FACTORS INFLUENCING STUDENTS' ENROLMENT IN PHYSICS IN SECONDARY SCHOOLS: A CASE OF BUNGOMA EAST SUB – COUNTY KENYA

BY

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NOVEMBER, 2014

DECLARATION

DECLARATION BY THE CANDIDATE

I the undersigned do declare to the best of my knowledge that this research thesis is my original work and that it has never been submitted to any University or any other institution for an award

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This work is dedicated to my dear wife Mary, daughter Esther and son Joseph. Not forgetting my Dad Jamin and Mum Pasilisa and siblings. God bless them all to enjoy the fruits of this sweat by rewarding them with abundant life.

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ABSTRACT

The purpose of this study was to investigate factors influencing students' enrolment in Physics in Secondary Schools in Bungoma East sub- County. Physics is now an optional subject in the secondary curriculum. Despite the fact that very few students are opting for Physics as their science subject choice, most of the major courses at university require that a student should have done Physics in the Kenya Certificate of Secondary Examination (KCSE). Diploma technical oriented courses also require that one should have done Physics to be admitted to the colleges. The objectives of the study were to determine the effect of students' attitude, gender, performance and timetabling on enrolment in Physics in Bungoma East Sub-County. The study was intended to establish major factors contributing to low enrolment in Physics and recommend strategies and principles that could raise the enrolment of students in the subject. The design of the study was descriptive survey. Purposive sampling was used to select Bungoma East Sub-County, Stratified and simple random sampling techniques were used to select the schools and participants respectively. Data was collected from 234 students selected from twelve secondary schools. A questionnaire was used to collect data after validating and testing reliability and in addition, data on performance and timetabling was collected by document analysis from District Education Officer (D.E.O's) and school principals' offices. The data was analyzed using both descriptive methods such as percentages and means. Inferential data analysis was done using chi-square. The study revealed that; students' attitude, gender, performance and timetabling are among the many other factors that influence a learner's choice for Physics or not. Teaching methods used and teaching resources also affect performance in Physics hence resulting into low enrolment. The study concluded that there is a very close relationship between enrolment in Physics and students attitude towards the subject. The study recommended that strategies should be put in place by educators and the ministry of education (M.O.E) to change the attitude of students towards Physics to enable them approach Physics with confidence and improve enrolment. More female teachers should be employed to teach Physics to act as role models to girls. Performance in Physics should be improved for the subject to attract more students and the timetables in schools be made more balanced. The study recommends that Physics teachers assess the attitude of students if negative, appropriate measures be taken, female students should be taught by female teachers as role models, Kenya National Examination Council (KNEC) should set Examinations that are fair to improve performance and Kenya Institute of Curriculum Development (KICD) to develop a suitable syllabus which is not overloaded.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF ABBREVIATIONS AND ACRONYMS

A.E.O – Area Education Officer

C.R.E. – Christian Religious Education

C.I.E.M. – Curriculum Instruction and Education Media.

D.E.O – District Education Officer.

E.F.A. – Education for all

J.A.B - Joint Admissions Board.

I.Q. – Intelligence Quotient

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

K.I.C.D..– Kenya Institute of Curriculum Development.

K.N.E.C.- Kenya National Examination Council

M.O.E – Ministry of Education

N.S.F- National Science Foundation.

N.C.S.T. – National Counsel for Science and Technology

P.D.E- Provincial Director Of Education.

SMASSE- Strengthening Maths and Science in Secondary Education

S.T.I - Science Technology and Innovation

TIQET – Totally Integrated Quality Education and Training

TSC- Teachers Service Commission

UNESCO – United Nations Education For Social and Cultural Organization

USA- United States of America

UK- United Kingdom

CHAPTER ONE

INTRODUCTION TO THE STUDY

1.0 Introduction

This chapter gives an overview and basis for the study. It provides the background, statement of the problem, purpose of the study, objectives of the study, research questions, and justification of the study, significance of the study, scope of the study, assumptions and limitations, conceptual framework, definition of operational terms.

1.1 Background to the study

Physics in Greek means 'nature'(Wikipedia encyclopedia, 2000) which is a natural science that involves the study of matter and its motion through space-time, along with related concepts such as energy and force. Physics is one of the oldest academic disciplines, perhaps the oldest through its inclusion of astronomy over the last two millennia. Physics was part of natural philosophy along with chemistry and certain branches of mathematics and biology. During the scientific revolution in the 16^{th} century, the natural sciences emerged as unique research programs in their own right (Wikipedia encyclopedia, 2000).

In 1872 Harvard University established physics as college entrance requirement; chemistry and biology were added latter. These universities requirement, for admission dictated secondary school courses and spurred the beginning of science curriculum (Momanyi, 2010). Kenya has implemented a number of curriculum reforms in science education such as Nuffield Science Project (1966), UNESCO Science Project (1969), School Science Project (1974) and now 8-4-4 curriculums. In

all these curricular, Physics has been one of the corner stones for national development. In industries, physics also makes significant contributions through advances in new technologies that arise from theoretical break through. For example, advances in the understanding of electromagnetism and nuclear physics led directly to the development of new products which dramatically transformed modern-day society devices, such as teleyvision, computer, domestic appliances and nuclear weapons. In addition; advances in thermodynamics led to the development of industrialization while advances in mechanics; inspired the development of calculus (Wikipedia encyclopedia, 2000)

A review of the industrialization process in many countries, particularly newly industrialized South East Asian countries, shows that education and finance have played a critical role in their path to industrialization. In Kenya, past education reports recognized that Kenya cannot industrialize unless the country has manpower at all levels by implementation of the recommendation as was suggested by the Mackay report of 1981 (Koech, 1999). However, as the Mungai report observed, the desired balance ratio of 1 professional to 5 technicians to 30 artisans is far from being achieved, as opposed to the one in the field (Koech, 1999). The Totally Integrated Quality and Training (TIQET) commission of 1999; noted that science is vital requirement for industrialization. Technical and Vocational Education also demands that in addition to a sound general knowledge, a good science background be provided for sound technological education and training. With this in mind and as a result of observed poor status of science education in some of the country's schools. The Koech (1999) commission recommends that;

(a) An appropriate balance between science and arts subjects is established, (b) Science teaching and examination is oriented to problem solving approaches, (c)

Children are exposed to science concepts from an early age. (d) Innovations that are identified through science congresses be developed and put into productive use. Despite all these recommendations by Koech and other Education commissions these suggested objectives have never been achieved.

Physics prepares students for vocations and careers at tertiary levels of learning and in life generally. Physics as a subject is like a pivot joint in the Kenyan Secondary Schools Curriculum; since other subjects such as Chemistry, Biology and Geography depend on it (Otieno, 2009). The study of physics involves pursuit of the truth and hence instills diligence, patience and objectivity among learners. Physics learning develop the scientific habits in students, which are transferrable to other areas in life. Such habits involve non-reliance on superstition, critical thinking and respect for other people's opinions. The above qualities when embraced can solve many problems of individual and social living.

Under the 8-4-4 system of education in Kenya, pupils take 8 years in primary schools and sit for the Kenya Certificate of Primary Education (K.C.P.E) examinations. Students who merit join form one and at form two levels; they are allowed to study at least eleven subjects. But at form three, under Kenya Certificate of Secondary Education (K.C.S.E) curriculum, a student is supposed to select two science subjects which are compulsory out of the three science subjects offered in school namely:- Physics, Chemistry and Biology, Kenya Institute of Curriculum Development (K.I.C.D, 2002). It is observed from the past years that few students take Physics as compared to the number of students who choose Chemistry and Biology (K.N.E.C., 2010). Some of the objectives of secondary education in Kenya under the 8-4-4 curriculum include;- building a firm foundation for further education and training and building foundation for technological and industrial development. In the same line,

the physics syllabus presents physics as a body of knowledge about the physical environment (K.I.C.D, 2002). It emphasizes the experimental approach which should prepare the learner to teaching and learning scientific concepts and ideas in the modern technology. Hence by the end of the course, the learner should be able to contribute to the technological and industrial development of the nation (K.I.C.D, 2002).

Despite the importance of physics, evidence shows that enrolment and performance in the subject has been poor (K.C.S.E results, 2010). Most of the courses at university level in Kenya require that a student should have done physics in the K.C.S.E examination. In fact, physics is so important that for some degrees and diploma courses, it is taken in place of mathematics where the student has not performed very well for a course that requires a good pass in mathematics, Joint Admissions Board (JAB, 2011). Although the problem of low enrolment in physics may seem to be small, 80% of science courses at University require physics. Therefore, small numbers of students enrolling in physics threatens to add another impediment to Kenya's efforts in achieving vision 2030 (G.O.K, 2007).

Table 1 and Table 2 show enrolments in sciences for the last five years in Kenya Certificate of secondary Education (K.C.S.E).

Table 1: National enrolment in sciences for K.C.S.E exams for the years 2006 to 2010

Year	**Total KCSE Candidates**	**Candidates in science subjects with respective percentage (%) enrolment**		
		Chemistry %	Biology %	Physics %
2006	243,453	236,831(97.27)	217,675 (89.41)	72,299(30.29)
2007	273,504	267,719(97.88)	248,519(90.86)	83,162 (30.40)
2008	311,795	255,671(81.99)	281,733(90.86)	113,521(36.46)
2009	335,195	305,027(90.99)	283,564(84.59)	127,542(38.05)
2010	357,458	328,922(92.00)	299,302(83.72)	180,248(50.42)

Note: Figures in parenthesis are percentages

Source: Kenya National Examination Council (K.N.E.C)

Table 2: Bungoma East Sub-County Enrolment in Sciences since the District was started in 2008 to 2010

Year	**Total KCSE Candidates**	**Candidates in science subjects with respective percentage (%) enrolment**		
		Chemistry%	Biology%	Physics%
2008	2,312	2,177(94.20)	2,124(91.89)	801(34.64)
2009	2,624	2,540(96.79)	2,448(93.29)	871(33.18)
2010	2,794	2,706(96.88)	2,635(94.30)	919(32.89)

Note: Figures in paranthesis are percentages
Source: D.E.O's office Bungoma East Sub-County

As observed from Table 1, students who enroll in Physics nationally and in Bungoma East Sub-County have been below 50% as compared to Chemistry and Biology which enrolls above 80% every year; these seem to indicate how students perceive Physics. Though from Table 1, there seems to be a gradual growth in Physics enrolment nationally for the period between 2006 to 2010, this is still far from the expectation, 80% for a Country like Kenya which aims at achieving Industrialization by the year 2030(G.O.K,2007).

Table 2, shows Bungoma East Sub-County Physics enrolment which does not reflect the observations from the national enrolment trends for the same period. Contrary for Bungoma East Sub-County; Physics enrolment declined from 34.64% to 32.89%. This raises more concerns as to what is the cause of the decline in enrolment in the subject? The declining interest to study science and Physics in particular as a high school subject and as a college major, on the other hand has been an international problem (Semela, 2010). Kenya in its vision 2030 endeavors to achieve scientific and technological development which will change Kenya from low income to a middle income and industrialized nation (G.O.K., 2007). Foundations to this vision include; educating the public continually, on technological and industrial development, lowering cost of power and electricity production hence it is a must that power production should be increased at a lower cost. All this cannot take place without having enough man power specialized in Physics. Therefore high enrolments in Physics are urgent for the entire country to achieve its vision.

Attitude of students has a direct influence on their enrolment and on the overall performance of the school (Semela, 2010). It should therefore be treated with due concern. It is therefore necessary to describe attitude and its effect on the interest of secondary school students in Bungoma East Sub-County. Unfortunately, little has

been done by the Government and educators to normalize the situation. Clearly, the kind of attitude someone holds towards a subject may determine whether he/she will make an effective engagement in it or not. Njuguna (1998) argues that the kind of attitude the student holds should therefore be a matter of great concern in the field of science education. A learner who holds positive attitude towards science subjects for example; is likely to work more effectively and therefore have a better achievement in these subjects. On the other hand, negative attitude towards these subjects, may make one to direct his/her interests elsewhere and this limit exploitation of the individual's science achievement potential.

Enrolment in Physics probably also be linked to gender, performance in Physics examinations and school timetabling. Gender refers to the male or female sex (Semela, 2010). Mallory (2004), observed that gender difference in interest seems to be sufficiently explained by gender stereotypic beliefs among boys and girls which have a direct influence on enrolment in Physics. Table 3 shows enrolment in physics by gender in Bungoma East sub- county.

