IMPACT OF STRENGTHENING OF MATHEMATICS AND SCIENCE IN SECONDARY EDUCATION PROGRAMME ON THE TEACHING AND LEARNING OF PHYSICS IN MIXED DAY SECONDARY SCHOOLS IN LARI DISTRICT, CENTRAL PROVINCE, KENYA

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E55/CE/11704/07

A RESEARCH PROJECT SUBMITTED TO THE SCHOOL OF EDUCATION IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE AWARD OF DEGREE OF MASTER OF EDUCATION OF KENYATTA UNIVERSITY

JUNE, 2011

DECLARATION

This project report is my original work and has not been presented for degree or any other award in any other university

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To my husband Wanyingi and daughters, Wambui and Muthoni, for their love and support.

ACKNOWLEDGEMENTS

My sincere gratitude goes to God for his daily blessings and seeing me through my studies.

This project is as a result of the support and encouragement from my family, friends and lecturers in the Department of Educational Administration, Policy and Curriculum studies.

Many thanks to my supervisors Dr. Libese L.I and Dr. Malusu J.M. who patiently guided me throughout this research. In spite of their busy schedule, they managed to set aside time to read my work, make corrections and offer suggestions.

I would like to thank Mr.Maate, a physics trainer at the Centre for Mathematics, Science and Technology Education in Africa (CEMASTEA) who helped me to source information that the study required.

My appreciation also goes to Lari District Education officers for their co-operation. To the principals, teachers and students of the schools visited, I say a million thanks.

I want to appreciate the good work done by Susan during the data analysis.

Finally, I want to thank my mum, sisters and the many friends who offered support, encouragement and prayers all along during my studies.

May the Almighty God bless you all.

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LIST OF ABBREVIATIONS AND ACRONYMS

ASEI	-	Activity-focused, Students-centred learning with Experiment and Improvisation
CEMASTEA	-	Centre for Mathematics, Science and Technology Education in Africa
FSE	-	Free Secondary Education
INSET	-	In-Service Education and Training
JICA	-	Japanese International Cooperation Agency
JODA	-	Japanese Official Development Assistance
KCSE	-	Kenya Certificate of Secondary Education
KESSP	-	Kenya Education Sector Support Programme
KIE	-	Kenya Institute of Education
KNEC	-	Kenya National Examinations Council
MPET	-	Master Plan on Education and Training
PDSI	-	Plan, Do, See, Improve
SMASSE	-	Strengthening of Mathematics and Science in Secondary Education
TIQET	-	Totally Integrated Quality Education and Training
UNESCO	-	United Nations Educational Scientific and Cultural Organizations
WECSA	-	Western, Eastern, Central and South Africa

ABSTRACT

This study focused on the impact of the Strengthening of Mathematics and Science in Secondary Education (SMASSE) programme on the teaching and learning of Physics in Mixed Day Schools in Lari District of Central Province. The SMASSE programme is a joint venture between Kenya government represented by the Ministry of Education and the government of Japan through Japanese International Cooperation Agency (JICA). It came into being in 1998 when the constantly poor performance in Mathematics and science (Physics, Biology and Chemistry) became a matter of serious concern. Broad curriculum, lack of facilities and inadequate staffing were always cited as the major causes of the failure. However, from the baseline studies conducted in the initial nine pilot districts, it emerged that other factors like students' and teachers' attitude, poor teaching strategies, poor mastery of content by the teachers alongside poor utilization of available resources hinder effective teaching and learning of mathematics and science. An INSET for science and mathematics teachers was established during the pilot phase in 1998 in nine pilot districts (Kajiado, Gucha, Kakamega, Lugari, Butere-Mumias, Kisii, Muranga and Makueni) and later spread to all other districts in 2003. The study established the impact of SMASSE on teacher/student attitudes towards Physics, teaching and learning of Physics and established any constraint that the programme may be experiencing. The researcher used descriptive survey research method to collect data in Mixed Day schools. The study targeted 12 head teachers, 16 Physics teachers and 360 Physics students. Simple random sampling was used to select 12 schools which accounted for 54% of the population. The administrators and physics teachers were purposively selected from the schools in the sample. The students made up 12% of the population were systematically sampled for study. Three instruments were used. An interview schedule for administrators, questionnaires for teachers and students and an observation guide for lessons. Data collected was organized then analyzed using both qualitative and quantitative techniques. Findings from the study showed that SMASSE has had an impact on the teaching and learning of physics. There is a positive attitude among majority of the physics teachers towards teaching physics. Similarly, majority of the students have a positive attitude towards learning physics. The physics teachers involve the students during physics lessons in activities such as question/answer, group discussions and experiments. In addition, the students' physics performance in Kenya Certificate of Secondary Education (KCSE) has improved and student enrolment in physics has increased. However, it was noted that only a few teachers improvise, evaluates the lessons and use Activities-focused, Students-centered learning with Experiments and Improvisation (ASEI) lesson plans. High workloads, lack of sufficient facilities and teachers' negative attitude towards SMASSE were the main challenges that affect successful implementation of SMASSE programme .The study gave various recommendations to address the challenges.

CHAPTER ONE

INTRODUCTION

1.0 Introduction

This chapter covers the background information, statement of the problem, the purpose and objectives of the study. It also highlights the research questions, assumptions, theoretical framework and conceptual framework for the study. Finally, the operational definitions of terms used are provided.

1.1 Background to the Study

In 1985, Kenya changed her education system from the previous seven years of primary, four years of ordinary level secondary, two years advanced level secondary education and three years of university education (7-4-2-3) to the current eight years of primary, four years of secondary and four years of university education (8-4-4) system following the recommendations made by the Report of the Presidential Working Party on Second University in Kenya in 1981. The changeover required students to acquire basic education with practical orientation and hence science subjects became compulsory in all Kenyan public schools. This new education policy found many schools ill-equipped to start science classes coupled with extra demand for science teachers in secondary schools. The new education system high demand for science facilities and teachers hardly gave room for teachers professional development on how to implement the new curriculum and according to Kenya National Examinations Council (KNEC, 1998) the overall performance in mathematics and science (Biology, Chemistry and Physics) at the national examinations was reported to be declining. Broad curricula, lack of facilities and inadequate staffing as Njuguna (1999) observes were always cited as the major causes of the poor performance.

The Master Plan on Education and Training (MPET) for the period 1997-2010 and the Report of The Commission of Inquiry into Education System of Kenya of 1998 acknowledged the necessity of implementing In-service Education and Training (INSET) as a way of addressing the difficulties teachers and students experience during the teaching and learning of science at the same time ensure professional development of teachers. One of the policy aims of MPET was to improve education quality by making teaching-learning transactions more learners' centered which would be achieved by ensuring regular and focused in-service courses for teachers.

The Strengthening of Mathematics and Science in Secondary Education (SMASSE) in-service was started in 1998 as a joint program between the government of Kenya and the government of Japan as a means of responding to the need for quality teaching and learning of mathematics and science at the secondary school level of education . The project's purpose was in line with Japanese Official Development Assistance (JODA) policy because the enhancement of mathematics and science education at the secondary school was one of the priority areas of Japanese International Cooperation Agency (JICA). Initially the project started on a pilot basis in nine districts namely; Kajiado, Gucha, Kakamega, Lugari, Butere-Mumias, Kisii, Muranga, Maragua and Makueni.A baseline survey was conducted and information gathered on what used to go on in the classroom at that time. Interviews were conducted for head teachers, teachers, students, parents and laboratory assistants and more data was collected by administering questionnaires to teachers and students. The analysis indicated that;

- The teacher 'has' the knowledge, determines what the learners should learn and how to learn.
- The teacher was the 'main actor' and students are passive recipients of teacher activity.
- Lecture method (chalk and talk, talk and talk) was the often and sometimes the only method of teaching.
- Very few if any experiments or practicals were carried out in the science classroom.
- Teachers complained of lack of resources and did not use or improvise what was available.
- General inability to carry out experiments/demonstrations successfully and over-reliance on laboratory technicians.

The results of the survey unearthed numerous problems that faced science and mathematics education. These problems were categorized broadly as those within the scope of SMASSE and those beyond .Problems beyond SMASSE as Njuguna (1999) notes were those affecting schools such as finance, staffing, indispline and drug abuse, those affecting students such as food, family problems and entry behavior and those affecting teachers such as working conditions, stagnation in job groups and overloaded syllabi/timetables.

Problems that SMASSE would deal with were:

- Poor attitude (both teachers and students) towards mathematics and science

- Inappropriate teaching methodology
- Poor content mastery by the teachers
- Inadequate assignments
- Few or no interactive fora for teachers
- Infrequent professional guidance by subject quality assurance and standards officers
- Lack of information about schools.

An INSET curriculum was then developed to improve teachers' competence which focused on the following main areas:

- Attitude
- Pedagogy/teaching methodology
- Mastery of content
- Developing teaching/learning materials
- Administration and management

The first National INSET according to Chesire, Nui, Gitau and Oduor (2008) took place in August 1999 at the Kenya Science Teachers' College which trained the District trainers, while the first District INSET took place in the pilot districts in August 2000. The SMASSE INSET comprises of four cycles each lasting ten (10) days. In July 2003, the SMASSE INSET went countrywide and is currently one of the funded programmes under Kenya Education Sector Support Programme (KESSP). The government through the Free Secondary Education (FSE) has dedicated Ksh. 100.00 per student towards facilitation of SMASSE INSET for science teachers as indicated in Ministry of Education's Circular on the Interim Guidelines for FSE of 2008.

Performance in mathematics and sciences in the KCSE exams in Kiambu District was poor as the Table 1.1 below shows.

Table 1.1 KCSE Mean Scores for Science and Mathematics

	MATHS		**BIOLOGY**		**CHEMISTRY**		**PHYSICS**	
YEAR	**ENTRY**	**M.S**	**ENTRY**	**M.S**	**ENTRY**	**M.S**	**ENTRY**	**M.S**
2001	8557	3.18	6799	5.46	7675	3.45	2902	3.63
2002	8426	3.03	7035	3.80	7427	3.65	2977	4.22
2003	9028	2.92	7813	4.23	8351	3.63	2925	4.25

Source: DEO's Office Kiambu

From the table 1.1 the average mean grade was 3.5 which translate to grade D. The entry in physics was also very low. The first district INSET in Kiambu took place in April 2002 and focused mainly on attitudes change. Other INSET sessions have been mounted successfully. During the INSET, teachers attend plenary session where issues that are general to all subjects are discussed. The teachers then break-up into particular subject groups. The emphasis during session is on practical skills acquisition using activities which are students-centred. They actually handle the apparatus and perform experiments. They also go for actualization in the schools near the INSET centre to ensure that they have mastered the methods and practices. Science teachers and hence physics teachers in Lari District attend their INSET at Ngarariga Girls Secondary in Limuru and some go to St. Joseph High School in Githunguri (those from lower Lari). It is then believed that they will apply the same back in their schools. Successful completion of an INSET which is based on attendance is followed by certification. All science teachers are expected to attend the training without fail whether trained or untrained or whether in public or private secondary schools.

The tables 1.2 and 1.3 below shows the KCSE performance in some selected subjects in Kiambu and Kiambu West districts respectively from which Lari has been curved out after the first four SMASSE-INSET cycles.

Table 1.2 Kiambu District KCSE subject mean score (M.S)

	SUBJECTS								
YEAR	**ENG**	**KISW**	**MATH**	**BIO**	**CHEM**	**PHY**	**HIST & GOVT**	**GEO**	**CRE**
2006 M.S	7.53	5.45	2.97	3.82	3.93	4.48	5.72	5.00	6.82
2005 M.S	5.64	5.08	2.66	4.49	3.76	4.65	5.75	5.09	6.4
2004 M.S	5.21	4.5	2.92	5.00	3.90	4.78	6.26	5.14	6.55

Source: DEO's Office Kiambu

Table 1.3 Kiambu West KCSE subject mean score (M.S).

	SUBJECTS								
YEAR	**ENG**	**KISW**	**MATH**	**BIO**	**CHEM**	**PHY**	**HIST & GOVT**	**GEO**	**CRE**
2008	5.39	5.25	2.93	4.54	3.89	4.73	5.38	5.09	6.61
2007	4.85	4.42	2.37	3.95	3.05	3.90	4.87	4.67	6.48
2006	4.92	4.5	2.38	3.30	2.75	3.29	4.75	4.10	5.84

Source: DEO's Office Kiambu West

Considering that the maximum score is twelve points it can be seen from the tables 1.2 and 1.3 above that science and mathematics continue to register lower mean scores compared to the languages and humanities even after the SMASSE intervention.

1.2 Statement of the Problem

Through the INSET for the teachers, the SMASSE project targeted to improve effectiveness in the classroom in order to achieve the goal of upgrading students' performance in science and mathematics in national exams. The teachers would be equipped with necessary skills to plan for and provide students with meaningful learning activities (minds-on, hands-on and hearts on) in order to develop knowledge, skills and attitudes respectively. The INSET also aimed at enabling teachers to develop teaching and learning materials improvise and use the limited resources efficiently. While the SMASSE progamme ownership and sustainability has already been established, there is need for follow-up activities to establish whether the skills acquired are being used to facilitate student-centered learning and hence assess SMASSE INSET's impact in addressing the overall goal.

1.3 Purpose of the Study

This study endeavoured to establish the impact of SMASSE in teaching and learning of physics in mixed day schools of Lari District. In particular the study focused on the extent to which the ASEI/PDSI approaches of SMASSE have been implemented by physics teachers and how the INSET has contributed towards the attitude change in both the teachers and learners and hence the effect on student performance in physics.

1.4 Objectives of the Study

The study focused on the following specific objectives:

(i) To determine how many teachers have attended the INSET.

(ii) To determine teacher's and students' attitude towards physics.

(iii) To determine the major method of teaching used by teachers of physics.

(iv) To determine levels of student participation in physics lessons.

(v) To establish the challenges faced by teachers in implementation of skills and techniques acquired from SMASSE INSET.

(vi) To determine students' performance in KCSE exams since the introduction of SMASSE INSET.

(vii) To determine the availability of requisite learning facilities.

1.5 Research Questions

The study was guided by the following research questions:

(i) What are teachers' and students' attitudes towards physics teaching and learning process?

(ii) To what extent do teachers facilitate student-centred physics learning?

(iii) To what extent are the students involved during physics lessons?

(iv) How have the student performance in KCSE been since the SMASSE INSET began?

(v) What challenges do the school administration and the teachers face in implementation of SMASSE programme?

1.6 Significance of the Study

The study avails data from which decisions can be made on how to make the programme more effective not only in Lari but also in other areas. The study also provided an opportunity to teachers to suggest possible ways of improving SMASSE programme in order to make it more effective. In addition, it provides a necessary experience and motivation to the researcher to plan and execute more complex studies in future.

1.7 Assumptions of the Study

According to Orodho (2005), assumption in any particular study is unique facts presumed to be true but have not been verified. In the study the following assumptions were made:

- All the respondents were honest in responding to the items of the questionnaire.
- The sample taken is a true representation of the whole students, teachers and administrators population in day schools of Lari District.
- There are no factors that influence students' performance apart from classroom experiences.
- The physics teachers have undergone SMASSE training sessions.

1.8 Limitation of the Study

Limitations of the study as Mugenda and Mugenda (1999) observe constitute the aspects of study that the researcher knows may negatively affect the results generalizability. The study had the following limitations:-

- The study limited itself to mixed day schools in Lari District.
- It was not possible to cover opinion of parents and other stakeholders of education outside the school.

1.9 Delimitations

The study confined itself to public day schools. The study focused on the impact of SMASSE and its constraints and not other socio-economic and cultural factors affecting teaching and learning of physics in secondary schools.

