STUDENTS’ LEARNING CHALLENGES IN PHYSICS IN PUBLIC SECONDARY SCHOOLS IN LAIKIPIACOUNTY, KENYA

FRASIAH NJERI NDEGWA
E55/NKI/PT/23438/2012

A RESEARCH PROJECT SUBMITTED TO THE DEPARTMENT OF EDUCATIONAL MANAGEMENT, POLICY AND CURRICULUM STUDIES IN PARTIAL FULFILLMENT OF THE REQUIREMENT FOR THE AWARD OF MASTER OF EDUCATION DEGREE OF KENYATTA UNIVERSITY
AUGUST 2018
DECLARATION

I declare that this research project is my original work and has not been presented for a degree in any other university or any other institution of higher learning for consideration. This research project has been complemented by referenced sources duly acknowledged. Where text, data, graphics, pictures or tables have been borrowed from other sources, including the internet, these are specifically accredited and references cited in accordance in line with anti-plagiarism regulations.

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Frasiah Njeri Ndegwa                           Date
E55/NKI/PT/23438/2012

This research project has been submitted with our approval as University supervisors.

-----------------------------------------------  -----------------------------------------------
Dr. Joseph Mungai (PhD)                        Date
Lecturer,
Department of Educational Management,
Policy and Curriculum Studies,
Kenyatta University.

-----------------------------------------------  -----------------------------------------------
Dr. Mary Otieno (PhD)                         Date
Senior Lecturer,
Department of Educational Management,
Policy and Curriculum Studies,
Kenyatta University.
DEDICATION

I dedicate this work to my sons; Ken, Renny, Robert and my daughters; Catherine and Wairimu and their children for allowing me to spare time for this work and their moral and spiritual support. Special tribute goes to the Almighty God for giving me strength and good health during the period of this study.
ACKNOWLEDGEMENT

The successful preparation of this research project involved the co-operation of several persons and institutions. Whereas it may not be practical to mention them all, I would wish to show my gratitude to my two supervisors; Dr. Mary Otieno (PhD) and Dr. Joseph Mungai (PhD) of the Department of Educational Management, Policy and Curriculum Studies, School of Education, Kenyatta University for providing me with professional advice and guidance.

Secondly, I wish to thank my colleagues in the Department of Educational Management, Policy and Curriculum Studies, Nanyuki Campus for the discussions that yielded this research project.

Last but not least my appreciation goes to Mr. Nderitu of Nanyuki High school for assisting me in editing this research Project. May God bless you all.
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### ABBREVIATIONS AND ACRONYMS

<table>
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<th>Abbreviation</th>
<th>Description</th>
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<tbody>
<tr>
<td>KICD:</td>
<td>Kenya Institute of Curriculum Development</td>
</tr>
<tr>
<td>KIE:</td>
<td>Kenya Institute of Education</td>
</tr>
<tr>
<td>NTFTEP:</td>
<td>National Task Force on Teachers Education in Physics</td>
</tr>
<tr>
<td>PER:</td>
<td>Physics Education Research</td>
</tr>
<tr>
<td>PTE:</td>
<td>Physics Teachers’ Education</td>
</tr>
<tr>
<td>ROSE:</td>
<td>The Relevance of Science Education</td>
</tr>
<tr>
<td>SMASSE:</td>
<td>Strengthening of Mathematics and Science in Secondary Education</td>
</tr>
<tr>
<td>TEP:</td>
<td>Teacher Education in Physics</td>
</tr>
<tr>
<td>TIMSS:</td>
<td>Trends in International Mathematics and Science Studies</td>
</tr>
<tr>
<td>UNESCO:</td>
<td>United Nations Educational, Scientific and Cultural Organization</td>
</tr>
<tr>
<td>USA:</td>
<td>United States of America</td>
</tr>
<tr>
<td>SPSS:</td>
<td>Statistical Packages for Social Sciences</td>
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</table>
ABSTRACT

The purpose of this study was to establish students’ learning challenges in the study of Physics in public secondary schools in Laikipia East Sub-County, Laikipia County, Kenya. The study was guided by the following objectives: To determine the effect of Practical work in the learning of Physics in public secondary schools in Laikipia East sub-county, find out whether Physics Instructional methods influence the students learning of Physics, determine whether students’ attitude towards physics is a challenge in the learning of physics and to establish whether student’s gender is a challenge to his/her learning of physics in Public Secondary Schools in Laikipia East Sub-county, Laikipia County, Kenya. This study was based on Bloom’s theory of School Learning as presented by Murphy Jo (2007). The research adopted descriptive survey design to establish students’ learning challenges in Physics in public secondary schools in Laikipia East Sub-County, Laikipia County. The researcher used two questionnaires, a student’s questionnaire and the physics teacher questionnaire as the research instruments. The researcher used stratified, purposive and simple random sampling whereby the students were stratified as boys only, girls only, and mixed. The sample size comprised of 360 students, in which 100 were boys, 82 were girls and 178 were in mixed category. Before the actual data collection, the questionnaires were piloted in three secondary schools, one boy’s only one girl only and one mixed to test the validity of the research instruments. The researcher employed split half method to test the reliability of the instruments. Quantitative data was coded, assigned labels to variable categories and entered into the analyzed by use of Statistical Package for Social Sciences (SPSS) to get descriptive statistics such as frequency tables, percentage, and graphs which were used to present the information. The study found that there was a significantly higher enrolment in single sex schools than in mixed schools. All single sex schools in the study were county boarding schools with more laboratory resources compared to mixed schools which were day schools and less established in terms of resources compared to the former schools. All students who enrolled in physics had a positive attitude towards the subject and therefore the study found that students’ attitude had a positive effect towards Physics learning. Boys performed better in physics in mixed schools than girls. However, in single sex schools, the girls’ schools performed better than the boys’ schools. Students whose physics lessons were conducted frequently in the laboratory performed better than those students who did not frequent the laboratory for their physics lessons. The study recommended that Physics teachers should effectively use teaching/learning resources to improve student’s conceptualization skills. Physics teachers should embrace modern teaching methods as the method of instruction was found to affect the performance of Physics. Further, it was recommended that school administrators prioritize the provision of laboratory equipment and for the physics teachers to expose students to the equipment in the laboratory more frequently. Further research needs to be carried out on challenges faced by students in the other science subjects.
CHAPTER ONE

INTRODUCTION

1.1 Introduction

This section of the study gives details on the background to the study, statement of the problem, purpose of the study, objectives of the study, research questions, and significance of the study, limitations of the study, delimitations of the study, assumptions of the study, theoretical framework and conceptual framework, and operational definition of terms. This chapter entails both theoretical and conceptual frameworks.

1.2 Background to the Study

Physics, which is the study of matter, energy and their interactions, is an international enterprise, which plays a key role in the future progress of mankind. It is one of the pre-requisite subjects for the study of engineering, technological, medical and other applied science courses in the university. Despite the undisputed importance of Physics, many students perceive it to be a difficult subject, Adelaide, now.com/math-science (2010).

Scholars in Physics education have made a deliberate effort to improve the way Physics is taught in order to try and remove the perception that Physics is difficult. Despite these efforts, the performance of physics in the summative evaluation after the secondary school cycle has been poor, KNEC, (2010) over the years. The number of students’ dropping the subject after the second year in secondary school in Kenya has also been increasing, MOEST Report, (2015). Even with the intervention programs by the Ministry of Education Science and Technology
(MOEST) such as Strengthening of Mathematics and Sciences in Secondary Education (SMASSE) program aimed at improving the performance in these subjects Mwambela, (2013) and the Government Economic Stimulus program to equip selected secondary schools with well-equipped laboratories, the situation of Physics performance has not shown any noticeable improvement.

According to UNESCO (2010), enrolment in Secondary schools has improved during the past five years due to improved transition from primary school, which reached 64.8 percent in 2008, up from 47 percent in 2002. But while the numbers attending high school has increased dramatically, the percentage enrolled in the physics course continues to drop. Studies by Bolstad and Hipkins (2005) in New Zealand, Lyons (2005) in Australia, Smither and Robinson (2006) in the UK, observe that the number of senior students who choose physics is relatively small and has shown a declining tendency.

Enrolment of physics in KCSE is always less than that of other science subjects namely chemistry and biology. This trend is even more common in schools in rural areas than in urban areas (MOEST2007). Likewise, students in high performing schools are more likely to enroll and perform better in physics than those in low performing schools. All schools in Laikipia East Sub-county are in the rural setting and enrollment in physics is significantly low as illustrated in Table 1.1.
Table 1.1: Students’ Enrolment in Physics in Laikipia East Sub-County in comparison with Biology between 2009 and 2016

<table>
<thead>
<tr>
<th>Year</th>
<th>Total</th>
<th>Physics</th>
<th>Biology</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Entry</td>
<td>%</td>
<td>Entry</td>
</tr>
<tr>
<td>2009</td>
<td>933</td>
<td>230</td>
<td>930</td>
</tr>
<tr>
<td>2010</td>
<td>1016</td>
<td>204</td>
<td>1008</td>
</tr>
<tr>
<td>2011</td>
<td>1232</td>
<td>237</td>
<td>1228</td>
</tr>
<tr>
<td>2012</td>
<td>1287</td>
<td>278</td>
<td>1280</td>
</tr>
<tr>
<td>2013</td>
<td>1273</td>
<td>285</td>
<td>1260</td>
</tr>
<tr>
<td>2014</td>
<td>1234</td>
<td>261</td>
<td>1224</td>
</tr>
<tr>
<td>2015</td>
<td>1404</td>
<td>300</td>
<td>1390</td>
</tr>
<tr>
<td>2016</td>
<td>1545</td>
<td>338</td>
<td>1530</td>
</tr>
</tbody>
</table>

Source: Laikipia East Sub-County Education Office KCSE2009-2016 Performance

As observed in Table 1.1, students’ enrolment in physics in Laikipia East Sub-county is quite low. An average of only 22% of the students enrolled for physics. With the assumption that the students who enrolled in physics were likely to be the bright ones, the mean score was expected to be higher compared that in biology which was done by almost all the students. However, this was not the case as observed in Table 1.2. Although the performance in physics was generally better than biology, this could be attributed to the fact that the enrolment in physics is far much lower than that of Biology. It was this concern that motivated the researcher to try and look into how the students’ learning challenges in physics was affecting the enrolment and performance of physics in Laikipia East Sub County.
Table 1.2: Laikipia East Sub County Mean Score for Physics and Biology from 2009 to 2016

<table>
<thead>
<tr>
<th>Year</th>
<th>Physics</th>
<th>Biology</th>
</tr>
</thead>
<tbody>
<tr>
<td>2009</td>
<td>4.595</td>
<td>3.400</td>
</tr>
<tr>
<td>2010</td>
<td>4.978</td>
<td>3.812</td>
</tr>
<tr>
<td>2011</td>
<td>4.987</td>
<td>4.025</td>
</tr>
<tr>
<td>2012</td>
<td>5.540</td>
<td>3.927</td>
</tr>
<tr>
<td>2013</td>
<td>3.570</td>
<td>4.788</td>
</tr>
<tr>
<td>2014</td>
<td>4.500</td>
<td>4.735</td>
</tr>
<tr>
<td>2015</td>
<td>4.250</td>
<td>4.130</td>
</tr>
<tr>
<td>2016</td>
<td>3.410</td>
<td>3.560</td>
</tr>
</tbody>
</table>

Source; Laikipia East Sub County Education Office KCSE 2009-2016 performance report

Often the teacher was blamed for the poor performance in Physics, among other factors such as availability of teaching facilities and attitudes of the students towards the subject as observed by Kamau (2011). According to Howell and Mordini (2003), physics teachers who use the project method as a means of teaching technical skills, tool use and problem solving, provide a means for increasing student participation in the learning process. Referring to the universities’ administration applications documents Physics, is required in all engineering courses and is an added advantage in great many careers including medicine.

This study attempted to establish the students’ learning challenges in Physics in public secondary schools in Laikipia East Sub-County, Laikipia County, Kenya.

1.3 Statement of the Problem

Physics has been mystified as difficult, resulting in some Kenyan schools opting not to offer it after Form Two in secondary school. Recent findings show that students
who hold stereotype images of scientists, science and technology in society are not only easily discouraged from pursuing scientific disciplines like Physics, but also usually perform poorly in them (Mwambela, 2013). The concern is that the performance in Physics is going down and the subject is less popular among students in Kenya’s public secondary schools as compared to other science subjects due to various unknown, hidden, or ignored challenges, According to a report in Examination analysis in DEO’s office, Laikipia East (2015&2016). In Kenya, Physics curriculum implementation is affected by difficulty and abstractness of certain topics, mismatch between the language of instruction and the commonly used language, shortage of appropriate books, pressure of examination oriented curricular and lack of appropriate and relevant Physics apparatus, Changetywo (2002). The Ministry of Education interventions such as SMASSE programs which was introduced in Kenyan secondary schools to help science and Mathematics teachers in 2003(SMASSE Report, 2003) and Kenya’s Economic Stimulus Program of 2009/2010 which involved building and equipping science laboratories have not changed the situation in Laikipia county for the better in regard to Physics enrolment and performance. Although research has been done to address factors that could be contributing to poor performance in Physics in some parts of the country, no similar research has been conducted to address students learning challenges in Physics in Laikipia County. A gap therefore exists in that the aforementioned interventions do not appear to have a significant impact in Physics learning which manifests itself in the KCSE results. It is in this context that the researcher decided to carry out a study to establish the students’ learning challenges in physics in public secondary schools in Laikipia East Sub-County, Laikipia County, Kenya.
The findings of this study will assist Physics teachers to try and use teaching approaches that will demystify Physics so that more students find it easy to understand. Teacher trainers will also benefit from the findings of the study and prepare teachers who are equipped to adapt to new challenges in the teaching of Physics.

1.4 Purpose of the Study

The purpose of this study was to establish the student’s learning challenges in physics in public secondary schools in Laikipia East Sub-County, Laikipia County, Kenya.

1.5 Objectives of the Study

The study was based on the following objectives;

i) To determine the effect of Laboratory practical work in the learning of Physics in public secondary schools in Laikipia East Sub -County, Laikipia County, Kenya.

ii) To find out whether physics instructional methods influence the students’ learning of Physics in Public Secondary Schools in Laikipia East Sub-county, Laikipia County, Kenya.

iii) To determine whether student’s attitude towards physics is a challenge in the learning of physics in Public Secondary Schools in Laikipia East Sub-County, Laikipia County, Kenya.

iv) To establish whether student’s gender is a challenge that influences their learning of Physics in Public Secondary Schools in Laikipia East Sub-County, Laikipia County, Kenya.
1.6 Research Questions

The research was guided by the following questions:

i) What are the effects of laboratory practical work in the learning of physics in public secondary schools in Laikipia East Sub-County Laikipia County?

ii) To what extent do Physics instructional methods influence the learning of physics in Public Secondary Schools in Laikipia East Sub-county, Laikipia County?

iii) To what extent does the students’ attitude towards physics pose a challenge to their learning of Physics in Public Secondary Schools in Laikipia East Sub-County, Laikipia County?

iv) How does the students’ gender influence their learning of Physics in Public Secondary Schools in Laikipia East Sub-County, Laikipia County?