Table 3: **Bungoma East Sub-County enrolment in Physics by gender 2008-2010**

Year	**Total K.C.S.E Candidates**	**Enrolment by gende**r	
		Male	**Female**
2008	801	504 (62.92)	297(37.07)
2009	871	531(60.96)	340(39.03)
2010	919	569(61.91)	350(38.08)
Total	2591	1604 (61.90)	987(38.09)

Note: Figures in parenthesis are percentages

Source: D.E.O.S' office Bungoma East Sub-County

As observed from Table 3, a large percentage of males (boys) enroll in physics in Bungoma East Sub-County as compared to females (girls). The average percentage for males for the period 2008 to 2010 was 61.90% while that for females was 38.09%. This contradicts the normal expectation which should be of equal enrollment. It is therefore necessary to determine the status of gender and its effect on enrolment in physics in secondary schools in Bungoma East Sub-County. Performance in Physics refers to the outcome of the national examination or other internal exams. It is an important aspect affecting enrollment because it is from previous performance in a subject that students decide to choose or not to choose a subject when it becomes optional. Prior academic achievement of a learner has a direct influence on students' enrolment in that subject (Njuguna, 1998). It should therefore be investigated because without proper balance then enrolment will be low.

Timetabling refers to the arrangement of the school learning program and activities. Time allocated to the science and technology classes is significantly less than that proposed; 12 instead of 18 hours during form one and form two (Woudo, 2010). Furthermore, many teachers lack the training needed for teaching interdisciplinary subjects. If the new Physics and technology curriculum is to succeed; so that students become more science literate and increase their interest in Physics. These shortcomings must be taken into account and overcome to increase enrolment in Physics. The scenario described above points to the need to determine the status of these factors vis-a-vis enrolment of secondary students in Bungoma East Sub-County. It raises the question of required attitude that can improve the enrolment of secondary school students in Physics in Bungoma East Sub-County.

Timetabling also determine the teaching methods a teacher uses (K.I.C.D, 2002). In case of a double lesson (80 minutes), a teacher may use practical or inquiry method

but a single lesson (40 minutes) a teacher may use lecture or demonstration method to be able to cover the work planned. Therefore, the way the time table is arranged in a school system determines students' enrolment in Physics. Teaching and learning resources available in school also influences students' enrolment in a subject particularly Physics. Teaching aids for Physics like; ripple tank, electroscope among others, are also expensive to acquire for some schools. Therefore, schools without enough teaching and learning resources, especially small schools, will have a low enrolment in physics (K.I.C.D, 2002). Hence need for this study.

1.2 Statement of the Problem

In Kenya, stakeholders' value education to improve an individual's upward social and economic mobility. Besides its role in national development, education equips individuals with certain skills and hence enables them to execute their duties effectively. The higher an individual's performance, the higher their opportunity to compete for lucrative and competitive courses (Mbathia, 2005).

Despite a small marginal growth in the enrolment as observed from Table 1; the numbers are still low as compared to the other two sciences;- Chemistry and Biology which register over 80% of the total candidature yearly. The decline in enrolment in physics at all levels has been the case in many countries including the United States of America (USA), and United Kingdom (UK), Germany and the Netherlands (Mallory, 2004). Research has shown that the erosion of interest in the subject found to emerge as early as lower secondary schools to later results in compromising college enrolment (Nderitu, 2011).

In view of this discrepancy, there is need to investigate factors influencing student’s enrollment in physics. If this problem is not addressed, the influence of low

enrollment may extend upwards to the colleges and universities and as a result lead o shortage of manpower in fields like engineering, medicine, computer, meteorology and geophysics. This is a dangerous precedent for the future of the whole country.

1.3 The purpose of the study

The purpose of this study was to determine factors influencing students' enrollment in Physics in Bungoma East Sub-County with a view to improve the enrolment in Physics in secondary schools. Key factors that were investigated included attitudes of students towards Physics, gender gap in enrolment in Physics, performance in Physics examinations and timetabling. In view of these, the study determined and described the effect of attitude, gender, performance and timetabling with regard to, perception, gender representation, means scores and number of candidates.

1.4 Objectives of the study

The objectives of this study were to:-

a) Establish the effect of attitude towards Physics on students' enrolment in secondary schools.

b) Determine the relationship between gender and students enrolment in Physics in secondary schools.

c) Find out the effect of performance in examinations on students enrolment in Physics in secondary schools.

d) Determine the effects of timetabling on students enrolment in Physics in secondary schools.

1.5 Research questions

The following were the study research questions; -

1. How does attitude towards Physics affect students' enrolment?
2. What is the relationship between gender and students' enrolment?
3. How does performance in examinations affect students' enrolment ?
4. How does timetabling affect students' enrolment?

1.6 Justification of the study

Over the last decade, researchers in science education have identified a variety of factors which influence students' enrolment in sciences. But, to this day, enrollment in Physics in secondary schools still remains low. Bungoma East sub -county has been enrolling on average 38% of students in Physics. A study of this nature is therefore necessary in determining factors influencing students' enrollment in Physics. It is also urgent in order for the sub-county and the country as a whole to achieve vision 2030. It is the only study that has focused on enrollment in Physics in Bungoma East sub-county. It is also the first study ever done in this sub-county. As such, it is expected to provide an available knowledge on this specific area. The findings of this study are going to course a dramatic change in Physics education in secondary schools. As envisaged in Kenyas' vision 2030, enough manpower specialized in careers related to physics like engineering, medicine, computer science among others will be available. The findings will propel the enrollment of students in physics, hence the country's economic growth.

1.7 Significance of the study.

This study contributes valuable knowledge to education stakeholders on enrolment in general. It therefore forms a useful material for reference to other researchers and other readers on Physics enrolment directly. The study has also suggested significant policy statements through its recommendations. The study has made recommendations on attitude, gender, performance and timetabling. Such recommendations inform policy formulators like education officers, teachers, parents, Kenya National Examination Council (KNEC), and Teachers Service Commission (TSC). The study influences the practice of management of secondary schools in Bungoma East sub –county. In the attempt to deal with low enrolment and its related problems, the management of the secondary schools will focus on specific factors on enrolment generated through research. Henceforth, they will no longer follow theories, rules or traditions that are remote and without specific relevance to them, but base their practices, decisions and other managerial behaviours on products of research that are specific to their situations. The use of this specific knowledge is going to improve the quality of management of the schools and raise the rate of enrolment in Physics in the country.

1.8 Scope of the study

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The study was conducted between May 2012 and July 2012. It covered 12 secondary schools selected from the entire Bungoma East Sub-County. It focused on factors influencing students' enrollment in Physics. The study specifically sought to determine the influence of; attitude, gender, performance and timetabling on students enrollment in Physics.

1.9 Assumptions of the study.

The following extraneous variables were expected to influence the dependent variable;- teaching and learning facilities, trained Physics teachers, career guidance and counseling programmes, K.C.P.E entry mark at form one, performance in primary science, family members and peers, correctness and accuracy of information collected among others. They were however controlled through randomization in selection of students' as respondents. Randomization as a quality control technique was employed to ensure selected respondents come from different family backgrounds, have different peers and different K.C.P.E entry marks. Assignment of subjects into treatment groups like Boys' girls' and mixed schools helped in having schools with a variety of facilities and teachers. The incorrectness of information given by respondents; however may not be adequately controlled because of misinterpretation of the questions of the questionnaire due to English proficiency. But it will not have a significant effect on the results because the overall objectives are focused.

The study therefore assumed that;-

1. Teaching/learning facilities, trained Physics teachers, career guidance and counseling programmes are in place.
2. Entry mark at form one when joining secondary school and performance in primary science was uniform.
3. Family members and peers are the same in terms of economic income, hence equal level of exposure.
4. Respondents involved gave valuable and correct information worth to be based on in making conclusions and recommendations.

1.10 Limitations

The major limitations of this study were;

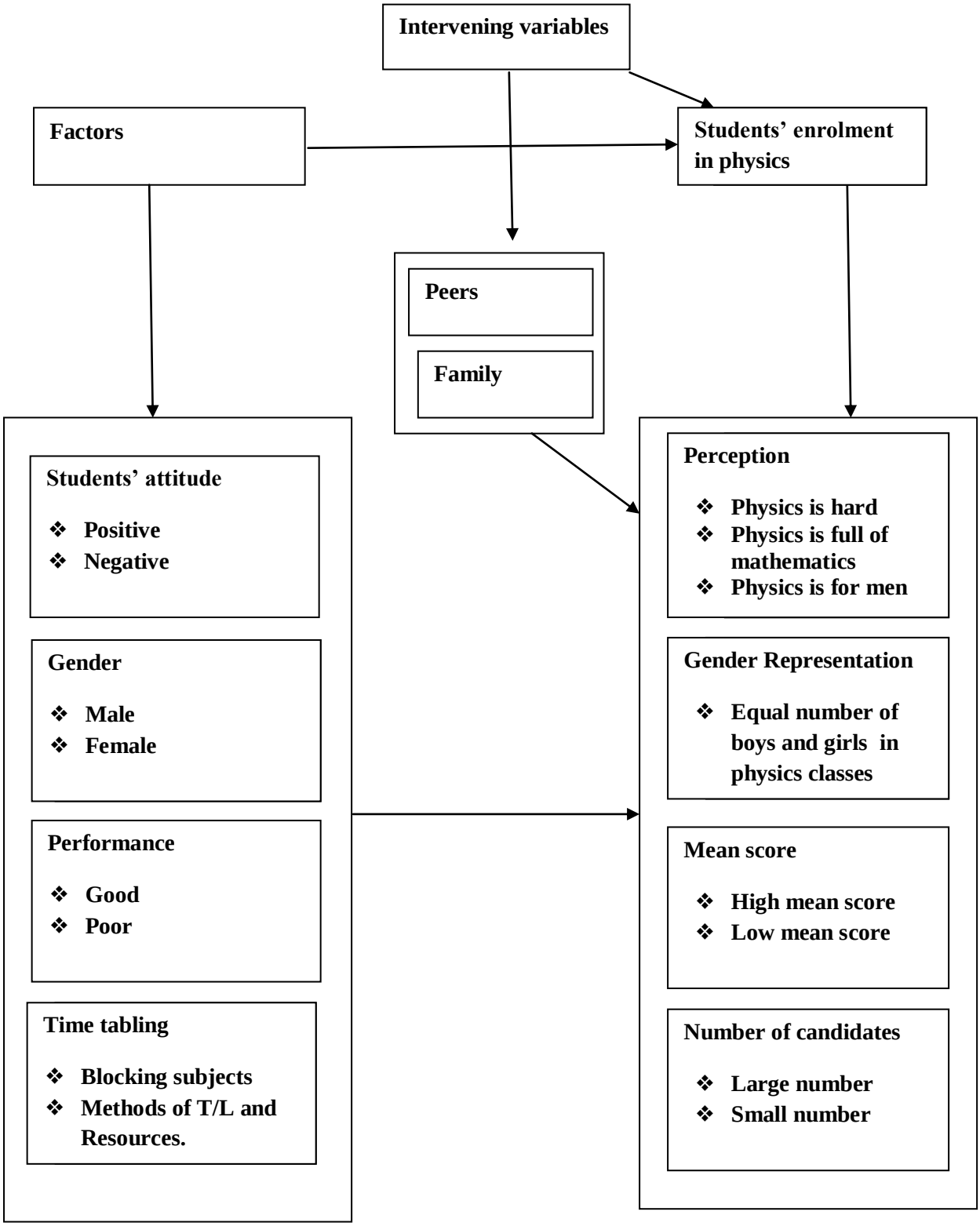
1. Time available to collect the information from respondents was limited but humble time was given to respondents to fill the questionnaires.
2. Financial limitations a lot of money was required for transport to reach schools due to the vast nature of Bungoma East Sub-County and also for producing questionnaires.
3. Obtaining information on school enrolment and performance in national examinations entailed gaining access to specific lists and files which itself was an infringement on the privacy and confidentiality of the office records, but this was the only way to collect the type of data required for this study.
4. The use of sample representation of students could lower the validity and reliability of the study. But this is the most suitable technique in the circumstances because it was not possible to involve each and every individual in a study.