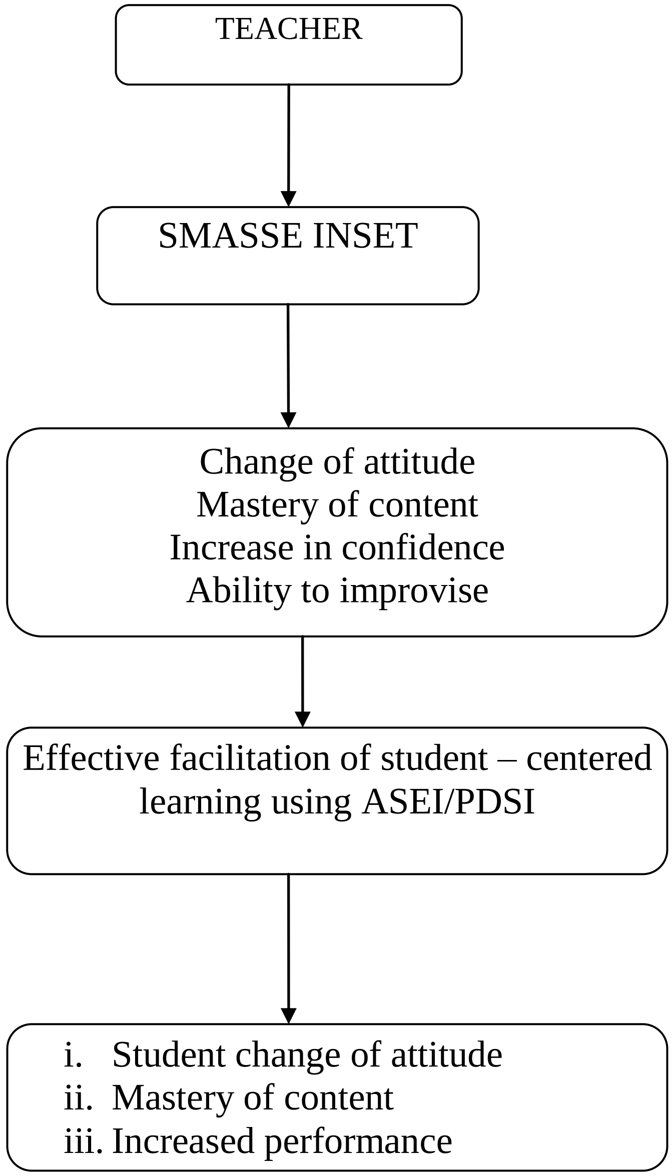
1.10 Theoretical Framework

This study was based on Bruner's (1966) constructivist theory of learning. Constructivist theory states that learning is an active process where the learner creates meaning from different experiences. The facets of the process include selection and transformation of information, decision making, generating hypothesis and making meaning from information and experiences while relying on cognitive structure to do so. Cognitive structure (i.e., schema or mental models) provides meaning and organization to experiences and allows the individual to "to go beyond the information given". According to Bruner, learners construct new ideas based upon their current and past knowledge. Instruction can be made more effective by providing a careful sequencing of materials to allow learners build upon what they already know in order to discover the key principles by themselves. This as Brooks and Brooks (1993) notes means that a teacher cannot "pour" information into a student's brain and expect them to process it and apply it correctly later. The teacher facilitates moderates and suggests while allowing the students to experiment asks questions or perform activities that require the student's full participation. The teacher may also provide tools such as problem solving and inquiry-based activities with which students formulate and test their ideas, draw conclusions and inferences, and pool and convey their knowledge collaboratively. Constructivist learning is a personal endeavor, whereby internalized concepts, rules and general principles may be consequently applied in a practical real-world context. It gives students ownership of what they learn and by grounding it in an authentic the real-world context, constructivism stimulates and engages them Constructivist posits that knowledge is constructed when individual engages in talk and activity about a problem or task. Learning is seen as a process by which individuals are introduced to a culture by more skilled members.

Constructivist theory of learning has many variations such as active learning upon which SMASSE is based and discovery and knowledge building. It promotes a student free explanation within a given framework or structure. The teacher acts as a facilitator who encourages students to discover principles for themselves and construct knowledge by working to solve realistic problem. Constructivist learning has wide ranging impact on teaching methods in education and is an underlying theme of many education reform movements like the SMASSE programme. The ASEI/PDSI paradigms advocated by SMASSE become powerful in ensuring meaningful teaching and learning of physics in secondary schools

1.11 Conceptual Framework

Figure 1.1 Conceptual framework for impact of SMASSE INSET



The core of the INSET is shifting teaching and learning process from teacher-centered to student-centered. Attending INSETs as shown in figure 1.2 will result in teacher change of attitude, improve his/her content mastery and acquisition of skills which will enable him plan, execute and continually improve lessons in which learners are actively involved. Teachers' positive attitude and involvement in the lessons will have a positive bearing on students' attitude. These together with improved content mastery by the teacher will lead to quality facilitation of physics learning which will lead to students' change of attitude and enhanced capacity.

1.12 Operational Definitions of Terms

Attitude : The way one thinks and feels about something, which may either be good, bad, positive or negative.

Experiment : A scientific test that is done in order to study what happens and gain knowledge.

Improvisation : Do something with use of whatever is available or use similar version when standard commercial approaches or equipments are insufficient.

Learning : Process of gaining knowledge or skills by studying, experience or from being taught.

Performance : Students achievements in physics examination.

Physics teacher: Teacher presently allocated physics lesson on the timetable and has taught physics to at least form four level.

Teaching : To give lesson or information to students in a school in order to help them learn something.

CHAPTER TWO

LITERATURE REVIEW

2.0 Introduction

This chapter contains a summary of relevant related literature used to conceptualize the research theme. The literature review will give an overview on what scholars and researchers have found out and said about physics, effect of teacher and student attitude towards physics and student-centred approaches to teaching and learning physics.

2.1 The Concept of Physics

Physics is defined as a branch of science that deals with study of matter and its relationship to energy (Kariuki and Balaraman 2003).Zimmerman (2005) defines it as a disipline that attempts to quantify reality through a precise application of observation coupled with logic and reason. Physics deals with concepts which are precisely defined. It is an experimental science whose main objectives as indicated in KNEC (2005) include:

- Use knowledge acquired to discover and explain the order of physical world.
- Apply the principles of Physics and acquired skills to construct appropriate scientific devices from available resources.
- Develop capacity for critical thinking in solving problems in any situation.
- Select and use appropriate instruments to carry out measurements in the physical environment.
- Contribute to the technological and industrial development of the nation.
- Acquire positive attitude towards physics.

Physics is an exciting intellectual adventure that inspires students and expands their knowledge about nature. It generates fundamental knowledge needed for the future technological advances that will continue to drive the economic engines of the world. In Kenya for example; becoming industrialized in line with the Vision 2030 will require knowledge based skills which call for more training in science and technology-related courses. Physics is essential in providing the basic understanding necessary for developing new instrumentation and techniques for medical application, engineering agricultural and information communication technology. Physics as Michael (2005) notes endeavors to understand the underlying laws governing our universe. By better understanding those laws, we can better interact with and harness our environment. To gain perspective into how much physics has contributed to our livelihoods, consider the following miracles from physicists: alternating current, hydroelectric power, electric motors, radio, mobile phones, microwave ovens, satellites, radar, modern rocketry, greenhouse technology, nuclear energy, magnetic resonance imaging, X-rays, lasers, light-emitting diodes, oscilloscopes, television, computers, and the World Wide Web, among many others. Only science, with physics as its foundation, can solve many of the impending crises facing our society, such as global warming, overpopulation, waning energy and other natural resources, and the poisoning of our planet.

Physics therefore is an important part of the education system of any advanced society. Being a practical subject it targets development of manipulative skills in the learner besides acquisition of knowledge in general. Study of physics ought to enable the learner to distinguish facts from opinion, and to form judgments and base conclusions on the known data. Das (1985) observed that physics involves pursuit of truth; hence it inculcates intellectual honesty, diligence, perseverance and observation in the learners. According to KIE (2002) and Minishi, Muni, Okumu and Mutai (2004), teaching of physics provides the learners with understanding, skills and scientific knowledge needed for scientific research, fostering technological and economic growth in the society where they live thus improving the standards of living.

In Kenya physics is compulsory in forms one and two but elective in form three and four. The evaluation like in the other subjects is formative at the school level but summative nationally. The national exam comprises of three papers; Paper 1 focusing on Heat and Mechanics, Paper 2 on Optics Waves Electricity, Magnetism and Modern Physics and Paper 3 which is a practical paper testing on a variety of skills in all areas of the syllabus.

2.2 Attitudes towards Physics

The SMASSE baseline survey of 1998 established that negative attitudes of students, teachers, parents and society in general contributed a lot to the poor performance in sciences. Koballa (1995) defines attitude as favourable or unfavourable responses to things, places, people, events or ideas. Mueller (1986) sees attitude as simply the extent of liking or disliking of something. According to him attitudes are internal states that influence the individual choice of action. Oppenhein (1966) observes that attitude is a tendency, a state of readiness to act or react in a certain manner when confronted with a certain stimuli. Attitudes are reinforced by beliefs and often attract strong feeling that lead to particular form of behaviour. The way people view situations in life depends on the attitude they hold and these attitudes impel them to react to objects, situation or propositions in ways that can be called favourable or unfavourable.

According to Ballone and Czerniak (2001), behaviour is better predicted from an individual belief and that beliefs are the best indicators of decision individual makes throughout their lives. They stress the connection between teachers' attitudes and students' beliefs about science. When attitude is negative or unfavourable students will take little or no interest in education and perform poorly in exams as Mueller (1986) observes. Keys and Bryan (2001) in their research on teachers' beliefs about the nature of science, students learning and the role of the teacher suggested that these beliefs do affect teachers' planning teaching and assessment. A teacher's belief about learning and knowledge strongly impact the classroom climate enabling students to explore articulate and analyze their beliefs on topics. Jones and Mooney (1981) admit that students have traditionally considered physics as being one of the most difficult areas of science. One of the reasons that make students shy away from physics is as Musyoka (2000) notes, its quantitative nature. Other reasons as outlined by Mwaura (2007) include socio-cultural factors where difficult tasks are seen as a male domain and also the contribution of the physics teacher in instilling negative attitude. Some students form negative attitudes towards physics long before they enroll in secondary school. This is due to the opinions they get from their parents, elder siblings, friends and sometimes teachers in their primary schools.

Negative attitudes are displayed through verbal expression such as “I hate Physics”, “Physics is difficult” or can also be expressed through acted tendencies like:

- Sleeping during the lesson
- Yawning in class and looking bored
- Absentmindedness during the lesson
- Refusing to participate in the practical activity
- Obtaining poor results that do not bother the student

The SMASSE report of 1999 also noted that teachers’ negative attitudes affected performance. Teachers’ attitude as Voss (1981) notes, determine the direction and action the students are likely to take. Teachers’ positive attitudes have been shown to attract more interest in their class and according to Sogomo (2001) students’ attitudes are a reflection of teachers’ attitudes. Though the teachers’ negative attitudes may be due to the problems they encounter in their schools, their effect goes down to the classroom where it may be noted that teachers put little or no effort into preparation and performance of activities pertaining to effective teaching and learning. Oliver (1967) observes that unless the teacher has the attitude s/he desires to foster, it is unlikely that s/he will have success in communicating it to his/her students.

Attitudes once formed may be resistant to change since they are wrapped up within a person’s feelings, needs and the self-concept. To let them go therefore requires a change in the self and this requires much effort. The first SMASSE INSET cycle was organized with intention of addressing the issue of teachers’ attitudes towards teaching of science, towards their students and towards their teaching environment. Through discussions, teachers were helped to reflect on their attitudes and also map-out strategies to change those that were unfavourable. It is therefore important in this study to find out the effect of the programme on the attitude. Some of the indicators of positive attitude were the levels of enjoyment of both teachers and students during the teaching and learning process, levels to which teachers engage student in practical work and the extent to which the teacher makes the learning environment friendly to the learner.

2.3 Student-centred Teaching and Learning

Teaching and learning of science and hence physics has been a subject of debate for a long time. The debate is often centred not only on what is taught (curriculum content and relevance), but how it is taught (teaching approach and methodology). The teacher is thought to have very little direct control over what is taught because it is already prescribed in the curriculum which also suggests the approaches and methods to be used for teaching. However, it may be argued that the selection of the method of presentation to be used in class is ultimately the task of the teacher. Atsiaya (2007), notes that good teaching is largely a matter of personal attitude and requires thorough planning and selection of the approaches and methods that will result in effective learning.

The baseline study report of 1999 established that inappropriate teaching methods and approaches was one of the major causative factors of the dismal performance in science. Teachers did not seem to take into consideration what was more important in teaching; the process or the content. According to the report they also did not take into account for whom they were carrying out the teaching process i.e. who is the most important person in class? Thus most of them ended up using inappropriate teaching approaches and methods unknowingly. The teaching/learning process, therefore became a teacher-centred affair being mainly knowledge based “chalk and talk” with little or no active learner involvement.

According to SMASSE (2003) the students were made to accumulate a great deal of unrelated facts, skills, formulae, laws and procedures without any attempt to relate them to their previous knowledge and experience. Activity and assignment were found to be few and inadequate thereby denying students the opportunity to engage in physics. Whatever activities occurred, students were not given the opportunity to reinforce and apply the concepts learnt during the lesson through practice and consolidation. Students therefore became passive recipients of knowledge with very little or no active involvement and participation. Not enough effort was put into raising the learners’ interests or curiosity in learning science and mathematics. Full scale experiments with conventional equipment and apparatus were the norm whenever the experiments were done. However, it was not unusual that these experiments were ignored altogether where the equipment and apparatus were not available.

Researchers agree on the need to shift learning to inquiry-based strategies so that students can take on a more active role in their learning. Abusharbain (2002) advices teachers to focus on students’ learning of concepts, science process skills rather than traditional memorized set of facts. She argues that teachers must acknowledge and pursue new roles such as reaching all students, turning responsibility to students, monitoring group interactions, providing alternative assessment and providing appropriate tools for study. Science teaching should engage students actively and physics teachers should design active learning environments since the activities and content that the teacher chooses affects the knowledge, abilities, understanding and attitudes that students develop. According to Ballone and Czerniak (2001), a teacher is successful with learners if he provides an environment that encourages the students to teach themselves and others through performance of well guided activities. JICA (2000) observes that school science teaching should be learner centered with the role of the teacher being that of a facilitator, guide, counselor, motivator, innovator and researcher.

Student-centered teaching is an approach that focuses on the learners and all activities of the lesson are planned and executed so as to involve the learner fully. Joyce & Weil (1986), Collins&O'Brien (2003) and Akinibolola (2009) observe that student-centered teaching gives learners an opportunity to think independently in order to obtain knowledge. According to them, this method helps the learner to discover how knowledge becomes known and helps learners to see for themselves how to formulate knowledge through collecting, organizing and manipulating data. In student-centered learning knowledge is constructed by students. Harden and Crosby (2000:335) describe student centered learning as focusing on students' learning and achievement rather than what teachers do. Student-centered learning is about helping students to discover their own learning styles, to understand their motivation and to acquire effective study skills that will be valuable throughout their lives as Brenda (2006) notes. Lea, Stephenson and Troy (2003:322) gives the tenets of student-centered learning as:

- The reliance on active leaning rather than passive learning
- An emphasis on deep learning and understanding
- Increased responsibility and accountability on the part of the student
- Increased sense of autonomy in the learner
- An interdependence between teacher and learner
- Reflexive approach to the teaching and learning process on the part of both teacher and learners.