1.7 Significance of the Study

The aim of this study was to contribute towards the improvement of teaching and learning of Physics at secondary school level. The researcher wished to establish the extent to which the students’ learning challenges in Physics considered in this study affects his/her opportunity to learn Physics. The research findings may sensitize Physics teachers, who are the implementers of the Physics curriculum, on the strategies and techniques suggested to improve the performance in Physics. The findings may also assist the students to identify difficult areas and to adopt the strategies suggested in handling the difficult areas. For curriculum developers, the findings may assist them to come up with more appropriate teaching methodologies so as to improve the students’ performance in Physics. The authors of Physics textbooks may also be sensitized through the research findings to prepare the
learning materials that enhance effective learning in Physics. This study may determine whether the present status is enough to develop a sense of enquiry, spirit of enthusiasm to investigate and to create favourable conditions for efficient teaching learning experience. The findings of the study may be useful to policy makers and stakeholders in the education sector to help put policies in place which may increase the number of students who choose physics. Lastly, since vision 2030 aims to capitalize on knowledge in science, technology and innovation of which Physics is a main ingredient, the study may be useful in gauging the viability of the vision 2030.

1.8 Limitations and Delimitations of the Study

1.8.1 Limitations of the Study

Laikipia East Sub-County is a large area and therefore due to the time frame given by the University it was not possible for the researcher to carry out research in all schools in the Sub-County. The researcher made recommendations and conclusions based on the results of the schools, which were sampled. This is because of the way the schools are scattered as the sub-county is sparsely populated. Since most of the schools in the Sub-County are in the rural areas and the terrain is very rough, travelling posed a challenge and this affected the final outcome of the study though to a small extent. Financial constraint is another factor that affected the depth of this study. With enough resources, this study could be more comprehensive and the sample size increased to improve reliability.

1.8.2 Delimitations of the Study

Considering the time and resources availability the study was restricted to public secondary schools of Laikipia East Sub-County only. The study was limited to
Laikipia East Sub- County and not other districts in the country and only involved the form three and four students. The students chosen for this study were the ones who had already made the choice to study physics for the KCSE examination. Although including students who had not chosen the subject would have added diverse knowledge, there was a challenge with time available. The researcher was of the opinion that the respondents were honest and motivated to respond to the students’ physics questionnaire since they had already chosen the subject without any coercion.

1.9 Assumptions of the Study

The study assumptions were that

i) The respondents are honest in responding to the items in the questionnaires.

ii) The teachers involved have been teaching Physics in the school for at least five years.

1.10 Theoretical Framework of the Study

This study was based on Bloom’s Theory of School Learning as presented by Murphy Jo (2007). In this theory, Benjamin Bloom suggested that children’s level of achievement and rate of learning in different academic subjects as well as their emotional wellbeing (positive and negative) is strongly influenced by the “quality of instruction” or what can be thought of as teacher effectiveness including the extent to which the instruction to be given is appropriate to the learner. He noted that even though the way children are taught is important, there are other factors that influence the way students receive information and the way they interact in the classroom. Based on Bloom’s Theory of School Learning, the study tried to establish the effect of practical work in the learning of physics and find out whether Physics
instructional methods influence the students’ learning of Physics. In the same context, the study sought to determine whether students’ attitude towards Physics is a challenge in the learning of Physics and lastly was to establish whether student’s gender is a challenge that influences students’ learning of Physics in Public secondary schools in Laikipia East Sub-county, Laikipia County.

1.11 Conceptual Framework of the Study

### Independent Variables
- Methods of instruction
  - Experimental approach
- Laboratory Practical Work in Physics
  - Frequency of practical work
- Student’s Attitudes
  - Family background
- Students’ Gender
  - Stereotype

### Intervening Variables
- Conducive School Environment
- Effective learner program background

### Dependent Variables
- Enhanced Performance in physics
- Increased Enrolment in Physics

**Figure 1.1: The Conceptual Framework of the Study**

Source: Researcher (2015)

Student learning in Physics is dependent on many variables. Some of these variables formed the bases of this study. Practical work in Physics in form of laboratory student experiments as well as project work greatly enhances learning in Physics.
Instructional methods used by the Physics teacher can influence the students’ perception of the subject, thereby cultivating the learners interest in the subject and motivating him/her to spend more time studying Physics and learning more on his/her own or to demotivate the learner such that he spends more time in other subjects.

The student’s attitude towards Physics affects the way he/she will relate to the teacher as well as interaction with other learning resources in Physics. This attitude may interfere with student’s performance in Physics and forms an important variable of study in this research.

Lastly the student’s gender appears to affect learning of Physic as observed from KCSE results as fewer girls than boys enroll in the subject and those who do so score lower grades in comparison to boys, KCSE Analysis 2015,2016(DEO’s office, Laikipia East).

Along with the above independent variables, there exists other significant intervening variables for example, school Learning Environment which is influenced by the administration of the school. An environment that is conducive to learning allows more interactive time between the teacher and learner as well as good communication between the teacher and administration in meeting the needs of the teacher in relation to quality learning resources. Motivation of the Physics teacher is an important aspect in teaching/learning process and is highly dependent with the school administrator.
1.12 **Operational Definitions of Terms**

**Curriculum:** Refers to all that is selected, organized integrative, evaluative and innovative Learning meant to achieve designated learning outcomes.

**Enrolment:** Refers to the total number of students who have registered for the Physics course for examination at KCSE level.

**Gender:** Refers to sexual identity, male or female, as it relates to culture and society.

**Laboratory:** Refers to a room or building equipped for scientific experiments, research or teaching

**Practical Work:** Refers to any teaching and learning activity where at some point the student is involved in observing and manipulating the objects and materials he/she is studying.

**Physics:** Refers to a body of knowledge that deals with the study of matter in relation to energy.

**Matter:** Refers to anything that has mass and occupies space
CHAPTER TWO
REVIEW OF RELATED LITERATURE

2.1 Introduction
This section reviews thematically and methodologically different literature on the effect of practical work in the learning of Physics, influence of physics instructional method in the learning of Physics, the extent to which students’ attitude towards teaching/learning of physics poses a challenge in the learning Physics and the influence of student’s gender to the learning of Physics in Public Secondary schools in Laikipia East Sub-County, Laikipia County, Kenya.

2.2 World Overview on Students’ Learning Challenges in Physics
Learning and teaching of Physics in public secondary schools faces a myriad of challenges world over. In the USA, an observation of Teacher Education in Physics (TEP) Report 2012 shows that even after registration of highly qualified teachers for every classroom, school districts confirmed a considerably shortage of Physics teachers’ year after year greater than in any other discipline. The potential negative consequences of maintaining the status quo were observed to be far reaching both for Physics as a discipline and for the U.S. economy and society as a whole. In response to the shortage of Physics Teachers in the U.S. and concerns about their effectiveness, the American Physical Society, American Association of Physics Teachers, and American Institute of Physics formed the Taskforce on Teacher Education in Physics (TEP). This Task force found that nationally, Physics teacher preparation was inefficient, incoherent and unprepared to deal with the current and future needs of the nation’s students. It was observed that an innovative national program was needed to develop new resources, expertise, and capacity in order to

These students’ learning challenges in Physics in public secondary schools is more pronounced in Africa. In Nigeria, a study on problems and prospects of teaching and learning of Physics in Senior science secondary schools in Sokoto state of Nigeria of 2014, revealed that the major challenges affecting student’s learning in Physics have been inadequate facilities, poor administration, inadequate training of teachers, overcrowded classrooms and laboratory as well as a poor attitude of students towards the Physics as a subject, Lanal Mohamed Anka, Abubakar M. Anka et al, (2014).

2.3 Effect of Laboratory Practical Work in Learning Physics

Laboratory Practical work refers to any teaching and learning activity where at some point the student is involved in observing and manipulating the objects and materials he/she is studying.

Demonstration of experiment is important for understanding the principles of physics. However, performing experiments by one’s own hand is far more important because it involves learning by doing. It is necessary to emphasize that for a systematic and scientific training of young minds, a genuine laboratory practice is necessary (Trivedi & Sharma, 2013). According to educational psychologists the attitude of the student plays an important role in his systematic and scientific training. According to Trivedi and Sharma (2013), science is a great human expertise. Open mindedness, curiosity, collection of data, demand for verification
and proofs, statistical reasoning, suspended judgments, acceptance of warranted conclusion and willingness to change opinion in the light of new evidence are the ferments which characterize the scientific enterprise.

According to NTI (2007) physics as a subject is activity oriented and the suggested method for teaching it is guided discovery method and is resource based. This suggests that the mastery of physics concept cannot be fully achieved without the use of instructional learning materials.

The teaching of physics without learning materials becomes a challenge in any education environment, resulting to poor performance. According to Alabi (2008) provision of necessary facilities in schools will provide a challenging environment for students to learn and for effective teaching by the teachers. On the other hand, Olubor (1998) says that lack of adequate facilities such as textbooks, ill-equipped classrooms, laboratories, workshops and library are among the probable challenges that may cause students’ poor performance in examinations.

A study conducted by Yildiz, Akpiner, Aydogdu and Ergn (2006) showed that having no science laboratories or inadequate equipment in physics laboratories in schools affect teachers’ attitudes towards the aims of science experiments in a negative way. Science experiments are inseparable and indispensable parts of learning experiences. The experiments provide both acquiring science concepts and learning scientific method for learning experiences.

Practical work brings in behavior changes in the students. The scientific temperament, curiosity, interest and creativity form the basis of this change.
Practical attempts to provide a body of knowledge through procedures that are demonstrated objectively but today they are often done in a subjective context. However, a study done in Indonesia by Abu Hassan and cited by Salleh (2004) on The Assessment of Physics Laboratory reported that the approach to laboratory work was traditional in nature and hence does not contribute towards conceptual understanding and development of Physics thinking. This scenario results in persistence in misconceptions among Physics students even in the midst of frequent use of experiments to verify theories (Lyons, 2005).

A survey carried out in Kenya on the status of Physics teaching and learning in secondary schools reviewed that teachers hardly used project work or field trips in teaching Physics, Status of Physics teaching and examinations in Kenya (Okere, 2000).

The literature review shows that a lot of research has been done concerning practical work in physics. Despite Kenyan Government interventions to equip secondary schools with laboratory equipment, the KCSE results in Laikipia East for the last nine years do not show much improvement in performance or enrollment in physics therefore a gap exists.

This study was to determine the effect of practical work in the learning of physics in public secondary schools in Laikipia East Sub- County, Laikipia County, Kenya.

2.4 Influence of Instructional Methods in Physics

The teacher is the link between learners and material to be learn, therefore, the mode of presentation (instructional method) is important and ultimately influences
learning outcomes as well as performance. In Nigeria, the content of the Physics curriculum being used in secondary school is at par to cope with the challenges of 21st century’s strive towards technological development. However, despite the introduction and continuous use of the Physics instructional methods in the schools many years ago, Nigeria still lacks the technology that could satisfy her daily needs and comfort hence a challenge (Ajayi, 2008). Perhaps, that was why (Alonge, 1982) remarked that the content of science taught in the school is void of local environment and does not identify with the technological needs of the society.

The method of instructions does not take into consideration the cultural values and beliefs of the society for which it was designed. The result of a study on subject matter carried out by African Development Bank Groups (1991) revealed that African education still reflects the colonial condition. The method of instructions in African schools still reflects the colonial orientation that is devoid of African values and environmental factors. It is only recently that efforts are being geared towards reforming the content to suit the needs of the society for which it is meant to serve (Ajayi, 2008), but the curriculum still lacks the values and materials that connects it to the immediate environment. In such a case, the advocacy of technology as a means to satisfy the society would be a mirage. The excitement and diverse possibilities of Physics must be infused into the minds of the student in an appropriate, interesting and dynamically evolving way.

The teaching approach or method of instruction that a teacher adopts is certainly a factor that may affect students interest, Onasanya, A., Adegbija, M, Olumorin C., and Daramola, F. (2008). Therefore, use of appropriate teaching methods is critical to the successful teaching and learning of Physics.
Physics teaching should emphasize processes rather than facts, such as performing experiments, taking observations, collecting data, objectives analysis, classification of data, and finally analyzing and drawing inferences. These process skills help in changing attitudes and values that make up the scientific temper among the learners (Ellen F., 2014). Viewed in this context the teacher’s role should be that of a guide and facilitator to learning rather than a controller of content.

Research studies by Adedayo (2010) revealed that most teachers teaching Physics are ignorant of the curriculum content of the subject and the best method used to impart knowledge on the student who is pursuing physics. The students taught by these rather incompetent teachers would be invariably shallow in Physics concepts and principles. This agrees with the submission of Omotayo (2009) that some Physics teachers who are masters of their subject lack the technical knowhow of impacting the concepts to the students. It is one thing is to be well grounded in the conceptual understating of a subject and another thing to be well acquainted with the best method to pass the concepts across to the learners for proper comprehension. A professional teacher would be desirable in this regard.

The K.I.E (2002) syllabus presents Physics as a body of knowledge about the physical environment. It employs a systematic scientific methodology of study to arouse learners’ way of reasoning and create a positive attitude. To this end the use of teacher/learner discussion, teacher demonstration and group/class experiments as methods of instruction is encouraged. The syllabus not only emphasizes the understanding of the fundamental scientific concept and principles, but also the experimental approach of investigation. The experimental approach should prepare the learner to present scientific concepts and ideals in the modern technology.
Further the syllabus presents project work and this approach provides the learner with opportunities in undertaking investigations for purposes of finding solutions to problems.

According to Salleh (2004) advancement in science and technology is coupled with the deterioration of the ecosystem and greater use of chemicals and technologies that affect our health systems. We therefore need the relevant science or physics knowledge and understanding that can help us understand the physical world around us. Kenya Institute of Education (2002) outlines that students must choose at least two sciences or chooses all the three which include physics, chemistry and Biology.

Statistics in 2010 and 2009 KCSE indicate that few students had chosen physics as one of the two or three sciences. This indicates that there are factors which inhibit the choice of physics.