1.11 Conceptual framework

A conceptual framework is a research tool intended to assist a researcher to develop awareness and understanding of the situation under scrutiny and to communicate. The conceptual framework has potential usefulness as a tool to assist the researcher to make meaning of subsequent findings. It forms part of the agenda for negotiation to be scrutinized, tested and reformed as a result of investigation (Kombo & Tromp, 2009).

This study sought to establish the kind of interaction taking place in school. Keywords are; factors (Students' attitude, gender, performance and timetabling) and students' enrolment (perception, gender representation, mean scores and number of candidates). In conceptualizing, the researcher attempt to point out how these factors affect students' enrolment in Physics in secondary schools (Kombo & Tromp, 2009). The conceptual framework is as in figure 1

Figure 1:**The conceptual framework for the relationship between factors and students' enrolment in physics**



Source: Oso and Onen, 2009

In the conceptual framework depicted in figure 1, various factors are hypothesized to influence enrolment in Physics. These factors are defined as students' attitude, gender, and performance and timetabling. While enrolments as gender representation, and total number of physics candidates. The framework postulates that; the students' attitude, gender, performance and timetabling in a school directly affect the perception, gender representation, mean score and number of candidates of Physics in a school. However, this relationship may be modified by peers and family members of the student from which they come.

1.12 Definition of Operational Terms

The following are definitions of the terms as used in this study.

Attitude- The way students think, feel and behave towards a subject by showing interest or disinterest.

Blocking – Teaching two subjects for the same class at the same time. Students attend one of the two.

Enrolment- The act of a student registering and officially joining a subject of study based on the students' perception, gender, mean score and number of candidates seating Kenya Certificate of Secondary Examination.

Gender- Male or female students registering to study Physics.

Physics - One of the three branches of science (Chemistry, Biology and Physics) that deals with the study of components of matter, their properties and energy exchange, useful in technological development and industrialization.

Performance- Outcome results of the Kenya Certificate of Secondary Examinations (K.C.S.E), in terms of mean grade; A,B,C,D,E, mean score and number of Kenya Certificate of Secondary Examination Candidates.

CHAPTER TWO

LITERATURE REVIEW

2.0. Introduction

This chapter discusses literature related to students' enrolment in Physics. It particularly focuses on students' attitudes towards Physics, gender in relation to Physics enrolment, performance and its influence on enrolment in Physics and timetabling and its effect on enrolment. These are considered the pillars of the study. In this chapter, the researcher reviews literature related to attitude and enrolment. The review is conceptualized under the objectives of the study and focuses mainly on students' attitude, gender, performance and timetabling and their effects on the enrolment. These are the main issues in this study.

2.1 Teaching of Physics in Kenya

Before the beginning of the nineteenth century, the study of science was either a hobby of the few people with means or solitary effort of someone with scientific talent. Since then science has developed to a level where we today live in scientific civilization in which science is no longer confined to a few individuals or countries that are devoted (Momanyi, 2010). However, less than half of the world's population ventures in science education. Science is involved in food production, preservation, health care, transport systems, telecommunication and energy conservation. Science affects all aspects of human life. Every person in society requires scientific knowledge in order to fit in the present society. Thus the teaching of science has become part of the general education of the society. According to K.I.C.D (2002) after four years of instruction the science curriculum should;-

- Create curious minds in learners which is a basic requirement to carrying out inquiries and arriving at conclusions and make use of discoveries.
- Create confidence in students to an extent that they can perform experiment with events in their day to day life.
- Stimulate students to view science as interplay of theory, experimentation and application for scientific discovery.

Furthermore, according to the ministry of industrial development in Kenya, the industrialization process has two main phases; phase one was scheduled to occur between 1997 and 2006 while phase two was scheduled to occur between 2007 and 2020. This was derived from the session paper on industrialization (Koech, 1999). In the current 8-4-4 Education system, eleven general objectives are set for the physics learner and they are stated as follows;-

By the end of the courses, the learner should be able to;-

- Select and us appropriate instruments to carry measurements in the physical environment
- Use the knowledge acquired to discover and explain the order of the physical environment
- Use the acquired knowledge in the conservation and management of the environment
- Apply the principles of physics and acquired skills to construct appropriate scientific devices from the available resources.
- Develop capacity for critical thinking in solving problems in any situation
- Contribute to the technological and industrial development of the nation
- Appreciate and explain the role of physics in promoting health in society

- Observe general safety precautions in all aspects of life
- Acquire and demonstrate a sense of honesty and high integrity in all aspects of physics and life in general
- Acquire positive attitude towards physics
- Acquire adequate knowledge in physics for further education and/or training (K.I.C.D, 2002). Despite the fact that the general aims of education are towards achieving scientific productivity, little has been achieved

2.2. Attitude and Students Enrolment in Physics

In Kenya, stakeholders' value education to improve an individual's upward social and economic mobility. Besides its role in national development, education equips individuals with certain skills and hence enables them to execute their duties effectively. The higher an individual's performance, the higher their opportunity to compete for lucrative and competitive courses (Mbathia, 2005).

We live in a world that is increasingly dependent on Physics and fueled by breakthroughs in Physics research. Technology continually advances, change in scientific technology, development of new methods of communication like the use of mobile phones, computers and fiber optics are some of the discoveries of Physics. Kenya as a country in the vision 2030, plans to build Konza Tecno city which will be the centre for technology on her advance towards industrialization. (G.O.K, 2007).Unfortunately, less and less students are studying Physics at high school which presents a challenge to effort in achieving vision 2030. How can we build taller buildings, create faster computers, or discover more accurate descriptions of the physical world around us, if enrollment in Physics continues to be low? (G.O.K,

2007).To achieve the vision as a country; more engineers, pilots, mechanics and technicians are needed for the country to industrialize by the year 2030.

Student enrolment in science classes have been influenced by affective factors. This is demonstrated by a study conducted by Daramola in 1982 that focused on factors influencing enrolment in physics in the upper forms of high school in Kwara state of Nigeria. Njuguna (1998), notes that there were several factors which influenced enrolment in physics or lack of enrolment in physics; in his study on the relationship between attitude and academic achievement in science subjects in Kigumo Division Kenya. Attitudes came at the top of his list of influential factors on science subjects. A learner who holds positive attitude towards science subjects for example; is likely to work more effectively and therefore have a better achievement in these subjects. On the other hand, negative attitude towards these subjects, may make one to direct his/her interests elsewhere and this limit exploitation of the individual's science achievement potential. Unfortunately, less and less students are studying Physics which indicate that the attitude is still negative (Nderitu, 2011).

According to a 1984 study by the National center for education statistics, only 3.9% of American ninth grade students will continue their education to get a bachelor degree in physics, only 0.5% will go on to get a master degree, and only 0.2% will receive a Doctorate in physics related discipline. How can we build taller buildings, create faster computers, or discover more accurate description of the physical world around us if no one tries to familiarize themselves with science (Mallory, 2004).

There is an extensive literature on student attitudes, and enrolments in science. It seems neural to assert that student attitude will influence their enrollments. Since enrolling for a subject at a stage when it becomes optional is ones interest'. As found out by studies, the most influential factor on student interest in physics is their poor

opinion about science in form one and two. In most countries, the evidence would indicate that children enter high school with a high favourable attitude &interest towards science, physics in particular; both of which are eroded by their experience of school science, particularly for girls. Research has concluded that it is the quality of teaching of school science that is a significant determinant of attitude towards school Physics. Osborne and Collins claim that; many contemporary curricular put too much emphasis on an demanding activities such as recall, copying and lack of intellectual challenge (Rose, 2003). Physics on the other hand deals with quantitative skills and connections or relationships between concepts.

Another possibility that many people have limited familiarity with physics is the fact that very few people ever actually take physics course. For instance, in the 1985 to 1986 school years, over 7000 (approximately 18%) of the high schools in the United States did not offer a single physics course (Mallory, 2004). Students simply decided not to enroll in physics classes and high schools were unable to offer courses that students will not take. The initial survey by Mallory 2004 found that the largest influence on student's attitude in physics was specific physics teacher or physics professor, students were equally influenced by family members, by the work of the famous physicists, or by no particular reason. Interestingly, the smallest influence on a student's interest towards physics comes from the students peers (Mallory, 2004).

With regard to the curriculum, though the graduate profile indicates that its graduates can be employed in areas of metrology, nuclear physics, medicine, geophysics and teaching, there are no courses that validate the assertions (Semela, 2010). The review of the existing physics undergraduate curriculum at Hawassa University of Ethopia by Semela (2010), show that declared profile of the graduate is not in par with the course offered in the program. Accordingly, the closer look at the courses offered in the

program refers to traditionally offered courses like mechanics, heat, optics, electricity, magnetism among others. Lack of job opportunities for physics graduates outside of teaching profession, may be another possible effect on students' attitude towards Physics. The industry can not employ graduates of all institutions who have the same specialization.

For instance, physics students should be allowed to vary in their concentration areas so that differentiated area of specialization may open possibilities to take specific courses which might create new career paths for which would be of use to graduates and minimizes the risk of being redundant (Semela, 2010). According to a study carried out in 2004, by Mallory in the USA, the largest percentage of student indicated that they were interested in physics, but intimidated or scared by the level of difficulty. Physics is also perceived as being tough, heard and analytical. This could also cause students to develop negative perception of Physics. The high school students gave a variety of other reasons for their dislike of physics including a general dislike for science, having been told that physics is boring, a dislike for the only physics teacher in the school, and bad mathematics skills. However, most students simply would not give physics a chance because they were told that physics is difficult (Mallory, 2004). Even though conflicting findings exist in the literature regarding the use of context based physics problems, there is evidence to suggest that the use of every day contexts help to acquire interpretation skills (Bridgeman and Wendler, 1991).

Results from most of the previous studies show that students are of the opinion that; physics is too abstract to make sense; previous studies raised them as a long standing and still unresolved issue as long as physics education is concerned. For instance, Mallory (2004) argued that "physics is an idealized world and has little to offer to the

real world". Because of the many and conflicting lists of factors and suggestions by various studies; this study digs in to iron out the specific factors determining enrolment in Physics in Secondary schools.

2.3. Enrolment and Gender in Physics

There is a long tradition in examination of gender differences when looking at students' enrollment and performance in Physics. Often, in some schools we have single – gender classrooms. As observed from Table 3, many questions a rise which require to be answered. Does this data confirm the gender stereotype theory existing in society that females are inclined more to live sciences while males are oriented towards physical sciences? The figures in Table 3 show girls' representation in Physics on average 38.00%. Thus, this is a clear evidence to suggest an extremely alarming situation when it comes to bringing females into Physics as well as their inclusion in science and technology.

Gender differences are evident in science self-efficacy, boys scored higher than the girls in science self-efficacy (Momanyi, 2010). This makes it clear that the country is still far from eliminating gender differences to achieve equality in science enrolment. The arrangement of school programs which may include the number of times in a week a subject is taught, the time a lesson takes place, the nature of lesson. For example, practical/theory in science subject is a very important factor. The number of teachers in a school affects the timetabling of a given subject. In some cases subjects are blocked; meaning two subjects being taught at the same time so that students decide to choose one of the two subjects.

Education is one of the main factors that facilitates and fosters effective attainment of social, economic and national development (G.O.K, 2007). Through education, individuals acquire knowledge, skills and self-confidence to be competitive in a world that requires them to be more productive economically. The world conference on education for all (EFA) held in March, 1990 in Jomtien, Thailand, observed that

despite notable efforts by countries around the globe, the following realities persisted; (a) out of a hundred million children who have no access to primary education worldwide, 60% are girls (b) more than 960 million adults, two thirds of whom constitute women, are illiterate, and (c) more than one third of world's adults have no access to printed knowledge, new skills and technologies that could improve the quality of their lives. Despite the fact that the general aims of education include social equity, full and equal rights between boys and girls, men and women, little has been achieved (Republic of Kenya, 1986)

A World Bank study conducted in 2001 in sub-saharan Africa noted that gender differences are close to being eliminated at the primary school level at least in the region as a whole. However, the disadvantage towards females is still prominent at the secondary school level (World Bank, 2001). Coombs (1985) acknowledges regional and gender disparities virtually in all countries in the provision of education albeit at varying levels. Besides this imbalance, also disadvantages women. Previous KCSE results in Lugari sub-county, 2005 highlight this disadvantage (Momanyi, 2010). For example, among those who obtained grade E in the sciences, 80.8% were girls while 19.2% were boys (DEO'S Office Lugari sub-county, 2005). A grade 'E' is the lowest score whereas a grade 'A' is the top score. These percentages show that compared to boys, girls are not performing well in the science subjects. Besides performance the worst hit is the enrolment of girls, particularly in Physics, which is too low (Momanyi, 2010). Self-efficacy may explain course selection patterns in high school, which eventually lead to the under representation of women in sciences. Self-efficacy strongly determines whether students continue pursuing science based courses. If a female student believes that she is unable to succeed in science, her poor perception manifests itself in lower grades or in avoidance of science courses

(American Association of University Women AAUW, 1999, Eshiwani, 1986). Gender differences in science classrooms have been and continue to be a problem (AAUW, 1999).

