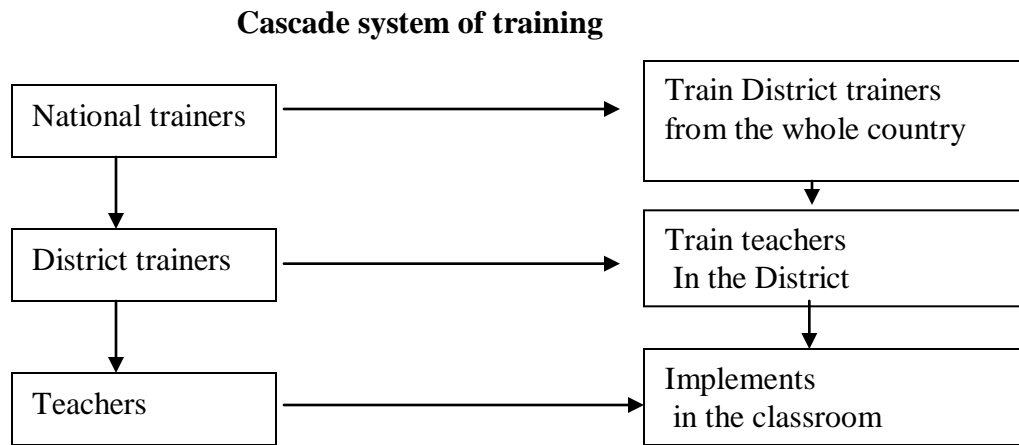
SMASSE Project was formulated to address the persistent low performance in mathematics and sciences (biology, chemistry and physics) in secondary schools.

The project introduced a planned change called ASEI movement and PDSI approach to change the approaches of teaching and learning of students towards science through SMASSE INSET.

Upon the end of SMASSE phase 1 (pilot) in June 2003, phase II was launched in 2004 to cover the whole country. The SMASSE INSET was organized into four cycles of ten days each with the following objectives:

- Cycle 1: Targets attitude change of teachers
- Cycle 2: Targets ASEI and hands- on activities with emphasis on bridging Practical activities to theory
- Cycle 3: Targets actualization and practice in the classroom
- Cycle 4: targets students growth and impact it transfers

The project operated through cascade system as illustrated below.



The SMASSE project emphasis ASEI and PDSI approach to teaching and learning. The ASEI- PDSI is concerned with the shift from chalk and talk to students' activity oriented teaching with the focus on meaningful activities.

The PDSI approach targets the teachers and emphasis on early preparation of the lesson, ensuring that the lesson is conducted effectively and making the necessary improvement during or after the lesson.

The SMASSE INSET activities intended to achieve the institutionalization of in-service training (INSET) for capacity building with the aim of changing the teachers teaching approaches along with the prudent use of school resources and improvisation. This was the key to unlocking the full potential of the learner as it lies in the expertise teacher. (SMASSE Project, 1998).

Education minister Sam Onger (2008) said that the government shall hold teachers accountable for their schools performance. He further said;

“With the decentralization of resources down to school management committee, there is no reason why teachers should not be gauged, our children are being placed in the hands of people who are paid, pensionable, they must derive education and knowledge from those given that responsibility”.

The performance of students in science subjects and mathematics as compared to other subjects in national examinations is still wanting. The table 1.1 shows the national performance of students in KCSE examinations.

Table 1.1 The National performances of candidates in KCSE examinations in 2007 and 2008.

SUBJECT NAME	2007 MEAN PERCENTAGE (%)	2008 MEAN PERCENTAGE
English	39.70	33.79
Kiswahili	45.76	37.27
Mathematics	15.74	21.30
Biology	41.95	30.32
Physics	41.32	36.71
Chemistry	25.38	22.74

SOURCE; KNEC report (2007-2008)

The science subjects and mathematics are generally poorly performed as compared to other core subjects in national KCSE examinations in 2007 and 2008. The performance in the science subjects i.e Biology, Physics and Chemistry further dropped in 2008.

Table 1.2 The National performance of Candidates in Biology KCSE examination from the year 2002 to 2008

Year	Candidates	Percentage means score (%)
2002	177,251	36.24
2003	184,438	41.11
2004	200,797	49.07
2005	234,975	41.59
2006	217,675	54.89
2007	246,662	41.95
2008	270,000	30.32

SOURCE; KNEC report (2002-2008)

From the data in the table 1.2, it is evidenced that the national performance of students in biology KCSE is still low in the whole country.

1.2 Statement of the Problem

The low performance of candidates in biology KCSE in the whole country prompted the researcher to find out whether the SMASSE project innovation of teaching and learning approach, ASEI- PDSI, is being applied by teachers in the classroom.

It was expected that teachers would acquire knowledge and skills during the INSET that would translate into quality teaching approaches, changing students' attitude toward learning and improving student's performance in biology KCSE examinations.

The researcher therefore based the study in Bomet district to find out the current state of students' attitude towards the learning of biology, state of performance and whether

the teachers are using the ASEI-PDSI teaching approach introduced during SMASSE INSET. Bomet district was chosen because it has two SMASSE INSET Centers for training the teachers, therefore teachers would access information easily.

1.3 Purpose of the Study

The purpose of the study was to investigate the effects of SMASSE INSET on the students' attitude teaching approaches and performance of students in biology KCSE in public secondary schools in Bomet district.

The specific objectives which guided the study were:

- (i) To find out whether SMASSE INSET changed students' attitudes towards the learning of biology.
- (ii) To find out whether SMASSE INSET has any effect on the teachers' teaching approaches in biology.
- (iii) To determine whether SMASSE INSET has any effect on the performance of students in biology KCSE examinations.

1.4 Research Questions

The study attempts to answer the following subsidiary research questions:

- 1 How has SMASSE INSET influence students' attitude towards the learning of biology in Bomet district?
- 2 How has SMASSE INSET influence teachers' teaching approach in biology in Bomet district?
- 3 How has SMASSE INSET influence the performance of students in biology KCSE examinations in Bomet district?

1.5 Research Hypothesis

The following research hypothesis as derived from the research questions and stated in their null form were tested using one way Analysis of variance (ANOVA) at alpha, 0.05 level of significance;

HO₁: There is no significance relationship between SMASSE INSET and students' attitude towards the teaching of biology.

HO₂: There is no significant relationship between SMASSE INSET and teachers' teaching approaches in biology

HO₃: There is no significant difference in performance of students before and after the introduction of SMASSE INSET in biology KCSE examinations.

1.6 Assumptions of the Study

The following assumptions were made during the study:

1. The schools selected had qualified teachers who have attended the SMASSE INSET.
2. The selected schools had done biology KCSE examinations prior to the introduction of SMASSE INSET.

1.7 Significance of the Study

The findings of this study are useful in the following ways:

1. The study would benefit DPC and the National SMASSE officials in assessing cycle 4 objectives on students' growth and the impact SMASSE INSET.
2. The Findings of the study would assist the school administrators and QASOS in doing follow up of SMASSE INSET.

1.8 Justification of the study

The study was done to establish whether the SMASSE INSET objectives translated into outcomes. The SMASSE INSET has been going on for the last six years in Kenyan secondary schools. The research findings would assist the DPC, QUASO and the school administrators in strengthening the SMASSE training of teachers in the district

1.9 Scope of the Study

The study was conducted in public secondary schools of Bomet district from September to November 2008. The content of the study was to determine the effects of SMASSE INSET on the teaching, learning and performance of students in biology.

1. The KCSE Examinations was done in October and November, 2008 during the period of collecting data. Some head teachers were not allowing visitors to talk to students. The researcher had to use the MOE letters of permit and authorization to be allowed to conduct the research.
2. Since the study was carried out between September and November 2008, the effects of heavy rain hindered accessibility to schools as most of the roads were muddy. However, the researcher had to use four-wheeled vehicle in some cases.

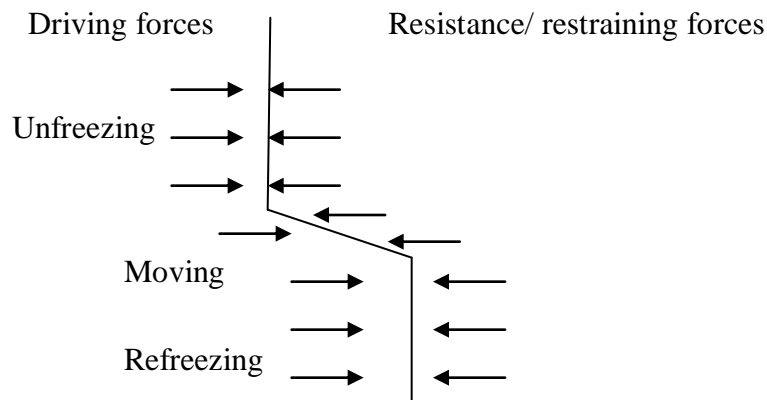
1.10 Theoretical Framework

The study was based on the theory of planned change as advanced by Kurt Lewin (1947).

The theory focuses on managing change successfully through three stages: Unfreezing, moving and refreezing. The unfreezing recognizes the need for change that is desirable as well as necessary. Once the motivation is created, people will accept the change. The second stage is moving, the person undergoes cognitive reconstruction. The person needs information and evidence to show that the change is desirable and possible. Once relevant information are there to explain why new behaviour is required, people will develop new behaviour, values, attitudes and participation.

The third stage is refreezing where the individuals settles for a new dynamic equilibrium or new behaviour stabilization.

Lewin three-stage model of planned change



Source: Allan D. (2002, P. 285) managing change successfully. Great Britain Thomson TJ international.

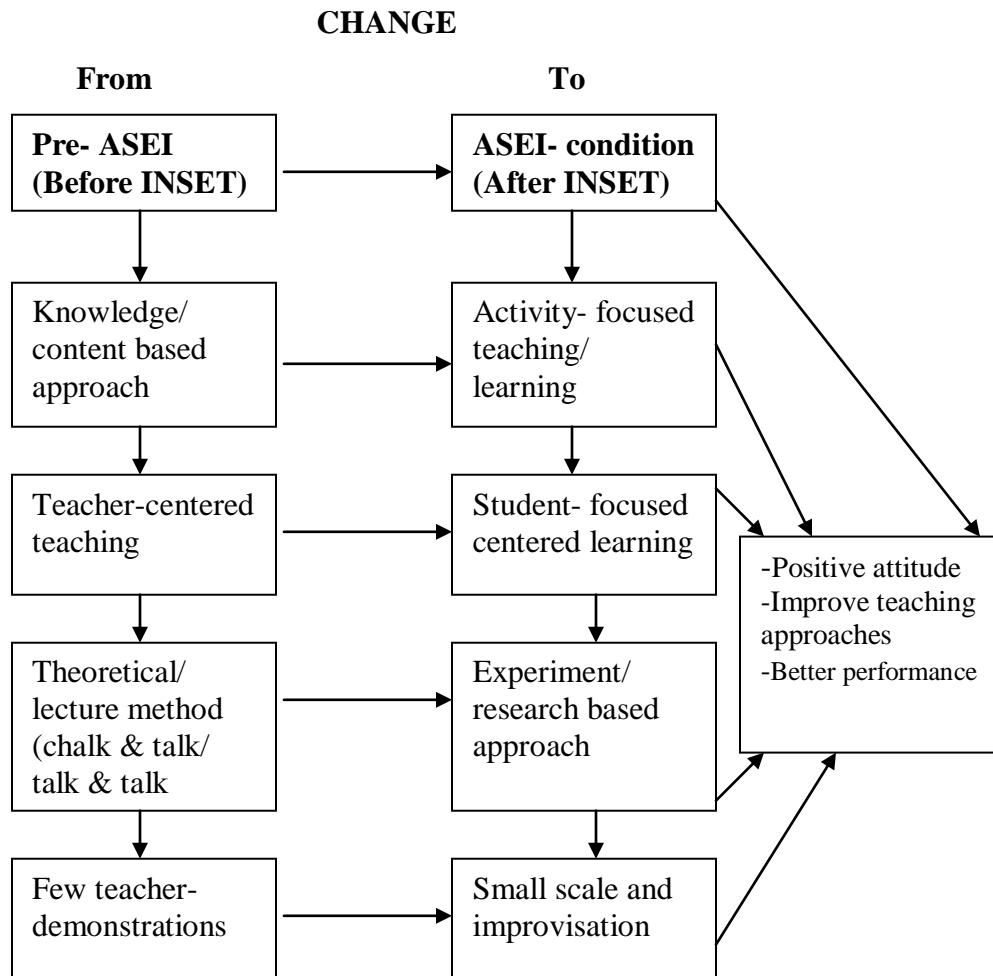
The theory guided the researcher in explaining whether SMASSE project was successful in changing the teachers' old ways of teaching in the classroom and its effects on the learning and performance of students in biology.