The concern of the researcher was whether physics teachers in Laikipia East Sub-County are using the modern and relevant methods to teach physics or where there is disconnect and whether this disconnect is the existing gap.

This study was therefore to fill this gap by finding out whether challenges related to methods of physics instruction influence the students’ learning of physics in public secondary schools in Laikipia East Sub-county. Laikipia County, Kenya.

2.5 Students’ Attitude in the Learning of Physics

According to American Association of Physics teachers of 1988, an effective Physics teacher should understand what constitutes effective teaching. He should understand how to develop learning outcomes for science instruction that
incorporate state and national standards for teaching science and select appropriate
curriculum materials to meet standards-based outcomes (Mwambela, 2013). They
understand the logical connections between the topics of the curriculum, the need to
build on each other, and to create learning progressions. They are aware of the
“depth versus breadth” conundrum of science teaching and have an understanding of
how to appropriately balance transmission and constructivist approaches to teaching
and learning.

As observed by Omosewo (2008), physics teachers ought to prepare lessons using a
variety of instructional approaches, create unit plans, and deal with the broad
implications of year-long curriculum planning. This includes the proper alignment
between preparing objectives, designing appropriate means of achieving these
objectives, and ways of assessing whether the goals are achieved. He should use a
variety of instructional strategies to help students learn and understand the concepts
of physics. These include but are not limited to interactive demonstrations, inquiry
lessons and experiments, reading, case study discussions, peer instruction,
cooperative learning, Socratic dialogues, problem-based learning, historical studies,
and the use of strategies tailored to meet the needs of diverse learner Omosewo
(2008). They will effectively utilize cooperative learning strategies that involve
small groups of students in roles where they share a common goal and resources in
order to build interdependence. The article by the American Association of Physics
Teachers (1988) and cited by Mwambela C. (2013) also suggests that Physics
teachers should elicit, identify, confront, and resolve resilient preconceptions that
students bring to the classroom that are derived from casual observations of the
physical world. Teachers should understand the difficulties that students encounter
in the formulation of scientifically acceptable explanations. They should help students self-assess and regulate their learning by reflecting critically on what they should know and be able to do Mazur, E. & Lorenzo M. (2006).

Physics teachers should understand and apply accepted practices of science to help students develop knowledge based on observation and experience. This includes the appropriate use of learning cycles and instructional practices such as discovery learning, interactive demonstrations, inquiry lessons, inquiry labs and hypothetical inquiry. Physics teachers assess student learning continually by effectively using diagnostic, formative, and summative practices. They should also be familiar with technology and the use of technology tools in physics lessons (Onasanya et al., 2008).

The school curriculum assumes different types of learning that call for different type of teaching. No single teaching method such as direct instruction or social construction of meaning can be the method of choice for all occasions. For any subject, Physics included, instructional needs change as the students’ expertise develops. Therefore, what constitutes an optimal mixture of instructional methods and learning activities will evolve as the student’s school years, instructional units and even individual lessons progress (Waititu&Orado, 2009).

The teacher’s methods of teaching may go a long way in enhancing effective learning by the students. The traditional method of teaching science (Physics included) in the schools involves “chalk and talk” activities which is fully teacher-centered. In this case, the students are passive “robots” in the classrooms who regards the teacher as the reservoir of knowledge. There is agitation to inculcate the
21st century approaches to science teaching in countries like Nigeria. These include inquiry method, collaborative teaching, discovery method and others. They are purely child-centered approaches. Here, the students are guided to discover facts and construct their own ideas and understanding of the concepts of the study. However, Nwagbo (1995) noted that science teachers shy away from activity-oriented instructional methods that are more effective and stick to inadequate traditional methods of teaching. The practical activities that could enhance creative thinking in the learners are given lip-service in Secondary schools.

This study was designed to find out whether the student’s attitude towards Physics influences his/her learning of Physics in Laikipia East Sub-County, Laikipia County. This will also affect their ability to implement the learning approach. For instance, Easton (2002) interviewed students from an alternative residential high school in the United States of America in order to determine attitude of learning. Students identified the need for self-esteem, personal accountability, and personalized learning. They talked about the need for teachers who care, as well as active learning.

They further mentioned the need to feel emotionally safe, the need for high expectancy on the part of the school and the need for self-directed learning or learning by choice hence good method of instruction in teaching physics. Although research has been carried out in Kangundo and Gatundu Districts regarding attitude towards physics, such research has not been done in Laikipia East Sub-County and this research hoped to close that gap by determining whether students’ attitude towards physics is a challenge in the learning of physics in secondary schools in Laikipia East Sub-County.
2.6 Influence of Student’s Gender in Learning Physics

The studies of physical science are among the most challenging and rewarding in our increasingly technological society - pivotal fields of human endeavour. They have a significant impact in our way of life and our standard of living. And whatever the future holds, there will be a need for scientists and engineers. However, studies indicate that there is a male-dominant characteristic in physics especially. While male students are interested in subjects such as atomic bombs, electronic devices and technology, female students are interested in subjects such as healthy diet, animal associations, weather and aids according to Jones, M. G., Howe, A., & Rua, J. M., (2000). Women earned only 15% of recent bachelor degrees and 12% of recent PhDs in physics, and women represent only 3% of the nation's college and university physics faculty members (Neuschatz and Alpert, 1996). Women fare slightly better in the study of astronomy but do worse in engineering, where they are awarded 8% of the PhDs granted (Holloway, 1993).

Why do males dominate physical science? A number of theories have been advanced. A study conducted by Walper, LM, Lange, K.; Kleickmann, T., & Moller, K. (2013) suggested that male students have a higher personal interest in Physics than female students. Some hold that females have a biological predisposition that limits their ability to achieve in physical science (Kimura, 1992). Others suggest that the problems, models, and approaches presented in physical science do not match the interests and experiences of girls and are at odds with the characteristics society values and encourages in girls (Leach 1995; Pollina, 1995). Additionally, male domination of physical science often results in hostile environments for females in physical science classes and degree programs (Geisel, 1996). Owoyele and Toyobo
(2008) indicated that gender within the peers has a positive effect on students’ subject selection and achievement growth in African Countries. Owoyele (2007) found out that peer support has also been found to be positively related to adolescents’ academic achievement and choice of school subjects. Smyth and Hannan (2006) concurs that peer groups have also been found to be influential, with boys’ and girls’ choices correlating with the choices of their same sex classmates, but not with those of opposite sex classmates.

Gender differences emerge when other factors come into play, which can compromise self-concept of performance in physics. A study by Balogun (1985) showed that more boys than girls tend to opt for all the basic sciences at school certificate level examination because boys are more generally disposed to science and mathematics than girls. Parents have great influence on their children especially when they are young. A study by Tuaundu (2009) revealed that there should be a strong bond between Physics contents and students’ everyday experiences. This implies that students who are exposed to technological toys and games (which in most cases are boys) will have greater interest in mathematics and science because of the existing knowledge that they have. This knowledge plays an important role in the understanding of mathematics and science. Gilbert and Calvert (2003) found out that most young women do not see themselves as being capable of studying and succeeding in mathematics and science, therefore they are not interested in it.

The myths and realities of women progressing in mathematics and science field were studied by David et al (1996) in Tuaundu (2009) concluded that the attitudes adopted by girls from parents, teachers, friends, and society have a significant influence on the girls’ choice and performance in science and mathematics. The
purpose of this study was to determine whether students’ gender influences their learning of physics in Laikipia East sub county, Laikipia County. Specifically, what action can be taken by physics teachers to increase the likelihood of greater gender balance in the population of physical science professionals in the future? And what strategies are physics teachers employing at present to reduce the gender gap?

2.7 Summary of Literature Review

The literature review has shown the various challenges experienced by students in the study of physics and how these challenges might have affected performance as well as enrolment in physics. Lack of adequate facilities such as textbooks, ill-equipped classrooms, laboratories, workshops and library are among the probable challenges that may cause students’ poor performance in Physics examinations. Inadequate equipment in science laboratories in schools affect teachers’ attitudes towards the aims of science experiments negatively. Well programmed physics practical work assist students in removing misconceptions and myths in physics. The impact of the teacher in the performance of students in Physics is based on the method of instruction the teacher uses. The experimental approach prepares the learner to present scientific concepts and ideals in the modern technology. Physics teachers should elicit, identify, confront, and resolve resilient preconceptions that students bring to the classroom that are derived from casual observations of the physical world. More boys than girls tend to opt for physics at school certificate level examination because boys are more disposed to science and mathematics than girls. Despite the fact that physics teachers have been trained professionally in the diverse teaching methods and are aware of advantages of having practical work in physics, there appears to be a mismatch between learning physics and performance.
in physics in Laikipia East Sub- County. There exists a knowledge gap that appears to interfere with performance and enrolment in secondary physics. This research therefore sought to address the student challenges in physics in secondary schools. The findings of the study may be useful to physics teachers, curriculum developers, authors of physics books, policy makers and stakeholders in the education sector to put policies in place which may improve students’ enrolment and performance in physics.
CHAPTER THREE
RESEARCH METHODOLOGY

3.1 Introduction

This chapter covers the research methodology; research design, variables, location of the study, target population, sampling techniques and sample size, research instruments, students’ questionnaire, teachers’ questionnaire, pilot study, validity of research instruments, reliability of research instruments, data collection procedure, method of data analysis, logical consideration and ethical consideration.

3.2 Research Design

Research design refers to a way a study is planned and conducted (Polonsky and Weller, 2009). The procedure and techniques employed to answer the research problem (Polonsky and Weller, 2009). This research was designed as a descriptive survey to establish the students learning challenges in physics in public secondary schools in Laikipia East Sub-County, Kenya. Descriptive research ensures systematic collection and analysis of data is done in order to answer research questions concerning current status of an activity, project, program, or event, Ng’ang’a(2009). Descriptive research design was adopted in this study as it enabled the researcher to obtain information and the student’s learning challenges in physics. This design also assisted the researcher to describe the dependent and independent variables. In order to come up with the schools that were involved in the study, the researcher used a stratified random sampling of the schools in Laikipia East Sub-County. The reason for using a stratified survey was to allow the researcher to include different categories of schools, which were boarding boys’ schools, boarding girls’ schools and mixed day schools. At least one practicing physics teacher in the
selected schools participated in the study by filling in the teachers’ questionnaire.

The collected data was then analyzed, discussed, and then presented in form of graphs, pie charts and tables. A summary, conclusion and recommendations were then drawn from the findings.

![Figure 3.1: A Concept Map of the Research Design Process](image)

3.2.1 Variables

This study had both dependent and independent variables. The independent variables are those factors which are measured, manipulated or selected by the researcher to determine its relationship to an observed phenomenon or dependent variable (https://statistics.laerd.com>types of vari-) For this study, independent variables
included: challenges of practical work, challenges of teaching methods and instruction, Students’ attitude towards physics and challenges related to students’ gender. On the other hand, dependent variable is the factor that varies as the researcher varies the independent variables (https://statistics.laerd.com>types of variables--). This study identified two independent variables which are performance and increase in student enrolments.

3.3 **Location of the Study**

The location of this study was in Laikipia East Sub-County in Laikipia County. The area was selected because of convenience and accessibility for the study. It is located in the Semi-Arid lands in the former Rift Valley Province of Kenya. The county has two major urban centres: Nanyuki to the southeast and Nyahururu to the southwest with an area of 8696 KM squared. Administratively, it borders 7 Counties namely Samburu to the North, Isiolo to the North East, Meru to the East, Nyeri to the South East, Nyandarua and Nakuru to the South West and Baringo to the West. Economically it hosts both pastoralists and agricultural communities, of Kikuyu, Meru, and Maasai ethnics. The pastoralist communities have cultures which suit their nomadic lifestyle, while the agricultural communities have different cultures suitable to their way of life. With its breathtaking landscape and spectacular backdrop of the snow-capped Mount Kenya, this County is an ideal holiday destination with modern hotels and resorts to fit any visitors budge (Laikipia County Information Guide, 2014).

3.4 **Target Population**

A target population is a group of individuals or a group of organization with some common definitive characteristics, (Creswell, 2005). The target population of this
study included 18 schools that were offering physics up to form four, 360 students representing 10% of form three and form four students in Laikipia East Sub-County, who had chosen physics as a subject from the 18 schools of the stratified categories as follows; 82 boys from boys, boarding schools, 100 girls from girls’ boarding schools and 120 from mixed day schools. The respondents also included 18 physics teachers at least 1 from each of the choosen schools. These physics teachers also acted as research assistants and guided the students to answer their questionnaire. They, teachers also answered the student questionnaire. Data collection took place in February 2017 and the previous exam results were taken at the end of year examination results for 2016.

3.5 Sample and Sampling Techniques

3.5.1 Sampling Techniques

The researcher used stratified, purposive and simple random sampling. According to Heiman (2002), stratified random sampling is a sampling technique that involves the identification of important sub-groups in a particular population. In this case the sub-groups were mixed schools, boys’ schools and girls’ schools. To allocate the sample size in the three strata that is mixed schools, boys’ schools and girls’ schools the researcher used equal allocation method. In equal allocation, (Orodho, 2009) states that subjects are selected in equal numbers per stratum. Thus, in the three strata, one third of the sample was selected from each stratum.

At the school level the study used purposive sampling to select form three and four students only who had already made their subject choice. Finally, at the class level the researcher used simple random sampling of students. According to
Orodho (2009) simple random sampling is a procedure in which all the individuals in the defined population have an equal and independent chance of being selected as a member of the sample. In mixed schools, the researcher further used equal allocation to ensure boys and girls were equally represented.

### 3.5.2 Sample Size

Gay (1992) suggests that at least 10% of the population is a good representation where the population is large and 20% where the population is small. He observes that a researcher selects the sample size due to various limitations that may not allow researching the whole population drawn. For this study, a sample size of 360 (10%) for students and 18 (100%) for teachers was applied as shown in Table 3.1.

#### Table 3.1: Sample size and Sampling frame

<table>
<thead>
<tr>
<th>Population</th>
<th>Population Size</th>
<th>Sample Size</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Students</td>
<td>3620</td>
<td>360</td>
<td>10</td>
</tr>
<tr>
<td>Teachers</td>
<td>18</td>
<td>18</td>
<td>45</td>
</tr>
<tr>
<td>Total</td>
<td>3638</td>
<td>378</td>
<td>55</td>
</tr>
</tbody>
</table>

### 3.6 Research Instruments

The research instruments used in this study were two questionnaires; that is, questionnaire for students (SQ) and questionnaire for teachers (TQ). According to Mugenda and Mugenda (2003), a questionnaire is defined as a set of questions formulated with an intention of addressing specific objective, research question or hypothesis of the study. Questionnaires are preferred because they consist of many items combined and more reliable measure of constructs than would any single item. They offer considerable advantages in administration. They also present an even
stimulus potentially to large numbers of people simultaneously and provides investigation with an easy accumulation of data. Questionnaires are cheap to administer and secondly they eliminate interaction between interviewer and respondents which reduces bias Kothari, (2004).