Despite improvement in enrolment in the past two decades, girls are still less likely than boys to take higher-level science courses in high school (AAUW, 1999). The courses or subjects the students choose at high school and their subsequent academic performance can influence not only their admission to college, but also their choice of a college major (Mbathia, 2005). Starting in seventh grade, girls tend to underestimate their abilities in science despite that their performance remains at par with that of the boys (Pajares, 2000). This trend continues in high school, therefore, fewer female students study science at college level. It is possible that sex role stereotype in our culture that reify man's abilities undermine girls' capabilities in science subjects. Boys score higher than the girls in science self-efficacy. Self-efficacy is especially important in learning challenging subjects such as (Physics and other sciences) given that students enter courses with varying levels of fear and anxiety (Momanyi, 2010). Bandura (1997) states that gender and attitude influence academic performance and enrolment in sciences.

There is a long tradition in the examination of gender differences when looking at students' enrolment in Physics study behavior and achievements. According to modern psychological theories, attitude in physics can be seen as a psychological contrast that emerges from a student's interaction with physical objects and phenomena and explanation of them. In physics as a school subject, attitude can be seen as a medium supporting learning process and the quality of learning. Gender comes second in influencing students' performance and enrolment in physics (Eshiwani, 1986). Research literature survey shows that one of the main motivators

for gender related research in science education is the fact that there are few girls in technical science -related occupations, but more qualified personnel are needed. In addition, the number of pupils in general who choose science courses in school appears to be decreasing. To solve this problem, different kind of intervention projects have been launched to increase the number of girls who select science subjects, especially physics (Kalle, 2004). Increasing the number of girls in science and technology has been seen as the solution to ensure productivity and the economic future of nations. This has been considered an international problem, at least in western countries; equal opportunity legislation has provided an additional reason to increase female participation. Thus, increasing the number of people in non-traditional occupations (Like girls in technology and boys in nurturing occupation like nursing), has been seen as a way to develop a more equal society (Kalle, 2004).

During the last two years of high school, the proportion of girls in gifted programs drops off. When high school students were asked what discouraged them from continuing in gifted program, parental pressure, peer pressure, attitude of teachers and counselors ranked high on girls' lists (Bridgeman and Wendler, 1991). It was observed that; much of what people in the industrialized world do in their daily life is probably partly governed by their interest. He further pointed out that interest in science appears to be aroused at an earlier age than interest in other curriculum areas, suggesting that primary science experience might be important for future students' long -term interest in the subject. More lately, (Picciano, 2004) stated that British girls in most of the primary classes stressed more interest in studying further school science topics than the boys, but it appeared to have dropped considerably so that the girls who are experienced now gave the lowest response to questions about interest in

future school science. The gender stereotype nature of society has been persistent hence need for elimination.

The phenomena that a low percentage of girls learn science and technology subjects at the high school level and that a low number of women is found in professions related to science and technology at the academic and industrial levels is well known around the world (Mallory, 2004). For instance, in the United States, women received about 40% of the bachelors degrees in mathematics and chemistry but only 19% of degrees in physics. This under-representation worsened at higher levels; the same year, woman constituted 13% of physics Ph.D recipients and 8% of physics faculty (Mallory, 1998). According to the National Science Foundation (N.S.F) the community of working Ph.D level physicists in 2000 was 84% white and 93% male (Rose, 2003). Therefore only 7% were women out of the total work force. We see that all the differences are statistically significant. Boys showed a higher interest in physics and have more out of school experience in physics than girls with a large effect size (Mallory, 2004). Boys also held more positive attitudes towards science and technology and better opinions about science classes than girls, but with a smaller effect size (Mallory, 2004).

Kalle (2004)) noted that girls have a different perception and reaction to the physics curriculum as opposed to that one of boys. It was reported that although the physical sciences and biology are normally available to both boys and girls at school, at the upper secondary level, one third of the girls do not do science at all, and over half do not do physical science beyond the third year. The gender difference in interest seems to be sufficiently explained by the gender differences of other variables especially by differences in self-concept (Picciano, 2004). The bourgeoning body of literature

regarding the pattern of major choice as a function of gender shows a consistent pattern.

Accordingly, females are inclined more to life sciences while males are oriented towards physical sciences. Nonetheless, findings indicated that women choosing quantitative fields were likely to major in physics and engineering. This kind of phenomenon seems to be influenced by experiences the child goes through in the process of socialization. There is that achievement in science which is influenced by sex-role learning. This is confirmed by Kelle's research (2004), in which she argues that the feminine sex-role brings about the characteristics low achievement of girls in science. The view that science courses are masculine becomes reinforced, especially where the number of boys taking science and of men teaching science increase (Pajares, 2000). Njuguna (1998) noted that; the society is responsible for both the masculine image of science and the gender identification for girls. This kind of phenomenon therefore may bring about differentiation in the type of attitudes boys and girls hold towards science and Physics in particular. From a study carried out on ninth grade students in Michigan in 1982, boys were significantly more interested in the manipulation of laboratory equipment and materials than the girls. This further confirms the kind of belief that is held in many societies that boys are likely to achieve better in sciences.

According to a study conducted by Njuguna in 1998 with the focus on general affective behavior towards science, and whether there could be significant difference in general affective behavior towards science between the male and female secondary school students. It was concluded from this study that females may not necessarily differ from males in their affective behavior towards science (Njuguna, 1998).

Despite all this conflicting findings from different studies from different countries the gender gap in Physics has been persistent and need to be addressed.

2.4. Enrolments and Performance in Physics

Discontent with the academic performance in science subjects by students in the national examinations has been an issue of concern. Parents, political leaders, psychologists, and other stakeholders complain about students' poor performance in science national exams (Momanyi, 2010). Ongeri, when releasing K.C.S.E results on 1st of March, 2011 for candidates of the year 2010. Said; "*There is a shortage of 12,000 science and mathematics teachers in secondary schools. This shortage is biggest factor contributing to poor performance and low enrolments in sciences."* He added that;"*teachers handling the subjects were ill-equipped and that in-service training needed to be intensified if performance in the areas was to be boosted (KCSE results, 2011)*".The decline in performance is worrying, given the fact that Kenya's vision 2030 is anchored on the sound performance in mathematics and science subjects. The persistent drop continues despite many strategies laid out by the government including the starting of a centre for mathematics and sciences, provision of laboratories and equipment. Due to this problem, a professional committee headed by the education secretary George Godia, is expected to iron out ways of stemming the shortage. Ongeri directed that the committee compile a report and present it to him for action (KCSE results, 2011). Boys dominated in mathematics with six schools appearing in the top 10. The best performing school in the subject was Alliance High School with a mean of 11.224, but girls hit back in physics with six schools appearing in the top 10. Kenya High School was the best with a mean of 11.2745 (KCSE results, 2011). Although physics mean score was higher than other two sciences, chemistry

and biology it doesn't attract high numbers of students. It is also possible that the higher mean score in physics is due to the smaller number of students who register in the subject because they already have positive attitude towards the subject

In Kenya, stakeholders value education to improve an individual's upward social and economic mobility, besides its role in national development, education equips individuals with certain skills and hence enables them to execute their duties effectively. The higher an individual's performance, the higher their opportunity to compete for lucrative and competitive courses (Mbathia, 2005).Despite all this, performance in Physics remains below average. This is a very critical issue that needs to be addressed to attract promising students into physics and also improve subject performance in national examinations. In some countries such as the Netherlands and the USA, several alternative measures were taken to booster the attractiveness of physics via introducing a range of alternatives in terms of course combination. Rose (2003), suggested introducing an unusual major/minor combinations such as physics and finance which allow graduates to contribute to the system design and analysis or "regulation law" which would prepare graduates to work with engineers and managers in planning and design project or with environmental safety or other regulatory bodies as possible to increase the attractiveness of physics (Semela, 2010).

In recent years, different lines of investigation have been developed, coinciding their analysis of the cause of students decreasing enrolment in physics, as well as possible solutions. Similarly, changes in society and in the interrelation between science and technology and also the disconnection between scholastic science and the reality of a scientifically oriented society, have necessitated the re-establishment of object in the teaching of science. The two paths have been fruitful and that appears to be an effective strategy in physics education (Rose, 2003).

Ongeri, when releasing K.C.S.E results on 1st of *March,*2011 for candidates of the year 2010 said "*There is a shortage of 12,000,* science *and mathematics teachers in secondary schools. This shortage is biggest factor contributing to decline grades in the two disciplines. He added that teachers handling the subjects were ill-equipped and that in-service training needed to be intensified if performance in the areas was to be boosted (KCSE results, 2011)*."The declining in performances was worrying, given the fact that Kenya's vision 2030 is anchored on the sound performance in mathematics and science subjects. The persistent drop continues despite many strategies laid out by the government including the starting of a centre for mathematics and sciences, to improve performance in the two areas and provision of laboratories and equipment. Due to this problem, a professional committee headed by the education secretary George Godia, was expected to iron out ways of stemming the shortage. Ongeri directed that the committee complies a report and present it to him for action (KCSE results, 2011).However, Ongeri said; "*Performance had improved in subjects including mathematics, biology, chemistry, physics and C.R.E. This was boost for the sciences which have generally recorded poor performance. He attributed the improved performance in science to government grants to schools for laboratories and in-service training for science teachers. However, he said teacher shortage, few science inspectors and inadequate science laboratories and equipment still cause under optimum performance in sciences (KCSE results, 2011). Boys dominated in mathematics with six schools appearing in the top 10."* The best performing school in the subject was Alliance High School with a mean of 11.224, but girls hit back in physics with six schools appearing in the top 10. Kenya High School was the best with a mean of 11.2745 (KCSE results, 2011). Although physics mean score was higher than other two sciences; chemistry and biology; it doesn't attract high numbers of students. It is also possible that the higher mean score in

physics is due to the smaller number of students who register in the subject because they already have positive attitude towards the subject.

In the released Bungoma county Mock results for the year 2012, Physics registered a mean score of 3.453 (D) for boys while girls had a mean score of 3.11 (D) (Mock results, 2012). This poor performance may cause a strong influence on enrolment in the subject. Students would wish to enroll in a subject they hope to do well in order to boost their average final grade. A student who has been doing poorly in a subject for example; Physics at form one and form two, is less likely to enroll in the subject at form three when it becomes optional. However, research show that girls tend to perform well in science subject where they are taught by female teachers. Informed by observational learning theory, female teachers can provide positive support to the female students through vicarious reinforcement to improve their self-efficacy and academic performance (Momanyi, 2010).

Nderitu (2011) notes that among the many factors that affect performance in Physics, attitude towards the subject plays an important role in determining whether a learner opts for Physics or not. There is a very close relationship between enrolment in Physics subject and its performance. Improvement in Physics performance is likely to attract higher enrolment and for this to happen, teachers and administrators need to provide a conducive environment which includes providing for resources and innovative teachers. Academic performance is influenced by several factors. For example attitude leads to achievement Njuguna (1998), and aptitude is needed for successful performance. Intellectual capability and motivation influences performance. According to research; attitude influences the choice and engagement in a task, the effort expended in performing it and the standard of the performance (Bandura, 1997).

Previous KCSE results in Lugari sub- county, a neighbor to Bungoma East sub-county highlight the poor performance in Physics. For example, among those who obtained grade E in the sciences, 80.8% were girls while 19.2% were boys (DEO's Office Lugari sub- County, 2005). A grade 'E' is the lowest score whereas a grade 'A' is the top score. These percentages show that compared to boys, girls are not performing well in science subjects. As assessment of the quality of grades in KCSE in Lugari sub- County indicates a very small percentage of students get good grades in science subjects. Poor academic performance in sciences could probably be linked to several factors among secondary school students. This study sought to establish these factors and their influence on students' enrolment in Physics in secondary schools.