SMASSE INSET aim was to change or unfreeze the old ways of teaching and learning which were characterized by pre- ASEI conditions: teacher- centered teaching, inadequate preparation, negative attitude, theoretical teaching, full scale experiments and poor performance.

The unfreezing stage requires teachers to be aware that change is needed, creating knowledge and skills to make changes and that change will make a difference. This stage will help the researcher in establishing whether SMASSE INSET made a difference among teachers in their teaching approaches and academic performance of students in biology national examinations. This is because teachers were provided opportunities during INSET to benefit from mistakes and learn from others through discussion.

Conceptual Framework

The conceptual Framework is provided to illustrate what teachers were to unfreeze and adopt. SMASSE INSET provided teachers with information aim at changing their old ways of teaching. The students were expected to change from negative to positive attitude hence improving their performance.



Source: Researcher’s designed conceptual framework.

At the moving stage, teachers were expected to shift from the previous teaching approaches to the new teaching and learning approaches called ASEI conditions

characterized by student-centered learning, activity based lessons, positive attitude, adequate teacher preparation, improvisation and small scale experiment.

According to Lewin theory, the most crucial stage of managing change successfully is the refreezing or sustaining the new change. Teachers should be motivated to stabilize the implementation of ASEI and PDSI approach to teaching and learning of students with a view of obtaining better and consistent performance in biology examinations.

The school administrators and QASOS are expected to ensure that teachers change features of their teaching instead of modifying them to fit their pre- existing approaches which may assimilates individual changes and swallows them up thus student's learning fail.

The refreezing stage of this theory will guide the researcher to establish whether the new change, ASEI- PDSI approach is being implemented in the classroom during the teaching and learning of biology.

On the other hand the theory will guide the researcher in finding out the involvement of the school administrators in helping teachers to sustain the dynamic equilibrium of change so that they don't revert back to the old habits of teaching and learning of biology in classroom.

1.11 Definition of Key Terms

The following are definition of some key terms used in the study;

Attitude: An individual opinions or feelings shown by behaviour or reaction towards learning or teaching.

Behavior An individual's observable response in a given situation with respect to a given target.

District INSET Centre: An institution which has been chosen as a centre for in-servicing of science and Mathematics teachers at the district level.

Effect: A positive or negative change which occurred as a result of SMASSE in- service education and training of teachers.

Learning: Acquisition of learning skills and attitude towards a subject that may result in better performance.

National INSET Centre: It is the headquarters of the SMASSE project in Kenya. It is called CEMASTEIA (Centre for Mathematics, Science and technology Education in Africa).

Performance: Status of students with respect to acquired skills and knowledge as measured by KCSE examinations.

School category: refers to a school with Boys only (BS), Girls only (GS) or both boys and girls (MS)

Secondary School: An institution of learning that offers four years of formal schooling preceding university education.

CHAPTER TWO

LITERATURE REVIEW

2.0 Introduction

Basing on the objectives of the study, this chapter has reviewed general and specific literature on attitude, teacher education, in-service and training of employees, change and management of change in an educational organization, teaching approaches in education, teaching and learning of science in secondary schools, the SMASSE project and critical literature.

2.1 Teacher education programme

Teacher education is an integral component of education. It involves the preparation of properly certified and selected individuals for teaching profession. Generally, this programme of education is designed and administered to produce a cadre of competent teachers to serve a prescribed system of education (Bogonko, 1992).

The introduction of graduate teacher education programme in Anglophone countries in Africa may be traced to recommendations by a commission of post-school certificate and higher Education in Nigeria, otherwise known as Ashby Commission. This commission presented its report in 1960 which proposed the introduction of an undergraduate degree in education in all Nigeria Universities (Karugu, 2007)

In 1978, the University of Nairobi appointed a committee chaired by J.K. Koinange to review the B.Ed programme.

Among its terms of reference was to examine existing concerns on the inadequacy of the preparation of B.Ed. graduate in terms of Academic subject content, and the perceived lack of professionalism.

Among other findings, the committee established that on completion of their course, the B.Ed graduate lacked knowledge of Secondary School subject matter. It attributed this to the lack of adequate study of the secondary school curriculum during the B.Ed programmes. The committee also noted that there was inadequate coordination between subject methods and secondary school courses which prepare student for KCSE examination in Kenya (University of Nairobi, 1979).

Kochhar (1992) affirms that it is a significant effort to make teacher education programme scientific, effective and meaningful. Teacher Education curriculum has remained narrow and rigid in nature and scope (Kafu, 1996), it emphasizes the training rather than preparation of teachers. There has been no attempt to make it responsive to the emerging trends in the society in general and education in particular (Jacinta, 1995). Consequently, it has continued to produce conservative/ traditional school teachers who are preserved to change, less creative and innovative, and unable to manage modern and non- instructional situations. Consequently, the new teacher education curriculum should be designed to address the new demands of the society and those of teaching profession. That is, the new curriculum should produce a pragmatic and creative teacher.

This requires that curriculum be broadened to include preparation of teachers in fields that have not been traditionally considered as the mainstream of teacher education programme (Lao, 2000).

There are many deficiencies in teacher education programme that were recognized and have to be appropriately addressed if the right quality of teachers is to be produced to serve the needs of the present millennium (Kiptoon, 1996). He recognized this situation and made suggestions that should be revisited. The critical suggestion is that the state should train or rather prepare teachers adequately. The issue of providing adequate time for both the academic and professional preparation of B.Ed graduates has been a recurring one in the debate about restructuring fly curriculum for B.Ed degree (Koech Report, 2000). The content of the secondary school curriculum be studied in the B.Ed programme.

2.2 In-service, and Training of employees

According to Bishop (1986) there is a dilemma inherent in an attempt to increase teacher effectiveness as there are factors that contribute to teacher effectiveness such as:

1. Overcoming the reluctance to change
 - lack of awareness that change is needed
 - lack of knowledge that change will make a difference
2. Support for improvement efforts
 - Providing opportunities to benefit from mistakes
 - Providing opportunities to learn from others
 - Treating teachers as individuals.

On the other hand, school administrators continue to struggle to find ways of helping teachers to become aware understand and apply knowledge and skills in the teaching and learning process. To change the status-quo and sustain it is not an easy task.

It needs a concerted effort on the part of the school administrator and those responsible for teacher education and management.

The overall aim of the managers is to bring about the required changes (most often in a planned way) by creating situations and circumstances whereby desired changes could occur and be sustained. This involves taking action as individuals or groups to alter existing practices. Managers during the change process need to plan and think about change. The managers should optimize the achievement of results through monitoring and responding to the actual against planned activities (Allan, 2002).

Several writers on management have emphasized the need for training of employees in any organization. Sagimo (2002) says of training;

“Training is a continuing process right from the initial induction at entry, through education and training in specific skills, to the security of maximum effectiveness in managerial and senior administrative position”.

From the foregoing statement, Sagimo stresses the need for training of employees at all levels.

Koontz (1984) states that training on job must be based on the needs analysis derived from a comparison of actual performance and behavior with required performance and behavior. On this he emphasizes that training on job should be for the purpose of filling into the gap between actual and expected performance.

Emphasizing the need for training employees, Eraut M. (1995:615) notes;

“Ensuring an adequate supply of appropriately trained and prepared people for all positions in the system and maximizing the potential of all current personnel is a major concern of human resource development (HRD)”.

He further states that enhancing peoples’ experience and developing the expertise to meet future demands should be the goal of any forward looking organization.

A study by Omoro (2001) revealed that teachers’ desire to participate in all staff development programmes is more than the actual participation. The Report of the National Committee on Educational Objectives and policies (Republic of Kenya 1976:108) suggested that improvement of the quality of the teacher is possible through training and retraining.

Omoro (2001) recognized retraining as the most desirable way to improve the teacher. To address the dynamism of education, Shaw (1992) suggests that staff development should be a continuous process in education system.

The initial training of secondary school teachers in Kenya is inadequate. This was revealed in the Report of the working Party on Education and training for the next Decade and beyond (Republic of Kenya, 1988) which observed that the three year training period did not provide adequate time for the coverage of degree subject context and foundation courses in education and pedagogy.

Although the years of training of graduate teachers have increased from 3 years to 4 years, the additional year is meant to address content that would have been learnt at the advanced level of education in the previous system of education. On this, the report suggests that staff development programmes are necessary to address the deficiency in the initial training of secondary school teachers.

The International Conference of Education Recommendation Number 66 (UNESCO , 1975) says that:

“Continuous education should be an integral part of the teachers’ education process and should therefore be arranged on a regular basis for all categories of the education personnel. Procedures should be as flexible as possible and adaptable to and in line with the teachers’ individual needs and to the special features of each region”

There is need to incorporate experiences from the practicing teacher in the teacher training institution this is necessary to reduce the gap between what is in practice and the theory in the teacher training institutions and colleges. In South Africa, when the curriculum research and development project known as Science through Application Project (STAP), with emphasis on student –Centered activities and collaborative group work was introduced, it was unanimously applauded by teachers as stimulating and useful project.

The STAP materials embody an approach that is markedly different from that generally adopted in South African schools. From the South African case, it was noted that the context within which teachers work can influence to a high degree how they can manage change.

This can be the physical condition of classroom, the enrolment, the functioning of the school, the actions of fellow teachers and responses of the students.

Commenting on mathematics and science teachers in-service training in Philippines, Frazer-Abder (2003) says

“Professional and Curriculum design are relegated to external agents instead of local practitioners. This is problematic in two regards. First, it does not recognize the knowledge Filipino educators themselves bring to science education and second it risks decontextualizing science teaching and learning”.

In her comments, the need for considering the input of teachers who are agents for change and implementers of an innovation is emphasized.

Frazer-Abder goes further to state that the history of science teacher’s professional development in the Philippines resembles teachers training world wide, wherein teachers are assumed to be consumers of knowledge. The history and experience of teachers are not seen as relevant to their practice.

Improvement of the quality of science and Mathematics teachers in Philippines started way back in 1960’s with the introduction of Science Teaching Centre which was later renamed the institute for science and Mathematics (Fraser-Abder, 2003).