3.6.1 Students’ Questionnaire

The students’ questionnaire was administered to Form Three and Form four physics students and was used to collect data on students’ gender, challenges related to practical work, attitude towards physics, students’ opinion to teacher characteristics, and the teaching methodology. This instrument collected data on students’ performance in the previous examination (APP III Item 5 and 6) the answers to these questions formed the basis for performance. The questionnaire was admitted to form three and form four students who had selected physics as subject.

3.6.2 Teachers’ Questionnaire

This instrument sought information on students’ and teachers’ experience, student’s enrolment, teaching methodology and availability of teaching/learning resources in the school. The instrument also collected data on the extent of gender disparity in physics classes and an opinion was sought on improving the same.

3.7 Pilot Study

According to Mugenda and Mugenda (2003), it is necessary to pilot-test the instruments to ensure that the items are clearly stated and can be understood by the respondents. The main purpose of the piloting was to determine validity and reliability of the research instruments. Before the actual data collection, the questionnaires were piloted in three secondary schools that is one boys’ boarding
school’ one girls’ boarding school and one mixed day school. Students answered the student questionnaire while their teacher answered the teacher questionnaire. The procedure used in pre-testing the questionnaire was identical to that used during the actual data collection. This allowed the researcher to make meaningful modifications to the research instruments. For example, unclear instructions, insufficient writing space, vague questions and wrong numbering. These modifications were revealed and corrected, to improve the final questionnaire.

### 3.7.1 Validity of the Study Instruments
Paton (2002), defines validity as a quality attributed to proposition or measures to the degree to which they conform to establish knowledge or truth. The instrument was evaluated for content validity that is, the extent to which the questionnaire content, which included vocabulary, sentence structure and the questions, were suitable for the intended respondents. Content validity was done by expert judgment. The study used validated instrument to address the objectives adequately. The researcher sought the expertise of other researchers who had conducted research on similar studies to check if the instruments were viable to collect the intended data.

### 3.7.2 Reliability of the Study Instruments
Reliability is a measure of the degree to which a research instrument yields consistent results. If tested on different of occasions by different testers or, as in this study when attempting to generate a scale score by adding together the scores of a number of variables. It is important to ensure that the questions are measuring the same thing. Cronbach’s alpha is a model of internal consistency, based on the average inter-item correlation (www.statisticsshowto. com). An acceptable value
should be close to 0.8 or above. The data in this study gives a Cronbach’s value of 0.762. These Cronbach’s alphas imply that the questionnaire was reliable.

\[
\alpha = \frac{N \cdot C}{V + (N - 1) \cdot C}
\]

Reliability Coefficient \( \alpha = \)

Where \( N = \) Number of items

\( C = \) Average covariance between item pairs

\( V = \) Average variance

Calculated using SPSS statistics output. For the data which was in likert scale

3.8 Data Collection Procedure

A research authorization permit was obtained from National Commission for Science Technology and Innovation and a copy submitted to the DEO Laikipia East sub-county. The researcher pre-visited the sampled schools to establish rapport with respondents and training of the research assistants. She then sought consent for participation before administering the questionnaires. As for the questionnaire, the researcher took them personally to the respective schools. The researcher sought assistance from the physics teachers to administer the questionnaires to the students to help reduce the Hawthorne effect. The teacher introduced the researcher to the student to reduce impressionistic factor. The researcher then explained to the students what was expected of them in filling the questionnaire. Arrangements were made to filling in the questionnaires within two days. At the end of the two days, the researcher personally collected the completed questionnaires for analysis.

3.9 Method of Data Analysis

After collecting the raw data from the field, the researcher edited and coded it for analysis. Editing was done to ensure accuracy and consistency while reducing the
number of responses to fewer categories. The raw data was then subjected to
descriptive statistics such as bar graphs, tables and pie charts using Statistical
Package for Social Sciences (SPSS).

Objective 1: To determine the effect of laboratory practical work in the learning of
physics in public secondary schools in Laikipia East Sub-County, 3 questions from
the student questionnaire were used and student responses sought; Item 9(a) (c) and
Item 10.

Students responded to the question of performance of physics practical work in a
separate laboratory and this was compared to the grade in physics at the end of that
term. Students were categorized in boys’ school, girls school and mixed school.
They responded to having a separate laboratory for physics with a Yes or No
response. The researcher used a table of values and for each category of school
student’s grade was put against their response of Yes or No. The researcher used
data in the table to describe the relationship between separate physics laboratory
and performance in physics. Item 9(c) responded to the question: Number of visits
to the physics laboratory in the term. The researcher tabulated the students’
responses against the grade in physics. Analysis of the results was done using the T
test that is chi-Square value to show the relationship between number of visits to
the laboratory and performances. The data was subjected to SPSS program for the
calculation.

Objective 2: To find out whether physics instructional methods influence the
students’ learning in physics, students responses were sought using student
questionnaire Item no.10 and no.11 and Teachers used teacher questionnaire item
Objective 3: To determine whether student’s attitude towards physics is a challenge in the learning of physics in public secondary schools in Laikipia East Sub-County. The students used Item no.13, in which they used the likert scale to give their responses. The researcher put the responses in a table of values matching each response with performance in physics at end of term. After that the researcher used the SPSS program to calculate the Correlation Coefficient between students’ attitude and performance in physics to assist him draw conclusions.

Objective 4: To establish whether student’s gender is a challenge that influences their learning of physics in public secondary schools in Laikipia East Sub-County. Students were asked to give their responses using Item number 1, 2, 3, 4, and 8. The researcher used the students, responses to tabulate the data collected against enrolment and the mean mark for physics at end of term three. Analysis of this data was done using descriptive survey method whereby the researcher observed the trend of the values in the table to make conclusions.
3.10 Logistical and Ethical Considerations

3.10.1 Logistical Considerations

The researcher applied for and was given a permit to conduct this research by the National Commission for Science, Technology and Innovation. After getting research permit the researcher gave a copy of the permit to the County Director of Education, Laikipia County. Then she proceeded to go and book for head teachers’ appointment. The researcher also made arrangements to meet with the research assistants and decided on the day research work was to begin.

3.10.1 Ethical Considerations

For ethical considerations, the nature of the study was made known to the participants. The participants were also allowed to choose to participate or not. To safeguard the privacy of the participants, respondents were kept in a private environment away from passersby or intruders. While preparing for data collection and analysis, the researcher maintained anonymity by separating information such as code numbers from the data itself. During the research, participants were requested not to write their names on the questionnaires to ensure anonymity.
CHAPTER FOUR
DATA ANALYSIS, PRESENTATION AND INTERPRETATION

4.1 Introduction

This chapter covers the data analysis, finding of the study and discussions of the findings. This chapter examines and explains how certain factors such as teaching methodology, learner’s attitude, gender, and practical work affects enrolment and performance in physics. As was expected, the study found out that there was a high correlation between the identified factors with enrolment and performance. The specific objectives of this study were;

i) To determine the effect of Practical work in the learning of Physics in public secondary schools in Laikipia East Sub-County, Laikipia County, Kenya.

ii) To find out whether physics instructional methods influence the students’ learning of Physics in Public Secondary Schools in Laikipia East Sub-county, Laikipia County, Kenya.

iii) To determine whether student’s attitude towards physics is a challenge in the learning of physics in Public Secondary Schools in Laikipia East Sub-County, Laikipia County, Kenya.

iv) To establish whether student’s gender is a challenge that influences their learning of Physics in Public Secondary Schools in Laikipia East Sub-County, Laikipia County, Kenya.

To gather this information, the following research instruments were used;

a) Students’ questionnaire.

b) Teachers’ questionnaire.
Quantitative data was coded, assigned labels to variable categories and entered into the computer code sheet. Frequency tables, percentage, and pie charts were used to present the information. Percentages and frequencies were analyzed using SPSS to assess how respondents agree or disagree with the items of the research questionnaires. On the other hand, qualitative data was organized in thematic areas for easier interpretation. Common items were obtained in data collected and clustered according to research objectives so as to identify variables that depict general concepts of the study.

4.2 General and Demographic Information

Questionnaires were distributed to the respondents from 18 secondary schools in Laikipia East Sub-county. The respondents included the Physics teachers and the students. Out of the 378 questionnaires distributed, all were duly filled and returned making are turn rate of 100% from all the respondents. However, some questions did not get 100% response. As for the demographic information, the study established the gender, level of education of teachers, number of years taught, and age as explained below.

4.2.1 Gender

The respondents were asked to state their gender. The findings were presented in Table 4.1 below.

<table>
<thead>
<tr>
<th>Respondents</th>
<th>Male</th>
<th>Female</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physics Teachers</td>
<td>14(77.8%)</td>
<td>4(22.2%)</td>
</tr>
<tr>
<td>Students</td>
<td>210(58.3%)</td>
<td>150(41.7%)</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>224(59.3%)</strong></td>
<td><strong>(40.7%)</strong></td>
</tr>
</tbody>
</table>
From the Table 4.1 above, female respondents comprised of 150(41.7%) of all students specializing in physics while males were 210(58.3%). The number of female physics teachers was 4 which was (22.2%) while the males were 14(77.8%). The low percentage of the number of female teachers, 4 (22.2%) has a negative influence on girls’ enrollment in physics because they lack a role model in terms of gender. The majority of physics teachers in all the sampled schools; boys’ schools, single sex girls’ schools and mixed schools were males as shown in Table 4.1. To some girls the information in the table confirmed the gender stereotyping that physics is a subject, which led to mainly male dominated careers. While the boys could identify with the male physics teachers, girls lacked a role model with whom to identify in physics. This results in a challenge for girls who find it difficult to connect with their male physics teachers. The low number of female teachers in physics could be a reflection of the small number of female students who choose to take physics as one of their teaching subjects at college level. The researcher asserted that women tend to be underrepresented in science and technology globally partly due to choices they make at lower levels in their education.

4.2.2 Level of Education

Professional and academic qualifications determine the effectiveness of teachers (Okumbe, 1999). The researcher sought the qualifications of the physics teachers to establish whether they were qualified to carry out their teaching responsibilities successfully.

The data regarding academic qualifications was presented in Table 4.2 below.
Table 4.2: Professional qualification of physics teachers

<table>
<thead>
<tr>
<th>Level</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diploma</td>
<td>3</td>
<td>16.7</td>
</tr>
<tr>
<td>Bachelor of Education</td>
<td>13</td>
<td>72.2</td>
</tr>
<tr>
<td>Master’s Degree</td>
<td>2</td>
<td>11.1</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>18</strong></td>
<td><strong>100</strong></td>
</tr>
</tbody>
</table>

It is evident from Table 4.2: above that all the physics teachers were professionally trained. The number of Diploma holders was 3 representing (16.7%) of all the teachers in the study, Bachelor of Education holders were 13 representing (72.2%) while 2 which was (11.1%) had Masters in Education after their first degree in sciences. These teachers were well qualified to competently take their teaching roles as physics teachers.

4.2.3 Age of the Physics teacher

The age of physics teachers was sought in order to determine whether it could have a direct influence on student’s performance and enrollment in physics.

The response was as presented in the Table 4.3 below.

Table 4.3: Age distribution of Physics Teachers

<table>
<thead>
<tr>
<th>Teachers age bracket</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>20-24 years</td>
<td>2</td>
<td>11.1</td>
</tr>
<tr>
<td>25-34</td>
<td>12</td>
<td>66.7</td>
</tr>
<tr>
<td>35-39</td>
<td>2</td>
<td>11.1</td>
</tr>
<tr>
<td>40-44</td>
<td>2</td>
<td>11.1</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>18</strong></td>
<td><strong>100</strong></td>
</tr>
</tbody>
</table>

Table 4.3 shows that physics teachers who were between 20-24 years account for 2(11.1%), 25-34 years account for 12(66.7%), 35-39 years account for 2(11.1%) and finally 40-44 years accounts for 2(11.1%). Majority of the teachers were between
25-34 years meaning that the majority of the physics teachers were mature and experienced in teaching the subject. The researcher noted that majority of physics teachers were in the age of establishment. At establishment stage, teachers’ endeavor to get an in depth understanding of their teaching job and then strive to make an impact in their institutions. The researcher noted that it was important for the school administration to assist teachers at this age to realize their potential. For instance, a teacher who was striving to make physics more popular to students by organizing educational trips and taking part in contests and symposiums should be given moral, material and financial support by the school administration.

4.2.4 Teaching Experience

The teaching experience determines the effectiveness of a teacher to a large extent (Cheryll & Rebecca, 2006). Physics teachers who had worked and interacted with students for a long time were more exposed to student’s perceived challenges in physics as a subject than the ones who had taught for less than three years. Figure 4.1 below shows the extent of experience of the participating teachers.

![Figure 4.1: Number of the years the teacher had served](image)

44.4 44.4
11.1

0 1-4 years 5-9 years 10-14 years
Figure 4.1 above showed that only 8 that is (44.4%) of teachers had taught for a period of less than five years. However, they were professionally trained. Eight teachers that is (44.4%) had a teaching experience ranging from five to nine years, while 2 that is (11.1%) had an experience of ten to fourteen years. This showed that most of the teachers were highly experienced to teach physics and therefore were expected to be thorough in mastery and delivery of the subject in question. In addition, all the physics teachers in the sampled schools had attended SMASSE in service training which had further enhanced their pedagogical skills.

4.2.5 Type of School

The respondents were asked to state the type of their school and Figure 4.2 presented the findings.

![Figure 4.2: Type of the School](image)

From the Figure 4.2 above, 178 (49.4%) of the respondents were from the day schools while 182 (50.6%) of the respondents come from boarding schools. This proportion of sampling ensured that the views from both boarding and day schools were equitably represented to avoid bias against any type of school and to establish a
representative information on the issues upon which the study was undertaken. This was also necessary so that the study could establish divergent opinions from students from day schools and those from boarding schools on the strategies that were employed by the two categories of schools to improve the performance and enrollment of physics.