Gibbs (1995) draws similar concepts when he describes student centered-learning as that which emphasize learner activity rather than passivity; students' past experience; process and competence rather than content; where key decisions are made by students through negotiation with teacher. Students involvement in class leads to positive learning outcomes where as Tinto (1997) and Kuh (2007) notes, the greater the involvement the greater the acquisition of knowledge and development of skills. Student-centered learning according to SMASSE (2005) promotes critical thinking skills such as analysis, synthesis and evaluation. Students-centered learning describes learning that is active, engaging, one that arouses curiosity and is concerned with the whole process of learning. To put this approach into practice Brenda (2006) advices on the need for teachers to help students set achievable goals; encourage students to assess themselves and their peers; help them to work cooperatively in groups and ensure that they know how to exploit all the available resources for learning. Njuguna (1999) noted that in student-centred teaching, 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. In practicing student-centered learning SMASSE (2001) reiterates that attitude of both the teacher and students are important. To change students' attitudes, the role of the teacher is important: the teacher sets up an environment in which students can ask questions freely.

Realization of student-centred teaching/learning requires that teachers are equipped with skills that will help them select the most suitable activities that will engage learners meaningfully. It is with the realization of this that the SMASSE project advocated for the ASEI movement. The ASEI movement is one of the most important tools of upgrading and revolutionizing the teaching methods. It considers the quality of classroom activities as critical to achieving effective teaching and learning. ASEI movement advocates for teaching and learning that is:

- **A**ctivity-focused-teaching should involve activities aimed at helping students arrive at the learning outcome. Activities must be well and carefully selected when formulating the kind of instructional techniques and procedures best suited for achieving the objectives of a particular lesson. These activities according to SMASSE (2004) can be hands-on (manipulation) minds-on (intellectual, thinking, and reasoning), mouths-on (discussion) and hearts-on (stirs up the learners' interests/feelings about the subject). KNEC reports of 2006, 2007 and 2009 emphasizes that physics cannot be adequately taught without letting students participate.
- **S**tudent-centred – a pedagogical shift so that the main focus of the lesson is on the students rather than the teacher. Activities should be designed to involve the participation of the learners while the teacher becomes a facilitator.

- **E**xperiment – use of experiments to enhance understanding of scientific concepts and principles. Experiments enhance learning by promoting curiosity and interest. Experiments according to Atsiaya (2007) are the very essence of science and whenever possible they should be done as a class activity with pupils working individually or in groups as opposed to teacher demonstration.
- **I**mprovisation – use of locally available materials to improvise if there is a shortage of conventional resources. Improvisation involves use of non-conventional materials for conventional. It may also mean use of materials in the environment in order to raise the students' interest and curiosity in addition to helping the learners relate the concepts learnt to the occurrence in day-to-day life. With improvisation, SMASSE (2004) indicates that numerous meaningful and focused activities can be organized for the students. Improvisation creates awareness in the teacher of the unlimited opportunities that exist in seeking and using locally available resources.

Effective practice of ASEI calls for proper *Planning*, *Doing* (carry-out the planed activity), *Seeing* (evaluating the outcome of activity) followed by *Improvement*; hence the acronym PDSI. Planning tools according to SMASSE (2004) such as lesson plans and schemes of work were not being made and whenever they were, it was for school inspectors other than use by the teacher. Use of lesson plans was observed in only few teachers. To assist the teachers in their planning, SMASSE advocates for what is referred to as an ASEI lesson plan, where the lesson notes are merged with plan of activities.

During planning, teachers are encouraged to take time to reflect on the most appropriate activities that will enhance effective learning. Planning entails the organization of the activities to be carried out in a systematic manner. Doing the planned activities is shared between the teacher and the learners where the teacher's role is facilitation and not the dispenser of knowledge. The teacher according to Kogolla (2001) should arrange for the learners to collaborate with others in pairs or small groups as s/he works on activities and assignments. This ensures that more time is spent on interactive discourse. Through participation in such discussions, the learner constructs and communicates content related understanding. In the process the learner recognizes naive ideas or misconceptions he/she has which he/she replaces with valid ones.

Seeing encourages the teacher to include feedback mechanism in their lesson. Lesson evaluation is seen as the key to improvement of lesson delivery. It is through evaluation that the effect of the process on the output can be seen and findings used to improve on the activity (lesson presentation) in order to enhance its quality. Evaluation according to SMASSE (2004) can be done in a number of ways which include: asking students, inviting a colleague to class and self-evaluation. Errors are seen as constructive part of the learning process and need not be a source of embarrassment. Results obtained from evaluation should be used for improvement of subsequent lessons. The PDSI approach depicts a continuous activity and it ensures the teachers skills improve, confidence increases and the instructional programme is enriched.

The cycle two of SMASSE INSET programme focused on the ASEI/PDSI approach as a vehicle for not only addressing the SMASSE goals, but also as a way of promoting effective teaching practices and efficient learning where the learner is the main focus. This study will look at teacher practice of student-centered teaching and also the levels to which students are involved during the various stages of a physics lesson.

2.4 Mastery of Content and Assessment

The baseline studies established that most young teachers seemed to have problem in determining the level of content to be given to students and for the experienced teachers they looked unprepared and repeated the same mistakes year in year out. Such insecurity with content as Mutetwa and Thompson (2000) observe could have a disastrous effect on the learning of physics by the pupils. They define content knowledge as the depth of understanding of concepts and processes that constitute the subject content often represented by verbal statements, symbolic expressions and diagrams that one encounters in the texts. They further argue that content knowledge determines the nature and depth of pedagogic content that evolves. Mohanty (2002) observes that students pay regards to those teachers who have proficiency in the subject and competent in their topics. Richard, Heidi and Andrew (2007) note that, students learning of science depends on teachers having adequate knowledge of it. They advice that teachers need sustained professional development in training and while in service. Alonzo (2002) also admits that teachers with more content knowledge are more likely to teach in ways that help students construct knowledge. Such teachers pose more questions and are more likely to have students consider alternative explanation or propose more investigation. Continuous study can improve teachers' mastery in the subject matter. The MPET 1997-2010 reiterates that, teacher's pedagogical skills and knowledge of content be updated through regular in-service. Simon&Schifter(1991) noted that in-service programmes which adopted constructivist approach to teachers' learning and provided opportunities for teachers to engage in problem solving were generally successful in facilitating change not only in teachers' classroom practices but also in their beliefs about and attitudes towards the subject and its teaching.

During the four cycles of the SMASSE INSET, teachers have had an opportunity to discuss topics in which both teachers and students encountered difficulties. These topics include: pressure, waves, electromagnetic, induction, refraction, thin lenses, photoelectric effect, radio-activity, electronics and quality of heat. During the session the teachers exchange ideas and also come up with innovative activities that which they can engage their learners in. SMASSE also advocates for team-teaching when teachers are continuously consulting each other as they teach and encourage them to try out problems and experiments before assigning them to students. This study will seek to establish if teachers are now more confident in their teaching after attending SMASSE.

Assessments in form of assignments, tests and exams, according to SMASSE (2005) act as a pointer of whether concepts learnt are understood. They provide students with a focus since they highlight their learning gaps and areas that they can develop on. Although many schools have a policy on the frequency of tests and quizzes/assignments/homework, this is usually left to the individual teachers. This sometimes leads to assignments being given at the end of a topic or as rare as once a month. The SMASSE programme puts a lot of emphasis on the need to streamline assessment so that teachers can get the desired feedback as early as possible so that necessary action can be taken. This study will be interested in the frequency of assessment in the sampled schools.

2.5 Summary of Literature Reviewed

SMASSE programme has been evaluated mostly by its own monitoring and internal control system and results show general improvement. These improvements are however on national scale. Independent studies are very few and have also been carried out on a very limited scale. Gathigi carried out an evaluation on SMASSE in 2003 and found that the programme had a positive impact on teaching and learning of mathematics in Kajiado. He concluded that SMASSE had contributed towards the positive improvement in performance at KCSE and better teaching methods. This evaluation was limited in the sense that it was on a small scale, focused on mathematics only and was conducted before the project became a national programme in 2003.Muthemi (2004) in his research found that SMASSE had contributed positively towards performance of mathematics in KCSE in Kibwezi Division of Makueni District. This study also focused on mathematics and may not be generalized to other science subjects like physics which is the core-focus of this study. Oirere (2008) in his study on the effectiveness of SMASSE INSET in Kenyenya Division, Gucha District found that there was general improvement in mathematics and sciences. Teachers were seen to have adopted some of the strategies advocated by SMASSE and reported that student participation was evident. However, this study focused on all the subjects and did not involve the views of the students.

CHAPTER THREE

METHODOLOGY AND DESIGN

3.0 Introduction

The chapter describes the research design, location of the study, target population and sample selection. Research instruments have also been described and their administration during piloting and actual data collection. Finally, the data analysis techniques have been outlined.

3.1 Research Design

The study employed a descriptive survey design to investigate the impact of SMASSE programme in the teaching of physics in mixed day schools of Lari District. Kombo and Tromp (2006) observe that the major purpose of descriptive survey research is to describe the state of affairs as it exists. According to them, descriptive survey can be used when collecting information about people's attitude, opinion, habit or any of the variety of educational or social issues. Mugenda and Mugenda (1999) on the other hand observe that descriptive survey research can be used to collect data to answer questions concerning the current status of the subject in the study. In this kind of design information is collected by interviewing or administering questionnaire to a sample of individuals.

3.2 Locale of the study

The figure 3.1 is the map of Lari District in Central Province where the study was conducted.

Figure 3.1 MAP OF LARI DISTRICT

SOURCE: C.D.F. OFFICE LARI

Lari District is about 50 kilometres west of Nairobi. From Nairobi one takes a vehicle headed to Njabini or Naivasha near the Khoja Mosque and alights at Kimende town which is the district's headquarter. Kimende town is along Nairobi-Nakuru highway. The district education office is about 1.5 kilometers from Kimende which is a walking distance or one can use a motorbike or public service vehicles which ply the Kimende-Githunguri route. The region is rural and is densely populated. It has adequate rainfall and the major economic activity is horticulture and dairy farming. It covers an area of 441.1 square kilometers. The terrain is hilly. The district is surrounded by four other districts namely; Githunguri, Kiambu West, Nakuru and Nyandarua. The district has 31 public schools of which 24 are day schools.

3.3 Target Population

Mugenda and Mugenda (1999) describe a population as the entire group of individuals, events and objects with common observable characteristics. It is the large population from which a sample will be selected. The study targeted 21 schools administrators, 35 physics teachers and 4000 physics students of the 21 mixed day secondary schools in Lari District.

3.4 Sample and Sampling Procedure

The researcher employed purposive sampling to select mixed day secondary schools. Simple random sampling was used to select 12 out of 21 schools which constituted about 54% of the population. Ary, Jacobs and Razaviah (1972) observes that a sample size of 10-20% of population is acceptable in a descriptive survey. Purposive sampling was used in sampling the head teachers and physics teachers in the sampled schools.

The researcher sampled students per school as shown in table 3.1:

Table 3.1: Sample size per school

School	Form One		Form Two		Form Three		Total
	Boys	Girls	Boys	Girls	Boys	Girls	
Kimende	5	5	5	5	5	5	**30**
Escarpment	5	5	5	5	5	5	**30**
Nyamweru	5	5	5	5	5	5	**30**
Lari	5	5	5	5	5	5	**30**
Kamuchege	5	5	5	5	5	5	**30**
Utugi	5	5	5	5	5	5	**30**
St. Joseph	5	5	5	5	5	5	**30**
Kamburu	5	5	5	5	5	5	**30**
Kamahindu	5	5	5	5	5	5	**30**
Gituamba	5	5	5	5	5	5	**30**
Kiambogo	5	5	5	5	5	5	**30**
Gitithia	5	5	5	5	5	5	**30**
Total	**60**	**60**	**60**	**60**	**60**	**60**	**360**

The students were selected through systematic sampling by use of physics teacher's progressive record book to ensure equal and fair representation of all students in the class. Form ones were left out, since they have not covered substantial work in physics course. Total number of students in the sample was three hundred and sixty (360) which amount to 15% of the population.

3.5 Research Instruments

The data for this study was generated using questionnaires, interview schedules and observation schedules.

3.5.1 Questionnaires

According to Ary Jacobs and Razavieh (1972), questionnaires are good in that standard instruction will be given to all subjects and the personal appearance, mood or conduct of the researcher will not affect the results. Questionnaires as Kombo and Tromp (2006) observe will help the researcher to obtain information from a large sample in diverse regions and it upholds confidentiality. Two sets of questionnaires were used: Physics teachers' questionnaire (appendix C) and Physics students' questionnaire (appendix D). Physics teachers' questionnaire had three sections; demographic data, their attitudes and their facilitation of student-centered teaching and learning while the students' questionnaire had two main sections; one to gauge their attitude and the other on their level of participation during physics lessons.

3.5.2 Interview Schedule

An interview schedule is more flexible and allows for rapport and cooperative atmosphere on which truthful information can be sought. An interview schedule for administrators (appendix B) was developed to seek their views on SMASSE impact in their schools and also to establish their level of support to the physics teachers.

3.5.3 Observation Guide

Direct observation provides information about actual behavior. A structured lesson observation guide (Appendix E) was used to investigate the teacher use of ASEI/PDSI paradigms during Physics lessons.

3.6 Piloting of Research Instruments

The research instruments were pre-tested in one public mixed school outside the sample. Piloting was done to refine the instruments before they were applied in actual research. Mugenda and Mugenda (1999) observe that piloting ensures that research instruments are clearly stated and have the same meaning to all respondents. Since the actual study was in 12 schools, pre-testing on one school constituted 8% coverage of the total sample population. Pre-testing ensured that the instruments are of acceptable reliability and validity.

3.6.1 Reliability

According to Kombo and Tromp (2006:97), reliability is a measure of how consistent the results from a test are. The instruments were administered twice to the same group within a time lapse of a fortnight between the first and second test. A comparison between the scores in the first and second test was made and a Pearson Product Formula was used to compute correlation coefficient in order to establish the extent to which the contents of the instrument were consistent in eliciting the same response every time the instrument was administered.

Formula:

$$r = \frac{\sum xy - \sum x \sum y / N}{\sqrt{\left(\sum x^2 - (\sum x)^2 / N\right)\left(\sum y^2 - (\sum y)^2\right)/ N}}$$

The correlation coefficient (r) of 0.8 was considered reliable for the study. Orodho (2004) observes that a correlation coefficient of about 0.8 is high enough to judge the instruments as reliable for study.

3.6.2 Validity

Wiesma (1985) posits that validity is the extent to which an instrument achieves the purpose for which it was designed. The researcher discussed with colleagues, consulted and got expert judgment from the supervisor who sought to validate and enhance the value and content of research instruments. Any item found to be ambiguous in eliciting relevant information was modified and restructured.

3.7 Data Collection

The researcher first obtained a research permit from the Ministry of Education through the graduate school of Kenyatta University. This permit was presented to District Education Officer – Lari District who wrote a covering letter to all the sampled schools to request them to allow the researcher to collect data and information from their schools. The researcher then booked appointments with the Principals of sampled schools and notified them of the mission and purpose of the study. The researcher personally visited the sampled schools on the appointed days and dates to deliver and monitor the instruments to the principal, teachers and students.

The Principal through the physics teacher assisted the researcher to reach out the sampled students who were then given the questionnaires. The respondents were given ample time to fill in the questionnaire before collection on the same day. After the exercise the researcher thanked all the respondents for their cooperation through the Principal.

3.8 Data Analysis

Data collected were organized, coded and analyzed using the Statistical Package for Social Sciences (SPSS). All the findings were presented according to the research questions. Qualitative data were analyzed thematically. Data presentation was enhanced through frequencies, totals, percentages, bar graphs and tabulation. Conclusion was drawn from the analysis and recommendations made.