2.3 Change and management of change

Most managers and consultants agree that deciding why changes need to be made and what needs to be changed are not the worrying problems.

The most worrying problem lies in the consistent implementation of the change because implementation is a process that spreads out overtime.

Even when there are visible signs that change are occurring there is still a long delay before one can ascertain whether the changes are resulting in the anticipated efficiency (Allan, 2002)

The managers who initiate or plan changes are rarely those whose jobs are affected by the changes. The power and authority involved in their roles allow them a fairly free hand in giving direction and determining how change should be implemented. It is because of this differentiation of roles (the changer and the changee) that many difficulties arise in implementing change. Those who are in a position to let changes pass them by or who have the power to manipulate the changes to enhance and protect their interests are less worried by change (Bishop, 1986).

The difficulties surface among those who have something to lose but little power and control over what they lose or what they give. This is made worse when they do not understand the reasons for the change and are not in the plans for change. Such circumstances lead to a climate of uncertainty and low self-esteem, resistance to change and low commitment. The effects of both the teacher and principal leadership are mediated by the same school and classroom conditions, but that the leadership of the teacher has a direct effect on student outcomes.

They further said that the number of times a teacher interacts with students are more than those of the principal hence the teacher has more influence on the teaching and learning of students (Leithwood and Jantic ,2000).

2.4 Teaching Approaches in Education

At the university of Georgia, shows in her research that' school science is often taught as a decontextualized narrative that fails to take into account the experiences, skills, values and life worlds of students. In developing countries like Kenya there have been debates on the relevance of education to the communities' science and technology (Deborah, 2003)

There have been frequent changes in the curricula and the perpetual changes in methodology and approaches in teaching (KIE, 2002).

In addition, developments in science education have seen various pedagogical strategies being used. These include didactic, expository discovery, process or constructivist, Heuristic, Empiricist and inquiry approach (Frazer-Abder, 2003).

In the early days, teaching of science was didactic, i.e. lecture method. Students were given rigidly formulated statements, which they had to memorize and regurgitate when required to do so by the teachers. Little or no emphasis was placed on understanding; learners were simply made to cram concepts. It was believed that the human brain is a blank store where knowledge can be pumped and stored. The method used to teach science differed very little from that used to teach history, geography or classical studies (telling).

Expository approach involves the kind of teaching that is characterized by predominance of teacher talk with little or no involvement of students in practical activities. It is a teacher-centered approach.

The teacher gives facts, explains concepts, and gives illustrations. Anything that needs to be taught practically is done through teacher demonstration. Student participation is limited to listening, answering and asking questions and writing notes as the lesson progresses. This approach is not considered very effective in the teaching of science.

However, it is alleged that there are some topics in science that can only be approached satisfactorily by exposition because by their very nature, they are difficult to teach practically.

Empiricist approach emphasizes the need to acquire scientific knowledge through observations. Laws were reached by induction. The learner was now given an opportunity to at least handle apparatus and make observations thus developing interest and manipulative skills.

At the turn of 20th century the Heuristic approach of teaching believed that learners could be trained to discover scientific ideas by using faculties of observation, reasoning and memory. Learners were involved in observation, recording, analyzing data and drawing conclusions on their own. This was a better approach since it involved real enquiry, which would lead to understanding of the theory. However, this approach tends to consume more time, hence delay in syllabus coverage.

The inquiry or discovery approach is a student-centered approach with a high degree of involvement of all who participate. It is systematic in that a set of activities is used, yet highly flexible in that the sequence of the activities can be changed and others can be substituted at any time.

The teacher involves students in activities that help in the development of scientific skills such as the ability to make observations, perform experiments, collect data, make deductions and present results towards the late 1950s, science education in Britain was undergoing dramatic change. There were the Nuffield science projects, which encouraged pupils to carry out experiments, which would bring about better understanding of scientific concepts.

The philosophy that followed this approach was obtained from the Chinese proverb that says "I hear and I forget, I see and I remember, I do and I understand". The learners would carry out experiments then create concepts at first hand in the laboratory, as a means of awakening original thought. With passage of time, it was realized that despite the many practical activities, many of the learners still faced problems understanding science, hence the slogan "I do and I am even more confused."

The teacher's role is to guide students by clarifying instructions where necessary and being available to answer any questions that may arise in the course of the activities.

The constructive approach takes cognizance of the fact that by the time a learner enters formal education he/she has already interacted with the environment and has developed ideas and concepts in relation to what he has experienced. As a child grows up, it continuously encounters new horizons in terms of knowledge gained, which require explanations either from its parents, family members, or peers. The entire encounter is digested and stored in its memory and becomes knowledge.

The learnt knowledge may not necessarily be scientifically correct, but the child accepts it as the truth. Learning therefore, should be built on the learner's practical experience while at the same time correcting any misconceptions or learner's alternative frameworks.

According to Piaget, an individual interprets reality via intellectual structures characterized by acting schemes that change as one grows. An individual therefore tries to attain a state of cognitive equilibrium by frequently altering his/her intellectual structures to make it consistent with the new experience. The role of the teacher is to provide guidance by giving students challenges that will help to correct their misconceptions and enable them to draw correct scientific concepts.

2.5 Teaching and Learning of Science in Secondary Schools

The common practice in our schools today is that science teaching is not integrated. The Science teaching is divided into theory and practical parts as indicated by the double lesson per week. The theory follows a didactic type of pedagogical instruction whereas the practical is taught to confirm the theory (K.I.E syllabus, 2002).

Research has indicated that most teachers tend to resort to the old ways of teaching even after being exposed to the new methods of instruction due to the influence of the methodologies used during their initial training (Langat, 2008).

The science teacher needs to be pro-active in seeking solutions to the problems that stand in the way of effective teaching and learning of science. The teacher must try to create and sustain interest in science by involving students in the lesson.

This can only be done through the application of appropriate teaching methods. The guiding principle should be activity focused and Student-centered, with experimentation and improvisation forming the core of the teaching/learning process (SMASSE Project, 1998).

Recent curriculum studies make it clear that young children, even at the elementary school level are capable of doing simple scientific work (Kamunge report, 1988).

SMASSE Project (1998) revealed that science classes at all levels have consisted of lecture and little discussion as well as of separate laboratory period once or perhaps twice each week. In all schools, a double period is available for laboratory work. Teachers normally use a text book as the central point of focus for their courses. A supplementary manual or workbook or worksheet used in conjunction with the laboratory manual may be more or less related to the textbook and lectures. The text and teachers assume the roles of authorities and dispensers of information. The laboratory commonly is a place where students prove the theories proposed by the teacher and textbook. Work book or work sheet exercises are mainly concerned with vocabulary drill rather than with scientific process.

2.6 Attitudes towards the teaching and learning of science

Attitudes are ways of thinking or feeling about something or somebody usually reflected in person's behavior. They are descriptions of a person's readiness to respond in a certain way to some stimulus. Attitudes are acquired through experiences in our environment and learned in much the same way as skills and habits.

Attitudes largely determine what students learn and their willingness to learn. Negative attitude can powerfully inhibit intellect and curiosity and keep us from learning what is well within our power to understand (Lingeron ,1980)

According to Fishbein and Azjen (1975) attitude is a general feeling of favor or otherwise towards some stimulus. One of the factors that affect our output when carrying out a task is our attitude towards that task or towards the people with whom we carry out the task. A positive disposition will enable one to "push" on with the task despite advance situations. One of the issues that were found to contribute to the low ability of students in science in secondary education is the negative attitude towards the teaching profession by the teachers themselves and towards the students that they teach.(SMASSE Project, 1998).

SMASSE Project (1998) show that there was a general feeling among some teachers, students and key stakeholders that Science is difficult subjects. This feeling is even greater in girls than boys. There are various reasons that have led to this feeling:

- 1) Poor performance during national examinations. Students consider it a waste of time to concentrate on subjects they will not pass.

This idea is supported by studies done by two psychologists Birch and Veroff: 'Anticipation of positive outcome enhances the tendency to action while anticipation of negative outcomes blocks or inhibits the action.'

- 2) Too much theoretical teaching of Mathematics and Science. This has made the subjects appear too abstract and boring.

- 3) Job market - the job market has not been very promising for some years. This has discouraged students from taking up subjects that appear more challenging, especially when they see their own brothers and sisters go without job for years.
- 4) Teachers contribute in instilling the negative attitude in students. They expect some students to pass and others to fail and show it openly. This is especially so in mixed schools where teachers expect boys to perform better in Sciences than girls.
- 5) Socio-cultural attitudes - traditionally, difficult tasks have been seen as male domain. Girls were associated with lighter household chores. This has led many girls to give up in any subjects viewed as more challenging at the very beginning.

A research on the Mathematics and science teachers' perception and expectations of SMASSE INSET found out that teachers welfare during the training is not catered for and recommended that all stakeholders should be included in designing, organizing and running of the teachers in-service training for them to have positive attitude on the implementation (Wabwile, 2007).

2.7 Review of literature related to SMASSE project

2.7.1 The 8.4.4. System of Education

The design and continuous review of curriculum content is the responsibility of the Kenya Institute of Education (KIE). Ndirangu (2004) notes that teachers play an important role in the interpretation and implementation of the curriculum. They are responsible for structuring learning experiences for the learners.

The transformation of Kenya's educational system from 7.4.2.3. (7 years in primary, 4 years of secondary, 2 years of advanced secondary and a minimum of 3 years of university education) to 8.4.4.

Was one of the major educational changes in Kenya. The system was introduced in Kenya following the recommendation of the Gachathi Report (Republic of Kenya, 1976) and the Mackay Commission (Republic of Kenya, 1981).

The 8.4.4. System of education was implemented despite experts sending signals that the financial and human resources necessary to implement the change were lacking (Olembo, 1985). It was evident that the transitional arrangements for the implementation of the 8.4.4. Systems were flawed. Fullan(1993) suggests that the preparation and the initial stages of change management process are the most crucial factors to successful change (Republic of Kenya, 1999).

2.7.2 SMASSE Project Innovation: ASEI movement and the PDSI approach

The acronym ASEI/PDSI stands for Activity, Student-centered, Experiments and Improvisation / Plan, Do, See and Improve. Recent studies in science education indicate that school science teaching should by far be learner centered. The teacher's role should be that of a facilitator, guide, counselor, motivator, innovator and researcher. As such, it is recommended that there must be as many activities during any one lesson as possible. These must be student-centered activities, involving many improvisations in the experiments (Wambui, 2006).

This kind of improvisation will help in demystifying the sciences. As well as helping the learner appreciate the ever-present science in the environment. In the ASEI lessons, a bridge is created to enable learners to relate and integrate practical activities with theoretical knowledge. The movement advocates a shift from teacher's centered approaches to student's centered approaches. The ASEI movement emphasizes teaching the student and not the subject. It emphasizes on teaching for understanding by actively engaging the learners in the construction of knowledge (SMASSE INSET Cycle 1, 2004).

The ASEI movement strength's lies in meaningful learning only in an environment where students are actively engaged with sequencing of activities necessary for the acquisition of skills and knowledge. It recognizes the power of improvisation in which the teacher identifies and selects teaching / learning materials from the local environment.

The activities can be hands- on (Psychomotor/ manipulative skills on minds- on (cognitive/ intellectual thinking/ reasoning) Hearts- on (effective aspects/ those that strike up the learners interests/ feelings about the subject) and mouths- on (communicative skills/ discussions). These activities are meant to increase the participation and understanding of skills and knowledge by students.