4.2.6 Nature of the School

Table 4.4: Nature of the school

<table>
<thead>
<tr>
<th>Nature of school</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Boys School</td>
<td>82</td>
<td>22.8</td>
</tr>
<tr>
<td>Girls School</td>
<td>100</td>
<td>27.8</td>
</tr>
<tr>
<td>Mixed School</td>
<td>178</td>
<td>49.4</td>
</tr>
</tbody>
</table>

From Table 4.4 above, 82(22.8%) of the respondents came from the Boys schools, 100(27.8%) of the respondents came from the Girls schools while 178(49.4%) of the respondents came from mixed schools.

4.2.7 Performance in Physics

Figure 4.3: Mean Grade at the End of Term Three Examination
The figure 4.3 above, shows the distribution of the respondents mean grades; D(plain)-E were 42(11.9%), C(plain)-D(plus) were 138(38.1%), B(plain)-C(plus) were150(41.7%) and A-B(plus)were 30(8.3%). Majority of the students had a mean score of B (plain)-C (plus) which comprised of 150(41.7%).

![Grades Distribution](image)

**Figure 4.4: Grade scored in Physics in the End of Term Three Examination**
The figure 4.4 above shows the distribution of the respondents’ physics mean grades; D(plain)-E were 48(13.3%), C(plain)-D(plus) were 108(30.0%), B(plain)-C(plus) were 175(48.6%) and A-B(plus) were 29(8.1%). Majority of the students had a mean score of 175(48.6%), B (plain)-C (plus) in Physics.

### 4.2.8 Enrollment in Physics

Students in Form Three have an opportunity to choose two science subjects from Physics, Biology or Chemistry or to pursue all the three of them. However, information available from the County Director of Education’s office, Laikipia County shows that out of 1545 candidates enrolled for K.C.S.E in that year only 338 of them enrolled for Physics Laikipia County (K.C.S.E results 2016). That is a very small representation by any standards. Enrolment in Physics will therefore be
determined by the number of students who choose to take physics and another subject or all the three sciences in Form Three.

Enrollment of students in physics in Form three was used in this study. This was at the level where the student chooses to do Physics and the numbers remain the same as they proceed to Form four. The information was analyzed from the teacher’s questionnaire. There was a higher percentage of enrolment in physics in both Boys and Girls schools than in mixed schools as shown in Table 4.5 below. The total number of Form Three students from the sampled schools was 943 out of which only 259 had enrolled in physics which was 27.46% of the total population of Form Three students from the sampled schools.

**Table 4.5: Students Enrolment in Physics in Form Three and the sampled population and Performance in Physics at end of term Examination**

<table>
<thead>
<tr>
<th>No of schools</th>
<th>Type of school</th>
<th>Students Population in Form Three</th>
<th>Number of students Enrolled in physics</th>
<th>% of students enrolled in physics in Form</th>
<th>End of Term’s Mean in Physics</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>Girls school</td>
<td>345</td>
<td>100</td>
<td>28.99</td>
<td>5.21</td>
</tr>
<tr>
<td>3</td>
<td>Boys school</td>
<td>231</td>
<td>82</td>
<td>35.5</td>
<td>7.3</td>
</tr>
<tr>
<td>11</td>
<td>Mixed day school</td>
<td>Boys: 350</td>
<td>120</td>
<td>34.28</td>
<td>4.1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Girls; 298</td>
<td>58</td>
<td>19.46</td>
<td>3.17</td>
</tr>
<tr>
<td>18</td>
<td>Total</td>
<td>1224</td>
<td>360</td>
<td>29.4</td>
<td>Average mean: 4.478</td>
</tr>
</tbody>
</table>

It was observed from Table 4.5 that physics students’ enrolment was higher in single sex schools than in mixed schools. Enrolment is also lower in girls’ schools than in boys’ schools. The number of sampled form three students was 360, which was 29.4% of the total number of students that is 1224. The physics teacher was given
the prerogative to select the students who participated in the study. Enrollment in physics was higher in single sex schools than in mixed day schools.

4.3 The Effect of Laboratory Practical Work in the learning of Physics in public secondary schools in Laikipia County

Objective one of the study sought to establish the effect of Laboratory Practical work in the learning of Physics in public secondary schools in Laikipia East Sub - County, Laikipia County, Kenya.

The factors of Laboratory practical work which formed the basis of this study were; availability of separate physics laboratory in school, whether experiments are performed individually or as in-group and how often students visited the laboratory.

4.3.1 Influence of Separate Physics Laboratory in Performance of Physics

Students were asked to state whether the availability of separate physics laboratory as a teaching and learning resource had an effect on performance in physics and Table 4.6 presented the findings as shown below.

<table>
<thead>
<tr>
<th>School type</th>
<th>Does the school have a separate Lab?</th>
<th>E-D (plain)</th>
<th>D+ (plain)</th>
<th>C+ (plain)</th>
<th>B+ (plain)</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Boys school</td>
<td>No</td>
<td>8.5%</td>
<td>23.2%</td>
<td>0%</td>
<td>31.7%</td>
<td></td>
</tr>
<tr>
<td>Girl school</td>
<td>Yes</td>
<td>8.5%</td>
<td>56.1%</td>
<td>3.7%</td>
<td>68.7%</td>
<td></td>
</tr>
<tr>
<td>Mixed</td>
<td>No</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
</tr>
<tr>
<td>school</td>
<td>Yes</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
</tr>
<tr>
<td></td>
<td>4.5%</td>
<td>29.2%</td>
<td>17.4%</td>
<td>3.9%</td>
<td>55.1%</td>
<td></td>
</tr>
</tbody>
</table>

Table 4.6: Resources and Performance in physics

47
From the Table above, 154(42.8%) of the respondents came from schools with separate physics laboratory while 206(57.2%) came from school with only one multipurpose laboratory. As observed from Table 4.6, availability of separate physics laboratory affected the performance. Of the 56(68.7%) of the students in boys’ schools with separate physics laboratory, 49((59.8%) had Grade C (plus) and above. This trend was however contradicted by Girls’ schools where 100 (100%) of the students lacked separate physics laboratory, 57(57%) of them got a grade C (plus) and above. This implied that girl’s performance in physics could not be attributed to lack of separate physics laboratory. The very laboratories that catered from any girls in chemistry and biology could also cater for girls in physics.

In mixed schools, 38(21.3%) of students in schools with separate physics laboratory scored grade C and above while only 26(14.8%) of students in schools without a separate physics laboratory managed grade c and above. This showed that having a separate physics laboratory affected performance in physic from majority of schools in this study.

The students were further asked to state whether they perform physics experiments individually or as a group and what were the implication of this in performance of physics. Table 4.7 presented the findings.

<table>
<thead>
<tr>
<th>Statement</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Individually</td>
<td>10</td>
<td>1.9</td>
</tr>
<tr>
<td>Group</td>
<td>350</td>
<td>98.1</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>360</strong></td>
<td><strong>100</strong></td>
</tr>
</tbody>
</table>
From the Table above, only 10(1.9%) of the respondents carried out the experiment individually while 350(98.1%) of the respondents carried out the experiments in groups. Therefore, majority of the students carried out the experiments in groups. The researcher established that the reason as to why majority performed experiments in groups was due to lack of adequate laboratory equipment and apparatus. Majority of the students therefore did not have time to interact with the apparatus individually and they ended up in being mere speculators during the laboratory practical work. This served to decrease the learner participation during the physics lesson which is in agreement with Salleh (2004) that laboratory work was traditional in nature consequently does not contribute towards conceptual understanding and development of physics thinking. This scenario results in persistence in misconceptions among physics students even in the midst of frequent use of experiments to verify theories (Lyons, 2005).

Table 4.8: Frequency of Students’ visit to the School Laboratory and Performance in Physics

<table>
<thead>
<tr>
<th>Number of visits of Term</th>
<th>Percentage of Respondents</th>
<th>Performance in Physics % at End of Term</th>
<th>Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>A- A<code> B- B</code> C+ C<code> D+ D</code> E</td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>60.5</td>
<td>11.2 22.5 56.1 12.2 0</td>
<td>6.698</td>
</tr>
<tr>
<td>6</td>
<td>26.9</td>
<td>3.9 5.9 27.4 34.8 28</td>
<td>3.46</td>
</tr>
<tr>
<td>1</td>
<td>3.0</td>
<td>3.0 0.1 1.2 15 48</td>
<td>35.7</td>
</tr>
<tr>
<td>0</td>
<td>5.6</td>
<td>0 0 5 70.2 24.8</td>
<td>1.9</td>
</tr>
<tr>
<td>Total</td>
<td>100</td>
<td>100</td>
<td></td>
</tr>
</tbody>
</table>

Table 4.8 indicates that 20(5.6%) of the respondents did not visit the laboratory, 218(60.5%) of the respondents visited the laboratory 12 times during the term of study, 96(26.9%) of the respondents visited the laboratory 6 times, 14(3.9%) of the
respondents visited the laboratory 3 times, 10(3.0%) of the respondents visited the laboratory once during that term, while 20(5.6%) did not visit the laboratory at all during that term. 218 which represented majority of the students visited the laboratory on weekly basis.

4.3.2 Correlation Coefficient between Number of Times the Student visited the Laboratory and Performance in Physics

For the values in table 4.8 above, the value of Correlation Coefficient between performance and number of times the students visited the laboratory was 0.127. Its P value was 0.016 which is less than 0.05. A value of P which is less than 0.05 implies that the relationship being examined is significant. It therefore implies that the number of times students visit the laboratory affects the performance in physics.

4.3.3 The Influence of Physics Instructional Methods to the Student’s Learning of Physics in Laikipia County

In this objective, the researcher sought to find out the extent to which the instructional methods used by the physics teachers influence the students’ learning of physics. For this purpose, the researcher used student’s questionnaire item number 11 and also teacher’s questionnaire item number 12.

The students were asked to state the extent to which instructional methods influenced the learning of Physics in public secondary schools in Laikipia East Sub-County, Laikipia County, Kenya. The responses given were based on the Likert-scale through which the respondents stated the extent to which they agreed with the given aspects which were indicators of the identified factor on a scale of 1–5 where 1 was strongly disagree and 5 was strongly agree. The items were subjected to descriptive analysis and the results obtained were presented in Table 4.9 below.
Table 4.9: Effect of Instructional Methods in the Learning of Physics in Public Secondary Schools

<table>
<thead>
<tr>
<th>Statement</th>
<th>SD</th>
<th>D</th>
<th>UD</th>
<th>A</th>
<th>SA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Our Physics teacher always uses charts, models and other teaching aids during Physics lessons.</td>
<td>35.8%</td>
<td>11.9%</td>
<td>7.8%</td>
<td>18.6%</td>
<td>25.8%</td>
</tr>
<tr>
<td>The apparatus in the Physics lab are adequate, and I perform experiments individually.</td>
<td>24.7%</td>
<td>35.6%</td>
<td>1.9%</td>
<td>31.1%</td>
<td>6.7%</td>
</tr>
<tr>
<td>All the apparatus are in proper working condition and the teacher gives me instructions to enable me to do experiments individually and analyze results.</td>
<td>37.2%</td>
<td>34.4%</td>
<td>4.0%</td>
<td>14.4%</td>
<td>10.6%</td>
</tr>
<tr>
<td>I learn all my double lessons in the laboratory doing experiments and this assists me in constructing meanings of taught concepts.</td>
<td>19.2%</td>
<td>12.4%</td>
<td>5.3%</td>
<td>24.7%</td>
<td>38.1%</td>
</tr>
<tr>
<td>Our physics teacher usually promptly marks and returns the laboratory practical work done before the next one, this assists me to improve on the next experiment.</td>
<td>35.9%</td>
<td>13.9%</td>
<td>9.2%</td>
<td>22.2%</td>
<td>19.7%</td>
</tr>
<tr>
<td>In our school, we participate in physics congress/symposiums and this participation creates awareness to the applicability of physics concepts learned leading to better performance.</td>
<td>40.2%</td>
<td>23.5%</td>
<td>8.3%</td>
<td>15%</td>
<td>13%</td>
</tr>
</tbody>
</table>
4.3.4 Correlation Coefficient between Instructional Methods and Student’s Learning in Physics

1) Our Physics teacher always uses charts, models and other teaching aids during physics lessons and grade in physics at end of term three examination;

2) The Correlation Coefficient is 0.338 and the p value of Chi-square test of grade in physics is 0.001 which is less than 0.05, hence significant. This means the use of charts, models and other teaching aids during physics lessons influences students’ learning of physics. However, the results from respondents indicated that less than half of them (44%) were taught using charts, models and other teaching aids.

3) The apparatus in the physics laboratory are adequate, so I perform experiments individually and the grade in physics at end of term three examination;

4) The Correlation Coefficient is 0.024 and the p value of chi-square test of grade in physics was 0.649 which is more than 0.05 therefore it is not significant. This means that having adequate facilities in the physics laboratory does not influence the learning of physics.

5) All the apparatus are in proper working condition and the grade in physics at the end of term three examination;

6) There was a weak positive correlation of 0.085 and the p value of chi-square of 0.01 which is less than 0.05 therefore it is significant. This means that all apparatus being in good working condition and students performed experiments individually influence learning in physics.

7) I learn all my physics double lessons in the laboratory doing experiments and this assists me in constructing meaning to concepts taught and the grade in physics at the end of term examination;
8) There was a weak negative correlation of -0.028 with a p value of 0.094 which is greater than 0.05, which means that performing all my double lessons in the laboratory does not influence performance in physics.

9) Our physics teacher usually promptly marks and returns the experimental practical work done before the next one and the grade at the end of term three grade in physics; The p value of the chi-square is 0.021 which is less than 0.05. This means that marking students’ experimental work before they do the next experiment influences performance in physics.

10) In our school, we participate in physics congress/symposiums and this participation creates awareness to the applicability of physics concepts and correlation to grade in physics at end of term three examination. The value of the correlation coefficient was 0.32 and the p value was 0.019, which is less than 0.05. This means participating in physics congress/symposium influences performance in physics.

Table 4.9 above majority of students 217(60.3%) indicated that apparatus used for Practical work was inadequate while 196(54.4%) said that the available apparatus are not in proper working condition. In the area of performing experiments individually under the teacher’s guidance 198(55%) of the students said that it did not happen while as almost half of the students 176 (48.9%) indicated that their physics teachers did not promptly mark neither did he/she return the practical work done before the next one was done. 168 (46.7%) of the students totally disagreed that their physics teacher always used charts, models and other teaching aids during physics lesson. The results showed that the utilization of practical work affected the academic achievement of students in physics as shown in Table 4.6. In single sex
schools, students reported that all physics lessons were conducted in the laboratory, which provided the students with an opportunity to handle science apparatus confidently. It is no wonder that performance of Physics in single-sex schools in Laikipia East Sub-county was better than in mixed schools considering the percentage of grade C+ and above.