CHAPTER FOUR

PRESENTATION OF FINDINGS AND DISCUSSION

4.0 Introduction

This chapter presents results of statistical analysis of the data collected from 360 students, 16 physics teachers and 12 administrators from secondary school in Lari District of Central Province. The findings are interpreted with regard to the stated research questions. Questionnaires and an observation guide were used as the primary tools for data collection. The data were analyzed using the statistical package for social sciences (SPSS). The results of the findings are presented in the following format:

- Demographic characteristics of the respondents,
- Teachers' and students' attitudes towards physics teaching and learning process,
- Teachers facilitation of student-centered physics learning,
- Students involvement during physics lessons,
- Student performance in KCSE been since the SMASSE INSET began,
- The challenges the school administration and the teachers face in implementation of SMASSE programme.

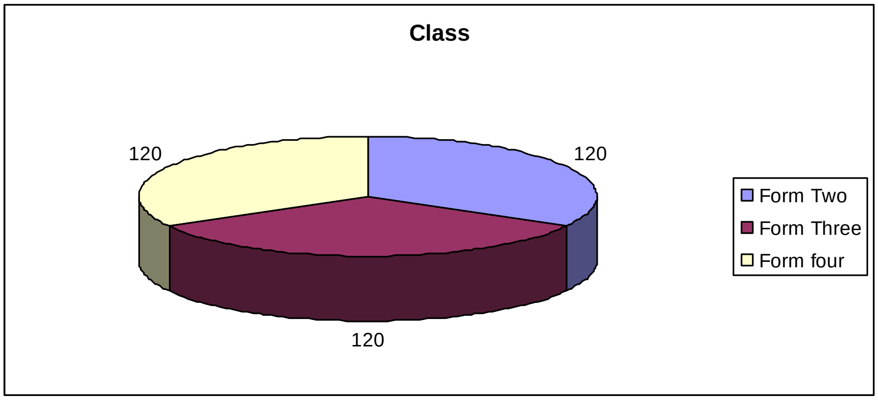
4.1 Demographic Characteristics of the Sample

This section presents the respondents' distribution by class, gender, age, marital status, teaching experience, professional qualifications, attendance of physics SMASSE INSET cycles as well as the resources found in the school.

4.1.1 Distribution of Respondents by Class

The distributions of the student sample by class are presented in figure 4.1.

Figure 4.1: Class of the Students

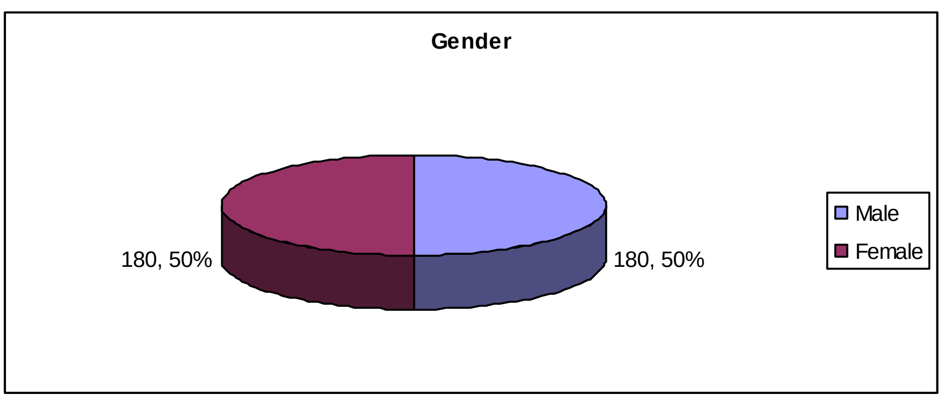


From the figure 4.1, out of the 360 student respondents, 120 respondents were in form two, 120 were in form three, while 120 were in form four. The students were distributed equally among the three forms.

4.1.2 Distribution of Respondents by Gender

The Figure 4.2 presents the distribution of the student respondents' sex.

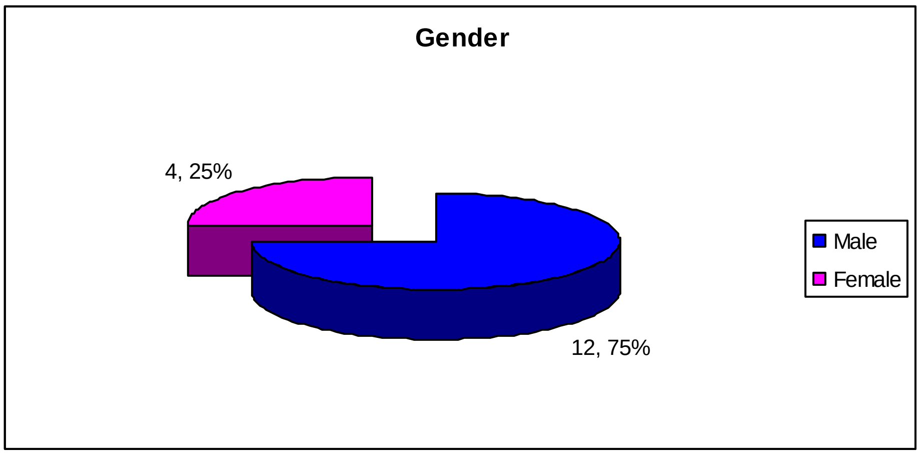
Figure 4.2: Gender of the Students



From the figure 4.2, it can be observed that half of the student respondents, that is, 180 students were male, while the other 180 students were female.

Figure 4.3 represents distribution of physics teachers' gender.

Figure 4.3: Gender of the Physics Teachers

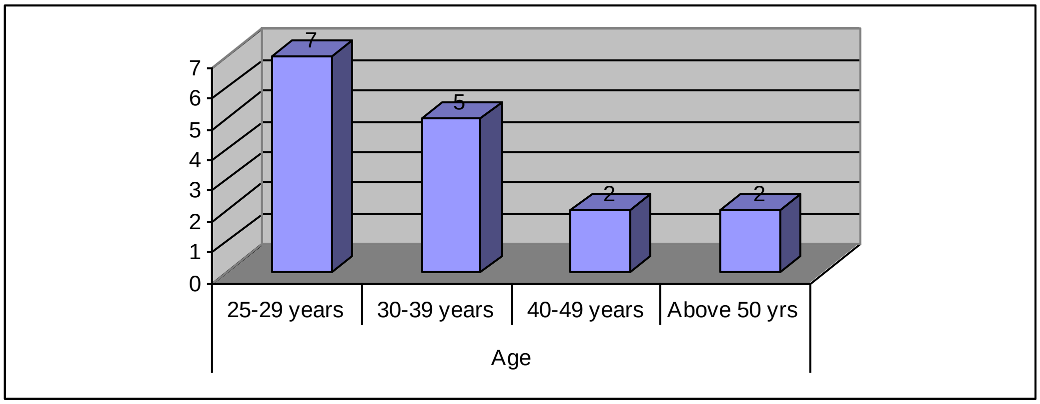


Among the physics teachers as figure 4.3 shows, 25% were female while 12 at 75% were male. The gender distribution of the administrators was 83% male and 17% female. Researches by USAID(2008) and UNESCO(2007) indicate that there is poor participation and performance in science and mathematics by females is because girls lack role models in science and mathematics. The Ministry of Education through the Gender Policy of 2007 is committed to improving gender participation and performance in science by increasing participation of women in all sectors of education. Deliberate efforts have also been put in place to ensure that curriculum design, development and implementation, pedagogy and teacher training processes as well as curriculum materials are gender-responsive. This has made the situation of the schools to improve. SMASSE on the other hand trains teachers in active-learning methodologies that help transform learning environment and hence ensure that both boys and girls are engaged.

4.1.3 Distribution of Respondents by Age

The following figure 4.4 presents the distribution of the respondents' age.

Figure 4.4: Age of the Physics Teachers



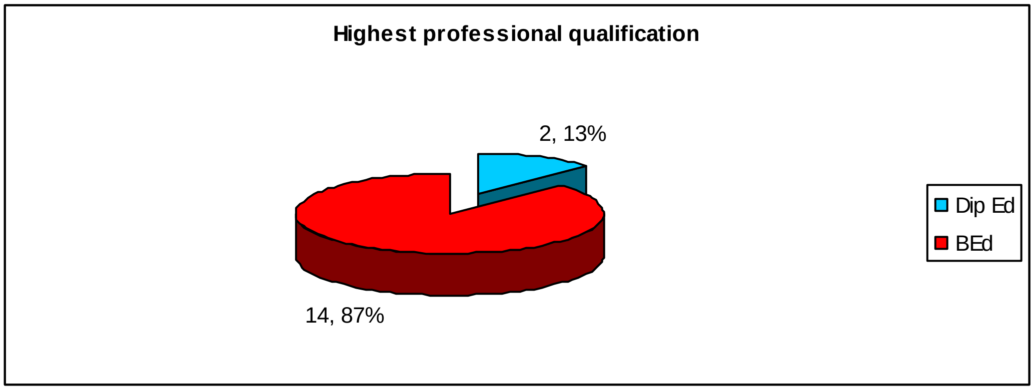
From the figure 4.4, seven of the physics teachers, who were the majority, were of age 25 – 29 years. Five were of 30 – 39 years, two of 40 – 49 years while two were above 50 years.

Among the administrators, ten were of between 40 – 49 years, one of 30 – 39 years and another one above 50 years.

4.1.4 Highest Professional Qualification of Respondents

The figure 4.5 presents the respondents' highest professional qualification.

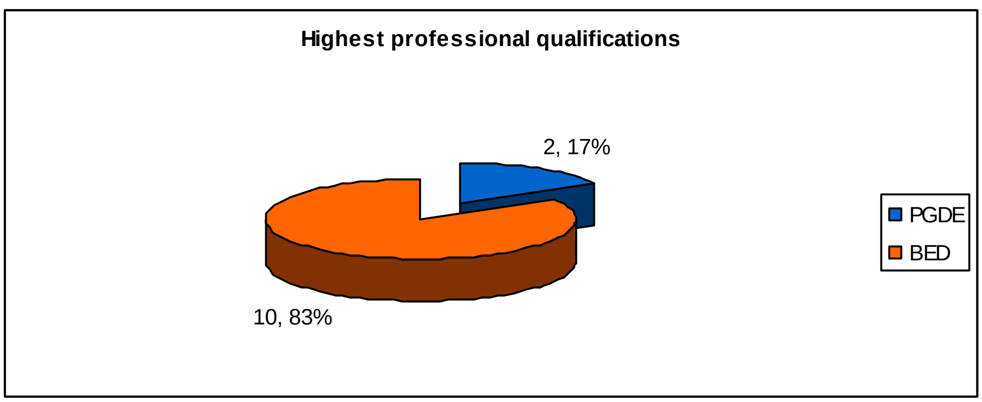
Figure 4.5: Highest Professional Qualification of the Physics Teachers



According the figure 4.5, 14 physics teachers at 87%, the majority, had their highest professional qualification as Bachelor of Education. Two at 13% held Diploma of Education as their highest professional qualification as Bachelor of Education.

The figure 4.6 presents highest professional qualifications of the administrators.

Figure 4.6: Highest Professional Qualifications for the Administrators



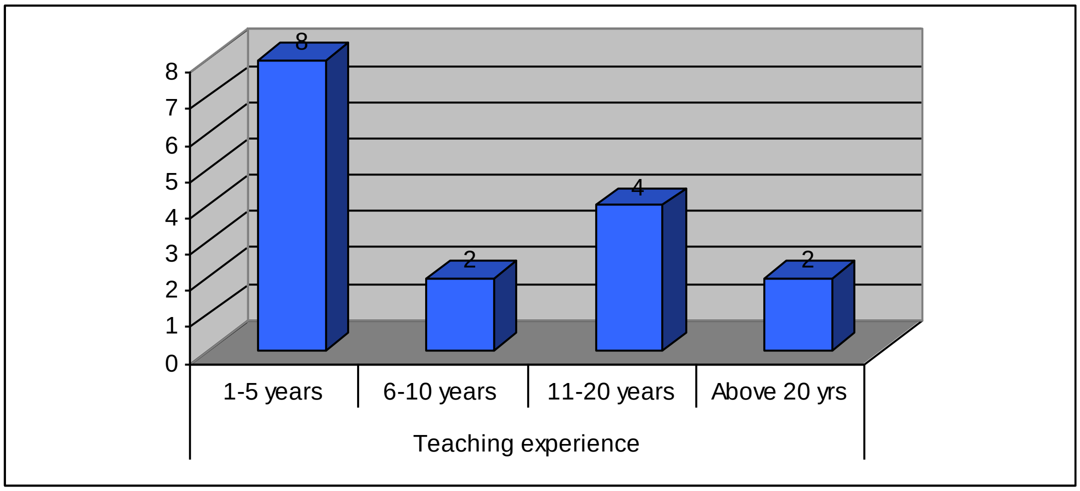
Among the administrators, two had PGDE as their highest professional qualification while ten (83%) had BED as their highest qualification as presented in the figure 4.6.

Quality of teaching is dependent on the professional qualification of teachers. Woolnough (1994) observes that for such teaching to take place, well qualified and enthusiastic graduate teachers should be employed since they have good mastery and expertise in the subject as well as the necessary pedagogical skills. According to this study the teachers are well qualified.

4.1.5 Teaching Experience of Respondents

The following figure 4.7 presents the physics teachers' teaching experience.

Figure 4.7: Teaching Experience of the Physics Teachers



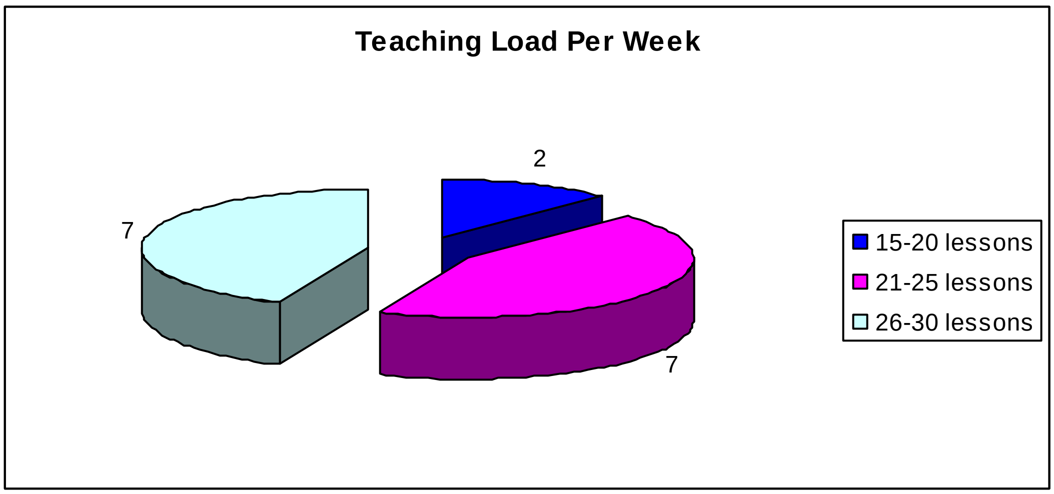
According the findings shown in figure 4.7, 8 teachers had 1 – 5 years teaching experience. Four teachers had 11 – 20 years; two had 6 – 10 years while two had above 20 years teaching experience.50% of the teacher had experience of above 6 years

Teaching experience is an asset. Experienced teachers are competent in their work since in the course of teaching they acquire new knowledge, skills and abilities. Adeyemi (2008) in a study on teachers' teaching experience and students' learning outcomes secondary schools concluded that teaching experience is a critical variable .He observed that experienced teachers' always have better strategies to apply at any given situation and better ways of bringing the subject matter being taught to students. Further on researches by Ladd(2008) and Harris &Sass(2007) show that on average teachers with many years of experience are more effective than teachers with no experience but are not much more effective than those with five years of experience. Ijaiya (2000) posits that experience improves skills, enhances knowledge and productivity of the teacher.