2.5. Time tabling and student's enrolment in Physics

In most schools in Kenya, Physics is blocked with humanity like: History, Christian Religious Education or Geography. Blocking of two subjects has an effect on students' enrolment in the blocked subjects such that it half's or divides the class. In most cases student opt for humanity, hence lowering enrolment in Physics. This study is therefore set to generate empirical evidence as to the existing trend in terms of attitude, gender balance, performance and timetabling on enrollment in KCSE.

The arrangement of school programs which may include; the number of times in a week a subject is taught, the time a lesson takes place, the nature of lesson for example; practical/theory in science subject is a very important factor. The number of teachers in a school affects the timetabling of a given subject. Mallory (2004) observed that another possibility for the small number of students in Physics classes is means by which most high schools arrange their science programmes. Many high schools have Physics as the last level of science course offered; students who wish to take Physics would usually have to wait until their upper forms. Many students would

decide not to take Physics in place of a less difficult elective subject. They will simply not be in Physics long enough to take a Physics course. This could also cause students to regard Physics as the "most difficult science". This negative perception of Physics could be in place before the student decide whether or not he / she wants to take a Physics course.

2.6 Other Factors

Resources for teaching Physics are not adequate, which affects performance in Physics and also its enrolment (Nderitu, 2011). Other factors that affect performance and enrolment include; lack of a suitable syllabus, absence of adapted facilities and learning equipments, lack of provision of adequate time to complete the syllabus. During the Examinations; questions that are not friendly to learners with cerebral palsy are set (Waundo, 2010). From the findings in Israel and also reported in United Kingdom by (Kalle, 2004), reported that; physics in Junior High School is often taught by teachers who lack expert knowledge and who have little enthusiasm for the subject, quality of teaching and learning is lowered. In such situations, teachers who lack confidence and familiarity fall back on didactic methods of teaching that increase students' reluctance to enroll in Physics. We clearly need to make the curriculum as relevant and as motivating to the students as possible, but as (Rose, 2003) has already noted, without lively teachers, with the time and inclination to teach in a stimulating manner, few students will become switched on to physics (Rose, 2003).

Otieno (2009) noted that teaching effectiveness has been identified as the most significant variable of student achievement. Teacher motivation or remuneration, mastery of content interpersonal skills and choice of teaching method influence

teaching effectiveness. Methods of instruction used in physics include;- Lecture Method According to a survey carried out by Otieno 2009 about teaching methods; found out that; 62.5% of teaching at form one and two was through lecture method. While 20.3% was by class experiments and 25.0% by teacher demonstration. The percentage changes at form three and four where 41.6% is by lecture method, 25.0% by class experiments, and 33.0% by teacher demonstration. This implies that; at lower levels, students are not exposed to practicals and hence may form misconceptions about physics.

However, Otieno, (2009) outlined limitations of lecture methods which include; encouraging retention of facts and making the learner passive agent in learning. Due to these limitations, physics teachers are encouraged not to major on teaching through lecture methods instead they should use it sparingly. SMASSE (1998) encourages physics teachers to teach through hands on activities. Other methods used in teaching physics are; question and answer method, teacher demonstration, project work method, field work method, class experiment, discussion method, problem solving, discovery method among others. Like Henry Edward Armstrong's 1970's who was a strong supporter of heuristic science teaching methods, this study also agree with him that physics should be taught using student-centred approach and discovery method.

Hence, it can be argued that efforts to make class lessons attractive and student-centered is lacking as the obsession of most instructors is to cover the topic they planned for the term. It is interesting to note once again that the instructors are to blame for making physics complex and unattractive as they are ones who take students to the next topic without making sure that they have the pre-requisites. In the same line, lack of adequate laboratory instruments, and equipment and course structuring of theory and practice has been a challenge in most schools (Semela,

2010). Accordingly, lack of adequate instruments and resources limit the direct hands – on; practical exposure of students. Shortage of equipment, and extremely limited opportunities for hands-on practice, absence of in-depth understanding of the major topics relevant to high school study and lack of practical laboratory work has complicated the matter (Semela, 2010). In the same manner, poor qualification of high school teachers and insufficient English language proficiency among students to read and understand physics concepts are some of the major factors that come into play (Semela, 2010).

Furthermore, physics text books used in high schools and universities are just copies of those used in the UK and USA and have little connection to physical, geographical and cultural realities in Kenya (Waundo,2010). This serves as case in point to demonstrate the disconnection of western knowledge with realities of countries in Africa.

Adams et al, (2003) noted that teacher education programs must design experiences to help aspiring teachers learn how to make instructional content meaningful by connecting it to their student everyday lives. Recent scholarship in cognitive science has demonstrated that effective teaching extends beyond segmenting and transmitting content to students in an efficient fashion. Rather to make learning more meaningful, curriculum instruction must enable students to connect their own experiences with the learning process (Otieno, 2009). The absence of qualified physics teachers/instructors both in secondary and higher education institutions is the other obstacle. In class, instructors rarely give chances to the students to respond to their questions. When they do, they do not wait until students are ready to replay. They often prefer to give the answer and move on to the next topic at hand without clearing student's

confusions or without making sure that the students are ready for the next lesson (Waudo 2010).

2.7. Summary

We today live in scientific civilization in which science is no longer confined to a few individuals or countries. But the enrolment of Physics at the end of Form two is so low. The number of students taking Physics, especially girls as their major field of study in secondary schools has been low. In national examinations, Physics has been registering below 50% of the candidates. In addition, the performance in Physics national examinations (KCSE) has been far below average. For example, in 2009 results the mean score for Physics was 31.33% (KCSE results, 2010).All this has been attributed to the poor attitude held by students, the gender stereotype, poor historic performance and school timetable, where in some schools Physics is blocked with another subjects like humanity. This issue must be addressed in order for the enrolment to improve. Previous investigations have given various suggestions; improvement in quality of teaching, working on students' attitude to change, changing the type of national examinations to be easier, employing more teachers especially female teachers to act as models to girls (Momanyi, 2010). In addition, prober balanced timetables in our schools which do not allow blocking of subjects, providing enough and relevant teaching and learning materials among other suggested solutions. Several factors influence students' enrolment in Physics. For example a positive attitude helps a student to persist in Physics which is important. This is likely to lead to future high-paying careers in the science and technology sector which leading to industrialization and economic growth of a nation. But negative attitude leads to students dropping out of Physics; especially the females probably because of lack of effort, persistence and stereotyped beliefs about Physics by the girls. Poor

performance and timetabling also influences enrolment in Physics positively or negatively.

CHAPTER THREE

RESEARCH DESIGN AND METHODOLOGY

3.0. Introduction

In this chapter, the research design and methodology are discussed. The chapter discusses the; study area, population, sample and sampling techniques, data collection, validity and reliability, data analysis, and ethical consideration.

3.1. Research design

A research design can be regarded as an arrangement of conditions for collection and analysis of data in a manner that aims to combine relevance with the research purpose (Kombo& Tromp, 2009). It is the conceptual structure with which this research was conducted. It constitutes the blueprint for the collection, measurement and analysis of data (Kothari, 2009). Therefore in this research design and methodology, the research looked at the process of arriving at effective solutions to the problems through scientific methods of systematic collection, analysis and interpretation of data (Mugenda & Mugenda, 2003).

The research design used in this study was descriptive survey. Descriptive survey is a method of collecting information by administering a questionnaire to a sample of individuals (Orodho, 2008). Descriptive survey design is ideally suitable for studies where description and explanations of events as they are is required. This study aimed at collecting information from respondents on factors influencing students' enrolment in Physics in secondary schools in Bungoma East Sub-County. The researcher designed a questionnaire as a tool of collecting data. Questionnaires were given to a sample of the target population. The researcher considered issues such as economy,

time available and the large population of Bungoma East sub- county, hence this design is suitable for the study.

3.2. Study area

Bungoma East Sub-County covers an area of about 90 square kilometers .The study area is part of Bungoma County of western region of Kenya. It is along the Eldoret-Malaba highway, on the Nairobi-Kampala road. This sub-county borders; Lugari, Kimilili and Tongaren sub-counties. The population of students in this Sub-County is largely literate; therefore it was unlikely to have difficulties responding to questionnaire items. The study was conducted in this Sub-County based on how the district is typical in that; the area is diversified in terms of national schools, county schools, district schools, boys schools, girls schools, mixed schools, boarding schools, day schools, very well performing schools and very poor performing schools in national examinations. Hence the researcher chose the Sub-County in order to collect focused information. Time and financial constraints were factors that also limited the study to this area.

3.3. Population and Sample

3.3.1. Target population

This study was carried out in Bungoma East Sub-County. Bungoma East Sub-County comprises of 40 secondary schools with an estimated population of 14,920 students (D.E.O's Office Bungoma East Sub-County, 2011). The target population consisted of all the 40 public secondary schools in Bungoma East Sub-County. The subjects of the study were drawn from all public secondary schools. The high enrolment of capable and motivated students in secondary schools, particularly Physics classes, is crucial for the success of the whole national technological development. The success or

failure in secondary education will be carried over to all other levels of education. High enrolment in a subject is crucial for the enrolment in specific careers placement in colleges and universities. The study therefore envisaged that subject enrolment at high school should provide an insight into the issue which can determine career enrolments in institutions of high learning and future of science and technology in Kenya.

3.3.2. Sample

A sample is part of the target (or accessible) population that has been procedurally selected to represent it. In this study the sample consisted of 12(30%) schools selected from 40 schools. A total of 234(105 boys and 129 girls) were randomly selected from a total population of 14,920 students in Bungoma East Sub-County. Twenty students were randomly selected from each sampled school and 10 respondents randomly picked from each stream of form four and form three classes respectively. Since they had already made subject choices and could report on what influence their choices. Non-mathematical or convenience methods where the sample is determined at the discretion of the researcher were employed in getting the sample.

3.3.4. Sampling techniques

This is a description of the strategies which the researcher used to select representative respondents from the target population (Oso & Onen, 2011). This study employed Purposive sampling, stratified sampling followed by simple random sampling techniques. Purposive sampling is a sampling technique that allows the researcher to use cases that have the required information with respect to the objectives of the study (Mugenda, 2003).Samples are therefore handpicked because they are informative or they possess the required characteristics (Mugenda, 2003).

This study used purposive sampling technique to pick Bungoma East Sub- County because it has National, County and Sub-County schools.

Stratified sampling technique was employed to select the schools. Stratified sampling technique is a technique that identifies sub-groups in the population and their proportions and select from each sub-group to form a sample. It groups a population into separate homogenous subjects that share similar characteristics and selects from each so as to ensure equitable representation with a view of accounting for the difference in sub-group characteristics (Kothari, 2009).The researcher stratified schools into mixed schools and single-sex schools. Single-sex schools were of two categories (boys' schools and girls schools). Lists of boys' schools and girls' schools and mixed schools were made. Two Boys' and girls' schools were selected respectively. From the boys and girls schools; the first and third school on the list was selected making up 50% of the single-sex schools. This was because of the small number of the single-sex schools in the study area. In total four single sex schools were selected with two boys' schools and two girls' schools. For the mixed schools; out of the total 32 schools, the fourth school was selected from every group of four schools. In total eight mixed schools were selected. The researcher was convinced that the target population was not uniform. This is because mixed and single sex schools may not necessarily have similar characteristics since even the boys and girls may not always think similarly over a given issue. As such; that target population cannot be regarded as homogeneous. Therefore stratified sampling technique was employed to ensure each sub-group (strata) was represented in the sample in a proportion equivalent to its size in the population.

Simple random sampling technique was then used to select individual students (respondents) without bias from the target population. This was to select a random

(representative) sample, but also ensure that each member of the target population has an equal and independent chance of being included in the sample. The study consisted of form 4 and forms 3 students in the sampled schools, assumed to represent the student population. It was because they had adjusted to secondary school and also made a decision to select or drop Physics as a subject as well as accurately report on the factors which influenced their subject choice. A simple random sample 30% of form 4 and form 3 students in the selected school of one stream participated in the study. In total the study involved 234 respondents (105 boys and 129 girls)

3.4. Data collection

3.4.1. Research instruments and tools

In this study, questionnaires and document analysis were used as the main tools for collecting data. The selections of these tools were guided by the nature of data to be collected, the time available as well as the objectives of the study. The overall objective of this study was to investigate the factors influencing students' enrolment in Physics in secondary schools in Bungoma East Sub-County. The study was mainly concerned with the views, opinions, perceptions, feelings and attitude of students towards physics. Gender, performance and timetabling were also investigated. Such information could best be collected through the use of questionnaire (Oso & Onen, 2009). Document analysis technique was used to obtain data on performance and timetabling. This saved time, expenses and access data at a convenience.