Planning, doing, seeing and improving (PDSI) is a vehicle that carries the ASEI movement. It involves:

- (i) **Planning-** where teachers are to take more time to reflect on the most appropriate activities that will enhance effective learning using the available resources
- (ii) **Doing-** which is shared between the teacher and the learners where the teacher's role is facilitation and not dispenser of knowledge
- (iii) **Seeing-** where the teacher includes a feedback mechanisms in their lessons and teaching functions. Lesson evaluation is seen as the key to the improvement of lesson delivery.
- (iv) **Improvement** should be done by incorporating information obtained from feedback during and after the lessons. This is a continuous activity which ensures that the teacher's confidence and skills are improved and as the instructional programs are enriched.

2.7.3 SMASSE Project Impact Assessment Survey Results (SPIASR) (2004, September).

It was undertaken nationwide to assess the impact of the INSET. The aim was to find out how SMASSE activities are practiced in the classroom and how they translate into achievement.

It was conducted in form two classes of selected schools, teachers taking the classes in sciences subject and mathematics and the principals of the schools (Wambui, 2006).

The following observations on the teachers and the learners were made after being exposed to the INSET;

Impact on teachers; Teachers plan better and more consistently, they attend to students needs more regularly, they are more open to team work. Teachers are more confident to

carry out practical activities and experiments previously thought to be difficult, they try out new methods, they can face the challenges arising from lack of resources and can face the challenge of large classes better.

Impact on students: Students are actively involved in class work, they show great interest and responsiveness, they attend lessons more punctually and promptly, they ask questions in and out of class, they do their assignment more neatly and promptly, they carry out discussion beyond class time, their curiosity is aroused and sustained as they relate biology to their real life experiences, there is team work and individual participation of the students is allowed and their attitudes towards science subjects gradually become positive.

SMASSE project expected that attitude would be positive for teachers and students. Teachers are expected to practice more effective teaching methodologies and develop efficient teaching and learning materials. The reform would improve administration and management of schools in the long run as the students become active in the learning process.

Curriculum and pedagogical changes in biology depend on teachers becoming the agents of change rather than the targets.

The quality of teaching has an impact on students learning. Thus substantial resources need to be invested in the professional development of teachers.

Research has found that teachers when asked to change features of their teaching often modify the features to fit their pre- existing system instead of changing the system itself. The system assimilates individual changes and swallows them up.

When this happens anticipated improvements in student's learning fail and everyone wonders why (Stigler, 1999)

2.8 Critical Review of the Literature

The literature review has revealed that there is need to review teacher education programme so as to remain relevant and responsive to the needs of the changing world.

The teacher education programme curriculum has to be revised and include courses that address some of the emerging needs of modern secondary school teachers and the changing trends in education.

The success of any educational change depends on management of the change process. Initially, some members may be reluctant to change, but such reluctance can be overcome by encouraging communication through teams that are able to solve problems.

Fullan (1993) points out that change process can be chaotic yet if well planned the process of change management can be smooth resulting in increased efficiency and effectiveness of educational organization.

The literature contends that changes in education have not been effective enough because of a variety of factors, the major one being that stakeholders are neither fully

informed nor involved in formulating and initiating change. The introduction of the 8.4.4. system of education and the SMASSE project demonstrates that the most challenges facing educational innovations emanate from lack of effective planning and implementation. Educational managers ought to learn, overcome and cope with the barriers that are naturally inherent in the complex process of change (Fullan & Miles, 1992).

CHAPTER THREE

RESEARCH DESIGN AND METHODOLOGY

3.0 Introduction

This chapter presents procedures that were followed in carrying out the study. It presents research design, study area, study populations, sample and sampling procedures, study variables, research instruments, validity and reliability of the research instruments and analysis techniques.

3.1 The Study Area

The study was carried out in Bomet District of Rift Valley province. Bomet is bordered by four districts; Narok South, Transmara, Sotik and Bureti). Bomet district has two SMASSE INSET centres, one at Tenwek high and the other at Moi Girls Siongiroi. The area is accessible and relevant to the objectives of the study.

3.2 Research Design

The study adopted a descriptive survey design. According to Gay (1981) descriptive research is a process of collecting data in order to test hypothesis or to answer questions concerning the current status of the subject in the study.

Borge and Gall (1989) state that descriptive survey designs are used in preliminary and exploratory studies to allow researchers to gather information, summarize, present and interpret for the purpose of clarification. The survey research is useful because of the economy of taking a sample of the population to generalize results for the whole population.

Descriptive survey design was employed because it guarantees breadth of information and accurate descriptive analysis of characteristics of a sample which can be used to make inferences about population (Kerlinger, 1973).

Orodho(2002) said that descriptive survey is a method of collecting information by interviewing or administering a questionnaire to a sample of individuals. It can be used when collecting information about peoples' attitudes, opinions, habits or any of the variety of education or social issues (Kombo and Tromp, 2001).

3.3 The Study Population

Bomet district has 72 public secondary schools with form three students' population of 4500, 48 Biology SMASSE trained teachers and 72 HOD sciences in the district. There are 6 boys, 6 girls and 60 mixed secondary schools in Bomet district (MOE, 2008).

3.4 Sample and Sampling Procedures

Orodho and Kombo(2002) define sampling as a procedure for obtaining a sample which researcher uses to gather people, places or things to study. According to Webster (1985) a sample is finite part of a statistical population where properties are studied to gain information about the whole.

The subjects of the study were drawn from form 3 students and their response to items in the questionnaire was used in finding out students' attitudes towards the learning and teaching approaches in biology.

The choice of the form 3 students was based on the assumption that they have a longer experience in learning biology after introduction of SMASSE INSET. The form 4 students were exempted because they were preparing for the KCSE Examinations. The Biology KCSE performance was gauged using KCSE performance before SMASSE (2002-2004) and after introduction of SMASSE INSET (2005-2007). The KCSE performance normally follows a similar trend every year.

A sample of 360 students was selected from Boys' schools (BS), Girls' schools (GS) and Mixed schools (MS). The sample size was arrived at by using a generalized scientific guideline for sample size decision by Krejcie and Morgan (1970). Out of 360 questionnaires, 16 students did not fill the entire questionnaire and their questionnaires were ignored (Kombo and Tromp, 2006).

Therefore 344 respondents were finally used in the analysis and interpretation of data. Stratified sampling procedure was used to categorize schools into BB; GB & MS while random sampling was used to select 2 BS, 2 GS and 20 MS Schools from the strata.

An average of 9 students per stream was randomly selected from the sample schools. From Sample schools there were 12- single, 8- double and 4- triple- stream schools giving a total of 40 streams.

A sample of 24 public secondary schools, 24 heads of science department and 24 biology SMASSE teachers were selected to participate in the study. A biology

SMASSE teacher in every sampled school was selected using simple random sampling technique.

Stratified sampling was done to ensure that there is an adequate representation of the different categories of schools which otherwise would have been omitted entirely by other sampling methods because of their small numbers in the population (Mugenda & Mugenda , 2003). Random sampling technique was used because it ensures that all the components of a population have equal probability of being included (Mugenda, 1999).

The independent variable in this study was SMASSE INSET while the dependent variables were teaching approaches, students' attitudes and performance in biology KCSE examinations. Variables are attributes or qualities of the cases that are measurable and vary in their scores. Independent variables refer to the cause or predictor while dependent variable is the outcome or effect (Kombo & Tromp, 2006).

3.5 Research Instruments

According to Mugenda (1999) research instruments are the means by which primary data is collected. The study being a descriptive survey would make use of the instruments that apply to social sciences. The study in particular used questionnaires. Document analysis was used to compliment and enhance the questionnaires in the study.

The following instruments and techniques were used in the study to collect data:

- (i) Students' Questionnaire (SQ)

- (ii) Teacher's questionnaire (TQ)
- (iii) HOD Science Questionnaire

The above instruments were used to supplement each other and to give a deeper and wider exploration into research perspective.

3.5.1 Questionnaires (SQ)

Mugenda (1999) says that a questionnaire is commonly used to obtain important information about the population. Tuchman (1978) defines a questionnaire as ways of getting data about persons by asking them rather than watch their behavior.

A questionnaire is a research tool whereby the respondent gives the responses to the questions asked through written mode.

Closed-ended questions which are accompanied by a list of all possible alternatives from which the respondents select the answer that best describes their situation were used. The questionnaire sought to obtain data on student's attitudes towards learning, teaching approaches and performance in biology.

3.5.2 Students' Questionnaire (SQ)

The questionnaire sought opinions on the students' attitudes toward learning of biology and gauges the teachers on their teaching approaches in biology. The questionnaire was administered by the researcher to students of the sampled schools.

3.5.3 Teacher's Questionnaires (TQ)

Teacher's questionnaire sought information on teaching experiences, in- service course attended during the SMASSE INSET and experiences gained after attending SMASSE INSET. The questionnaire was administered by the researcher to biology SMASSE teachers of the sampled schools.

3.5.4 HOD Science Questionnaire

The HOD science questionnaire in the study sought information on the performance of students in biology at KCSE examination from the year 2002 to 2007. The records of KCSE performance in the sample schools were made available by the head of science department.

3.6 Validity of the Research Instruments

Validity is the degree to which the results obtained from the analysis of data actually represent the phenomenon under study. Validity has to do with how accurately the data obtained in the study represent the variables of the study. (Mugenda, 1999).

According to Nachmis (1992) validity is concerned with whether one is measuring what he intends to measure. The researcher gave the experts in the EMPS department who provided proposals on how to improve the questionnaire.

3.7 Reliability of the Research Instruments

Mugenda (1999) defines reliability as a measure of the degree to which a research instrument yields consistent results after repeated trials. Reliability is the extent to

which data collection procedures and research tools are consistent and accurate (Seliger and Shohamy, 1989).

The split-half reliability coefficients (r) were determined during piloting phase where three schools from each stratum of BS, GS, MS that did not take part in the main study were selected for piloting. This pre-testing of the results of the research on a small sample of respondents was a preparatory exercise to find out if there was any weakness so that it could be corrected before the main research was carried.

The reliability coefficient (r) for students' questionnaire was 0.77 while for the teachers' was 0.82. A positive coefficient, $r > 0.5$ is strong and the research instruments are deemed reliable (Koul,1984) The advantage of half- split technique is that it eliminates chance error resulting from differing test conditions as in the case of test-retest technique (Langridge, 2004).

3.8 Data Collection and Analysis

Kombo and Tromp (2006) define data collection as gathering of specific information to prove or refute some facts. The data collected were analyzed using both descriptive and inferential statistical techniques. Frequencies, percentages and means of the respondents were employed for the descriptive statistics. The chi-square was used to analyze relationship of SMASSE INSET and school categories while one way analysis of variance (ANOVA) were employed for inferential statistics to test the hypotheses. The Significance was tested by computing F ratio at a significance or alpha level of 0.05.

3.9 Summary

In this chapter the procedures of collecting and analyzing data have been presented. Research instruments were important tools for carrying out the research. There was a need to scrutinize their validity and reliability before carrying out the actual research. The researcher had to carefully formulate items in the questionnaires and based the analysis on their measurement scales.

The research design, methodology and sampling procedures were appropriately used in this study; hence generalization of results can be made on the whole population.

CHAPTER FOUR

DATA ANALYSIS, PRESENTATION AND INTERPRETATION.

4.0 Introduction

This chapter presents data, analysis, presentation, discussion and interpretation of results, based on student's attitude, teachers, teaching approaches and performance of students in biology KCSE before and after the introduction of SMASSE INSET.