4.1.6 Teaching Load of the Respondents

The following figure 4.8 presents the physics teachers' teaching load.

Figure 4.8: Teaching Load of the Physics Teachers



From the figure 4.8, 7 physics teachers had 21 – 25 lessons per week; another 7 had 26 – 30 lessons per week. Two teachers had 15 – 20 lessons per week. Majority of teachers interviewed (88%) had a teaching load of above 20 lessons per week with 44% actually having above 25.

4.1.7 Teacher attendance of SMASSE INSET cycle

From the findings on the attendance of SMASSE INSET by the physics teachers, 63% of the teachers had attended all the mandatory four SMASSE INSET cycles, 12% had attended once, while 4 teachers had not attended any. The four physics teachers gave the reasons of being recently employed by the TSC or BOG, thus had not had opportunity to attend any of the SMASSE INSET cycles.

Mohanty(2002),Somers &Sikirova(2002) and Busher &Wise(2001) agree that with effective planning and teaching of in-service courses there is evidence that teachers do change their practices. Most of the teachers had attended SMASSE INSET cycles and had enough basis to judge the impact of the programme on attitudes, facilitation of student-centered learning using ASEI/PDSI paradigm and student performance in KCSE.

4.1.8 Administrators' Involvement in SMASSE INSET Organization

The researcher sought to find out if the administrators had been involved in SMASSE INSET organization. From the findings, 8 of the 12 principals had as facilitators, in funding of the INSET cycles and also by ensuring the teachers attended. However, 4 administrators were not involved in the SMASSE INSET organization. In addition, 10 administrators facilitated forums such as staff and departmental meetings where the teachers can share their experiences after the SMASSE training. One administrator did not facilitate such forums because most teachers are employed by the BOG and do not attend SMASSE INSET cycles. Majority of the administrators support the programme.

The research inquired about the adequacy of the equipment in the schools. Of the 16 schools, 8 were well/moderately equipped; 6 were not well equipped while 2 did not have a laboratory.

If physics is to be learnt it must be must be experienced. It involves carrying out experiments from which observations and measurements are taken. In most schools these hands-on activities are performed in the laboratory and do require specialized tools and equipment. Where facilities exist there is more effective science advancement while lack of equipment results in “chalk and talk” which makes the learner passive rather than active. Science lab activities stimulate student interest in the subject and provide vital skills for future success. Laboratory offers opportunities for productive interactions among the students and with the teacher that have the potential to promote a positive learning environment which as Miller (2004) notes is essential for learning.

4.2 Attitude Towards Physics Teaching and Learning

The researcher was interested in finding out the teacher’s attitude towards teaching physics. The findings are presented in the table 4.1.

Table 4.1: Attitude towards Teaching Physics

	Strongly Agree	Agree	Not Certain	Disagree	Strongly Disagree
Teaching physics is interesting and enjoyable	5	10	1	0	0
Practical activities can be performed during physics lessons	2	13	1	0	0
I am interested in my learners and the difficulties they face in learning physics	6	9	1	0	1
Effective teaching can be achieved through improvisation	5	11	0	0	0
Both boys and girls are capable of doing well if effectively taught	14	1	1	0	0
I spare some time to help the slow learners	1	11	3	1	0
I pay individual attention to students in physics class	1	10	5	0	0
Other school duties cannot hinder effective teaching/learning session in physics	0	8	3	4	1
I always set positive and realistic goals for my students	7	8	0	1	0
I always consult other colleagues whenever a problem arises	8	6	1	1	0

From the findings presented in the table 4.1, majority of the teachers (94%) agreed that teaching physics is interesting and enjoyable. A similar percent are of the opinion that practical activities can be performed while teaching physics. Still 94% are interested in their learners and the difficulties they face in learning physics and also agree that effective teaching can be achieved through improvisation. 74% of the teachers interviewed agree that they pay individual attention to students and also they spared time to help slow learners. As concerns other school duties 50 % of the teachers agreed that they do not hinder effective teaching. Further majority of the teachers (94%) do set positive and realistic goals for their students and also they consulted their colleagues whenever there is need.

Attitudes can be evaluated using attributes such as interest, enjoyment, patience confidence and impartiality. The findings of this study show a positive attitude of the teachers toward physics teaching and towards physics students. The positive attitude may be due to the first SMASSE INSET cycle organized with the intention of addressing the issue of teacher's attitudes towards teaching of science, towards their students and towards their teaching environment. Adesina&Akinibobola (2007) observes that attitudes once established, help to shape the experience the individual has with objects, subject or person. They further agree that although attitudes change takes time, people constantly form new attitudes and modify old ones when they are exposed to new information and experiences. Mueller (1986), Keys &Brian (2001) and Akinibolola (2010) do agree that teachers' attitudes towards the subject and the student have strong impact on the classroom activities. Physics teachers should have a positive attitude towards their teaching and the student learning. This can be enhanced by use of various methods appropriate to stimulate students' interests

In addition, the researcher sought the students' attitude towards learning physics. The findings are presented in the table 4.2.

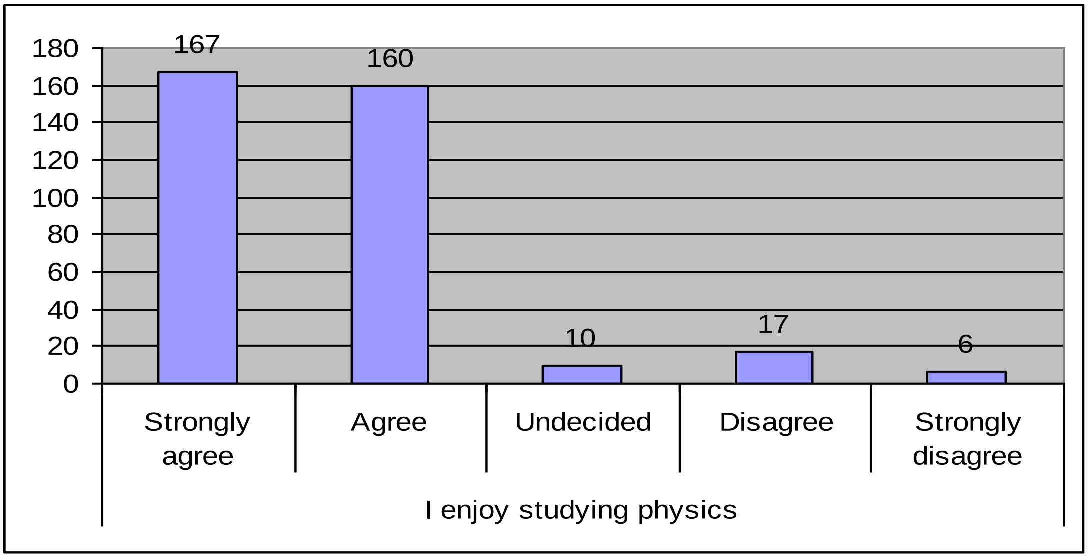
Table 4.2: Physics is not as difficult

		Frequency	Percentage
Physics is not as difficult	Strongly agree	115	32
	Agree	200	56
	Undecided	9	2
	Disagree	31	9
	Strongly disagree	5	1
	Total	**360**	**100**

From the table 4.2, 315 respondents who were the majority at 88% were of the attitude that physics is not as difficult. The findings are dissimilar to findings of Jones & Mooney (1981) and Musyoka (2007) who found that students traditionally considered physics as being one of the most difficult areas of science due to its quantitative nature. Changeiywo (2000) in his study on student's image of science in Kenya found that students who hold negative stereotypes toward science especially physics were easily discouraged from pursuing it and those who did performed poorly. The KNEC (2000) reported a decline in academic achievement as well as low enrolment in physics which was attributed to students' innate predisposition among other factors. However KNEC report of 2009 shows an improvement in physics performance and increased enrolment which may be attributed to changed attitudes.

The Figure 4.9 presents student responses on whether or not they enjoy studying physics.

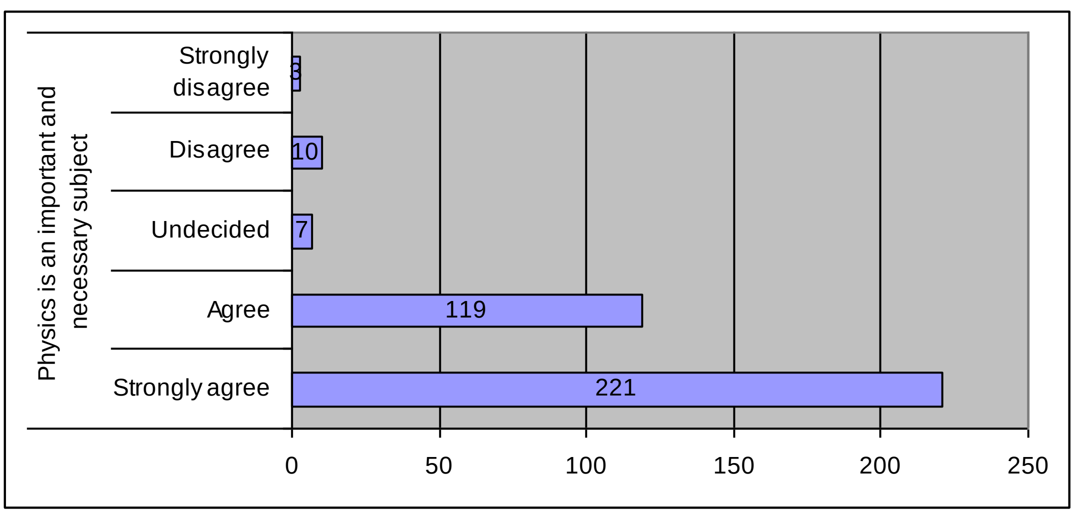
Figure 4.9: I enjoy studying physics



Majority of the students at 90% enjoy studying physics as shown in figure 4.9. About 23 students at 7% did not enjoy studying physics.

Figure 4.10 presents student responses on the importance of physics.

Figure 4.10: Physics is an important and necessary subject

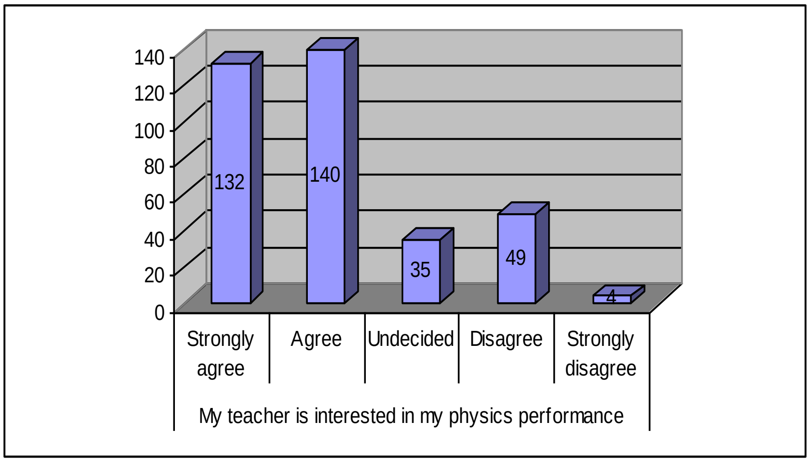


From figure 4.10, about 340 students at 94% were of the attitude that physics is an important and necessary subject. The students who did not think physics is an important and necessary subject were only 13 at 4%. Further on, 330 students at 91% felt that they can do well in physics. Only fifteen respondents at 5% did not believe they could do well in physics.

It has been shown that enjoyment is strongly related to other attitudinal concepts such as relevance, confidence and effort. Brok (2005), Adesoji (2008) and Cokadar&Kulce (2008) agree that the more enjoyment students experience in science the more relevance they attach it for their future education and hence the more confidence they have in performing well. The findings are similar to those of Mueller (1986) who found that positive or favourable attitude will determine the interest and performance of students in physics exams.

The figure 4.11 represents students' responses on their teacher's interest in their performance.

Figure 4.11: My teacher is interested in my physics performance



From the figure 4.11, 272 respondents at 76% were of the attitude that their teacher was interested in their physics performance. Fifty three respondents at 14% did not believe that their teacher was interested in their physics performance.

Students are interested in physics as Akinibolola (2010) notes, if their teacher is Enthusiastic about his teaching and their learning. Brenda (2006) observes that teachers should motivate, guide and encourage students in performing the various tasks that would help them acquire knowledge and develop scientific skill. Key components of learning include the classroom climate, feeling accepted by teachers and peers, and experiencing a sense of comfort and order. Thus, teachers are encouraged by SMASSE to be positive and supportive of students in the classroom.

On the issue of whether or not both boys and girls can do well in physics, majority of students at 87% were of the attitude that both girls and boys can do well in physics. Only

26 respondents at 8% disagreed that both girls and boys can do well in physics. 295 students at 90%, who were the majority, were of the attitude that their teacher has made them feel they have the ability to improve in their physics performance.

The table 4.3 represents students' responses on their satisfaction with the way their teacher teaches.

Table 4.3: I am satisfied with the way the teacher teaches physics

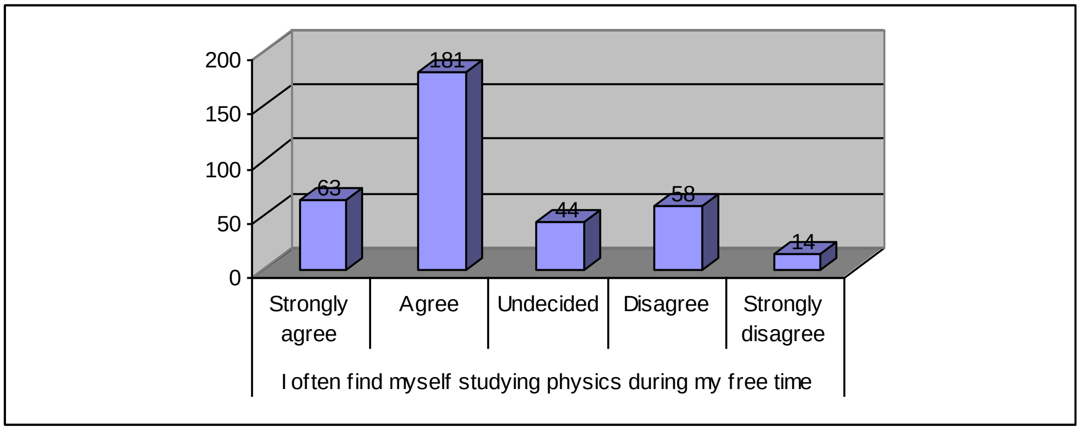
		Frequency	Percentage
I am satisfied with the way the teacher teaches physics	Strongly agree	203	56
	Agree	111	31
	Undecided	12	3
	Disagree	17	5
	Strongly disagree	17	5
	Total	**360**	**100**

Majority of the students at 87% were satisfied with the way the teacher teaches physics as shown in table 4.3. However, 34 respondents at 10% were not.

The findings above strongly indicates that physics teachers are interested in their learner performance irrespective of their sex and have made them feel that they can do well. These findings concur with those of Keys &Brian (2001) and Patrick &Kempler (2000) who observes that teachers who exhibit interest, enthusiasm and energy are likely to lead their students to be more engaged, interested and be curious about learning the subject matter.

The figure 4.12 presents students responses on whether or not they study physics during their free time.

Figure 4.12: I often find myself studying physics during my free time



From the figure 4.12, 244 respondents at 68% find themselves studying physics during their free time, while 72 respondents at 20% did not find themselves studying physics during their free time.