The study adapted some items on factors influencing students' enrolment in Physics from a validated questionnaire developed by Mallory (2004); Rose (2003) and Adams et al (2003). Some of the items were modified to fit the present study. Items had been adapted to measure attitudes, perceptions and opinions on students' enrolment in Physics. Items in the questionnaire were structured/closed-ended, open-ended and

likert type of scale that sought the respondents' response on five possible responses on each item. This was to enable the researcher balance between the quality and quantity of data collected. But on the other hand, provide more information. This balance between the quality and quantity of information is useful for a fuller explanation of the phenomena under investigation. Questionnaires were used since the study is concerned also with variables that cannot be directly observed such as views, opinions, perceptions and feelings of the respondents. Such information is best collected through questionnaires. The sample size was also quite large (234) and given the time constraints, questionnaire was the ideal tool for collecting data. Also when the target population is largely literate, it is unlikely to have difficulties responding to questionnaire items (Oso & Onen, 2009). This was the case for the study area.

The data on academic performance in Physics examinations and timetable in science subjects was collected by document analysis of previous performance of students and timetabling observation from school records. Thus, the Kenya Certificate of Secondary Education (K.C.S.E) results for previous years were used as the measure of academic performance of the students in Physics. Questions in the questionnaire on academic performance and timetabling were self made by the researcher. This is because there are limited sources and research done on science timetabling in secondary schools was unavailable.

3.4.2. Procedure for data collection

The researcher developed a proposal over a period of about six months under the guidance of the supervisors. When the proposal was ready, the researcher sought authorization from the National Council for Science and Technology (NCST) to

proceed with the study. After being granted the research permission, the researcher proceeded to collect data. First, the researcher and research assistant observed research ethics by introducing themselves through the administrations of various selected schools. The questionnaires were distributed to the respondents by research assistants and because of various reasons, like number of subjects, costs and time available; respondents were allowed humble time to complete responding to questions. All questionnaires were gathered after the given time for data analysis.

3.5. Validity and reliability

3.5.1. Validity

Validity of an instrument is a measure of how well an instrument measures what it is supposed to measure (Mugenda, 2003). Validity is the extent to which research results can be accurately interpreted and generalized to other populations. It is the extent to which research instruments measure what they are intended to measure (Mugenda, 2003). In this study, the instruments were piloted in two schools on 40 students which were not included in the study sample and modified to improve their validity to at least 0.95 or 95%. Items with validity coefficient of at least 0.95 were accepted as valid (Oso & Onen, 2009). To establish validity, the instruments were given to two supervisors in the school of education in the department of Curriculum Instruction and Education Media (C.I.E.M) to evaluate the relevance of each item in the instrument to the objectives and rated each item on the scale of very relevant (4), quite relevant (3), somewhat relevant (2), and not relevant (1). Validity was determined using content validity index C.V.I= items rated 3 or 4 by both judges divided by the total number of items in the questionnaire. This can be symbolized as C.V.I= $\frac{n3/4}{N}$.

Where n = number of relevant items

N = total number of items

C.V.I = content validity index

3.5.2 Reliability

Reliability is a measure of the degree to which a research instrument yields consistent results or data after repeated trials (Mugenda, 2003).To establish reliability, the instruments were piloted in two schools on forty students who did not participate in the study to evaluate the reliability of instrument. The tools were also given to two supervisors in the school of education department of (C.I.E.M) to evaluate the relevance of each item in the instrument to the objectives and rate each item on the scale of very relevant (4), quite relevant (3), somewhat relevant (2) and not relevant (1). Reliability was determined using content reliability index (C.R.I). C.R.I = items rated 3 or 4 by both judges divided by the total number of items in the questionnaire. This can be symbolized as C.R.I= $\frac{n3/4}{N}$. since the validity and reliability coefficient of items was 0.95 the instruments were recorded for the study.

3.6. Data analysis and interpretation

Data collected was analyzed using both descriptive and inferential statistics. The descriptive statistics were means and percentages, whereas the inferential statics was the chi-square (x^2).Descriptive analysis refers to the use of measures of central tendencies and measures of dispersion. In this study, means were used which is one of the measures of central tendency. Mean is the average of a set of quantitative data. Mean is found by finding the sum of all scores divided by the total number of items in the set. Mean is used to describe the central measure if the sample is normally distributed.

Inferential analysis is used to draw conclusions concerning the relationships and differences found in research results. In this study, chi-square (x^2) was used. Chi-square statistical technique was used to establish relationship between two variables. This technique deals with differences between frequencies rather than scores (Kothari, 2009). This is because the data was categorical and drawn from a population with uniform distribution in which all alternative responses are equally likely. In this study, the independent variable (factors) and dependent variable (enrolment) are both categorical in nature. It was therefore suitable to analyze data using chi-square. Chi-square is an analysis technique which attempts to establish relationship between two variables both of which are categorical in nature. The chi-square technique therefore is a more mutually exclusive category. The technique compares the proportion observed in each category with what would be expected under the assumption of independence between the two variables. If the observed frequency greatly departs from what is expected, then we reject the null-hypothesis that the two variables are independent of each other. We would then conclude that one variable is related to the other.

Data was collected in form of strongly agree, agree, undecided, disagree and strongly disagree. A response of strongly agree was scored 5, agree 4, undecided 3, disagree 2, strongly disagree 1 and then scores of each variable added together. Since each main variable has two other subsidiary variable (see the conceptual frame work); the maximum score for each variable on each objective was 10 and minimum 2 on each variable for each respondent. The total response for each question was then converted to percentage fraction of the total. The means of all responses on a given objective

was also determined. For further analysis, the observed and expected were determined and the chi-square calculated to determine the effect of each factor on students' enrolment.

For all statistical tests conducted in this study, the alpha level was set at .05 significance; which was chosen at the discretion of the researcher and because it is usually the most commonly used value. In this level of significance, the researcher was 95% confident that any effect noticed were due to the factor and not as a result of chance. Thus in 100 possible cases, only 5 of such could be due to chance (Oso & Onen, 2009). If a significant result was found, then the strength of the significance was to be determined through chi-square (x^2) technique indicated in equation 1.

$$x^2 = \frac{E(oij - Eij)^2}{Eij} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots Eq1$$

Where: oij - Observed frequency of the cell in the ith row and jth column

Eij - Expected frequency of the cell in the ith row and ith column

While the degree of freedom (d.f) was determined as indicated in equation 2.

$d.f = (r - 1)(c - 1)$……..*Eq2*

Where: r = number of rows

c = number of columns

3.7 Ethical Considerations

The major ethical problem in this study was confidentiality of the school and education office records and respondents. A written communication to the administration (principals) of the sampled schools requesting for permission to carry out the study in their schools was observed during this study in advance. A covering letter with official authority from the university was also used and university identity card as a way of identification was observed. Justification of the benefits of the study to the respondents, school and nation was explained as introduction of the questionnaires. Confidentiality was maintained at all times and all respondents asked to participate voluntarily and without disclosing their identity by not writing their names on the questionnaire. This was by ensuring honest and openness. The information collected was under full responsibility of the researcher as an individual and therefore ensured the information was safely kept and used only for the purposes of the study. The collected data was stored on paper for short-term and for purposes of long-term after analysis it was stored using electronic storage.

CHAPTER FOUR

DATA PRESENTATION, ANALYSIS, INTERPRETATION AND DISCUSSION

4.0 Introduction

This chapter presents the detailed analysis of findings on the factors influencing students' enrollment in physics in secondary schools in Bungoma East sub-county. In an attempt to provide empirical evidence regarding students enrollment in Physics, this part presents findings with respect to: effect of attitude on students enrollment; relationship between gender and students enrollment; effect of performance on students enrollment and effect of timetabling on students enrollment in Physics in secondary schools in Bungoma East sub-county.

4.1 Attitude and student's enrollment in Physics in secondary schools.

The first object of this study was to establish the effect of attitude on students' enrollments in Physics in secondary schools in Bungoma East sub – county. To achieve the objective, students in secondary schools were asked to react to several statements intended to describe the attitude of students in secondary schools. Attitude was defined in terms of positive, moderate and negative. The status of attitude was rated as; good, moderate and poor , then compared against the corresponding value of enrollment. Data on this objective was analyzed under the question "how does attitude towards physics affect students' enrollment in physics in Bungoma East sub- county?" The results are presented in Table 4

Table 4: Students' enrolment in Physics based on attitude

Attitude	Male	Female	Total	Mean
Positive	67(63.80)	40(31.00)	107(45.72)	(47.4)
Moderate	18(17.14)	54(41.86)	72(30.76)	(29.51)
Negative	20(19.04)	35(27.13)	55(23.50)	(23.08)
Total	105	129	234(100)	

Note: Figures in parenthesis are percentages

According to Table 4, 45.72% of the respondents stated that positive attitude influences students enrolment in Physics, while 23.5% of the respondents indicated that negative attitude influences students enrolment in Physics, moderate attitude contribute up to 30.76% of students enrolment in Physics. It can be concluded that positive attitude towards Physics can contribute up to 45.72% chances of a students' enrolment in Physics. While negative attitude provides 23.5% of chances for a student to enroll in Physics as a subject of study. As can be designed from Table 4, of the total students only 31.00% were females with positive attitudes towards Physics. Males with positive attitudes were 63.80%. This is a great difference between the two gender, considered in terms of how they view Physics as a subject. From this finding, one can easily note that generally males have a higher positive attitude towards physics than females. Comparing the two gender, with negative attitude; females are observed to be at 27.13% while males at a lower 19.04%. Females are at 41.86% moderate in attitude towards Physics as opposed to males who registered 17.14%. This study can assert that women have generally moderate or low attitude towards physics as opposed to males who are generally positive in attitude towards physics. Positive attitude accounts for over 63.80% of the total number of students' that join the physics classes. According to this ratio, majority of the female students end up joining the two other sciences namely; Biology and Chemistry. As can be seen from Table 4, the salient majority with a mean of 47.41 have a positive attitude

towards physics when both genders are combined. Moderate attitude had a mean of 29.51, while negative attitude had a mean of 23.08. This preliminary result makes it clear that students believe and attitude towards Physics are directly related to enrollment in Physics. The data was analyzed using chi-square (X^2) to establish the relationship between attitude and enrolment in Physics. The chi-square was calculated using the equation 1. Values of the observed frequency and expected were substituted in the equation

$$x^2 = \frac{E(oij - Eij)^2}{Eij} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots Eq1$$

The calculated X^2Value of 45.95 was obtained. The table value of x^2 for 2 degree of freedom at 5 percent level of significance is 5.991. Comparing calculated and table value of x^2, the calculated value is much higher than this table value. It was concluded that attitude influences positively students' enrolment in Physics.

4.2. Relationship between gender and students' enrolment in Physics.

The second objective of this study was to determine the relationship between gender and students' enrolment in Physics in secondary schools in Bungoma East Sub-County. To achieve the objective, students in secondary schools were asked to react to several statements intended to describe the relationship. Gender was defined in terms of male and female. The status of enrolment was rated high, moderate and low. Data on this objective was analyzed under the question "What is the relationship between gender and students' enrolment in Physics in Bungoma East Sub-County?" The results are presented in Table 5.