4.1 Students' attitude

The students' attitude towards the teaching and learning of biology before the introduction of SMASSE INSET was negative. This was attributed to the poor teaching approaches of the teachers. The introduction of new teaching approach called ASEI PDSI was meant to change students' attitude from negative to positive (SMASSE project baseline survey, 1998).

The table 4.1 shows the analysis of students' attitude towards the learning of biology after the introduction of SMASSE INSET in the year 2004.

Table 4.1 Student's overall analysis of attitude towards the learning of Biology

Item	Statement	N	Sum	Mean \bar{X}
3	Biology is very interesting to me	344	1596.00	4.6395
4	I have not got chance to do practical in Biology	344	859.00	2.4971
5	Biology questions are challenging and difficult	344	988.00	2.8721
6	I don't have adequate knowledge of biology to enable me pass the exams	344	725.00	2.1076
7	Biology lessons have helped me to learn values that are useful in life	344	1619.00	4.7064
8	Students who study biology get good grades	344	1447.00	4.2064
	Total	344	7,234	$\bar{X} =$ 3.8381

There were 6 items that were testing students' attitude towards the learning of biology.

The grand mean of all the items is 3.8381.

The results reveals high mean for the following items; Biology is very interesting to students, Students get chance to do practical, biology lessons have helped students to learn values of life and students who study biology get good grades.

However other items have low mean i.e. students have not got chance to do practical in biology, biology questions are challenging and difficult and students have adequate knowledge of biology to pass KCSE.

The study reveals that majority of the students have positive perception of the teaching and learning of biology. They now believe that if they study biology they can get good grades and acquire values that are useful in life.

The grand mean of the attitude is a high positive value (3.8381) which shows that students have improved their attitude towards the learning of biology. The students currently find biology enjoyable and interesting. This can be attributed to the positive attitude teachers acquired during the SMASSE INSET. The teachers must have translated hands-on activities they were exposed to in the SMASSE INSET to students.

Despite the improvement of students' attitude towards the learning of biology there were some students who did not get chance to do practicals in biology. This may be due to large number of students in class and inadequate teaching and learning resources in the school. The students still find biology questions challenging and difficult. This could be due to inadequate practical to improve student understanding.

4.1.2 Attitude of students and school category

The researcher collected data in Boys schools, girls' schools and mixed schools to find out of the attitude of students towards the teaching and learning of biology.

The table 4.2 shows the analysis of student attitude towards the learning of biology in boys' schools, girls' schools and mixed schools.

Table 4.2 Analysis of students' attitude towards the learning of biology by School category

Item	Statement	Means of boys school \bar{X}_1	Means of girls school \bar{X}_2	Means of mixed school \bar{X}_3
3	Biology is very interesting	4.4727	4.8868	4.6229
4	I have not got chance to do practicals in biology	2.1818	1.6038	2.7712
5	Biology questions are challenging and difficult	2.8727	2.6226	2.9280
6	I don't have adequate knowledge to pass biology exams	2.1091	1.7170	2.1949
7	Biology lessons have helped me to learn values of life	4.7636	4.6604	4.7034
8	Students who study biology get good grades	4.1455	4.2455	4.2119
		$\bar{X}_1 =$ 3.2970	$\bar{X}_2 =$ 3.2894	$\bar{X}_3 =$ 3.5721

There is a high mean in the attitude of students in the three categories of schools in the average of the following items, biology is currently interesting to students (4.6395), biology lessons have helped students to learn values of life (4.7064) and students who study biology get good grades (4.2067).

However, students in boy's schools are not given more chance like those in Girls schools as their mean in attitude is lower. Biology questions are challenging and difficult among the students in the three categories of schools. The students don't have adequate knowledge to pass biology examinations in all the school categories as revealed by low mean in their attitude. The results show that there is more attention given to students in Girls schools than both boys and mixed schools. The grand means in attitudes of students in both Girls and boys' school are generally lower than those in mixed schools.

The participation of students in mixed schools in practical is the lowest (92.5029) students' attitude. The grand means of student's attitude for mixed schools is the highest (3.5721) with the girls' schools grand mean being the least (3.2894).

The mean in attitude for the three categories of schools is generally high. It suggests that SMASSE INSET has greatly improved the attitude of all the students towards the learning of biology. The students in Girls schools get more chance to do practical than those in both boys and mixed schools, implying that girls are more engaged in biology activities. The students in mixed schools have low participation and could be attributed to inadequate learning resources and teachers.

The research revealed that students in the three categories of schools find biology question challenging and difficult. This could be attributed to lack of practice in biology question. Teachers may not be giving or marking assignments.

The grand mean for mixed schools on attitude is the highest because teachers would have improvised resources from the immediate environment. Mixed schools lack conventional teaching and learning resources so teachers could have improvised which made the students to enjoy the teaching during the lesson. SMASSE INSET emphasized hands- on activities hence teachers in mixed schools could have applied more than those in both girls and Boys schools.

4.1.3 Hypothesis testing of attitude of students towards the learning of Biology

The research hypothesis (H_{O1}) on attitude to be tested was; there is no significant relationship between SMASSE INSET and students' attitude towards the learning of biology by school category.

The means of school categories were subjected to one- way analysis of variance (ANOVA) to establish whether there is statistical difference in means among the three categories of schools.

Table 4.3 Analysis of variance (ANOVA) of students' attitude towards the learning of Biology.

	Sum of squares	df	Mean squares	F	Sig.
Between groups	0.295	2	0.147	0.506	0.365
Within groups	7.025	341	0.572		
Total	7.678	343			

When the differences in means of students' attitude in the three categories of schools were subjected to ANOVA and the p- values of 0.365 was obtained. The P- value which is calculated value is greater than the expected value of 0.05. Since the calculated ANOVA p- value of 0.365 is greater than 0.05 the differences in the means of attitudes of students in the three categories of school is not statistically significant. The null hypothesis H_{01} is therefore rejected.

4.1.4 Chi- Square tests of relationship between attitude of students towards the learning of biology and school category

The Chi- Square tests were carried out using statistical packages for social sciences (SPSS) to establish the relationship between the attitude of students towards the learning of biology and the school categories.

The table 4.4 shows analysis of chi- Square tests to establish whether there is relationship between the students' attitude towards the learning of biology and the school category.

Table 4.4 Analysis of chi- square tests of relationship between school category and attitude of students towards the learning of biology

Item	Statement	X ²	df	Sig.	Remarks	S or NS
3	Biology is very interesting	28.384	8	0.000	P< 0.05	S
4	I have not got chance to do practical in biology	59.663	8	0.000	P<0.05	S
5	Biology questions are challenging and difficult	5.895	8	0.659	P> 0.05	NS
6	I don't have adequate knowledge to pass biology exams	13.694	8	0.090	P>0.05	NS
7	Biology lessons have helped me to learn values of life	5.424	8	0.711	P>0.05	NS
8	Students who study biology get good grades	2.470	8	0.963	P>0.05	NS

There are three items out of six that are significant i.e. items 3, 4, and 8. The significant value obtained for these three items are less than the expected value 0.05.

From the research findings there is significant relationship between SMASSE INSET and student's attitude towards the learning of biology. As the students find biology very interesting The null hypothesis, H_{01} : was therefore rejected.

4.2 Teachers' teaching approaches

SMASSE project (1998) initiated a new teaching approach called ASEI-PDSI where teachers were expected to adopt and implement it in 2004 country wide. The students were used in the study to assess their teachers and teaching approaches during their biology lesson. The students were given questionnaires so as obtain information on whether the teachers have implemented the new teaching approaches in the classroom.

The results of the students' responses were analyzed using SPSS and the results are as shown in the table 4.5 .

Table 4.5 Students overall analysis of responses to teachers teaching Approaches in biology

item	Statement	N	Sum	Mean \bar{X}
9	Our biology teacher starts a lesson by reviewing the previous lesson	344	1368.00	3.9767
10	Our biology teacher gives us practical/ activities to do	344	1314.00	3.8198
11	Our biology teachers use locally available materials to teach us biology	344	1425.00	4.1424
12	Our biology teacher uses prepared notes to teach us	344	1367.00	3.9738
13	Our biology teacher guides us during practical lessons	344	1394.00	4.0523
14	Our biology teacher allow us to present activities in class	344	1294.00	3.7616
15	Our biology teacher summarizes what she or he has taught at the end of the lesson	344	1389.00	4.0378
16	Our biology teacher marks our assignments	344	1238.00	3.5988
17	Our biology teacher does not give us chance to ask questions	344	650.00	1.8895
18	Our biology teacher give us assignments	344	1509.00	4.3866
19	Our biology teacher like and enjoy teaching the subject	344	1498.00	4.3547
20	Our biology teacher takes us for a field study	344	1240.00	3.6047
				$\bar{X} =$ 3.7495

Key \bar{X} = grand mean (mean of means)

The student's responses in the majority of the items indicated high means (3.7495), there are 4 items out of 20 that were rated lower than the others.

The results shows that teachers give students practical activities (3.8195), review the previous lesson and majority use prepared notes teach student. The student reveals that majority of the review previous lessons, improvise, design activities prepare for the lesson, guides students and allow them to present the practical activities in class. This implies that teachers have moved from teacher- centeredness to student-centeredness (ASEI conditions). When students are allowed to present in class their findings, they get opportunity to share their experiences and correct misconceptions that exist in subject. The review of the previous lesson was meant to create interest among learners and link the current lesson topic to the past knowledge. This is an indication that teachers have implemented ASEI- PDSI approach to teaching in biology.

4.2.1 Analysis of students responses to teaching approaches in biology by school category

This analysis was done to find out whether the implementation of SMASSE project of ASEI- PDSI approach to teaching was done uniformly in all the three categories of schools.

The data were subjected to analysis and the results were as shown in the table 4.6.

Table 4.6: Analysis of students' response to teachers' teaching approaches in biology and school category

item	Statement	Means of Boys schools (X ₁)	Means of Girls schools (X ₂)	Means of mixed schools (X ₃)
9	Our biology teacher starts a lesson by reviewing the previous lesson	3.8182	4.0000	4.0085
10	Our biology teacher gives us practical/ activities to do	4.2909	4.1321	3.6398
11	Our biology teachers uses locally available materials to teach us biology	4.0000	4.3019	4.1398
12	Our biology teacher uses prepared notes to teach us instead of textbook alone	3.6909	4.4151	3.9407
13	Our biology teacher guides us during practical lessons	4.1818	4.4717	3.9280
14	Our biology teacher summarizes what she or he has taught at the end of the lesson	3.6364	4.1887	3.6949
15	Our biology allow us to present in class activities.	3.9091	3.8491	4.1102
16	Our biology teacher marks our assignments	3.8727	3.8113	3.4873
17	Our biology teacher does not give us chance to ask questions	2.0727	1.8113	1.8644
18	Our biology teacher give us assignments	4.2545	4.6415	4.3602
19	Our biology teacher like and enjoy teaching the subject	4.4727	4.6038	4.2712
20	Our biology teacher takes us for a field study	3.8364	4.3585	3.3812
		<u><u>X₁</u></u> =3.8364	<u><u>X₂</u></u> =4.0189	<u><u>X₃</u></u> =3.4788

Key: grand mean (mean of means)

X₁, X₂, X₃

The items on teaching approaches were rated high in the three categories of schools i.e. boys (3.8364) Girls (4.0189) and mixed schools (3.4788). Students in mixed schools rated their teachers the lowest in most of the items (items 10, 13, 16, 19, 20); the students in the three categories of schools agreed that most teachers mark assignments, summarizes the lesson, uses prepared notes, and improvises teaching learning materials.