Students were also supposed to give their opinion on solving new problems in physics and skipping physics lessons. About 60% of the respondents liked solving new problems in physics. Forty eight respondents at 13% did not like solving new problems in physics. Majority of the students at 91% rarely skipped physics lessons.

The above findings agree with JICA (2000) who observes that school science teaching should be learner centered with the role of the teacher being that of a facilitator, guide. In addition, according to Ballone and Czerniak (2001), a teacher is successful with learners if he provides an environment that encourages the students to teach themselves and others through performance of well guided activities. This would lead to students becoming more self-motivated and determined in their own learning. Students are interested in the subject and usually get themselves involved in learning when the teacher is also interested and enthusiastic about his teaching. Abusharbain (2002) advices teachers to focus on student's learning of concepts, science process skills rather than traditional memorized set of facts. Brenda (2006) and (SMASSE, 2005) notes that students are able to acquire effective study skills such as analysis, synthesis and evaluation that will be valuable throughout their lives.

4.3 Student-Centered Physics Learning

The researcher sought to find out the extent to which teachers involve students during physics lesson. The findings from the teachers are presented in the table 4.4.

From Table 4.4, majority of the teachers at 75% engage students in group work in some of the lessons. 63% of teachers use appropriate question/answer technique with reinforcement of student response in most of the lessons. Majority of the teachers (70%) assign students discussion work while 88% assign practical work in some of the lessons and allow them to report the results of the practical work. 50% of the teachers rarely give students with difficulties more exercises and practice on observation, with 38% doing so in some lessons. 56% of the teachers rarely practice team teaching with their colleagues with only 12% trying it in some lessons. 50% of the teachers rarely make lesson plans with only 25% preparing lesson plans in some lessons. 63% of the teachers use lesson notes instead of lesson plans in most lessons.

Table 4.4 presents teachers' responses on extent to which they involve students during physics lessons.

Table 4.4: Student-Centred Learning

	Every lesson	**Most lessons**	**Some lessons**	**Rarely**	**Never**
Engage students in group work	0	3	12	1	0
Use appropriate question/answer technique with reinforcement of student response	4	10	2	0	0
Assign student discussion work	0	2	11	2	1
Assign student practical work	0	2	14	0	0
Allow students to report the results of practical work	0	6	9	1	0
Give students with difficulties more exercises and practice on observation	0	2	6	8	0
Practice team teaching with your colleagues	0	2	2	9	3
Make lesson plans	0	1	3	9	3
Use lesson notes instead of lesson plans	2	8	5	1	0
Use both lesson plans and lesson notes	0	2	5	9	0
Try-out experiments or any other practical work before going to class	1	10	4	1	0
Give students take home assignments	3	9	3	1	0
Invite a colleague to sit in class during a lesson	0	0	1	8	7

Nine of the teachers at 56% rarely use both lesson notes and lesson plans. In addition, 70% of teachers try-out experiments or other practical work before going to class in most of the lessons and give students take home assignments in most of the lessons.44% of the teachers never invite a colleague to sit in class during a lesson while 50% rarely do.

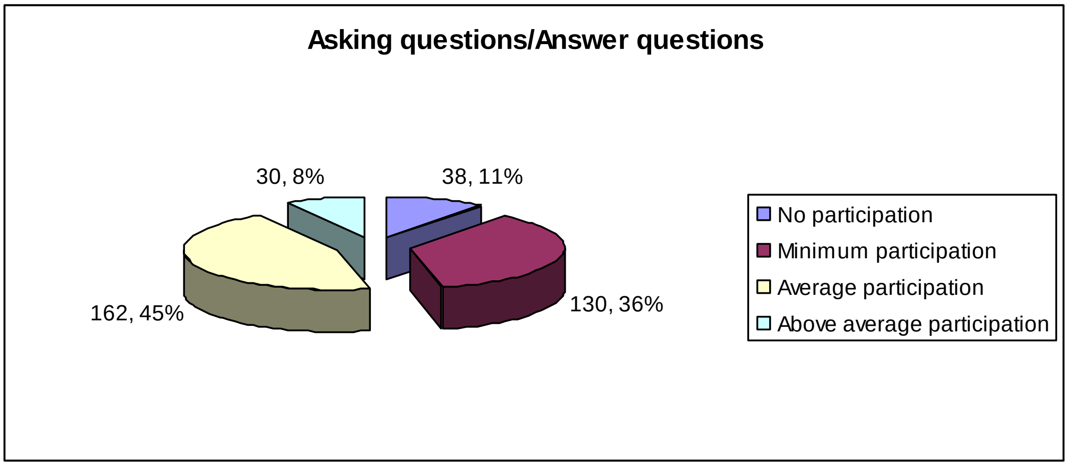
The above results clearly indicate that majority of the teachers (70%) use groupwork, question/answer and practical work techniques in some of the lessons. These findings negate those of the Baseline studies of 1999 which established that teachers mainly used lecture method with little or no activity by the learner. Akinibolola (2010) in his study involving 140 high school physics students established that groups ensures that students are actively involved in the intellectual work of organizing materials, explaining it, summarizing it and integrating it into existing knowledge. Student-centered methods have repeatedly been shown to be superior to the traditional teacher centered approaches to instruction. Felder & Brent (2009) reaffirms that student-centered approaches leads to long-term retention and deeper understanding of content, acquisition of problem solving skills, formation of positive attitudes towards the subject and an increased level of confidence.

The SMASSE programme advocates for careful planning and execution of activities so that the learners can be fully involved. The ASEI/PDSI paradigm requires that teachers selects the activities, plans for the activities, evaluates them and hence improve where necessary. In majority of the schools the administrators rated as good the preparation, use and updating of schemes of work, lesson notes and records of work. Majority of teachers (80%) give monthly tests. However, the study also revealed that less than 20% of the teachers write lesson plans in some lessons while still a majority never invites their colleagues in class to help evaluate or improve their lessons.

4.4 Students' Involvement During Physics Lessons

Further on, the researcher sought to find out the extent of students' involvement during physics lessons. Figure 4.13 represents students' responses to how they participate in asking and answering question during physics lessons.

Figure 4.13: Asking questions/Answer questions

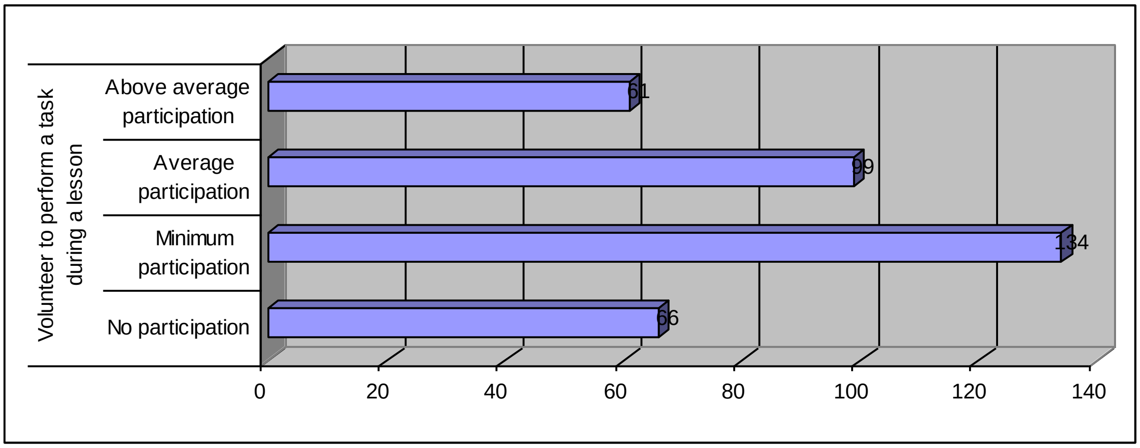


From the figure 4.13, 30 students at 8% and 162 students at 45% had above average and average participation respectively. The students with no participation were 38 at 11% while 130 students at 8% had minimum participation during physics lessons.

The researcher sought students' participation in seeking clarification on areas not understood. According to their responses, 123 at 34% had average participation, while 120 at 33% had minimum participation. The students with no participation at seeking clarification on areas not understood were 45 at 13%, while 72 at 20% had above average participation.

Figure 4.14 shows students' responses on their level of participation in volunteering to perform tasks during lessons.

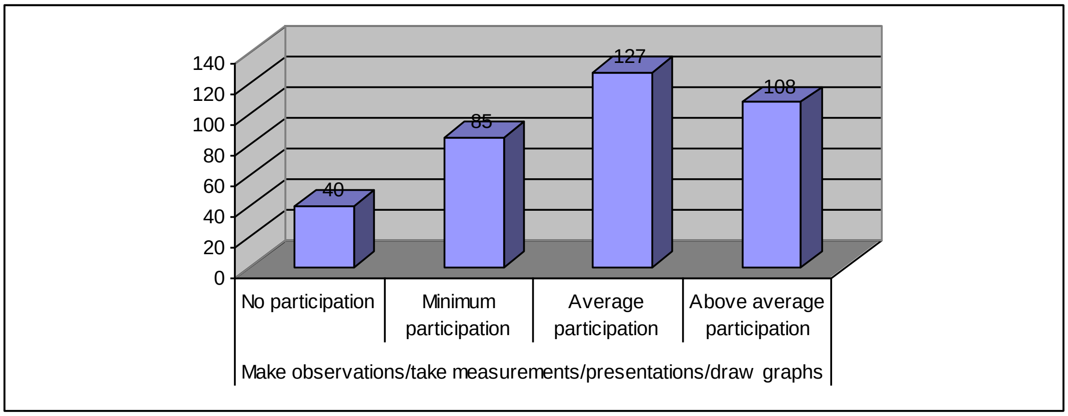
Figure 4.14: Volunteer to perform a task during a lesson



From the findings presented in the figure 4.14, 134 respondents at 37% who were the majority of the students reported minimum participation in volunteering to perform a task during the physics lessons. Sixty one students at 17% reported above average participation. In as far as suggesting possible outcomes of an experiment was concerned majority, that is, 144 at 40% responded to average participation. Those who responded to no participation and minimum participation were 39 at 11% and 129 at 36% respectively.

The figure 4.15 represents levels of students' participation in making observation, taking measurement and drawing graphs.

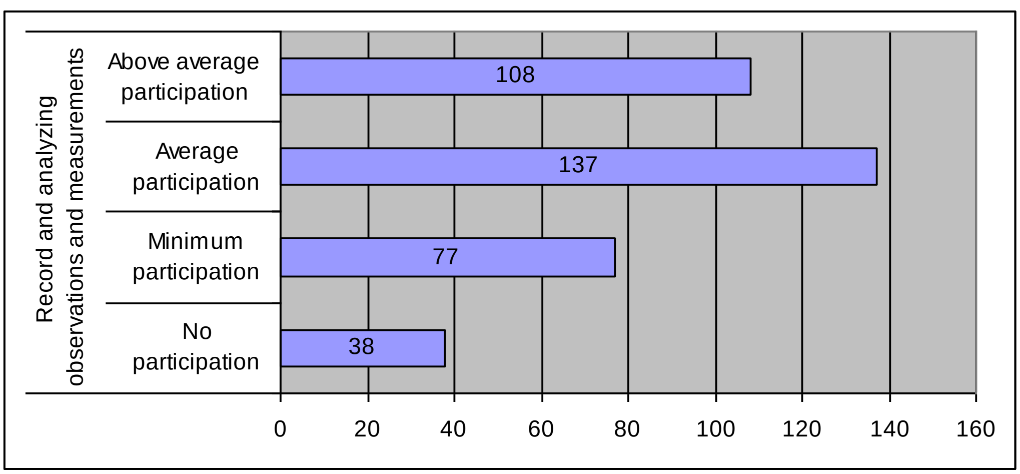
Figure 4.15: Make observations/Take measurements/Presentations/Draw graphs



From figure 4.15, majority of the students, that is 127 at 35% and 108 at 30% reported to having average participation and above average participation respectively in making observations/taking measurements/presentations/drawing graphs, pictures during physics lesson. Those who reported no participation and minimum participation were 40 at 11% and 85 at 24% respectively.

Figure 4.16 shows the extent of students' participation in recording and analyzing of data.

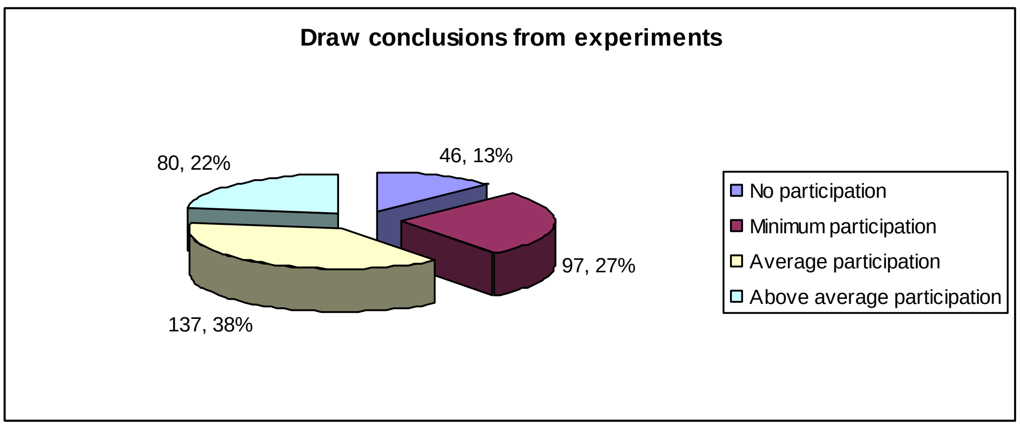
Figure 4.16: Record and analyzing observations and measurement



According to the findings in figure 4.16, 108 students at 30% and 137 students at 38% reported to above average and average participation in recording and analyzing observations and measurements during physics lessons. Thirty eight respondents at 11% reported no participation in recording and analyzing observations and measurements during physics lessons.

Further on students' participation in drawing conclusions from experiments was sought. Figure 4.17 represents responses on the extent to which they participate.

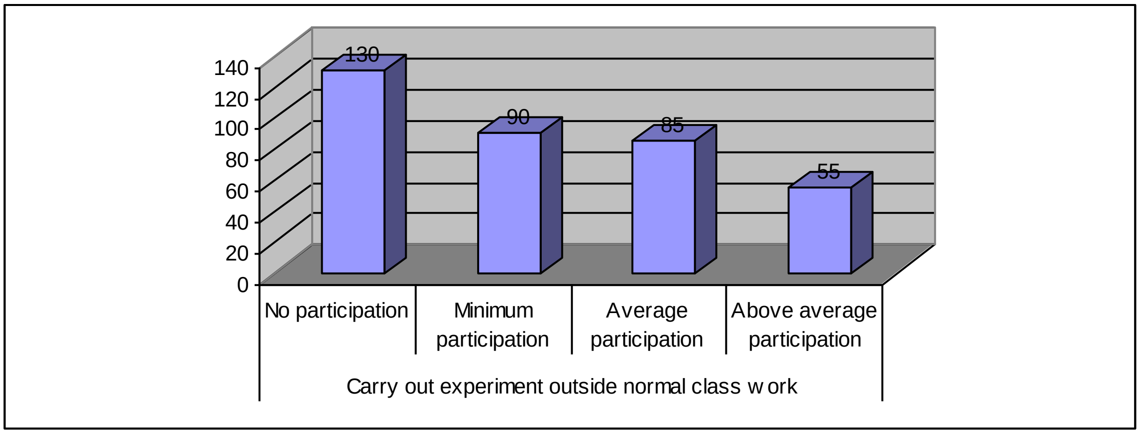
Figure 4.17: Draw conclusions from experiments



From the findings as presented in the figure 4.17, 137 students at 38% and 80 students at 22% reported to average participation and above average participation respectively in drawing conclusions from experiments. Students who reported no participation and minimum participation were 46 at 13% and 97 at 27% respectively.

