FACTORS CONTRIBUTING TO LOW ENROLMENT OF STUDENTS IN PHYSICS AT SECONDARY SCHOOL LEVEL IN CENTRAL DIVISION, GARISSA DISTRICT, KENYA

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DECLARATION

This is my original work and has not been presented for a degree in any other university

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To my son, Nixon Jawajir Muharo. May he grow up to surpass both the education level as well as the level of prosperity I have so far attained in life

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LIST OF ABBREVIATIONS AND ACRONYMS

A-Level: Advanced Level

FGD: Focused group discussion.

HoD: Head of Department

IEA: International Education Achievement.

IIEP: International Institute for Educational Planning

KCE: Kenya Certificate of Education

KCSE: Kenya Certificate of Secondary Education

KNEC: Kenya National Examinations Council

KIE Kenya Institute of Education

NEP: North Eastern Province.

O-Level: Ordinary Level

PDE: Provincial Director of Education

PES: Public Examination Subject

SAS: School-Assessed Subject

S I Units: *Systeme Internationale de'Units*

ABSTRACT

The purpose of this study was to examine the factors that contribute to low student enrolment in Physics in forms three and four in secondary schools in Central Division of Garissa District, considering the importance of Physics in industrial and technical development. The study adopted a descriptive survey design. The study was located in Central Division of Garissa District, due to the extremely low student enrolment in Physics in North Eastern Province, with the province registering just 0.1% of the national Physics KCSE candidature. The study targeted a population of 673 students in forms two and three in four public secondary schools in the locale, all Physics teachers in the same schools, all the HoDs and the headteachers of the four schools. A sample of 223 students was selected by systematic random sampling method using class registers to randomly select the students. Questionnaires and Focused Group Discussion (FGD) guides were used to conduct the survey on students, while interview schedules were used to gather information from teachers, heads of science departments and school headteachers. Validation of the instruments was done through discussion with other lecturers and by seeking expert advice through discussions, observation, comments and suggestions of the study supervisors. Instrument reliability was determined by the split half method after a pilot study. Qualitative data gathered was analysed by discussing the major themes and content in the study, tabulation of the responses and triangulation. Quantitative data were analysed using descriptive statistical tools i.e. the mean, mode, frequencies and percentages. Excel computer program was used to draw graphs to show the relative distribution of particular responses. The main finding of the study was that previous poor performance in Physics affects student enrolment in the subject in subsequent years. School examination policies and subject selection criteria, both of which favoured Biology and Chemistry, greatly reduced student enrolment in Physics. Other subject's teachers, together with students' peers, verbally discouraged prospective students from registering for Physics. There was preferential treatment of Biology and Chemistry during procurement of practical facilities in schools, with very few Physics equipment procured. The main recommendation is that all science subjects be made compulsory as a KNEC policy so that all secondary school students study Physics, from where those who pass can then opt to further their studies in the subject to higher levels. Before this, all secondary schools should be compelled to have some students registered for Physics to reverse the low enrolment trend in view of the importance of Physics. Further, Physics teachers should strive to ensure that the few students who register for the subject pass well so as to attract future students to register in it. Finally, further research should be done regarding factors contributing to low students enrolment in Physics in mixed schools as all schools in this study were single sex schools, while the scope of the new study should encompass other parts of Kenya in order to formulate a national policy based on the current study and the new study following recommendations from both studies.

CHAPTER ONE

INTRODUCTION

1.1 Introduction

This chapter gives the background to the study. It gives the statement of the problem, the purpose and objectives of the study. It also develops the questions that were used in the study, the study assumptions, the scope, limitation and delimitations, as well as the significance of the study. The chapter provides the theoretical and conceptual frameworks that guided the study, as well as the definition of operational terms used in the study.

1.2 Background to the Study

Physics is a branch of science that deals with the study of mainly non-living matter (KIE, 2002). It is first introduced as an independent subject in Kenya's education system in form one in secondary schools, just like it is done in most other countries of the world, where the broad science subject is split into its three main branches at secondary school level (Tsuma, 1998). During the past two decades, Australia and much of the Western world have raised a growing concern about the low enrolment in Physics at senior secondary level. The number of senior students who choose Physics is relatively small and has shown a declining tendency (Bolstad & Hipkins, 2005; Dekkers & de-Laeter, 2001; Lyons, 2005; Smithers &Robinson, 2006). Much research has also shown that the interest of students in Physics is declining (George, 2000; Haussler & Hoffmann, 2000; Hoffmann, 2002; Jucevicienė & Karenauskaitė, 2004; Rosier & Banks, 1990; Simpson &

Oliver, 1990; Trumper, 2006). Under such circumstances, the number of students who decide to pursue Physics/engineering in university is very low.

Available literature reveals that senior secondary students decisions about taking Physics seem to be based on a comprehensive consideration of a long list of factors which influence their decision-making the world over (Zheng, 2007). The factors could be roughly grouped into two categories: 'external' reasons which are concerned with influences from outside, such as family, school and science teachers, peers, mass media and the society, and 'internal' reasons which are related to students perceptions and experiences of school science. This study concentrates more on the external factors, though the internal factors have been considered to some extent. Various family considerations have been identified as having an effect on the subject choices students make, such as parents occupation and students experiences in sciences (SES) background (Beverly & Stephen, 1999; Crawley & Black, 1990; Fullarton & Ainley, 2000; Fullarton, Walker, Ainley, & Hillman, 2003; South Australia, 2006; Tobin & McRobbie, 1996; Woolnough, 1994).