However, the rating of the implementation of the new teaching approach ASEI- PDSI was the highest in Girls Schools while that of mixed schools was the lowest. This could be due to inadequate teaching and learning resources in mixed schools.

The research reveals that some teachers don't mark students' assignments whereas assignments form the basis of feedback and doing remedial work for slow learners. The ASEI- PDSI advocates that each lesson should have an assignment. Most teachers review the previous lesson so as to create interest among the learners and linked the past knowledge to the current lesson topic. Students in mixed schools rated their teachers lowest because of inadequate practical activities they are being given. The high students rating of their teachers imply that teachers are practicing ASEI approach in teaching students biology.

4.2.2 Hypothesis testing of teachers' teaching approaches in Biology by school category

The research hypothesis to be tested was H_{O2} ; there is no significant differences in means relationship between SMASSE INSET and teachers teaching approaches in biology.

The one way analysis of variance (ANOVA) was used to establish whether the differences in means for the three categories of schools were statistically significant.

The results are presented in table 4.7.

Table 4.7: Analysis of variance (ANOVA) of students' responses to teachers teaching approaches in the classroom per school Category

	Sum of squares	df	Mean square	F	Sig.
Between groups	1.649	42	0.825	0.441	0.644
Within groups	638.165	341	1.871		
Total	639.814	343			

The results gave p- value (0.644) which is greater than 0.05 i.e $P > 0.05$.

Since the P- value is > 0.05 the differences in the means of the responses on the teaching approaches in the three categories of schools are not statistically significant. The null hypothesis was therefore not accepted. It implies that there is difference between SMASSE INSET and teachers teaching approaches in biology in the three categories of schools.

This suggests that SMASSE INSET has improved the teachers teaching approaches in all the three categories of schools. SMASSE INSET provided skills and knowledge to teachers for improving the quality of teaching in Biology. The study reveals that teachers apply the skills and approaches acquired among SMASSE INSET in the teaching of students.

4.2.3: Chi- square tests of relationship between students' responses on the teaching approaches and the school categories

The chi - square test of relationship was done to establish whether the students' responses to the teaching approaches in the three categories of school were uniform.

The students responses on the teaching approaches were subjected to chi- square tests and the results are as shown in the table 4.8.

Table 4.8: Analysis of chi- square tests of relationship between School category and students responses to teachers teaching approaches in biology

item	Statement	X ² -value	df	sig	Remarks	S or NS
9	Our biology teacher starts a lesson by reviewing the previous lesson		8	0.017	P<0.05	S
10	Our biology teacher gives us practical/ activities to do		8	0.001	P<0.05	S
11	Our biology teachers uses locally available materials to teach us biology		8	0.303	P>0.05	NS
12	Our biology teacher uses prepared notes to teach us instead of textbook alone		8	0.105	P>0.05	NS
13	Our biology teacher guides us during practical lessons		8	0.275	P>0.05	NS
14	Our biology teacher allow us to present activities in class		8	0.098	P>0.05	NS
15	Our biology teacher summarizes what she or he has taught at the end of the lesson		8	0.145	P>0.05	NS
16	Our biology teacher marks our assignments		8	0.087	P>0.05	NS
17	Our biology teacher does not give us chance to ask questions		8	0.646	P>0.05	NS
18	Our biology teacher give us assignments		8	0.556	P>0.05	NS
19	Our biology teacher like and enjoy teaching the subject		8	0.219	P>0.05	NS
20	Our biology teacher takes us for a field study		8	0.002	P<0.05	S

S- Significant NS- Not significant

There were only 3 items (9, 10, 20) which were statistically significant i.e. $P < 0.05$. The rest of the 9 items were not significant, $P > 0.05$, for the test items.

There is a significant relationship between SMASSE INSET and the teachers teaching approaches in Biology. The students in the three categories of schools rated their teachers in a similar way that teachers use the same approaches of teaching

4.3 Students performance in biology KCSE Examination in the sample schools

The objective of the study was to find out the students' performance in biology KCSE examinations before and after the introduction of SMASSE INSET. The years, 2002 to 2004, refer to before SMASSE while 2005 to 2007 refer to years after introduction of SMASSE INSET.

The results are presented in table 4.9.

Table 4.9: Performance of students in Biology KCSE examination analysis for sampled schools

Year	Candidates	Mean index (max. 12.00)	Percentage mean index (%)
2002	1008	4.0342	33.6
2003	1089	4.2308	35.3
2004	1130	5.0275	41.3
2005	1231	4.9817	41.9
2006	1070	4.1171	41.5
2007	1117	6.0532	54.3

The analysis of performance shows that the performance has been increasing steadily from the year 2002 to 2004. However, the performance dropped slightly in the years 2005 and 2006. The performance in 2007 was the highest. The performance of students in biology reveals that students have been scoring below average (50%) except in the year 2007.

The performance of students in Biology KCSE has not been steady. However there is slight improvement of the performance after the introduction of SMASSE INSET. The students had developed positive attitude towards the learning and teachers employed the new teaching approach (ASEI -PDSI) after undergoing the INSET.

4.3.1 Analysis of biology KCSE performance for the sample schools by school category

The researcher collected data from the three categories of schools i.e. BS, GS and MS to establish the current performance of students in Biology KCSE before and after the introduction of SMASSE INSET.

The results are presented in table 4.10.

Table 4.10: Analysis of biology KCSE performance for the sample schools as per school category

Year	School category	N	Mean \bar{X}
2002	Boys schools	2	4.6950
	Girls schools	2	5.4000
	Mixed school	20	3.8315
2003	Boys schools	2	4.8550
	Girls schools	2	6.4400
	Mixed school	20	3.8315
2004	Boys schools	2	5.4000
	Girls schools	2	7.7450
	Mixed school	20	4.7185
2005	Boys schools	2	6.1650
	Girls schools	2	6.440
	Mixed school	20	4.3940
2006	Boys schools	2	4.7500
	Girls schools	2	6.3750
	Mixed school	20	3.8280
2007	Boys schools	2	5.8150
	Girls schools	2	6.9600
	Mixed school	20	5.3845

The performance in all the three school categories was rising from 2002 to 2004 and began to drop from 2005 to 2006 but improved in 2007.

The performance of students in biology KCSE has been the highest in girls' schools and the lowest in mixed schools.

Students in girls' schools have been performing above average in all the years except 2002. It was only in 2005 when students in boys' schools attained performance that was above average. Students in mixed schools have never got performance which is above average.

The performance shows general improvement in the mean scores in all the school categories after SMASSE INSET was introduced in 2004. The mean score performance of boys schools before SMASSE INSET (2002 to 2004) is 4.9833 while the mean score after introduction of SMASSE INSET (2005 to 2007) is 5.1660. Students in girls' schools had a mean of 6.5283 before the introduction of SMASSE INSET and 6.6133 after SMASSE INSET was introduced in the District. Mixed schools had a mean of 4.308 before SMASSE INSET and 4.7242 after the introduction of SMASSE INSET. The grand means before and after introduction of SMASSE INSET in all the school categories were 4.4308 and 5.1684 respectively.

This shows that the introduction of SMASSE INSET improved the performance in biology KCSE examinations in the three categories of Schools.

4.3.2: Hypothesis testing of performance of students in Biology KCSE by school

Category

The hypothesis to tests (H_{O3}), there is no relationship between SMASSE INSET and the performance of students in Biology KCSE after and before SMASSE INSET

The data was subjected to One- way analysis of variance to establish whether the hypothesis (H_{O3}) is significant and the results are presented in table 4.11.

Table 4.11: Analysis of variance (ANOVA) test of biology KCSE Results before and after SMASSE INSET

	Sum of Squares	Squares df	Mean squares	F	Sig. 2 tailed
Between groups	32.442	2	16.225	16.635	0.000
Within groups	82.086	69	9.190		
Total	114.528	71			

The calculated P value (0.000) is less than 0.05 i.e. $P < 0.05$

Since the P- value (0.000) is less than 0.05, the differences in performance are significant. The null hypothesis, H_{O3} was therefore rejected. This shows that there is significant difference between the performance of students in biology KCSE before and after the introduction of SMASSE INSET.

The research finding revealed that the performance of students in biology KCSE has been on the rise as from the year 2005. The performance in biology KCSE in Bomet District before and after the introduction of SMASSE INSET shows a great significant difference. SMASSE INSET has translated into an improved performance in biology KCSE.

However, the study revealed that the national performance in biology KCSE over the past six years in Bomet district have been below average (50%). The study revealed that the school administrators don't supervise the implementation of ASEI-PDSI regularly.

4.4 Teachers characteristics and experiences on SMASSE INSET

The study was carried out to obtain feedback from biology SMASSE teachers through questionnaire on the effect of SMASSE INSET on the teaching approaches and students' attitude towards biology.

The results are presented in table 4.12.

Table 4.12: Analysis of teachers' characteristics and experiences on SMASSE INSET.

Item	Statement	Attribute	Frequency (N)	Percentage
1.	Classes teacher taught	4 classes	14	58.3
		4 classes	5	20.8
		2 classes	1	4.8
		1 class	4	4.2
2.	Teacher's employer	TSC	17	70.8
		BOG	7	29.2
3.	Cycles teachers attended	4 cycles	10	41.7
		3 cycles	7	29.2
		2 cycles	1	4.2
		1 cycle	6	25.0
4.	Teachers liking hands on activities	Strongly agree	23	95.5
		Agree	1	4.2
		Disagree	0	0
5.	Teachers liking of plenary session	Agree	0	0
		Disagree	5	20.8
		Strongly agree	5	62.5
		Undecided	4	16.7
6.	Teacher's opinion on SMASSE and non-SMASSE teacher	Yes	24	100
		No	0	0
7.	Effects of SMASSE on teaching approaches	Yes	22	91.7
		No	2	8.3
8.	Adequate SMASSE INSET curriculum	Yes	21	87.5
		No	3	12.5
9.	Use of ASEI lesson plan	Always	5	20.8
		Occasionally	14	58.3
		Rarely	3	12.5
		Nil	2	8.3
10.	Teacher's supervision	Yes	3	12.5
		No	21	87.5
11.	Teacher's give students practical	Yes	21	87.5
		No	3	12.5

SMASSE cycles teachers attended: SMASSE INSET had four cycles. In Bomet district, 41.7% biology teachers were attended all the four cycles were 41.7%, three cycles, 29.2% one cycle, 25 .0 per cent and two cycles, 4.2%.

This reveals that a number of teachers have not completed all the four cycles. Teacher's attitude towards ASEI- PDSI approach: The study shows that 95.8% of the biology teachers like hands- on activities in the INSET and majority of them were rated high by the students on reviewing their previous lesson, marking assignments, guiding students during practical, improvising the teaching-learning resources and liking the subject.

SMASSE project recommended that there should be adequate activities during a lesson. The activities should be student- centered and involve improvisation to demystify the teaching of biology. The activities help the learners to develop psychomotor skills, intellectual thinking, effective aspects and communication skills. The students are currently performing practical activities during the lesson and like biology as revealed by the study.

This suggests that the teachers have improved their attitude and changed their old teaching approaches to ASEI-PDSI approach. SMASSE –INSET provided teachers with an opportunity to share experiences and challenges in the teaching of biology with other experienced teachers. This has translated to positive attitude in students and an improvement in performance in biology.