The study also investigated students' participation in carrying out experiments outside normal class work. Figure 4.18 represents students' responses.

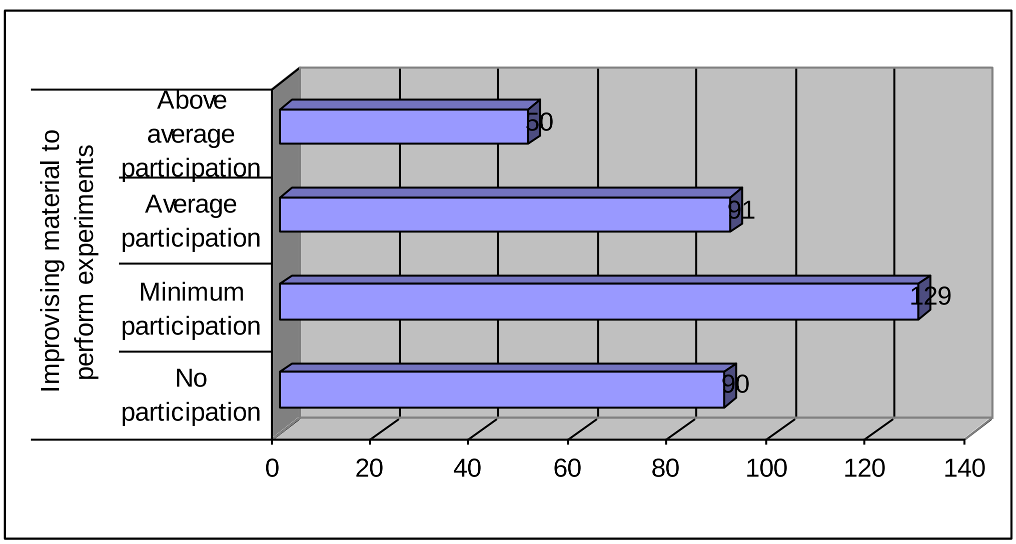
Figure 4.18: Carry out experiments outside normal class work



Majority of the respondents, that is, 130 at 36% and 90 at 25% reported no participation and minimum participation respectively in carrying out experiments outside normal class work as shown in figure 4.18. Those who reported average participation and above average participation in carrying out experiments outside normal class work were 85 at 24% and 55 at 15% respectively.

Figure 4.19 shows the levels of students' participation in improvising learning materials.

Figure 4.19: Improvising material to perform experiments



From the findings as presented in the figure 4.19, 90 respondents at 25% and 129 respondents at 36% reported no participation and minimum participation respectively in improvising material to perform experiments. Fifty and ninety one respondents reported above average participation and average participation in imposing material to perform experiments during physics lessons.

Table 4.5 presents students' participation in group work activity and discussion.

Table 4.5: Participating in group work activity/discussion

		Frequency	Percentage
Participating in group work activity/discussion	No participation	27	8
	Minimum participation	43	12
	Average participation	100	27
	Above average participation	190	53
	Total	**360**	**100**

From the table 4.5, majority of the respondents reported to above average participation and average participation in group work activity/discussion, that is, 190 respondents at 53% and 100 at 27% respectively. Those who reported no participation and minimum participation in group work activity/discussion were 27 at 8% and 43 at 12% respectively.

From the above findings it is clear that only about half of the students participate in question/answer sessions, in seeking clarifications from the teacher and in suggesting possible outcomes of an experiment. Majority of the students do participate in making observations/taking measurement, recording/analyzing, in making conclusions and in group work activities. However most of the students neither volunteer to perform experiment in class and outside normal classwork nor participate in improvising materials. Kuh (2007), Felder &Brent (2009) and Akinibolola (2010) do agree that student involvement matters in that the greater the involvement, the greater the acquisition of knowledge and the development of skills. Student-centered approaches help shift focus of the activity to the learner. The learners solve problems, answer questions, discuss, explain, debate or brainstorm in class. Student may work co-operatively in teams/groups on the problems or experiments under conditions that assure both positive interdependence and individual accountability. SMASSE encourages teachers to ensure that students are involved in activities that help in the development of scientific skills such as the ability to collect data, make observations, perform experiments, makes deductions and present findings.

In addition, the researcher used an observation guide to assess students' involvement during the physics lesson. The findings are presented in the table 4.6.

Table 4.6: Teaching procedures

Teaching Procedures	**0**	**1**	**2**	**3**	**4**
Clarity/feasibility of lesson objectives	0	0	0	9	3
Stated in simple and clear language	0	3	0	0	9
Stated in terms of what learners are expected to achieve	0	0	3	6	3
Achievable within stipulated time	0	0	0	9	3

From the findings presented in the table 4.6, majority of the teachers clarified on the lesson objectives and stated the teaching procedures in simple and clear language though they did not have a written ASEI/PDSI lesson plan. They also stated what the learners were expected to achieve as well as achieved the objectives within the stipulated time.

The table 4.7 and 4.8 presents findings on the appropriateness of the lessons observed.

Table 4.7: Appropriateness of lesson – 1

Appropriateness of lesson in terms of:	**0**	**1**	**2**	**3**	**4**
i) Introduction	0	0	0	3	9
Helps learners to focus on content of lesson	0	0	0	12	0
Stimulating	0	0	3	6	3
Makes reference to previous lessons, everyday experience	0	0	0	3	9
ii) Content Related to learners' previous experience	0	3	0	9	0
Geared to level of learners	3	0	0	9	0
Stimulus variation (use of a variety of techniques) apparent in handling of content	0	0	6	6	0
Teacher well versed in content	0	0	0	3	9
iii) Gender Questions distributed evenly	0	0	6	6	0
Motivational cues free of gender bias	3	0	0	6	3
iv) Language Voice well projected	0	0	3	3	6
Language appropriate to the level of learners	0	0	3	6	3
Teacher defines and explains difficult terms	0	0	3	3	6
Friendly in terms of communication with learners	0	0	0	6	6
Instructions given clearly and unambiguously	0	0	0	9	3

It can be seen from table 4.7 that majority of the respondents helped learners to focus on the content of the lesson, stimulated the learners and made reference to previous lessons or everyday experiences. It can also be deduced that the content was related to learners' previous experience and was geared to the level of the learners. In addition, the teachers used a variety of techniques and were well versed in the content. The questions were evenly distributed among the gender and motivational cues free of gender bias were used. On the language, the voice of the teacher was well projected and the language appropriate to the level of learners. In addition, majority of the teachers defined and explained the difficult terms, were friendly in terms of communication with learners and gave instructions clearly and unambiguously.

Table 4.8: Appropriateness of lesson – 2

3. Emphasis on main concept	**0**	**1**	**2**	**3**	**4**
Use of appropriate and familiar examples to illustrate main concept	0	0	0	6	6
4. Lesson consolidation/summary	**0**	**1**	**2**	**3**	**4**
Reference to main concept	0	0	3	6	3
Sufficient time for learners to ask questions seek clarification	0	6	3	3	0
5. Achievement of set objectives as apparent in:	**0**	**1**	**2**	**3**	**4**
Activities	0	0	6	6	0
Teachers questions	0	0	3	9	0
Students' questions	0	6	3	3	0
Students' answers	0	0	0	12	0
Level of enthusiasm	0	0	0	12	0

From the findings presented in the table 4.8, majority of the teacher use appropriate and familiar examples to illustrate main concepts and during the lesson summary, they refer to the main concept. However, majority of the teachers do not give sufficient time for learners to ask questions and to seek clarification. On achievement of goals, it can mainly be seen in the activities and in teacher's questions. Students' answers and their level of enthusiasm also show that the set objectives are being achieved.

During lesson observation the researcher sought the strategies used by the teacher as well as how students were involved. The findings are shown in the table 4.9.

Table 4.9: Fundamental technique/methodology

II. Fundamental Technique/ methodology	**0**	**1**	**2**	**3**	**4**
1. Student involvement through questioning and discussion Did the teacher ask questions?	0	0	0	12	0
Did students ask questions?	0	6	5	1	0
Were the learners involved in discussions?	0	0	12	0	0
2. Student involvement in hands-on/minds-on activities Were learners meaningfully engaged in learning activities?	0	0	4	8	0
Were the activities planned to arouse and sustain interest?	0	0	4	8	0
3. Appropriateness of demonstrations, teaching aids and improvised materials Materials, demonstrations appropriate for the purpose	0	4	0	8	0
Evidence of improvisation and economy in use of materials	0	8	0	4	0
4. Appropriateness of teacher's attitude and expression Did the teacher appear to be enjoying the teaching?	0	0	0	0	12
Was the teacher sympathetic to the needs and problems of the learners?	0	0	4	8	0
Did the teacher exercise patience with the learners?	0	0	0	8	4

On student's involvement through questioning and discussion, majority of the teachers asked questions as it can be seen in table 4.9. However the levels of students asking questions and being involved in discussions were mainly satisfactory. In the schools studied, majority of the learners were meaningfully engaged in learning activities, and the activities were planned to arouse and sustain interest. While most of the schools had materials and demonstrations appropriate for the purpose, a minority scored fair. In most of the schools the teacher appeared to be enjoying the teaching and was sympathetic to the needs and problems of the learners. In addition, majority of the teachers exercised patience with the learners. Improvisation in majority of the lessons observed was low.

Table 4.10 presents time management, class control and evaluation of the lesson by the teacher.

Table 4.10: Management

III. Management	**0**	**1**	**2**	**3**	**4**
Was the time appropriately distributed In the work plan?	0	0	4	8	0
In the execution of the lesson?	0	0	0	12	0
Class control Did the teacher ensure that all students were engaged in relevant learning activities?	0	0	0	4	8
Did the teacher handle disruptive behaviour appropriately?	0	0	0	8	4
Did the teacher actively solicit students' ideas on content being taught?	0	0	0	12	0
Did the teacher relate students' ideas to the content being taught?	0	0	0	8	4
Did the teacher discuss and correct students' misconceptions?	0	0	0	8	4
Evaluation of the lesson by the teacher Was evaluation incorporated in the plan?	0	4	8	0	0
Did the teacher indicate measures to be taken to improve future planning/execution?	2	3	4	3	0

Table 4.10 shows that majority of the schools had good time management in the work plan and in the execution of time during the lesson. In addition, majority of the schools had very good class control with the teacher ensuring that all students were engaged in relevant learning activities. Majority of the teachers were good in handling disrupting behaviour appropriately and all teachers were good in actively soliciting students' ideas on content being taught. Majority of the teachers were good in relating students' ideas to the content being taught and in discussing and correcting students' misconceptions. Most of the teachers scored satisfactory in incorporating evaluation of the lesson and in indicating measures to be taken to improve future planning/execution of lessons.

4.5 Student Performance in KCSE Since the SMASSE INSET Began

The researcher sought to find out if students' physics performance improved since SMASSE INSET began. The following table 4.11 presents findings as reported by the administrators.

Table 4.11: Physics performance

	Strongly Agree	Agree	Not Certain	Disagree	Strongly Disagree
KCSE performance has improved	3	6	2	0	1
Enrolment in physics has increased	3	7	2	0	0
There is more efficient use of science facilities	1	11	0	0	0
Attitude of teachers towards physics is now positive	7	2	3	0	0
Teachers are more confident in their teaching	4	6	2	0	0

From the table 4.11, three administrators at 25% strongly agreed while six (50%) agreed that KCSE performance has improved since the SMASSE INSET began. However, one administrator disagreed. 80% agreed that enrolment in physics has increased.66% agreed that there is more efficient use of science facilities. On the attitude of teacher towards physics, 58% strongly agreed that it is now positive. 33% of the administrators strongly agreed, while 50% agreed that teachers are more confident in their teaching. Using the teachers' questionnaire the researcher enquired on schools physics performance at KCSE. Out the 12 schools visited, two had never registered students for KCSE physics and were only teaching up to form two while three had only started in 2007.From the remaining seven schools the physics mean grades for 2003, 2006 and 2009 were 2.31(D-),3.52(D+)

and3.04(D) respectively. The findings of the study indicates only a slight improvement in performance since 2003 .The enrolment has improved considering the fact that more schools are registering for KCSE physics. The SMASSE programme focused on changing attitudes and teaching approaches so as to create a positive cycle of good performance, higher self-esteem and more interest in the subject

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The above findings agree with findings by Gathigi (2003) that found the programme had a positive impact on teaching and learning of mathematics in Kajiado district. He concluded that SMASSE had contributed towards the positive improvement in performance at KCSE and better teaching methods. Muthemi (2004) also found that SMASSE had contributed positively towards performance of mathematics in KCSE in Kibwezi Division of Makueni District. In addition, Oirere (2008) found a general improvement in mathematics and sciences due to effectiveness of SMASSE INSET in Kenyenya Division of Gucha District.

4.6 The Challenges Faced in Implementation of SMASSE Programme

The following are the challenges faced in implementation of SMASSE programme. Table 4.12 presents physics teachers' responses.

Table 4.12: Challenges faced in implementation of SMASSE Programme – Teachers' opinion

Challenge	**Frequency**
High workloads	5
Lack of sufficient facilities	4
Curriculum exam oriented	1
Lack of commitment in implementation	1
Students' absenteeism	1
Intellectual ability of students	1
Negative attitude towards SMASSE	1
Scope of content	1
Lack of enough time to improvise facilities	1
Total	**16**

From the table 4.12, high teacher workload was cited as the main challenge followed by lack of sufficient facilities in the school. The administrators cited teachers' negative attitude towards SMASSE programme, students' negative attitude towards physics subject and high teachers' workload as the main challenges.

CHAPTER FIVE

SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.0 Introduction

This chapter presents the summary, conclusion and recommendations based on the findings of this study.

5.1 Summary

The purpose of this study was to investigate impact of SMASSE programme on the teaching and learning of physics. The study objectives were:-

- To determine how many teachers have attended the SMASSE INSET.
- To determine teachers' and students' attitude towards physics
- To determine the major methods of teaching used by teachers of physics.
- To determine the availability of requisite learning facilities.
- To determine levels of student participation in physics lessons.
- To determine students' performance in KCSE exams since the introduction of SMASSE INSET.
- To establish the challenges faced by teachers in implementation of skills and techniques acquired from SMASSE INSET.

5.1.1 Teacher Attendance of SMASSE INSET Cycle

Majority of the teachers (63%) had attended the mandatory four cycles while 25% had not attended any. Those who had not attended had been recently recruited by the TSC and the BOG.

5.1.2 Attitudes towards Physics Teaching and Learning

There is evidence that majority of the teachers have a positive attitude towards teaching physics and towards physics students. Above 90% find teaching physics interesting and enjoyable and always consult their colleagues. A similar percentage is interested in their learners irrespective of their sex and goes an extra mile to set realistic goals for them.80% believed that teaching can be enhanced using practical activities with improvisation where necessary. A majority of the teachers (63%) spare time to help slow learners and often give individual attention.

On students' attitude towards learning physics, the findings indicate that majority of the students have a positive attitude towards learning physics. This is evidenced by the fact above 90% enjoy studying physics, rarely skip lessons and believe they can do well. Still a majority (94%) believe physics is an important and necessary subject which can be studied by both boys and girls. Further on, about 80% agree that the teacher is interested in their performance and have made them feel that they can do well. The findings also show that about 65% study physics during free time and try solving new problems.

5.1.3 Student-Centered Physics Teaching.

The study found that majority of the physics teachers engage students in most of the lessons.70% mainly use question/answer technique, practical work (experiments) and group discussions in some of the lessons. They also encourage students to report the results of practical and group work. A similar percent try-out experiments before presenting them to students which gives them an opportunity to make any necessary adjustments. Majority of the teachers (70%) do give students take home assignments in most of the lessons. However, 50% rarely gave students with difficulties more exercises and practice on observation.