Students’ hands on activities significantly improve conceptualization of science and this leads to higher achievement (SMASSE Report, 2005). Availability and proper use of resources play an important role in teaching and learning (Wasanga 1996). Using practical approach in teaching science improves retention especially among the girls (Twoli, 1986). Therefore, students should be given an opportunity to perform experiments on their own to enhance retention of concepts and processes.

Item number 11 on student’s questionnaire also was used to find out the various methods used by the physics teachers and the responses were recorded in table 4.10 below.

<table>
<thead>
<tr>
<th>Teaching Method</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lecture</td>
<td>182</td>
<td>50.6</td>
</tr>
<tr>
<td>Demonstration</td>
<td>114</td>
<td>31.7</td>
</tr>
<tr>
<td>Experimental practical</td>
<td>10</td>
<td>2.8</td>
</tr>
<tr>
<td>Discussion</td>
<td>54</td>
<td>15.0</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>360</strong></td>
<td><strong>100</strong></td>
</tr>
</tbody>
</table>

The correlation coefficient between the instructional methods and performance in physics was 0.324 and the p value of chi-square test of grade in physics and instructional methods was 0.045 which is less than 0.05. This indicates that instructional methods influence performance in physics.
The lecture and the demonstration methods were most commonly used by 182(50.6%) and 114(31.7%) of the respondents respectively. Experimental Practical method was least popular among physics teachers.

The researcher established that the method used in teaching physics was dependent on the availability of the facilities. Results from table 4.9 showed that more than 216(60%) of respondents were in schools where apparatus in physics laboratory were inadequate. Moreover, more than half of the respondents were in schools where not all the apparatus in physics laboratories were in proper working conditions. These two factors in particular make it difficult for the physics teacher to use the practical approach of teaching physics or demonstration in their teaching which explains why most teachers in Laikipia East Sub-County resorted to the use of lecture method or demonstration. Lecture method is a teacher centered approach which makes the subject appear abstract and boring. This method has made the subject to be perceived as difficult and boring and sometimes the students fail to relate what they are learning in the subject to their day-to-day life. This leads to dismal performance and low enrollment in the subject as was evident in this study.

4.4 The Effect of Students’ Attitude towards Physics to the Learning of Physics

This is the third objective of this study.

To determine whether student’s attitude towards physics is a challenge in the learning of physics in public secondary schools in Laikipia East, the researcher used responses from the students’ questionnaire using items 13(a), (b), (c), (d)(e), (f), (g), (h) and (i) The results of the respondents were represented in table 4.11 below. From the results, most of the students had a positive attitude towards physics. 260(72.3%)
of the respondents reported that they liked studying physics during their free time. Most of these students associated their liking for physics to its applicability in life and their future career expectations. None of the students in Form three stated that physics was their least liked subject and also none of them regretted having enrolled in physics. 308(85.6%) of them strongly disagreed that they choose physics since they did not have an alternative, meaning that they chose to enroll in Physics out of their own will. Out of those taking physics in Form three and four, only 97(2.7%) said they took physics since they did not have an alternative.

Table 4.11: Students’ Attitude Towards Physics

<table>
<thead>
<tr>
<th>Statement</th>
<th>SD</th>
<th>D</th>
<th>UD</th>
<th>A</th>
<th>SA</th>
</tr>
</thead>
<tbody>
<tr>
<td>I like my Physics teacher</td>
<td>5.3%</td>
<td>2.2%</td>
<td>8.6%</td>
<td>28.9%</td>
<td>55.0%</td>
</tr>
<tr>
<td>Our Physics teacher allows us to participate in the learning of Physics</td>
<td>6.7%</td>
<td>3.9%</td>
<td>3.1%</td>
<td>43.1%</td>
<td>43.3%</td>
</tr>
<tr>
<td>Our Physics teacher usually gives us assignments.</td>
<td>3.1%</td>
<td>1.9%</td>
<td>1.9%</td>
<td>36.7%</td>
<td>56.4%</td>
</tr>
<tr>
<td>Our Physics teacher always marks the assignment he/she gives us</td>
<td>14.7%</td>
<td>11.9%</td>
<td>5.0%</td>
<td>40.0%</td>
<td>28.3%</td>
</tr>
<tr>
<td>Our Physics teacher is friendly</td>
<td>9.7%</td>
<td>8.1%</td>
<td>8.1%</td>
<td>24.2%</td>
<td>50.0%</td>
</tr>
<tr>
<td>Our Physics teacher makes the lesson enjoyable</td>
<td>13.1%</td>
<td>7.8%</td>
<td>8.3%</td>
<td>25.0%</td>
<td>45.8%</td>
</tr>
<tr>
<td>I only took Physics because I did not have an alternative.</td>
<td>85.6%</td>
<td>11.7%</td>
<td>0.0%</td>
<td>0.8%</td>
<td>1.9%</td>
</tr>
<tr>
<td>I always complete my physics assignment</td>
<td>1.9%</td>
<td>10.6%</td>
<td>8.1%</td>
<td>25.0%</td>
<td>54.4%</td>
</tr>
<tr>
<td>I like studying Physics most of my free time.</td>
<td>8.3%</td>
<td>4.2%</td>
<td>15.3%</td>
<td>33.1%</td>
<td>39.2%</td>
</tr>
</tbody>
</table>
Table 4.12: Correlation Coefficient between Students’ Attitude and Performance in Physics

<table>
<thead>
<tr>
<th></th>
<th>Our Physics teacher is friendly</th>
<th>Our Physics makes the lesson enjoyable</th>
<th>I only took Physics because I did not have an alternative</th>
<th>I always complete my assignments in Physics</th>
<th>I like studying Physics most of my free time</th>
</tr>
</thead>
<tbody>
<tr>
<td>Correlation Coefficient</td>
<td>0.344</td>
<td>0.384</td>
<td>-0.022</td>
<td>0.035</td>
<td>0.049</td>
</tr>
<tr>
<td>Sig.(2-tailed)</td>
<td>0.000</td>
<td>0.000</td>
<td>0.680</td>
<td>0.511</td>
<td>0.356</td>
</tr>
<tr>
<td>N</td>
<td>360</td>
<td>360</td>
<td>360</td>
<td>360</td>
<td>360</td>
</tr>
<tr>
<td>Coefficient of determination</td>
<td>11.83%</td>
<td>14.75%</td>
<td>0.048%</td>
<td>0.123%</td>
<td>0.24%</td>
</tr>
</tbody>
</table>

From table 4.12 above, there was a weak positive correlation between the performance in physics and I always complete my assignment in physics and I like studying Physics most of my free time of 0.035 and 0.049 respectively. Their p values were 0.511 and 0.356 respectively, which were greater than 0.05. This means that these two factors do not affect performance in physics.

There was a weak negative correlation between I only took physics because I did not have an alternative and performance in physics was 0.002. The p value was 0.68 which was greater than 0.05 therefore, this factor does not affect performance in physics.
There was a moderate correlation between our physics teacher is friendly and our physics teacher makes the lesson enjoyable and performance in physics of 0.344 and 0.384 respectively. The $p$ values were 0.000 and 0.000 respectively, which were less than 0.05 and therefore these two factors affect performance in physics because their $p$ values are significant. The $p$ values of chi-square of our physics teacher is friendly and our physics teacher makes the lesson enjoyable and the grade in physics at the end of term three were 0.022 and 0.002 which were less than 0.05. This implies that our physics teacher is friendly and our physics teacher makes the lesson enjoyable influence the performance in physics.

4.4.1 Summary of Influence of Students’ Attitude to Learning of Physics

From the above discussion, it was found that students’ attitude influenced their learning of physics.

From the responses of students’ questionnaire, the following findings were made;

i) Majority of the students that is more than three quarter liked their physics teacher meaning they had a positive attitude towards physics.

ii) 288 that is 80% of the respondents associated their liking of physics to its applicability in life and their future career expectations.

iii) 324 that is ninety percent of the respondents disagreed to the fact that they chose to do physics because they did not have any other alternative subject.

iv) A friendly teacher creates a positive attitude in his/her students and this positive attitude influences the students’ learning of physics positively and vice versa.
v) A physics teacher who makes his/her physics lesson enjoyable by allowing learner participation makes the student to have a positive attitude towards physics learning which promotes performance in physics.

4.5 To establish whether student’s gender is a challenge that influences their learning of Physics in public secondary schools in Laikipia East Sub-County, Laikipia County

This objective sought to find out if students’ gender affected enrolment and performance in physics. Students’ questionnaire on performance in physics in the end of term exam was categorized as male or female. 158 girls were involved in the study out of which 100 (63.29%) were sampled from three Girls’ only schools and 58 (36.73%) came from six mixed schools. The number of boys who participated in the study were 202 out of which 82 (40.59%) were from three Boys’ only schools and 120 (59.4%) were sampled from 6 mixed schools. As observed from the findings of this study, majority of students who enrolled for physics in Form three in mixed schools were boys. Actually, in one of the mixed school visited, only three girls had enrolled for physics out of the 28 students in the class.

The results from respondents were as shown in table 4.5 below;
Table 4.13: Students Enrolment in Physics in Form Three and the Sampled Population Performance in Physics at End of term Examination

<table>
<thead>
<tr>
<th>No of schools</th>
<th>Type of school</th>
<th>Students Population in Form Three</th>
<th>Number of students Enrolled in physics in Form Three</th>
<th>% of students enrolled in physics in Form Three</th>
<th>End of Term’s Mean in Physics</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>Girls school</td>
<td>345</td>
<td>100</td>
<td>28.99</td>
<td>5.21</td>
</tr>
<tr>
<td>3</td>
<td>Boys school</td>
<td>231</td>
<td>82</td>
<td>35.5</td>
<td>7.3</td>
</tr>
<tr>
<td>11</td>
<td>Mixed day school Boys: 350</td>
<td>120</td>
<td>34.28</td>
<td>4.1</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Girls: 298</td>
<td>58</td>
<td>19.46</td>
<td>3.17</td>
<td></td>
</tr>
<tr>
<td>18</td>
<td>Total</td>
<td>1224</td>
<td>360</td>
<td>29.4</td>
<td>Average mean: 4.478</td>
</tr>
</tbody>
</table>

It was observed from Table 4.5 that physics students’ enrolment was higher in single sex schools than in mixed schools. Enrolment is also lower in girls’ schools than in boys’ schools. The percentage of sampled form three students was 105 (29.4%) . The physics teacher was given the prerogative to select the students who participated in the study. Enrollment in physics was higher in single sex schools than in mixed day school.

The above discussion shows that gender is a challenge that affects student learning in physics in secondary schools in Laikipia East. It affects both performance and enrolment in physics.
4.5.1 Students supposed to Enroll in Physics

The table below shows the responses of the students on who were supposed to enroll for physics.

Table 4.14: Students supposed to Enroll for Physics

<table>
<thead>
<tr>
<th>Gender</th>
<th>Who are supposed to do physics?</th>
<th>Boys</th>
<th>Girls</th>
<th>Both (boys and girls)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td></td>
<td>7.6%</td>
<td>0%</td>
<td>92.4%</td>
</tr>
<tr>
<td>Female</td>
<td></td>
<td>21.3%</td>
<td>2.7%</td>
<td>76%</td>
</tr>
</tbody>
</table>

About 34(21.3%) of girls believed that boys were supposed to do physics. These girls believed that boys performed better in Physics than girls. However, the majority of girls120 (76%) believed that physics was supposed to be done by both boys and girls. From teacher’s questionnaires, girls scored better in questions that required comprehension than those that required numerical solutions. This is in agreement with (Twoli, 1986) that indeed boys seem to have higher mathematical and spatial visualization ability than girls. All the respondents agreed that physics was a basic requirement in the society that each and everyone needs to have some knowledge in. To ensure gender equality and equity in higher education and employment, more girls need to enroll in physics.

Although girls in the girls school had the quality grades in the physics examination, the number of all the girls with c+ (plus) and above from the sampled schools was relatively lower at 107(68%) compared to that of boys at 168(83%) as indicated in table 4.6. This difference could be attributed to the Socialization Theory (Semala, 2009). On average men perform better than women in college in high school physics. Studies of elementary and secondary education suggest that these disparities
originate when students are in junior high school (Mazur et al 2006). Some studies have shown that women perform better in science classes that are taught co-operatively than in those that are taught competitively. They also benefit from classes that challenge every student to think about and respond to questions asked during class (Tobias et al 1999, Osborne et al 2003 and Mazur et al 2006). The findings of this study are in agreement with (Orodho, 1996) that indeed there is sex difference in science achievement and particularly in physics at secondary school level in Kenya.

Table 4.15: Awareness of Physics Related Careers amongst the Students

<table>
<thead>
<tr>
<th>Responses</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>348</td>
<td>96.7</td>
</tr>
<tr>
<td>No</td>
<td>12</td>
<td>3.3</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>360</strong></td>
<td><strong>100.0</strong></td>
</tr>
</tbody>
</table>

Table 4.13 above indicates that 348(96.7%) of the respondents were aware of physics related careers while 12(3.3%) were not aware of physics related careers. This means that a majority of the students were aware of physics related careers. From the findings it also emerged that most of the students appreciated the importance of Physics for their career in future. One of the students put it this way and I quote, “I want to be an engineer, so I need Physics”. This is an encouraging observation, as Physics is increasingly becoming a gateway to a number of key careers in the world of work.
4.5.2 Circumstances that Led to Subject Combination

The researcher wanted to establish who motivated the students in selection of physics. The responses were as shown in Table 4.16.

Table 4.16: Response on Circumstances that Led to Subject Combination

<table>
<thead>
<tr>
<th>Statement</th>
<th>SD</th>
<th>D</th>
<th>UD</th>
<th>A</th>
<th>SA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Peer influence</td>
<td>76.1%</td>
<td>13.9%</td>
<td>3.6%</td>
<td>2.2%</td>
<td>4.2%</td>
</tr>
<tr>
<td>Awareness of physics related careers</td>
<td>2.2%</td>
<td>0.8%</td>
<td>1.1%</td>
<td>35.8%</td>
<td>60.0%</td>
</tr>
<tr>
<td>Physics facilities especially in laboratory</td>
<td>43.9%</td>
<td>30.3%</td>
<td>6.4%</td>
<td>13.9%</td>
<td>5.6%</td>
</tr>
<tr>
<td>Parental influence</td>
<td>65.6%</td>
<td>18.9%</td>
<td>3.9%</td>
<td>9.4%</td>
<td>2.2%</td>
</tr>
<tr>
<td>The principal’s encouragement</td>
<td>64.4%</td>
<td>16.7%</td>
<td>2.5%</td>
<td>7.2%</td>
<td>9.2%</td>
</tr>
</tbody>
</table>

From the Table 4.16 above, the study shows that when students were asked to state what encouraged them to enroll in physics subject, majority of them, 345 (95.8%) stated that they were encouraged by their awareness of physics related careers. Those who were influenced by friends were 23 (6.4%). There was a high percentage of students 291 (81.1%) who responded that their choice of physics was not encouragement from the principals. That meant that principals did not actively participate in selection of physics. This shows that the exercise of subject selection has been left in the hands of academic masters who decided when the subject selection was to be done, which optional subject was to be made compulsory, as well as what science subject combination was to be offered in the school.