All biology teachers sampled (100%) agreed that there is a difference between a teacher who has attended SMASSE INSET and that who has not.

Most of the sampled teachers (87.5%) agreed that SMASSE INSET curriculum was adequate to equip them with knowledge and skills on the teaching of biology.

A number of teachers (54.2%) agreed that SMASSE INSET enabled them to complete biology syllabus in good time because the practical activities make teaching and learning simpler. On the use of ASEI lesson plan, 53.3% of teachers occasionally use it, 20.8% always used, 12.5% rarely use and 8.3% didn't use.

This implies that majority of the teachers do not use the ASEI lesson plan but instead use lesson notes and occasionally textbook to teach the students. Teacher's supervision: About 87.5% of the teachers indicated that they are not supervised in the implementation of SMASSE in the classroom. Only 12.5% agreed that they are supervised by the head of science department (HOD). This suggests that teachers are able to do their work without supervision. However, there is a need for monitoring and evaluation on the implementation of the SMASSE project.

The school administrators, SMASSE officials and QASO officers should ensure that teachers implement and sustain the SMASSE project objectives for quality teaching, learning and performance of students in Biology.

4.5 Summary

The effects of SMASSE INSET on the teaching, learning and performance of students in biology were analyzed in this chapter. The findings showed that SMASSE INSET has improved the student's attitude towards learning of biology and the teachers'

teaching approaches in biology. The improvement in both the student's attitude and teachers' teaching approaches have translated into improved performance in biology KCSE examination.

The research hypotheses were tested to determine whether there were any significant differences or relationship between independent variable and dependent variables. The independent variable was SMASSE INSET while the dependent variables were student's attitude towards learning, teachers teaching approaches and performance of students in biology KCSE examination.

CHAPTER FIVE
SUMMARY OF THE FINDINGS, CONCLUSIONS AND
RECOMMENDATIONS

5.0 Introduction

This chapter presents the summary of the findings, conclusions, recommendations and suggestions for further research.

5.1 Summary of the findings

The study shows that there is a great improvement of students' attitudes after the introduction of SMASSE INSET. The null hypothesis, HO1, which stated that there is no significant relationship between SMASSE INSET and attitude of students was therefore rejected because there is a statistics significant relationship between SMASSE INSET and the attitude of students towards the learning of biology.

This may be attributed to the SMASSE INSET which developed teachers' positive attitude which was translated to students. The SMASSE INSET cycle 1 targeted attitude change of teachers because they spend more time with students and are the change agents in the management of change.

Attitude is very important in the learning process because it determines what students learn and their willingness to learn. Negative attitude inhibit intellect and curiosity among the learners.

Students acquire attitudes through experiences in their environment. Teachers should therefore facilitate an enabling environment for students to acquire skills and habits (Di Martino & Zam, 2003).

Despite the improvement of students' attitude towards the learning of biology, some students in the three categories of schools still find biology questions challenging and difficult. This could be due to the fact that some teachers do not complete biology syllabus in good time. The students do not get adequate time to revise all the work they covered in four years.

A number of students in the three categories of schools were not given chance to do practical individually. This suggests that some teachers use group work or demonstration during biology practical activities. However, group work is a good idea that SMASSE project gave emphasis. Teachers should be keen on students who monopolize the activities leaving out slow learners. Teachers should ensure that each student is engaged during practical activity. Overall, the SMASSE INSET has developed great interest in students towards the learning of biology irrespective of their gender and the school category.

The research findings revealed that teachers were using ASEI- PDSI approach in biology. This suggests that teachers shifted from their old ways of teaching to the new SMASSE initiative approach of teaching after undergoing SMASSE INSET.

The null hypothesis which stated that there is no relationship between SMASSE INSET and teaching approaches in biology was therefore not accepted because there is a significant relationship between SMASSE INSET and teachers teaching approaches in biology.

From the study, teachers were engaging students in practical activities and allowing them to ask questions during the lesson. The students were given practical as part of their internal term examination. This suggests that teachers have implemented SMASSE project and have adopted ASEI- PDSI approach.

The study also revealed that very few teachers use ASEI lesson plan. The lesson plan is necessary because it enable the teachers to plan for the practical activities, experiments, resources and incorporating new ideas from different authors or text books. Teachers should prepare well for the lesson instead of using only lesson notes and textbook.

The study revealed that there is statistic significant difference in performance of students in biology KCSE before and after the introduction of SMASSE INSET. The one- way analysis of variance (ANOVA) was used to test the null hypothesis at alpha, 0.05 significant level.

The study showed that performance of students in biology KCSE examinations improved significantly after the introduction of SMASSE INSET. There is improvement of performance in the three categories of schools as well as the overall

performance in biology KCSE after the introduction of SMASSE INSET in 2004 in Bomet district.

The study showed that there was more improvement in performance in biology KCSE in girls' schools than in both boys and mixed schools. Girls are performing better than boys in biology in Bomet district. This could be attributed to the fact that their attitude towards biology was higher than boys. They have more interest to learn biology than boys.

However, the study revealed that the performance of students in biology before and after SMASSE INSET has been below average (50%). This might be attributed to other factors such as inadequate number of teachers and students entry behaviour in the three school categories. The SMASSE INSET changed the teachers' negative attitude and old teaching approaches which translated into better performance in biology KCSE examinations.

5.2 Conclusion

The study established that SMASSE INSET has changed the teaching, learning and performance of students in biology. The study found out that the attitude of students towards the learning of biology has improved as a result of SMASSE INSET. The SMASSE INSET provided teachers with opportunities to develop skills and knowledge on the best ways of teaching students. The teachers have translated the skills into their teaching approaches and the students are now motivated to learn biology.

The research found out that teaching approaches has greatly improved. Teachers are now preparing lesson notes and give students practical activities during the lesson. They allow students to ask questions and test students in practical in internal term examination. The change of the teachers, from knowledge dispensers to facilitators has made the teaching and learning of biology more interesting to students. This has translated into improved performance in biology KCSE examinations.

Although the SMASSE INSET has improved the performance of students in biology KCSE examination, the performance is still below average (50%). The study shows that there is no follow- up in the implementation of SMASSE project in terms of supervision to ensure that teachers implement ASEI- PDSI approach. Performance of students in biology would continue to improve if teachers sustain the implementation of ASEI-PDSI approach.

Most of the teachers agreed that SMASSE project is a good innovation and has helped them to improve their teaching approaches in biology.

5.3 Recommendations

Based on the findings and conclusion, the following recommendations were proposed:

- (1) The government through the TSC should employ more biology teachers so that there is effectiveness and quality in teaching, learning and performance of students in biology. When teachers are over loaded, there is little preparation and improvisation given that most of the schools lack teaching and learning resources.

- (2) SMASSE INSET curriculum should be incorporated in the teacher training institutions to avoid duplication of training.
- (3) The District trainers, DPC, QASO and school administrators should form a panel that monitors and supervises full implementation of SMASSE project in the district.

5.4 Suggestions for further research

The following are proposed areas that need further research:

- (1) The study could be replicated using other subjects such as chemistry and physics.
- (2) Similar studies could be carried out in other districts so that a generalization can be made on the effects of SMASSE INSET on the teaching learning and performance of students in biology.
- (3) A research should be conducted to establish the factors that teachers faced in the implementation of SMASSE project at the school level.
- (4) A research should be carried out to find out why the performance of students in biology is below average (50%) despite the implementation of SMASSE INSET.
- (5) A study should be done to investigate whether the major steps of innovation were considered before the implementation of SMASSE INSET in the whole country.
- (6) A research should be conducted to find out the effect of English language on the performance of students in biology KCSE examination.

- (7) A study should be carried out to find out the effect of discipline on the teaching and learning of students in public secondary schools.

REFERENCES

- Ajzen , L and Fish Bein M. (1995). *Theory of Reasoned Action*. New Jersey: prentice Hall.
- Ajzen, I. (1991). *Theory of Planned behaviour*. New Jersey: prentice Hall.
- Allan, P.O.W, Sally, W. and Paul, D (2002) *Managing change successfully; using Theory and experience to implement change*. Great Britain: TJ International, Padstow.
- Bell, B. and Gilbert, J. (2004): *Teacher Development, A model from Science Education*: London, Routledge Falmer.
- Birgen, P. (2007) may- June, issue 12 (ed) *Education Insight*. SMASSE WECSA getting notes in Africa, 40-45.
- Bishop , G , (1986). , *Curriculum development; A text book for students* , Hong Kong , Macmillan Publisher.
- Bogonko, J. N (1992). *Reflecting on Education in East Africa*. Nairobi: Oxford University.
- Borg, R. W and Gall, M. D (1989). *Educational research: An introduction to theory and practice*. London: alley and Becon.
- Chisika, E. (2003). *Overhaul 8-4-4 KNUT urges in East African standard* January 3, Nairobi: Daily Nation (2003). Nairobi: Nation Printers and Publishers.
- Cross, G. (1999) (Ed). *A vision for Science Education: Responding to the work of Peter Fensaham*. New York: Routledge Falma.
- De wit, B. and Meyer R. (1999). *Strategy synthesis Paradoxes to create competitive advantage*. London: International Thomson Business Press.
- Di Martino P. and Zam R. (2003). *“What does positive attitude really means?”* In pateman N. Dongherty B. and Zilliox, J. (eds) proceedings of the 2003 joint meeting of PME and PMENA Vol 4 Hono/Wn,P. 451-458.
- Digolo, O. O. (2006). *The Challenges of Education in Kenya in the 21st Century*. A journal of the school of Education, Moi University: 1 (i-xxvii), 1-226, Eldoret, Kenya.
- Education For All (2003/2004). *Global Monitoring Report* available at <http://www.fareport.Unesco.org>. retrieved December 17,2008.

- Fullan, M. G. and Miles. M.B. (1992). Getting the Reform right: “What Works and What doesn’t”. Phi Delta Kappan 73 (10) 745-752.
- Fullan, M. G (1993). “Change Forces: probing the depth of Educational Reform”. Bristol: P. A Fal
- Fraser- Abder, P. (2002): *Professional Development of Science, Teachers*; local insights with lessons for the Global community, London, Routledge Falmer.
- Goet, Z. J. P and Le compete, M. (1984). *Ethnography and Qualitative design in Educational research*. San Diego: Academic press.
- Government of Kenya (1998). Master Plan on Education and Training 1997- 2010. Nairobi: Jomo Kenyatta foundation.
- Inyega, J. & Thomson, N. (2002): *Change in attitudes toward the teaching strategies in secondary schools teachers in Kenya following in-service professional Development*. Retrieved on 8th march 2008 from: <http://jinyega.myweb.uga.ed/indefile/SAETS.pdf>
- Kafu , PA. (1996). Attitude of Fourth year education students pursuing Education Degree programmes in Moi University. Unpublished Research paper, Moi University.
- Kafu, P. A (2001). Future Development in Education Technology. Eldoret: Moi University.
- Karugu, A. M (2007) Challenges of Graduate Teacher Education in Kenya on the 21st Century. Eldoret: Moi University.
- Kenya National Examinations council (2002): The year 2001 KCSE Examinations Candidates, Performance Report.
- Kenya National Examinations Council (2003): The year 2002 KCSE Examination Candidate’s Performance Report.
- Kenya National Examinations Council (2004): The year 2003 KCSE Examination Candidate’s Performance Report.
- Kenya National Examinations Council (2005): The year 2004 KCSE Examination Candidate’s Performance Report.
- Kenya National Examinations Council (2006): The year 2005 KCSE Examination Candidate’s Performance Report.