In as far as the teaching tools are concerned the study established that majority of teachers prepare, update and make good use of schemes of work, lesson notes, records of work and assessment records. However the preparation and use of lesson plan was rated poor. SMASSE requires that evaluation be done so as to have basis for improvement. The findings of this study is that only 6% of the teachers invite colleagues to some of their lesson with monthly tests being the most commonly used evaluation tool for students.

5.1.4 Students' Involvement during Physics Lesson

According to the findings, about 50% students participate in asking or answering questions and in seeking clarification on areas not understood. Majority of the students (about 70%) averagely participates in group work/discussion and also in making observations, taking measurements, analyzing and presentation of findings. Majority of students at 37 % do not volunteer to perform tasks during lessons. Further 36% do not carry out experiments outside normal class work while still 25% never participate in improvisation of materials.

5.1.5 Student Performance in KCSE since the SMASSE INSET Began

From the findings, there has been an improvement in the students' performance in KCSE. Majority of the administrators (75%) agree that performance has improved. However considering the schools' mean grades this improvement is minimal. The physics performance in the school visited is still below average. The best mean grade recorded was C- in only one school.

5.1.6 The Challenges Faced in Implementation of SMASSE Programme

The study found that the implementation of SMASSE programme has encountered a number of challenges. High teacher workloads and lack of sufficient facilities were cited as the main challenges. Others include teachers' negative attitude towards SMASSE programme and students' negative attitude towards physics subject were cited as the main challenges.

5.2 Conclusion

The purpose of this study was to establish the impact of SMASSE INSET on the teaching and learning of physics in mixed day secondary schools in Lari District. Through the INSET, SMASSE targeted to change teachers' and students' attitude towards physics and to improve effectiveness in the classroom in order to achieve the overall goal of upgrading students' performance in the national exams. The programme came up with the ASEI/PDSI approach to make learning student-centered where the students would be active in their own learning.

The findings of the study show that teachers' attitudes towards physics as a subject and also towards its teaching are now positive. There is also evidence that students' attitude towards physics is positive. Both teachers and students are interested in physics and enjoy themselves during the lessons. Students' performance at KCSE has improved slightly.

From the findings, it is clear that ASEI/PDSI approach has not been fully implemented. Though majority of the teachers' use activities which are student-centered like question/answer, group discussions and experiments there is minimal improvisation. Students' participation in some of the activities is also minimal. Teachers execute lessons in an orderly and organized manner but it was noted that majority do not write ASEI lesson plans.

The effective implementation of the programme has been affected by high teacher workloads, insufficient learning resources and teachers' negative attitude towards SMASSE.

5.3 Recommendations

From the discussion and conclusions derived from the data collected and analyzed, the researcher suggests the following recommendations:

1. The challenge of high workloads and insufficient facilities in schools should be addressed to facilitate better physics performance among the students.
2. In order to motivate science teachers' SMASSE certificates should be recognized for promotion/upgrading purpose.

3. Physics teachers should seek ways of encouraging and motivating students during the physics experiment lessons, for example, in volunteering to perform a task, in suggesting possible outcomes to the experiments, and in improvising materials to perform experiments.

4. Further on, the students should be encouraged to perform and carry out experiments outside normal class work under supervision. School laboratories should be made available to students.

5. Special INSET for newly employed teachers should be organized yearly so as to ensure they are brought on board. Alternatively the teacher educators should consider including SMASSE tenets in the pre-service programmes.

6. SMASSE organizers should vary INSET activities with inclusion of more actualization sessions in order to motivate teachers.

7. SMASSE trainers should conduct a teacher' needs survey before mounting INSET in order to make it more teacher- centered.

8. Follow-up activities by SMASSE trainers and District Quality Assurance officers should be enhanced at the school level.

5.3.1 Recommendations for Further Research

The researcher makes the following recommendations for further research:

1. This research was conducted in only one district. Future research can be done in other districts and in other provinces.

2. Similar studies should be undertaken in other science subjects-chemistry, biology and mathematics within the district.

3. This study focuses mainly on the classroom activities; a further study can be done on factors outside class that affect implementation of SMASSE.

4. A study can also be done on the appropriateness of the INSET curriculum.

5. Future research can also be done among students in tertiary institutions of learning such as colleges and university to find out if SMASSE INSET gives them an advantage.

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APPENDIX A

LETTER OF INTRODUCTION TO HEADTEACHER

Kenyatta University
Department of Educational Management,
Policy and Curriculum Studies
P. O. Box 43844,
NAIROBI

The Principal
....

LARI DISTRICT.

Dear Principal,

RE: RESEARCH INFORMATION

I am a student at Kenyatta University pursuing a Masters Degree in Education. I am conducting a research on the impact of SMASSE programme on the teaching and learning of Physics in Mixed Day Secondary Schools in Lari District. I would be very grateful if you, your physics teacher(s) and students would respond to my questionnaires.

I would like to assure you that the information gathered will be for the purpose of this research only and will be treated with strict confidentiality.

Thank you.

Yours Faithfully,

Margaret W. Kahare

APPENDIX B

SCHOOL ADMINISTRATION INTERVIEW SCHEDULE

SCHOOL……………………………………………………………………….

1. Gender Male [ ] Female[ ]
2. Age 30-39 [ ] 40-49 [ ] above 50 [ ]
3. What is you highest professional qualification?

   DipED [ ] PGDE [ ] BED [ ] MED/MA/MSC [ ]
4. How long have you been a principal in this school? …………………………………..
5. What is your teaching subject? ……………………………………………………...
6. Have you ever been involved in SMASSE INSET organization? Yes/No

   If yes, state how?

   ………………………………………………………………………………………

   ………………………………………………………………………………………..

   ....

   ....
7. In your school do you have a forum in which SMASSE trained teachers share their experiences with other teachers? Yes/No

   If yes, how is this facilitated?

   ………………………………………………………………………………………

   ………………………………………………………………………………………

   ………………………………………………………………………………………..

   ....

8. Respond to the following statements on the impact of SMASSE INSET on physics in your school.

   Key: SA – Strongly Agree   A – Agree   NC – Not Certain   DA – Disagree

   SD – Strongly Disagree

No.		SA	A	NC	DA	SD
(i)	KCSE performance has improved					
(ii)	Enrolment in physics has increased					
(iii)	There is more efficient use of science facilities					
(iv)	Attitude of teachers towards physics is now positive					
(v)	Teachers are more confident in their teaching					

9. How would you rate the preparation, updating and use of the following official documents by physics teachers?

Document	Poor	Fair	Fairly good	Good	Very good
Scheme of work					
Lesson plan					
Lesson notes					
Record of work					
Assessment records					

10. Does your school participate in physics contests and science congress? Yes/No

    If no, why not?

    …………………………………………………………………………………………

    …………………………………………………………………………………………..

    ....

11. What factors in your opinion hinder successful implementation of SMASSE approaches to teaching/learning in your school?

    …………………………………………………………………………………………

    …………………………………………………………………………………………..

    ....

12. What suggestions would you make in order to improve teaching/learning of physics?

    …………………………………………………………………………………………

    …………………………………………………………………………………………

    …………………………………………………………………………………………..

    ....

Thank you for participating.

APPENDIX C

PHYSICS TEACHERS QUESTIONNAIRE

Do not write your name on the questionnaire since the information you shall give will be treated with confidentiality and will be used only for the purpose of this research. Kindly write your hones response to each question.

SECTION 1

Tick ☑ where appropriate

1. Gender Male [ ] Female[ ]

2. Age 25-29 [ ] 30-39 [ ] 40-49 [ ] above 50 [ ]

3. What is your highest professional qualification?

   Dip Ed [ ] PGDE [ ] BED [ ] MED/MSC/MA [ ]

4. How long have you been in the teaching profession?

   1-5 years [ ] 6-10 [ ] 11-20 [ ] Above 20 [ ]

5. What is your teaching load per week?

   ……………………………………………………………………………………

6. Have you attended any physics SMASSE INSET cycle? Yes/No

   If yes, how many? ………………………………………………………………..

   If no, why not?

   ....

7. What is the teacher-student ratio in your school? ……………………………………..

8. How often do you give continuous assessment test?

   1 week [ ] 2 weeks [ ] monthly [ ] after a topic [ ]

9. Do you have a science laboratory in your school? Yes/ No

   If yes, is it well equipped? ……………………………………………………………

SECTION II

What is your opinion on each of the following statements? Please tick ☑ in the appropriate box (es).

No		Strongly Agree	Agree	Not certain	Disagree	Strongly disagree
10	Teaching Physics in interesting					
11	Practical activities can be performed even without a laboratory					
12	I am interested in my learners and the difficulties they face in learning physics					
13	Effective teaching can be achieved through improvisation					
14	Both boys and girls are capable of doing well if effectively taught					
15	I spare sometime to help the slow learners					
16	I pay individual attention to students in physics class					
17	Other school duties cannot hinder effective teaching/learning session in physics					
18	I always set positive and realistic goals for my students					
19	I always consult other colleagues whenever a problem arises					

SECTION III

How often do you do the following activities? Please a tick ☑ in appropriate box.

No		Every Lesson	Most Lessons	Some Lessons	Rarely	never
20	Engage students in group work					
21	Use appropriate question/answer technique with reinforcement of student response					
22	Assign student discussion work					
23	Assign student practical work					
24	Allow students to report the results of practical work					
25	Give students with difficulties more exercises and practice on observation					
26	Practice team teaching with your colleagues					
27	Make lesson plans					
28	Use lesson notes instead of lesson plans					
29	Use both lesson plans and lesson notes					
30	Try-out experiments or any other practical work before going to class					
31	Give students take home assignments					
32	Invite a colleague to sit in class during a lesson					

SECTION IV

32. Please fill the table for physics performance at the KCSE level for the period 2003-2009.

YEAR	**ENROLMENT**			**MEAN**
	BOY	**GIRL**	**TOTAL**	
2003				
2004				
2005				
2006				
2007				
2008				
2009				

33. What factors in your opinion hinder implementation of SMASSE approaches in your teaching?

…………………………………………………………………………………………

…………………………………………………………………………………………..

34. Suggest ways in which SMASSE programme may be improved in order to further improve teaching and learning of physics.

…………………………………………………………………………………………

…………………………………………………………………………………………

…………………………………………………………………………………………

Thank you for participating

APPENDIX D

STUDENTS' QUESTIONNAIRE

SCHOOL ………………………………………………………………………………………

CLASS ……………………………………………………………………………………..

SEX MALE [ ] FEMALE [ ]

SECTION I

Read the following statements and kindly give your honest opinion by placing a tick in the appropriate box.

No		Strongly Agree	Agree	undecided	Disagree	Strongly disagree
1	Physics is not as difficult					
2	I enjoy studying physics					
3	Physics is an important and necessary subject					
4	I know I can do well in physics					
5	My teacher is interested in my physics performance					
6	Both girls and boys can do well in physics					
7	My teacher has made me feel I have the ability to improve					
8	I often find myself studying physics during my free time					
9	I like solving new problems in physics					
10	I rarely skip physics lessons					
11	I am satisfied with the way the teacher teaches physics					

SECTION II

The following statements refer to your participation in a physics lesson. Read each statement carefully and evaluate your level of participation by placing a tick ☑ in the relevant position.

Key

No participation [0]

Minimum participation [1]

Average participation [2]

Above average participation [3]

No		0	1	2	3
12	Asking question/answer question				
13	Seeking clarification on areas not understood				
14	Volunteer to perform a task during a lesson				
15	Suggest possible outcome of an experiment				
16	Make observations/take measurements/presentations/draw graphs, pictures etc.				
17	Record and analyzing observations and measurements				
18	Draw conclusions from experiments				
19	Carry out experiment outside normal class work				
20	Imposing material to perform experiments				
21	Participating in group work activity/discussion				

22. What suggestions would you give that would help improve the teaching and learning of physics?

…………………………………………………………………………………………………

…………………………………………………………………………………………………

…………………………………………………………………………………………………

Thank you for participating

APPENDIX E

LESSON OBSERVATION GUIDE

School………………… Class…...........................Date…………………………..

Topic/Subtopic…………………………………………………………………

Number of students…………………………Observer…………………………..

Please indicate your assessment of the following aspects of the lesson by placing a tick in the appropriate box on the rating scale (Rating scale: 0-poor; 1-fair; 2-satisfactory; 3-good; 4-very good)

I. Teaching procedure	Rating scale				
	0	1	2	3	4
Clarity/feasibility of lesson objectives Stated in simple and clear language Stated in terms of what learners are expected to achieve Achievable within stipulated time					

2. Appropriateness of lesson in terms of: i) Introduction Helps learners to focus on content of lesson Stimulating Makes reference to previous lessons, everyday experience					
ii) Content Related to learners' previous experience Geared to level of learners Stimulus variation (use of a variety of techniques) apparent in handling of content Teacher well versed in content					
iii) Gender Questions distributed evenly Motivational cues free of gender bias					

iv) Language Voice well projected Language appropriate to the level of learners Teacher defines and explains difficult terms Friendly in terms of communication with learners Instructions given clearly and unambiguously					
3. Emphasis on main concept Use of appropriate and familiar examples to illustrate main concept					
4. Lesson consolidation/summary Reference to main concept, Sufficient time for learners to ask questions seek clarification					
5. Achievement of set objectives as apparent in: Activities Teachers questions Students' questions					

Students' answers Level of enthusiasm					
II. Fundamental Technique/ methodology					
1. Student involvement through questioning and discussion Did the teacher ask questions? Did students ask questions? Were the learners involved in discussions?					
2. Student involvement in hands-on/minds-on activities Were learners meaningfully engaged in learning activities? Were the activities planned to arouse and sustain interest? 3. Appropriateness of demonstrations, teaching aids and improvised materials Materials, demonstrations appropriate for the purpose Evidence of improvisation and economy in use of materials					

4. Appropriateness of teacher's attitude and expression Did the teacher appear to be enjoying the teaching? Was the teacher sympathetic to the needs and problems of the learners? Did the teacher exercise patience with the learners?					
III. Management					
Was the time appropriately distributed In the work plan? In the execution of the lesson?					
Class control Did the teacher ensure that all students were engaged in relevant learning activities? Did the teacher handle disruptive behaviour appropriately?					
Did the teacher actively solicit students' ideas on content being taught? Did the teacher relate students' ideas to the content being taught?					

Did the teacher discuss and correct students' misconceptions?					
Evaluation of the lesson by the teacher Was evaluation incorporated in the plan? Did the teacher indicate measures to be taken to improve future planning/execution?					

Additional comments

…………………………………………………………………………………………

…………………………………………………………………………………………

…………………………………………………………………………………………

…………………………………………………………………………………………

APPENDIX F

LIST OF MIXED DAY SCHOOLS IN LARI DISTRICT AND THE ENROLMENT 2009

	NAME OF SCHOOL	BOYS	GIRLS	TOTAL
1.	BATHI	96	113	209
2	ESCARPMENT	69	84	153
3	GITITHIA	298	179	477
4	GITUAMBA	109	164	273
5	JUVENALIS	70	71	141
6	KAGAA	100	67	167
7	KAMAHINDU	89	88	177
8	KAMUCHEGE	140	145	285
9	KIAMBOGO	81	75	156
10	KIMENDE	123	93	216
11	LARI	435	284	719
12	MAGINA	81	80	161
13	MBAU-INI	143	114	257
14	MUGIKO	179	120	299
15	NDURIRI	125	170	295
16	NYANDUMA	108	124	232
17	ST. JOSEPH	81	88	169
18	ST. PATRICK NYANDUMA	84	83	167
19	UTUGI	146	135	281
20	KAMBURU	101	91	192
21	NYAMWERU	209	127	336