These findings agreed with Mwangi (2009) who found that the principal’s laxity in providing appropriate leadership in students’ subjects selection has provided impetus to different teacher’s self-made criteria which students had to adhere to when they
were enrolling in their subjects. Very few students were influenced by their parents on subject selection, only 41 (11.6%) of them.

4.6 Summary of Data Analysis

This research came up with the following findings;

i) Laboratory practical work in physics has a positive impact in performance of physics.

ii) Among the students sampled, the ones from schools with a separate physics laboratory had better grades in physics (C+ and above) than the ones coming from schools without a separate physics laboratory.

iii) Most of the sampled students reported a lack of adequate laboratory equipment.

iv) More than 216(60%) of the sampled students observed that many of the physics apparatus were not in good working condition.

v) Students performed physics experiments in large groups which method did not encourage hands on activities on the part of the student.

vi) In mixed schools, boys dominated in handling physics apparatus resulting in better grades for boys than girls.

vii) Most physics teachers did not mark the practical work promptly before performing the next one and this was established to have an impact in performance in physics.

viii) Lastly majority of the students performed experiments without the assistance of the physics teacher and students reported that this had a negative impact on student’s attitude towards physics.
The following findings were related to Instructional methods:

i) This study established that instructional methods influence the performance of physics as the students in schools where experimental practical method was used performed better, had more quality grades in physics compared to schools where lecture method was used.

ii) This study revealed that more than 11(60%) of physics teachers in public secondary schools in Laikipia East used lecture methods in teaching physics even where there were apparatus while experimental practical method was least popular method. This scenario could have contributed to the dismal performance as well as the low student enrolment in physics in public schools in Laikipia East as is evident in this study.

iii) Teachers do not use the learner centered methods like discussion, field work, experimental, and constructivism. These are the methods where the learner participation is evident.

Attitude towards Physics:

The researcher established that student’s attitude towards physics is not a challenge in the learning of physics in the learning of physics in public secondary schools in Laikipia East.

i) More than 324(90%) of the students have a positive attitude towards physics and the physics teacher at the time of choosing the physics subject.

ii) Students reported of being aware of physics related careers therefore were easily motivated to perform the subject.
iii) The Physics teachers, who were friendly, marked students work on time, allowed more student participation during physics learning promoted a positive attitude and improved performance in physics.

**Gender Issues in Physics**

The findings of this study showed that gender is a challenge that influences student’s learning of physics in public secondary schools in Laikipia East.

i) Generally, performance of girls was found to be lower than that of boys.

ii) The researcher observed that the enrollment of boys for physics was higher than that of girls. This was also the same trend in mixed schools.

iii) Majority of the students in this study reported that they believed that both sexes should enroll in physics.

**Intervening Variables**

This study established other factors that played a significant role in the student’s learning of physics in Laikipia East among them;

i) Parental guidance; The students reported that parents did not participate actively in guiding students in the choosing of physics.

ii) School administrators; In particular principals did not seem to take charge of the subjects’ selection process and holly depended on career masters or guidance departments to make the school’s subject policy not minding about the consequences of such decisions.

iii) Peer pressure did not influence the students’ choice of physics

iv) The student participation in the laboratory depended more on the individual physics teacher and not necessarily on the presence or the condition of the apparatus in the laboratory.
CHAPTER FIVE
SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction
This chapter focuses on the summary, conclusion and recommendations based on the study findings. The fundamental purpose of educational research is to develop new knowledge about educational phenomena and to develop our confidence regarding particular knowledge while confirming whether it is true or false. The purpose of this study was to identify and examine the factors affecting enrolment and performance in physics among secondary school students in Laikipia East Sub-County. Having collected and analyzed data, a summary of findings, conclusion and recommendations are outlined in this chapter.

5.2 Summary of the Main Findings
The study was anchored on four objectives that included; To determine the effect of laboratory practical work in physics in public secondary schools in Laikipia East; To find out whether physics instructional methods influence the students’ learning of physics in Laikipia sub-County; To determine whether students’ attitude towards physics is a challenge in the learning of physics in public secondary school in Laikipia East sub-county and to establish whether students’ gender is a challenge that influences their learning of physics in public secondary schools in Laikipia East sub-county. These factors were assumed to affect enrolment and performance in physics among secondary school students in Laikipia East Sub-county. Five research questions guided the study and they formed the following outline in the summary.
5.2.1 Resources for Physics Instruction

One of the key determinants of students’ attitudes to physics is their experience of school physics (Sharp, 2004). This implies that Physics laboratory work helps to simplify the abstractness aspect of Physics thereby increasing the students’ performance in the academic environment. It also caters for individual differences which encourages sharing of ideas and team work. Therefore, there is a strong positive significant relationship between laboratory equipment and academic performance. In cognizance of this fact, the researcher observed several physics practical sessions and used student’s questionnaire to come up with the following findings:

i) In 39(98%) of schools, students performed experiments in large groups due to inadequate laboratory equipment. Not every student had a chance to interact with the apparatus individually as most become mere observers, as the experiments were done by one or two active participants. This observation showed that practical lessons were not fully utilized to serve their full purpose in learning.

ii) Students reported that although 244(68%) of them learn the physics lessons in the laboratory, the apparatus are not in proper working conditions and 216(60%) of them also reported that experiments are performed by students without the teacher’s guidance and supervision.

iii) 10(58%) of the 18 physics teachers in this study did not promptly mark nor return the practical work done before the next experimental work was done. Students were not in a position to check on their mistakes neither would they be able to know the correct interpretation, analysis and conclusions of results from the experiments.
iv) More than 24(60%) of the 40 schools in this study did not have a separate physics laboratory and having a separate physics laboratory was found to have a direct relationship with performance in physics.

v) In mixed schools, boys dominated in handling apparatus while the other students were discussing other issues unrelated to the experimental work.

These findings indicated that the way physics practical work conducted was neither interesting nor motivating and students especially girls were less eager to continue with physics beyond form two compared to the boys.

5.2.2 Teaching Methods for Physics and Teacher Characteristics

The method of presentation of materials to the learners is key to acquisition and retention of the content learnt.

i) This study established that instructional methods influence the performance of physics as the students in schools where experimental practical method was used performed better and had more quality grades that is B+ and above in physics compared to schools where lecture method was used.

ii) More than 11(60%) of 18 physics teachers in this study in public secondary schools in Laikipia East used lecture methods in teaching physics even where there were apparatus while experimental practical method was least popular method. This scenario could have contributed to the dismal performance as well as the low student enrolment in physics in public schools in Laikipia East as is evident in this study.

iii) Teachers do not use the learner centered methods like discussion, field work, experimental, and constructivism as according to this research only 64(17.8%)
of the 360 students were taught using discussion, experimental or field work.
These are the methods where the learner participation is evident.
iv) Little time was spared for student-centered activities as advocated by SMASSE project. As has been stated earlier, pedagogy should encourage the use of student centered approach to teaching of sciences

5.2.3 Attitude towards Physics
The attitude of the students towards a particular science subject was found to significantly affect the choice of subject in Form three.
(i) In this study all the students who had enrolled in physics had positive attitude towards the physics subject their physics teacher. The attitude was positive among those students who performed well.
(ii) Students attitude determines the amount of time and effort the student dedicated to the subject and this ultimately improves enrollment and performance in the subject.
(iii) Teachers should work towards improving students’ achievement in the subject in order to inculcate positive attitude to the learners.

5.2.4 Gender and Learning Physics
The findings of this study showed that gender is a challenge that influences student’s learning of physics in public secondary schools in Laikipia East.
i) Generally, performance of girls was found to be lower than that of boys.
ii) The researcher also observed that the enrollment of boys for physics was higher than that of girls. This trend was the same in mixed schools.
iii) Majority of the students in this study that is 340(94%) out of 360 reported that they believed that both sexes should enroll in physics.
iv) Performance was better among boys in mixed schools than their female counterparts.

v) The girls in Girls schools performed better than the boys. Teachers should therefore make a deliberate effort to encourage the girls in mixed schools and employ teaching methods that are girl friendly.

vi) Inclusion of guidance and counseling during selection of subjects at Form two is highly recommended. This would go a long way in assisting the students to choose subjects that will assist them in their future career.

5.3 Conclusions of the Study

5.3.1 Laboratory Practical Work in Physics

The effect of laboratory Practical work in the learning of Physics in public secondary schools in Laikipia East Sub -County, Laikipia County, Kenya.

i) The findings showed that effective utilization of practical laboratory equipment affects the academic achievement of students in physics.

ii) It was further shown that students from schools with adequate teaching/learning resources and effectively utilized physics apparatus and equipment performed better than those without. This implies that Physics laboratory work simplified abstractness aspect of Physics thereby increasing the student’s performance in the academic environment. It also caters for individual differences, which encourages sharing of ideas and team work.

iii) Majority, 11 out of 18 of the physics teachers were found not to effectively utilize the physics practical lessons even in cases where the laboratory equipment was adequate and in good working condition.
iv) 23 out of 40 of the schools in this study were found not to have a separate physics laboratory and this scenario made it difficult to program for laboratory practical work. This calls for the school administrators to construct and equip the physics laboratory if any meaningful teaching/learning of physics is to take place.

5.3.2 Instructional Methods

On physics instructional methods influencing the students’ learning of Physics in Public Secondary Schools in Laikipia East Sub-county, Laikipia County, Kenya, the findings showed that the type of instruction methods used by the physics teacher affected performance in Physics.

i) The method of presentation of materials to the learners is key to acquisition and retention of the content learnt. Despite this fact only 9 out of 18 physics teachers in this study did not use lecture method in their teaching of physics. This is despite the fact that all the teachers had the minimum training and exposure in teaching physics.

ii) Physics teachers should try and embrace recommended methods of teaching such as discussion, constructivism, field trips, exploration and project so as to spice up the subject.

iii) Little time was spared for student centered activities as advocated by SMASSE project. As have been stated earlier, pedagogy should encourage the use of student centered approach to teaching of sciences. Materials learnt in physics should not always come from the textbooks. Retention of materials learnt is clearly a result of active participation by the learner and interaction with learning materials.
iv) From the teachers’ questionnaires the students indicated difficulty in solving problems, doing calculations and constructing meanings of taught concepts. The implication of not having conceptual understanding results in regurgitation, superficial learning and intuitive application of principles. By providing concrete experiences in physics lessons, students would associate meanings to learning material and thereby achieve better understanding and retention of information. The findings that students do not like to ask for help from their teacher or answer questions in class should also be addressed. These require that teachers should emphasize active teaching methods for example, group work, cooperative learning, and presentations which create a friendly classroom environment that could initiate quality interactions between the students and their teacher.

5.3.3 Attitude towards Physics

i) The attitude of students towards a particular science subject physics included was found to significantly affect the choice of subject in Form Three (Literature review). All the students who had enrolled in physics had a positive attitude towards the subject. The attitude was even higher among the students who performed well. Student attitude determines the amount of time and effort dedicated to the subject and this ultimately improves enrolment and performance in the subject. Acquisition of proficiency in a subject may lead to a positive attitude in the subject. Teachers should take advantage of the learner’s positive attitude in physics and work towards improving students’ achievement.

ii) The results from this study suggested that secondary school students in Laikipia East Sub-County are aware of the importance of physics in relation to
career progression. School administrators particularly principals should take a lead in exposing students to the various careers where physics is applied and encourage them to pursue the subject. Students should be given more opportunities to work on non-routine and challenging physics problems so as to improve their thinking skills and value to the intrinsic essence of physics.

### 5.3.4 Gender Challenges in Physics

i) The performance of girls was found to be below that of boys in mixed schools and much lower performance for the girls who were in girls’ only school. This poor performance was partly because in mixed schools, boys denied the girls an opportunity to handle apparatus which contributed to their poor manipulative skills. Teachers in these schools should therefore adopt more cooperative than competitive methods in the process of instructions. Single gender schools performed better than mixed schools for both sexes.

ii) 338 out of 360 of the students in the study were in agreement that both boys and girls are supposed to enroll in physics. However, the study revealed that out of 360 students in the study, 150 were girls while 210 were boys and therefore the issue of gender and enrollment in physics needs to be addressed further.

### 5.4 Recommendations of the Study

The following recommendations for action were made based on the findings of this study.

i) Teachers are advised to use effective modern teaching methods to improve absorption and retention of learnt materials. The use of field trips and laboratory work in particular should be encouraged to give the student
experience with their surrounding and appreciate the importance of physics to the environment. Together with these methods, physics teachers should embrace integrated computer lessons to enhance diversity in passing information to learners.

ii) Resources assist in visualization and conceptualization of concepts more so in physics. The school administration should therefore prioritize provision of adequate and quality physics laboratory equipment to improve the quality of class experiments. It is recommended that school heads liaise with science department heads while purchasing the laboratory equipment to cater for quality.

iii) Teachers should also make use of locally available materials so that learners can relate the subject to the surrounding environment.

iv) The study found out that girls learning physics without the boys were more confident and consequently performed better than their counterparts in mixed schools were. There is need therefore for the government to minimize the number of mixed schools and increase the number of single sex schools. Teachers teaching the girls are encouraged to use the practical approach to improve the girls’ masterly of concept and improve their spatial ability.

v) The school administration can add value to the learning environment in the schools by provision of not only adequate teaching/learning resources but also strengthening the guidance and counseling team to guide the students on careers related to physics. This is likely to improve enrolment and performance in physics.

vi) The positive attitude of students towards physics was found to greatly improve performance. It is therefore the responsibility of the physics teachers to make
the subject more appealing to the learner since this will consequently lead to a more positive attitude towards the subject.

vii) All physics teachers should attend in-service training after every two years so that they can be acquainted to any new knowledge in the subject. These trainings should be followed by subject inspection in the classrooms so as to assess application of the same.