- Kenya National Examinations Council (2007): The year 2006 KCSE Examination Candidate's Performance Report.
- Kenya National Examinations Council (2008): The year 2007 KCSE Examination Candidate's Performance Report.
- Kerlinger, F. N (1973). *Foundation of behaviour research*. New York: Surject Publication.
- Kiptoon, J. (1996). Universities producing Half Baked Graduates. Nairobi: Daily Nation. Media Group.
- Koech report. (2000). Totally integrated Quality Education and Training (TIQET). Nairobi: Government printers.
- Kochhar, S. K. (1992). *Methods and Techniques of Teaching*. New Delhi: Sterling Publishers: PVT Ltd.
- Kombo D. K and Tromp D. L. A (2006) *Proposal and Thesis Writing. An Introduction. Nairobi. Pauline's publication Africa.*
- Kothari, C. R (2006). *Research methodology: methods and techniques*. New Delhi: new Age International (P) Limited publishers.
- Koul, L. (1984). *Methodology of Educational research*, 2nd edition. New Delhi: Vikas.
- Krejciec, R. & Morgan, D. (1970). Determining Sample Size for research Activities, Educational and psychological measurement.
- Kumar, R. (1999). *Research methodology: A Step- by- Step guide for beginners*. New Delhi: SAGE publications.
- Langat, R. (2008) The Impact of SMASSE INSET on the students' attitudes and Teachers Teaching methodology and approaches in Secondary schools. A case of Bomet District: Moi University, M. Phil Thesis, Unpublished.
- Lao, J. (2000). *Education and Development: The Emerging Role*. New York: Bantam Books INC.
- Mugenda, O. M and Mugenda A. G (2003). *Research Methods: Quantitative and Qualitative Approaches*. Nairobi: ACTS press.
- Mulusa, T. (1990). *Research for Beginners. A Practical study Guide* Bonn: German foundation for International Developments.

- Ndirangu, M. (2004). An analysis of factors hindering the achievement of curriculum goals in Kenyan schools in journal of education and Human Resource (vol. 3 (2) March 2004) Nakuru: Amu press.
- Njuguna, B. M. (1999). The Findings from Baseline Studies by SMASSE project Bulletin, unpublished.
- Omoro O. S (2001): *Staff Development Needs of Secondary School Teachers in Kenya: A survey of Selected Secondary schools in Homabay.*
- Orodho, A. J (2002). Essential of Educational and Social Sciences research methods. Nairobi: Malosa Publishers.
- Pioneer School. (2004). KCSE guide. Nairobi: Pioneer School.
- Republic of Kenya (2005): Ministry of Education Science and Technology. Kenya. Education Sector support Programme 2005-2010. Nairobi, Government Printers.
- Republic of Kenya (ROK) (1999) Commission of Inquiry into the Education system of Kenya as (Koech Report) Nairobi: Government printers.
- Rogers E. M (1995). Business Press Diffusion of Innovations. 4th edition New York: The Free press.
- ROK (1984) 8-4-4- system of Education. Ministry of Education Science and Technology. Nairobi: Government Printers.
- ROK (1981). The Presidential working Party Report on the Second University in Kenya (Mackay Report) Nairobi: Government Printers.
- ROK (1976). The Gachathi Report On National curriculum on Educational Objectives and Policies. Nairobi: Government printers.
- Sagimo P. O (2002): *Management Dynamics towards Efficiency, Effectiveness, Competence and productivity*, Nairobi, East African Educational Publishers.
- Seliger, J. and Shohamy (1989). Second Language Research Methods: Cambridge. Cambridge University press.
- Shaw, R. (1992). Teacher Training in Secondary Schools. London, Kogan Press.

- SMASSE project (1998). Strengthening mathematics and science in Secondary Education, Science and technology, Republic of Kenya. Retrieved on 9th march 2008 from <http://www.Smasse.org>.
- Stigler, J. W. and Hiebert, J. (1999). *The teaching Gap: Best ideas from the worlds' teachers for improving education in the classroom*. New York: the Free press.
- Teachers Service Commission (2002). *Operational Manual on Teacher Management*. Nairobi. Jomo Kenyatta Foundation.
- The Kenya National Examination council (2007) 2006 KCSE Examination Report. Nairobi: the Kenya National Examinations Council.
- Toffler, A. . (1970). *The future shock*. New York. Bantam Books Inc.
- Tuchman, M. S. (1987). *Scientific methods and social Research (revised Edition)*. New York: sterling.
- UNESCO ,(1995). *Report on the state of Education in Africa, Dekar.UNESCO – BREDA*.
- UNESCO, (2000). *Education for All 2000 Assessment*. Dakar: Senegal. Paris, UNESCO.
- Wabwile J. (2007): *Mathematics and Science Teachers' Perception and Expectations of SMASSE In-service Training. A case study of Trans- Nzoia District*. Unpublished M. phil thesis submitted to school of Education- Moi University.
- Webster, S. (1985). *Educational Research: Competence for Analysis and Application*, 6th Edition. New Jersey: Macmillan.

APPENDICES

APPENDIX 1

STUDENT'S QUESTIONNAIRE (SQ)

Please do not write your name. Fill and tick honestly where appropriate

1. Gender: male [] female []
2. School category: Boys school [] Girls school [] mixed school []

SECTION B: Effects of SMASSE INSET on students' attitude towards the learning of Biology

Please use the key below to indicate your feeling and opinion by ticking (✓)

Strongly agree (SA) 5-Agree (A), 4-Undecided (U) 3-Disagree (D) 2- Strongly Disagree (SD)-1

		SA	A	U	D	SD
		5	4	3	2	1
3	Biology is very interesting to me.					
4	I have not got chance to do practical in biology					
5	Biology problems are challenging, and difficult					
6	I don't have adequate knowledge of Biology to enable me pass the exams					
7	Biology lessons have helped me to learn values that are useful in life.					
8	Students who studied Biology get good grades					

SECTION C: Effects of SMASSE INSET on the Teachers' Teaching Approaches in biology.

		SA	A	U	D	SD
		5	4	3	2	1
9	Our Biology teacher starts a lesson by reviewing the previous lesson					
10	Our Biology teacher gives us practical / activities to do.					
11	Our Biology teacher uses locally available materials to teach us biology					
12	Our Biology teacher uses prepared notes to teach us instead of textbook alone					
13	Our Biology teacher guides us during practical lessons					
14	Our Biology teacher allows us to present the activities in class					
15	Our Biology teacher summarizes what she or he has taught at the end of the lesson					
16	Our Biology teacher marks our assignments					
17	Our Biology teacher does not give us chance to ask questions.					
18	Our Biology teacher gives us assignments.					
19	Our Biology teacher like and enjoy teaching the subject					
20	Our Biology teacher takes us for a field study					

Thank you.

APPENDIX 2

TEACHERS' QUESTIONNAIRE (TQ)

This research study aims at establishing the effects of SMASSE INSET on teaching, learning and performance of students in Biology in public secondary schools in Bomet district. Please respond to this questionnaire honestly.

Section A: General Information

Please respond by putting a tick (√) where applicable to you.

1. Gender: Male [] Female []
2. School category: Boys school [] Girls school [] Mixed School []
3. Qualification: Diploma [] B.E.D [] B sc/B.Arts. [] PGDE [] M. Ed []
4. Teaching experience; 0-2 yrs [] 3-5 yrs [] 6-9 yrs [] over 10 yrs []
5. Which classes do you teach or have taught biology mainly?
Form 1 [] Form 2 [] Form 3 [] Form 4 []
6. Who is your employer TSC [] BOG []

SECTION B: Effects of SMASSE INSET on Teachers' Teaching approaches

7. State whether you are Biology trainer or participant?
Biology trainer [] Participant []

-
8. State the SMASSE INSET cycles you have attended in Biology since August 2004
Cycle 1 [] Cycle 2 [] cycle 3 [] cycle 4 []

What did you like most about the SMASSE INSET you have attended? Rate the following appropriately.

	Statement	Strongly Agree (SA) 5	Agree (A) 4	Undecided (U) 3	Disagree (D) 2	Strongly disagree (SD) 1
9	Hands on activities					
10	Plenary session					
11	Lesson plan preparation					

12. Is there a difference between a teacher who has undergone SMASSE INSET and the one who has not? Yes [] No []
If No, in what way _____
13. Did SMASSE INSET change your teaching approaches? Yes [] No []
If Yes, in what way? _____
14. Do you think the SMASSE INSET curriculum was adequate to equip you with the modern teaching approaches and methodology in Biology?
Yes [] No []
If No, please give reason (s) _____
15. Has SMASSE INSET enabled you to complete the Biology syllabus in good time?
Yes [] No []
If No, give reason (s) _____
16. How often do you use ASEI lesson plan during your teaching?
Always [] Occasionally [] Rarely [] Nil []
17. Is there somebody who ensures that what you have learned in SMASSE INSET (ASEI- PDSI) is applied during teaching? Yes [] No []
If yes, specify _____
18. Do you give students practical as part of internal term examinations and include them in their report from? Yes [] No []
If No, give reason(s) _____

APPENDIX 3

HOD QUESTIONNAIRE

Biology KCSE Results Analysis

SHEET NO _____

YEAR	ENTRY	MEAN INDEX	MEAN GRADE
2002			
2003			
2004			
2005			
2006			
2007			

APPENDIX 4

RESEARCH AUTHORIZATION



REPUBLIC OF KENYA

MINISTRY OF HIGHER EDUCATION SCIENCE & TECHNOLOGY

Telegrams: "SCIENCE TEC", Nairobi
Telephone: 02-318581
E-Mail: ps@scienceandtechnology.go.ke

JOGOO HOUSE "B"
HARAMBEE AVENUE,
P.O. Box 9583-00200
NAIROBI

When Replying please quote

Ref. MOHEST 13/001/38C 653/2

Date: 23rd October, 2008

Rotich K. A. Stephen
Moi University P. O.
Box 3900 ELDORET

RE: RESEARCH AUTHORIZATION

Following your application for authority to undertake research on, *'Effects of SMASSE Inset on the Teaching, Learning and Biology Performance of Students in Public Secondary Schools in Bomet District,*

I am pleased to inform you that you have been authorized to conduct Research in Bomet District for a period ending 28th February 2009.

You are advised to report to the District Commissioner and the District Education Officer Bomet before embarking on your research project.

On completion of your research, you are expected to submit two copies of your research report to this office.


M. O. ONDIEKI
FOR: PERMANENT SECRETARY

Copy to: The District Commissioner BOMET DISTRICT,

The District Education Officer: BOMET DISTRICT

APPENDIX 5

RESEARCH PERMIT

THIS IS TO CERTIFY THAT:


MR. ROTICH K. A STEPHEN

of (Address) MOI UNIVERSITY
P. O. BOX 3900 ELDORET

has been permitted to conduct research in..
BOMET DISTRICT, RIFT VALLEY PROVINCE,
On the topic; EFFECTS OF SPASSE INSET ON THE
TEACHING, LEARNING AND BIOLOGY
PERFORMANCE OF STUDENTS IN SEC.
SCHOOLS IN BOMET DISTRICT

for a period ending 28TH. FEBRUARY 2009

Research Permit No MOHEST 13/001/38C
653
Date of issue. 23.10.2008
Fee received. SHS. 500



Rotich
Applicant's
Signature

M. OMONDI
Ministry Secretary
Ministry of
Ministry of Science
and Technology