Table 5: Students' enrolment in physics by gender

Gender	Male	Female	Total	Mean
High	68(64.76)	55(40.63)	123(52.56)	(53.69)
Moderate	27(25.71)	44(34.10)	71(30.34)	(29.90)
Low	10(9.52)	30(23.25)	40(17.09)	(16.30)
Total	105	129	234(100.00)	

Note: Figures in parenthesis are percentages

As observed from Table 5, out of 234 respondents involved in this study, a total of 123 respondents indicated that gender influences positively students' enrolment in physics. This makes up to 52.56% of the respondents. But 40 of the respondents indicated that gender does not influence student's enrolment in physics. This is a smaller percentage of 17.09%, respondents who indicated that gender is a moderate factor in this study were 30.34%. This study found out a mean of 53.69 for high enrolment but the mean for the lowest enrolment was 16.30. The results in Table 5, indicate that males generally registered a higher percentage of enrolment than females .While males registered 64.76%, females registered 40.63% high respectively. As depicted in Table 5, of the total 234 respondents involved in this study, 40.63% of the females showed a high enrolment rate, contrary to 64.76% of the males showed a high enrolment rate. On the contrary only 9.52% of the males showed a low enrolment rate of (23.25%) for females showed a low enrolment rate. From these findings there is an indication that females have a higher percentage of low enrolment rate than males while males have a higher percentage of high enrolment rate.

The data was analyzed using Chi- square (x^2) using equation 1. The calculated X^2 value of 13.08 was obtained. The table value of x^2 for 2 degree of freedom at 5 percent level of significance is 5.991. Comparing calculated and table value of x^2, calculated value is much higher than Table value. It was concluded that gender influences positively students' enrolment in Physics.

4.3. Effects of Performance on Students' Enrolment in Physics in Secondary Schools

The third objective posed in this study was to find out the effect of performance on students' enrolment in Physics in secondary schools in Bungoma East Sub-County. To achieve this objective, the students in secondary schools were asked to respond to several statements intended to describe the performance of students in Physics in secondary schools. Performance was defined in terms of good, moderate or poor. The status of performance was rated as good, moderate and poor. Data on this objective was analyzed under the question "How does performance affect students' enrolment in Physics in Bungoma East Sub-County?" The results are presented in Table 6.

Table 6: Students' enrolment in physics based on performance

Performance	Male	Female	Total	Mean
Good	70(66.66)	56(43.41)	126(53.84)	(55.03)
Moderate	24(22.85)	31(24.03)	55(23.50)	(23.44)
Poor	11(10.47)	42(32.55)	53(22.64)	(21.51)
Total	105	129	234(100)	

Note: Figures in parenthesis are percentages

As shown in Table 6, 53.84% of the respondents were of the opinion that good performance influences students' enrolment in physics. Furthermore good performance contributes to a mean enrolment of 55.03, moderate and poor performance registered 23.50% and 22.64%respectively. From these findings it is clear that more than half of the enrolment in Physics is contributed by students' performance in the previous classes or general performance of students in the subject in the past K.C.S.E examinations. This study also found out that boys recorded a higher good performance in Physics at 66.66% as compared to a lower 43.41% for the girls. This explains why more males enroll in physics than females. The results in Table6, indicate that good performance contributes up to 53.84 percent chances for student to enroll in Physics while poor performance contributes 22.64 % percent chances for a student to enroll in Physics in secondary schools. These results suggest that performance determines students' enrolment in Physics. A good performance increases chances of a student to enroll in the subject. The data was analyzed using x^2 to establish the effect of performance on students' enrolment in Physics. The x^2 was calculated using equation 1.

The calculated X^2 value of l8.28 was obtained. The table value of x^2 for 2 degree of freedom at 5 percent level of significance is 5.991. Comparing the calculated value and table value of x^2.The calculated value is higher than table value. It was concluded that performance influences positively students' enrolment in Physics.

4.4. **Effects of Timetabling on Students' Enrolment in Physics.**

The final objective of this study was to determine the effect of timetabling on students enrolment in Physics in secondary schools in Bungoma East Sub-County. To achieve this objective, students' in secondary schools were asked to react to several statements intended to describe the effect of timetabling on students enrolment in Physics in secondary schools. Timetabling was defined in terms of favorable or unfavorable. The status of timetabling was rated as good, moderate and poor.Data on this objective was analyzed under the question "How does timetabling affect students' enrolment in Physics in Bungoma East sub-county?" The results are presented in Table7.

Table 7: Students' Enrolment in Physics Based on Timetabling

Timetabling	Male	Female	Total	Mean
Unfavorable	64(60.95)	63(48.83)	130(55.55)	(54.89)
Favorable	41(39.04)	66(51.16)	104(44.44)	(45.10)
Total	105	129	234(100.00)	

Note: Figures in parenthesis are percentages

As indicated in Table 7, 60.95% of the male respondents were of the opinion that timetables are unfavorable against 48.83% for female respondents, who indicated that; timetables are unfavorable. Both the male and female respondents who indicated that the timetables are unfavorable had a mean of 54.89. On the contrary; 39.04% male respondents indicated that timetables in schools are favourable but a slightly higher percentage of 51.16% females indicated that timetables are favorable. The mean for favourable was 45.1. The results in Table 7, suggest that the mean for unfavorable was slightly above 50% while for the favorable was slightly below 50%. There is a significance difference between males and females on the way the timetable affect their enrolment in Physics.

The data was analyzed using x^2 to establish the effect of school timetabling on enrolment in Physics in secondary schools. The x^2 was calculated using equation 1. The calculated x^2 value of 3.5985 was obtained. The table value of x^2 at 5 percent level of significance and 1 degree of freedom is 3.841. Comparing the calculated and table value, the calculated value is less than the table value. As such could have arisen due to fluctuations of sampling; some schools are; national, county or sub- county schools. Such schools have different facilities and programmes. It was concluded that school timetabling does not influence students' enrolment in Physics in secondary schools in Bungoma East Sub-County.

4.5 Discussion

The first objective was to establish the effect of attitude towards Physics on students' enrollment in secondary schools. The results revealed that attitude influences students' enrollment positively by 47.41%. Students with negative attitude have only 23.08% chances to enroll in Physics. Results obtained showed that attitude is the most influential factor. This concurred with Semela (2010) in a study in Ethiopia that found out that the most influential factor on students' enrolment in physics at secondary school, College or University is the students' attitude. Hence this study is consistent by asserting that in the absence of all other factors affecting a student, positive attitude provides up to 45.72% possibility that a students will enroll in physics. This study found out that Physics requires strong Mathematical background which most students lack. This finding only partially confirms a recent study by Waundo(2010). Although it is also consistent with Mbithi(2010) who reported that students and instructors regarding the need for better Mathematical background to study Physics. Rose(2003) study in Israel found out that Mathematics is the most important predictor of success in all Sciences including Physics.

Again as found out by this study, the other key factor that negatively impacts on the choice of Physics as a subject of study is the student deficient form one and two preparation. Students relate their poor preparation with the qualification of their teachers, lack of adequate and relevant textbooks, absence of an in-depth understand of the major topics relevant to junior high school Physics topics taught in form1and form 2, which are foundational to the ones taught at form3 and form 4. Therefore, the weak foundation in Physics makes students opt out of Physics. Furthermore, in society; there are very few professionals in the fields like; engineering, medicine and

physical sciences to act as role models to the students. It can therefore be argued that at home students have no mentors to encourage and advice them on career choice. Instead, family members and siblings who failed in Physics discourage students from choosing the subject as a result; students come to school with already formed opinion about Physics.

These findings only partially confirm a recent study by Semela (2010). Physics is too abstract and theoretical such that one cannot see the application in the day to day life. It is also consistent with Mallory (2004). Mallory reported that high school students gave a variety of other reasons for their dislike of physics including a general dislike for science, having been told that physics is boring, a dislike for the only physics teacher in school, and bad mathematics skills. All these reasons revolve around student's attitude towards physics. This finding is in agreement with the views of Mallory (2004), Njuguna (1998) and Rose (2003) who also expressed the same view. Students' attitude, as described by Mallory (2004) and Rose (2003) is the most influential factor on students' enrolment in Physics in secondary schools. Low enrolment in Physics is determined by the poor opinions about Physics classes in form one and two. In most countries, the evidence would indicate that children enter secondary school with a high favorable attitude towards Physics and interest in Physics both of which are eroded by their experience of school Physics, particularly for girls. Rose (2003) concluded that it is the quality of teaching of school Physics that is a significant determinant of attitude towards the subject which finally lower the enrolment. Mallory (2004) observed that the negative attitude towards Physics is based on the opinions held. Physics is said to be difficult. This is what causes so many students' to turn away from Physics before they have even had the opportunity to enroll in Physics class. If we can find ways to dispel rumors about how Physics

classes are excessively challenging, we will give more students the chance to become more familiar with the world of Physics and everything it can offer.

Adams et al. (2003) Colorado University, documented that there is no difference in attitude between male and female students in physics, contrary to the present study. This study established that males have a more positive attitude towards Physics at 63.8% while females are at 30.0% positive attitude towards Physics. It is possible that sex role stereotype in our culture that reify mens' abilities undermine females' capabilities in Physics. Nevertheless, students who possess positive attitude are more successful in school, unlike inefficacious students who avoid subjects they perceive as difficult because they lack the belief and abilities for success and as a result they drop out of the subject (Mbithi, 2010).

The second objective was to determine the relationship between gender and students' enrollment in physics. Results indicated a positive relationship between gender and students' enrollment. This show a trend which has existed for many decades. With regard to gender balance, the findings revealed that 40.63% of the females have a high interest towards physics and therefore physics attracts a maximum of 40.63% of the female to enroll. Furthermore , of the total female who participated in this study, 23.25% and 34.10% had moderate and low enrolment towards physics respectively . At this juncture, though not surprising, it is interesting to note to what extent females are underrepresented in the field of physics. It was also disclosed by Mallory, 2004 that institutional policies and teaching method apparently played an unintended role by facilitating the exclusion of females from enrolling in physics . Since most teachers of physics are male; class demonstrations favour, male students in class participation hence failing to attract more females in physics classes .To date, little attempt has

been made to encourage women to join non-traditional subjects such as physics and limited work seem to have gone into getting female role models in such fields (Mallory, 2004).

This finding is in agreement with the views of Semela (2010), Rose (2003) and Momanyi, (2010) who also expressed the same view. Gender in relation to students' enrolment, as described by Semela (2010) and Rose (2003); revealed that there are large gender differences in beliefs and enrolment in Physics that are undoubtedly relevant to the discussion as to how to attract more women into Physics for higher total enrolment. Girls are not encouraged to study Physics like high achieving males. They have not been persuaded to do the same. Hence, often we have single gender classrooms. Boys have more positive attitude towards Physics and technology and better about science classes than girls but with a smaller effect size. This findings just confirm the observation by Rose in Israel in 2003.

The phenomena that a low percentage of girls learn science subjects, Physics in particular at the high school level, and that a low number of women is found in professions related to Physics and technology at the academic and industrial levels, is well known around the world. The under-representation worsens at higher levels (Rose, 2003). Teachers should be aware of how teaching might strengthen gender stereotypes. Both genders must have equal opportunities to become familiar with Physics knowledge. Thus equality could mean teaching and studying, these contents through the contexts most likely to arouse girls' interest in Physics. Therefore teachers of Physics should take seriously ideas of the theory of social construction explanation of gender that explains how the environment makes boys and girls have different attitudes towards sciences and Physics in particular. The underrepresentation of females may not result from their own lack of interest in Physics but most

importantly, their entry into Physics and other so called hard sciences have been effectively discouraged at institutional level. At high levels in universities, the size of female students is far much smaller, consistent with the national scenario; the percentage of female in the departments of Physics is very small. Under such circumstances, it is naive to assume that females are getting their role models anytime soon in the so called hard sciences like Physics. This is a disturbing finding, particularly for a country that thrives to have equal gender representation as in the new Kenyan constitution (G.O.K, 2010).

However, research done by Momanyi, (2010) shows that girls tend to perform well in science and develop positive attitude towards the science subjects, when they are taught by female teachers. Informed by observational learning theory, female teachers can provide positive support to the female students through vicarious reinforcement to improve their attitude and academic performance in the subject. The closer look into the proportional share of male and female students with respect to enrolment, it generally concurs with the existing findings in European and North American context. This findings agree with the findings by Rose (2003) study in Israel which concluded that generally a low percentage of girls learn science and technology subjects at high school level, and that a low number of women is found in professions related to science and technology at the academic and industrial levels. Rose (2003) by Citing an example, that in 1998 in the United States, women received about 40% of the bachelor's degrees in Mathematics and Chemistry, but only 19% of the degrees in physics. This under representation worsened at higher levels.