5.5 Suggestions for Further Research

i) The study focused on physics at secondary school level. Other studies should be considered in other science subject areas to establish the extent to which these factors affect enrolment and performance in those subjects.

ii) That there is a gender disparity in physics achievement and enrolment is not in dispute, therefore further research should be carried out to find out the major causes of the disparity and recommend action to bridge the gap.

iii) Such a study should identify the social, cultural, ecological, economic, physiological and political factors that tend to influence gender differences in physics achievement and enrolment.

iv) A similar study is necessary in other parts of the country for comparison purposes so that all stakeholders can take action before the subject becomes extinct.

v) Further research is required to establish the extent of utilization of laboratory equipment during physics learning/teaching.
REFERENCES


Easton, L. (2002). Lessons from Learners Educational Leadership, 60(7), 64-68


Kenya National Examination Council (2005). *Circular on the KCSE examination to be offered with the effect of 2006.*


Paton (2002) Qualitative evaluation and Research Methods


Tep Report (2012) Observation of Teacher Education in Physics, American Physical Society, College Park, MD.


APPENDICIES

APPENDIX I: LETTER OF INTRODUCTION

My name is Frasiah Njeri Ndegwa. I am a Master of Education (Med.) student at Kenyatta University, Nairobi. As a requirement of this course, I am undertaking a research project on “STUDENTS’ LEARNING CHALLENGES IN PHYSICS IN PUBLIC SECONDARY SCHOOLS IN LAIKIPIA EAST SUB-COUNTY, LAIKIPIA COUNTY”

I assure you that the answers provided will be used only for the purposes intended in the study.

Thank you in advance

FNN
Frasiah N. Ndegwa.
APPENDIX II: QUESTIONNAIRE FOR PHYSICS TEACHERS

I am a Master of Education, (MEd.) student at Kenyatta University, Nairobi. As a requirement of this course I am undertaking a research project on “STUDENTS' LEARNING CHALLENGES IN PHYSICS IN PUBLIC SECONDARY SCHOOLS IN LAIKIPIA EAST SUB COUNTY, LAIKIPIA COUNTY.”

Please feel free to answer the questionnaire as frankly as possible. Responses to these questions will be treated confidentially. Do not write your name anywhere on this paper.

Please tick (√) on the appropriate choice(s) which you think is the answer(S) or more correct response(s) to the questionnaire.

SECTION I: Personal Information
1. Your gender            Male [ ]          Female [ ]

2. What is your level of education?
   Diploma / S1 [ ]          Bachelor Degree [ ]
   B.ED [ ]          Masters in Education [ ]
   Others (specify)........................................................................................................

3. The number of years that you have taught:
   0-4 years [ ]          5-9 years [ ]          10-14 years [ ]
   15-19 years [ ]          20-24 years [ ]         25-29 years [ ]
   Under 4 Years [ ]         Under 20 years [ ]         20-24 years [ ]
   25-34 years [ ]         35-39 years [ ]         40-44 years [ ]
   45-49 years [ ]         50 and above years [ ]

4. How many physics teachers are there in your school? ...........................................

5. How many physics students are there in your school?
   Boys .............................................  Girls .............................................
   Total .............................................
6. Which classes do you teach Physics?
   Form 1 [ ] Form 2 [ ] Form 3 [ ] Form 4 [ ]

7. How many science labs do you have in your school? .............................................

SECTION II: Challenges related to Practical Work

8. What is the enrolment rate of physics students in the school?

<table>
<thead>
<tr>
<th>Class</th>
<th>Form 3</th>
<th>Form 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Year 2010</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Year 2011</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Year 2012</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Year 2013</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Year 2015</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

9. Do you know of any student who dropped out of the physics class?
   Yes [ ] No [ ]

(a) How many dropped out from your own class?

<table>
<thead>
<tr>
<th>Class</th>
<th>Form 3</th>
<th>Form 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Year 2010</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Year 2011</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Year 2012</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Year 2013</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Year 2015</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

If yes what were the main reasons of dropping out? ..................................................
..........................................................................................................................
..........................................................................................................................
..........................................................................................................................

10. To what extent do you agree with following statements?

<table>
<thead>
<tr>
<th>Statement</th>
<th>Yes [ ]</th>
<th>No [ ]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Our school has separate Physics laboratory</td>
<td></td>
<td></td>
</tr>
<tr>
<td>The apparatus in the Physics lab are adequate</td>
<td>(SA)</td>
<td>(A)</td>
</tr>
<tr>
<td>All the apparatus are in proper working condition</td>
<td>(SA)</td>
<td>(A)</td>
</tr>
<tr>
<td>I teach all my double lessons in the laboratory</td>
<td>(SA)</td>
<td>(A)</td>
</tr>
</tbody>
</table>
SECTION III: Challenges related Methods of Physics Instruction

11. Why do you think some students find physics to be difficult?
   Too many formulae/laws/content to memorize [ ]
   Theoretical content [ ]
   Problems not easy to solve [ ]
   Content not easily understood [ ]
   Too many calculations [ ]
   Physics not enjoyable [ ]
   Too much hard/difficult formulae/laws/concepts/contents [ ]

12. What challenges do you face in the method of teaching physics?
   Constructing meanings of taught concepts [ ]
   Too little practical work [ ]
   Worked examples simpler than class exercises [ ]
   Textbooks not easy to follow [ ]
   Syllabus too wide [ ]

13. What are the challenges related to physics subject?
   Interpreting/answering questions [ ]
   Mathematical skill for solving Problems [ ]
   Exposure to practical work [ ]
   Seriousness/concentration in class [ ]
   Reading habit [ ]
   Use of textbook [ ]
   Mindset/attitude [ ]
   Learning environment [ ]
   Lack of Foundation [ ]
   Lack of Parental support [ ]

14. In your opinion what are the challenges related to methods of physics instruction?

SECTION IV: Gender related Challenges

15. What is the gender related challenges experienced by students in the study of physics?

THANK YOU
APPENDIX III: QUESTIONNAIRE FOR STUDENTS

My name is Fresiah Njeri Ndegwa, I am a Master of Education, (MEd) student at Kenyatta University, Nairobi. As a requirement of this course I am undertaking a research project on “STUDENTS’ LEARNING CHALLENGES IN PHYSICS IN PUBLIC SECONDARY SCHOOLS IN LAIKIPIA EAST SUB COUNTY, LAIKIPIA COUNTY, KENYA.

Please feel free to answer the questionnaire as frankly as possible. Responses to these questions will be treated confidentially. Do not write your name anywhere on this paper. Please tick (✓) on the appropriate choice(s) which you think is the answer(S) or more correct response(s) to the questionnaire.

SECTION I: Personal Information

1. Your gender            Male [ ] Female [ ]
2. Your Class (Form)      Three [ ] Four [ ]
3. How many students are there in your class?
   Boys..........................Girls......................... Total..........................
4. How many students are there in your physics class?
   Boys..........................Girls......................... Total..........................
5. What was your mean grade in the end of term three examination?
   A - B (plus) [ ] B (plan) - C (plus) [ ]
   C (plain) – D (plus) [ ] D (plain)-E [ ]
6. What was your grade in physics the end of term three examination?
   A - B (plus) [ ] B (plan)- C (plus) [ ]
   C (plain) – D (plus) [ ] D (plain)-E [ ]
7. What is the type of your school? Day [ ] Boarding [ ]
8. What is the nature of your school
   Boys School [ ] Girls School [ ] Mixed [ ]
SECTION II: Challenges related to Practical Work

9. a) Our school has separate Physics laboratory  Yes [ ]  No [ ]

b) Do you perform experiments individually or as a group?
   Individually [ ]  Group [ ]

c) How many times did you visit the laboratory this year before midterm?
   Twice a week [ ]  Weekly [ ]
   Once a month [ ]  Once a month [ ]
   Never [ ]

10. This section examines how practical work influence performance in physics. Kindly respond with the response that matches your opinion. Please rank by ticking (√) or cross mark (×) basing on a scale of 1-5 where; 1-Strongly Disagree (SD), 2-Disagree (DA), 3-Undecided (UD), 4-Agree (A), 5-Strongly Agree (SA).

<table>
<thead>
<tr>
<th>Practical work</th>
<th>SD</th>
<th>DA</th>
<th>UD</th>
<th>A</th>
<th>SA</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. The apparatus in the Physics lab are adequate</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>b. All the apparatus are in proper working condition</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>c. I learn all my double lessons in the laboratory</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>d. We usually perform experiments individually under the teacher’s guidance</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>e. Our Physics teacher usually promptly marks and returns the practical work done before the next one</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>f. Our Physics teacher always uses charts, models and other teaching aids during Physics lesson</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
SECTION III: Challenges related to Methods of Physics Instruction

11. The following statements describe the commonly used method of teaching physics. Using a tick (✓) mark, indicate one method commonly used in teaching physics in your school.

<table>
<thead>
<tr>
<th>Practical method</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Lecture (explaining only)</td>
<td></td>
</tr>
<tr>
<td>Demonstration</td>
<td></td>
</tr>
<tr>
<td>Group discussion</td>
<td></td>
</tr>
</tbody>
</table>

12. In your opinion, what are the challenges you encounter due to method of physics instruction,.................................................................................................................................................................

SECTION IV: Students’ Attitude towards Physics Teaching/Learning

13. This section examines how do Students’ Attitude towards Physics Teaching/Learning influence performance in physics. Kindly respond with the response that matches your opinion. Please rank by ticking (✓) or cross mark (×) basing on a scale of 1-5 where; 1-Strongly Disagree (SD), 2-Disagree (DA), 3-Undecided (UD), 4-Agree (A), 5- Strongly Agree (SA).

<table>
<thead>
<tr>
<th>Students’ Attitude</th>
<th>SD</th>
<th>DA</th>
<th>UD</th>
<th>A</th>
<th>SA</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. I like my Physics teacher</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>b. Our Physics teacher allows us to participate in the learning of Physics</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>c. Our Physics teacher usually gives us assignments.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>d. Our Physics teacher always marks the assignment he/she gives us</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>e. Our Physics teacher is friendly</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>f. Our Physics teacher makes the lesson enjoyable</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>g. I only took Physics because I did not have an alternative.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>h. I always complete my physics assignment</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>i. I like studying Physics most of my free time.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
SECTION V: Gender related Challenges

14. Are you aware of any physics related career?  Yes [ ]  No [ ]

15. Have you ever heard of gender equality?  Yes [ ]  No [ ]

16. Who are supposed to do physics?
   Boys [ ]  Girls [ ]  Both (boys and girls) [ ]

   Give your reason....................................................................................................................................................

17. The following statements describe the factors that influence your choice of Physics. Using a tick (✓) mark, indicate the extent to which you agree or disagree with each statement in regard to your school.

   Choices are as follows:

   1-Strongly Disagree (SD), 2-Disagree (DA), 3-Undecided (UD), 4-Agree (A), 5-Strongly Agree (SA).

<table>
<thead>
<tr>
<th>Practical work</th>
<th>SD</th>
<th>DA</th>
<th>UD</th>
<th>A</th>
<th>SA</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. Peer influence</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>b. Awareness of physics related careers</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>c. Physics facilities especially in laboratory</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>d. Parental influence</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>e. The principal’s encouragement</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

   Other Specify ....................................................................................................................................................

THANK YOU
APPENDIX IV: TIME FRAME FOR THE PROJECT

Chronology 2015-2016

<table>
<thead>
<tr>
<th>Activity</th>
<th>Month</th>
</tr>
</thead>
<tbody>
<tr>
<td>Formulation of research problem</td>
<td>Jan 2015</td>
</tr>
<tr>
<td>Writing the Proposal (Chapters 1-3)</td>
<td>Jan-Feb 2015</td>
</tr>
<tr>
<td>Marking of First draft</td>
<td>Feb 2015</td>
</tr>
<tr>
<td>Consultation of supervisors</td>
<td>March 2015-May 2016</td>
</tr>
<tr>
<td>Piloting of research instruments</td>
<td>August 2016</td>
</tr>
<tr>
<td>Data collection</td>
<td>February – April 2017</td>
</tr>
<tr>
<td>Data entry, cleaning and analysis</td>
<td>June – July 2017</td>
</tr>
<tr>
<td>Writing the report</td>
<td>July 2017</td>
</tr>
<tr>
<td>Submission of research project for examination</td>
<td>July 2017</td>
</tr>
<tr>
<td>Submission of final research project</td>
<td>August 2017</td>
</tr>
</tbody>
</table>
## APPENDIX V: BUDGET

<table>
<thead>
<tr>
<th></th>
<th>During</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Field work</td>
<td>3 weeks</td>
<td>19,000</td>
<td>19,000</td>
</tr>
<tr>
<td><strong>Transport cost:</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bus Fare</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sub total</td>
<td></td>
<td></td>
<td></td>
<td>19,000</td>
</tr>
<tr>
<td><strong>Miscellaneous:</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stationery</td>
<td>5 reams</td>
<td></td>
<td>500</td>
<td>2,500</td>
</tr>
<tr>
<td>Telephone/e-mail/postage</td>
<td></td>
<td></td>
<td>2,000</td>
<td>2,000</td>
</tr>
<tr>
<td>Secretarial service</td>
<td></td>
<td></td>
<td>3,000</td>
<td>3,000</td>
</tr>
<tr>
<td>Data collection</td>
<td></td>
<td></td>
<td></td>
<td>25,000</td>
</tr>
<tr>
<td>Data analysis</td>
<td></td>
<td></td>
<td></td>
<td>20,000</td>
</tr>
<tr>
<td>Sub total</td>
<td></td>
<td></td>
<td></td>
<td>52,500</td>
</tr>
<tr>
<td><strong>Total Project Cost</strong></td>
<td></td>
<td></td>
<td></td>
<td><strong>71,500</strong></td>
</tr>
</tbody>
</table>
APPENDIX VI: LETTER OF AUTHORIZATION

NATIONAL COMMISSION FOR SCIENCE, TECHNOLOGY AND INNOVATION

Telephone: +254-20-2213471, 2241349, 3310751, 2219420
Fax: +254-20-3318245, 318249
Email: dg@nacosti.go.ke
Website: www.nacosti.go.ke
when replying please quote

Ref. No. NACOSTI/P/17/62673/15471

13th February, 2017

Frasiah Njeri Ndegwa
Kenyatta University
P.O. Box 43844-00100
NAIROBI.

RE: RESEARCH AUTHORIZATION

Following your application for authority to carry out research on “Students’ learning challenges in physics in public secondary schools in Laikipia County, Kenya,” I am pleased to inform you that you have been authorized to undertake research in Laikipia County for the period ending 11th February, 2018.

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

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

BONIFACE WANYAMA
FOR: DIRECTOR-GENERAL/CEO

Copy to:

The County Commissioner
Laikipia County.

The County Director of Education
Laikipia County.