This study found out a slightly higher percentage of girls taking physics at high school level but at university level the percentage is likely to drop to the suggested world

average of 19%. Rose (2003), study further indicated that at Ph.D level, female representation is on average 8% of the physics faculty. This study concurs with the study by Momanyi (2010) on gender differences in self-efficiency in science subjects among secondary school students in Lugari Sub-County. The study showed that there is evidence of gender differences in science self-efficiency. Boys scored higher than girls in science self-efficiency. Self-efficiency is especially important in learning challenging subjects (such as physics and other sciences) given that students enter courses with varying levels of fear and anxiety. Adams et al. (2003) also found out that there are large gender differences in beliefs that are undoubtedly relevant to the discussion as to how to attract more women into physics. These beliefs are related to the physics education experiences the learner undergoes. The sex role stereotypes in our culture undermine girl's capabilities in science subjects, specifically physics.

The third objective was to find out the effect of performance in examinations on students' enrollment in physics. Findings revealed that; good performance in examinations provide up to 53.84% chances of a student to enroll in physics. While poor performance provides only 22.64% chances of enrollment in Physics. This study found out that performance influence positively students' enrolment in physics. This study agree with the study by Momanyi (2010) who found out that performance in science, subjects like physics, is determined by the students self –efficiency .It was found out that there are no gender difference in levels of self –efficiency .Performance in sciences particularly physics has been poor for over a decade .This has been a challenge posed to educators every year whenever national examination results are released by the Kenya National Examination Council. Nderitu's (2011) study on determinants of enrolment and performance in physics concluded that improvement in

physics performance is likely to attract higher enrolment in physics. Some students indicated that they were intimidated or scared by the level of difficult. This was through the result of the internal examination done termly or annually in respective schools as also established by this study. This study concurs with Waundo (2010) in the study on factors affecting performance in physics among learners with cerebral palsy in the Kenya Certificate of Secondary Education. It was observed that factors affecting performance in physics include lack of suitable syllabus, absence of adapted facilities and learning equipments, lack of provision of adequate time to complete the syllabus and also during K.C.S.E examination, questions that are not friendly to learners with cerebral palsy are set.

This findings is in agreement with views of Semela (2010), Momanyi, (2010) Waudo (2010), Nderitu (2011),and who also expressed the same view. Students' performance in Physics as described by Waudo (2010) and Nderitu (2011) is a very closely related to factor with students' enrolment in Physics. Momanyi (2010), argues that boys outperform girls in the science subjects. Gender parity in academic performance in Physics is supported by findings of this study. Poor performance which lowers enrolment may also be due to lack of effort, persistence and stereotyped beliefs about Physics by students (Momanyi, 2010). Semela (2010) documented that least achieving group of students compared to any other group is of those assigned to Physics. This is a disturbing finding particularly for a country that thrives to build its human resources in science and technology. Researchers have shown that Physics is for low achievers. Improvement in Physics performance is likely to attract higher enrolment. For this to happen, teachers and administrators need to provide a conducive environment which include providing for resources and innovative teachers.

This study agrees with the study by Rose (2003) who found out that boys outperformed girls in science subjects, contrary to assertions by Bridgeman and Wandler (1991) that girls or women performance in the sciences is actually at par with boy's or men's . Gender parity in academic performance in science subjects is supported by the findings of this study. However Mamanyi (2010) noted that girls tend to perform better in science subjects when they are taught by female teachers who can provide positive support to the female students through vicarious reinforcement to improve their self –efficiency and academic performance.

The fourth and last objective was to determine the effect of timetabling on students' enrollment in physics. The results revealed that; timetables in schools are unfavorable at 60.95% and 48.83% to males and females respectively. Results also indicated that; timetables are favorable at 39.04% and 51.16% for males and females respectively. Averagely, for both gender timetables are favorable at 45.10% and unfavorable at 54.89%. Therefore, this study established that; timetabling in secondary schools influence students enrolment in physics. The 8-4-4 education system in Kenya is very overloaded particularly the physics syllabus. A student taking physics is supposed to cover 10 topics in each of the first three classes and cover 11 topics at form four, which totals to 41 topics to be covered by the end of the four secondary school years (K.I.C.D, 2002). This many topics present a big challenge to the physics teacher and more so, the school timetabler. This is quite opposite to the other two science subjects; chemistry and biology which have at most 5 topics for every class in a year. It can be argued that efforts to make class lessons attractive and student - centered is lacking. This may be attributed to the many topics to be covered within one year and because of the overloaded physics syllabus, most teachers are forced to cover the

topics they planned for the term or year without making sure students understand the content .This is consistent with Semela (2010) who referred to physics teacher emphatically asks, “is it any wonder why we don’t understand most of our beginning students and they don’t understand us”, at this point, he seem to underscore instructors failure to understand their students problems in the one hand and their inability to allow the letters participation via employing student - centered learning on the other hand .

This indicates absence of skills required to address students’ concerns and pursued them develop solid interest to study physics .These findings are consistent with the findings by Nderitu (2011) who found out that resources for teaching physic are not adequate. This affects performance in physics and also enrolment. This findings concurred with Waundo (2010) who also identified luck of provision of adequate time to complete the syllabus as one of the main factors affecting performance in physics among learners with celebral palsy in Kenya certificate of secondary education.

This finding is in agreement with the views of Nderitu (2011), Mallory (2004), Rose (2003) and Semela (2010) who expressed the view that school timetabling influence students enrolment in Physics. Timetabling as described by Rose (2003) and Semela (2010) is one of the most influential factors on students' enrolment in Physics in secondary schools. Low students' enrolment is determined by the school timetable. Rose (2003) in her argument said, in many junior high schools the time allocated to science classes is significantly less than that proposed by the report, 12 instead of 18 hours during the junior high school years. Secondly, teachers in Spain also stated the

same problem and furthermore, many teachers lack the training to teach interdisciplinary subjects like Mathematics and Physics or Physics and Chemistry; and as a result they end up being inclined to one subject more than the other (Rose, 2003). If the new Physics and technology curriculum is to succeed so that students become more Physics literate and increase their enrolment in Physics, then these shortcomings must be taken into account and overcome.

These findings are consisted with findings by; Mallory (2004) who also had noted that arrangement of science classes is another possibility for low student enrolment in Physics. Many high schools have Physics as an elective subject and only taken serious at form three and four. Semela (2010) noted that in class instructors/teachers rarely give chances to students to respond to their questions. When they do they do not wait until students are ready to replay. They will often prefer to give the answer and move on to the next topic at hand without clearing students' confusions or without making sure that students are ready for the next lesson. The obsession of most teachers is to cover the topic they planned for the semester/term. It is interesting to note once again that teachers are to blame for making physics complex and unattractive as they are the ones who take student to the next topic without making sure that they have the pre-requisite. At this point, this study seems to underscore teachers' failure to understand their students' problem. In turn, this indicates the absence of pedagogical knowledge and skills required to address students concerns and persuade them to develop solid positive attitude and interest to study Physics (Semela, 2010).

Lack of adequate laboratory instruments, equipment and course structure, which fail to consider alignment of theory and practical; due to shortage of equipment are among other factors. Students have to be divided into groups of 5 - 10 in number per group and take turns to look at laboratory demonstration by the teacher or laboratory technician hence students have limited opportunity for direct hands on activities. Waudo (2010) noted that lack of a suitable syllabus, absence of adapted facilities and learning equipment, lack of provision of adequate time to complete the syllabus are other factors contributing to low enrolments in Physics. However, blocking of Physics with another subject may also contribute to low students' enrolment in Physics as most students will opt for the other subject other than Physics with the mind that the other subject is easier while Physics is difficult. Therefore, the timetables should be made in such a way as Physics is independent in order to allow students all possible chances of enrolling in the subject, if it has to be increased. Because of the little time allocated for physics on the school timetable, most teachers are forced to avoid practical activities which require slightly more time. This has been strengthened by the limited laboratory apparatus required for the practice lessons and in addition, most school laboratories are poorly equipped; therefore teachers teach using lecture method.

Overall, the response from students who participated in this study indicated that teaching physics in the abstract nature further complicated the issue of students attitude towards Physics. Hence, negatively affecting student’s enrolment in Physics.

CHAPTER FIVE

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.0. Introduction

In this chapter the findings are summarized, conclusions are made and recommendations postulated. In addition, recommendations for further research are made.

5.1. Summary of Findings

This study investigated factors influencing students' enrolment in Physics in secondary schools in Bungoma East Sub-County. Questionnaires were used to collect data from participants, in the sampled schools. Respondents were asked to react to several statements intended to describe a given factor and how it influences students' enrolment in Physics. Results of the findings were presented in tabular form and analyzed using both descriptive and inferential statistics. Means and percentages were the descriptive analysis methods used, while chi-square was the inferential method use to draw inference of the findings.

With regard to data analysis and interpretation of questionnaire responses from students' revealed that; attitude influences positively students' enrolment of secondary school students in Physics. These findings indicate that; attitude is a significant factor on students' enrolment in Physics. It must therefore be taken into account while teaching and seeking ways to increase enrolment in Physics.

The second objective of this study was to determine the relationship between gender and students' enrolment in Physics in Bungoma East Sub-County. Data analysis and interpretation of questionnaire responses from students revealed that there is a significant relationship between gender and students enrolment in Physics. These findings indicated that gender is a significant factor on students' enrolment in Physics in secondary schools. Few girls (females) enroll in Physics than boys. It must therefore be addressed while seeking ways to increase enrolment in Physics.

The third objective of this study was to find out the effect of performance on students' enrolment in Physics in secondary schools in Bungoma East Sub-County. Data analysis and interpretation of questionnaire responses from students' revealed that performance affect the students' enrolment in Physics in secondary schools. Poor performance will result to attracting a low enrolment in the subject while good performance (high mean scores) will attract a high enrolment in Physics. Performance must therefore be worked on while seeking ways to increase enrolment in Physics.

The forth and last objective of this study was to determine the effect of timetabling on students' enrolment in Physics in secondary schools in Bungoma East Sub-County. Data analysis and responses from students revealed that timetabling in schools does not affect students' enrolment in Physics in secondary schools. These findings indicated that the school timetable therefore is not important and should not be taken into account while seeking ways to increase students' enrolment in Physics.

5.2. Conclusions

The following conclusions were made on the basis of the research findings: -

1. The study established that students' attitude influence students' enrolment in physics, students with positive attitude towards the subject will enroll in the subject but those with a negative attitude will opt not to.
2. Secondly, gender is a very influential factor on enrolment in physics; few females end up enrolling in physics as compared to the males. This is attributable to the society's stereotype and lack of role models for girls.
3. Thirdly, Physics examinations have been done poorly nationally in the past and students also perfomed poorly at individual level in lower classes; hence they end up not choosing physics. Therefore performance has a direct influence on physics enrolment. High mean scores attract high enrolment and low mean score result to low enrolment;
4. Fourthly, timetabling in schools in Bungoma East Sub-County does not influence students' enrolment in physics as established by this study.

5.3. Recommendations

In view of the above findings and conclusions, the study recommends the following:-

1. Teachers of physics and counselors should assess the existing level of attitude in students, and appropriate measures should be taken to help raise students' attitude through verbal persuasion and encouragements.
2. Schools should expose students to successful role models as peers or teachers especially; female students should be given positive support in developing

positive attitude by watching and being taught by female teachers particularly in physics.

3. Since students' enrolment and academic performance are directly related, teachers should first become aware and undertake efforts to increase students' academic self-confidence and achievement in Physics. The Kenya National Examination Council (KNEC) should moderate the national examinations of Physics; such that the performance in Physics is relative to the performance in other subjects.
4. Education stakeholders should provide laboratory facilities and learning equipment Strategies to boost attitude which could help increase students enrolment in physics as well as increase their academic self confidence and achievement be put in place.
5. Kenya Institute of Curriculum Development (K.I.C.D) should develop a suitable syllabus that is not overloaded with topics so that enough time is allowed for in-depth understanding of Physics by students. Topics in the syllabus that are very challenging to students in high school should be transferred to be covered at a higher level.

5.4. Suggestions for further research

The following recommendations for further research are made:

1. Present findings have confirmed earlier findings and assumptions on students' enrolment in physics in secondary schools in Bungoma East Sub-County. Since the study confined itself to Bungoma East sub-county, a similar study may be carried out in the larger Bungoma County or the whole country so as to enhance the reliability.

2. This study confined itself to the few factors influencing students enrolment in physics. A similar study to be carried out to establish the effect of KCPE entry mark and intelligence quotient (IQ) influence on students enrolment in physics.

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