In Kenya, the number of students enrolling for Physics has been low since the Kenya National Examinations Council changed science subjects selection policy in secondary school examination in the late 1990s (KNEC, 1999). Most students opt to enrol for Chemistry and Biology while leaving Physics with a very small percentage of students (KNEC, 2002). Besides, poor performance in the science subjects has also been a concern, with many students performing poorly in them. In most cases, the low grades of E and D in KCSE (where E is the lowest grade with one point while A is the highest

grade with 12 points) characterize national examination results in Physics (KNEC, 1998, 1999 and 2000). Before the 8-4-4 system of education was implemented in Kenya in 1989, students sitting for Kenya Certificate of Education (KCE, an examination done by "A" level students) had an option of choosing between pure science, physical science and general science. In physical sciences, Physics and Chemistry were treated as a single subject referred to as physical science, though tested on separate papers. The results of the different papers were added up to give results of a single paper- physical science. This paper was generally considered to be easier than the pure science paper as it did not require as much in-depth knowledge of the subject as was the pure science paper, and had fewer practical proficiency requirements. The rest of the students who could not do either pure science or physical science opted for the General Science. General Science paper was so general that students who opted for it could not be admitted to study any science subject at 'A' level. Students enrolled in General Science in large numbers as the perception among them was that it was the easiest among the three science papers.

The current trend where students avoid Physics, but prefer Biology and Chemistry is a rather new phenomenon. Its evidence first emerged in 2000 when KNEC changed its examination policy such that candidates could opt for any two of the science subjects, with the first such group of students sitting for KCSE in 2000. The number of students registering for Physics has been dropping since then, with some schools not offering Physics at all (KNEC, 2003). This then negates one of the major objectives of the 8:4:4 school curriculum, which is to equip learners with relevant scientific and technical skills to enable them to become self-reliant (Republic of Kenya, 1985). Dropping Physics

implies forfeiting the necessary technical knowledge as Physics is the main component of technology.

The tendency by students not to enrol for Physics when given a chance is not solely a Kenyan problem. The same trend has been found in other parts of the world. In South Australia, Physics is taught as a component of compulsory school science at lower secondary school level through years 8 to 10 (Dekkers & de-Laeter, 2001). It is offered as a separate subject in upper secondary school level (year 11-12), and at this level Physics becomes an elective course for students. There is no barrier set by the curricula to Australian students who want to choose Physics or other school subjects for their upper secondary schooling.

In China, Physics is taught as a compulsory subject from year 8 to 11, although in year11, Physics is offered in two forms: Physics for art students and Physics for science students. The content of Physics for art students is simpler than the other. In year 12, art students can omit Physics. Thus, students in other parts of the world have this option of proceeding with the subject to the final year or not. China seems not to have such problems in students Physics enrolment at senior secondary level. The country has a different educational system with most of the Western countries, such as Australia. The pathway from compulsory school science to enrolling in a tertiary course in the field of Physics or engineering is very different from those in the Western countries. However, Chinese scholars have pointed out that Chinese students generally feel senior secondary Physics difficult, uninteresting and irrelevant to life experience (Ren, 2002; Zhu, 2007).

Furthermore, studies also reported declining and little interest of senior secondary students in tertiary study in the field of Physics/engineering (Ren, 2002).

According to the Kenya National Examinations Council (KNEC, 2003: 9), one of the aims of studying Physics in Kenya, among others is to:

> …Enable students understand the world around us, and to prepare them for further studies in Physics or training in which an elementary understanding of Physics is a requirement (KNEC, 2003:9).

According to Eshiwani (1985), one of the aims of teaching Physics is to learn how to measure and handle equipment. This aspect of Physics is applicable in all areas of scientific study. Physics is the only subject that the students are taught about units used in measurements, such as metre, kilogram, Newton etc, right from the S.I. units (the standard units) to their smaller and bigger derivatives. Conversion of the units is also taught in this subject. In the rest of the subjects, whether science or otherwise, the units of measurement are only applied without further discussion. Besides, Physics enables its learners to be active consumers of technological gadgets that have infiltrated many of the daily activities like radios, remote controls, computers and its peripherals and so on. Thus, dropping Physics as a subject of study by most students in early secondary school education inhibits the development of these capabilities.

Some of the areas that require early preparation in Physics include all aspects of engineering, whether mechanical, electrical, civil, electronic, or the new fields of chemical and biological engineering. To study any of these courses at any level right from certificate to degree level, one needs prior knowledge of Physics. Apart from the

professional application of Physics knowledge, Physics is also applied on daily basis at home or at work, knowingly or without knowing. For example, simple arrangement of cells in a torch or musical system requires some knowledge of Physics. Ordinary *Jua Kali* artisans apply Physics principles to twist their metal pieces into the right shape, albeit unknowingly. In professions such as aircraft pilots, locomotive drivers and electrical power generation including geothermal, hydro as well as nuclear power generation, or just simple technicians require application of Physics.

At the moment, Kenya is gearing up for industrialization by the year 2020 (Republic of Kenya, 1996). Physics is a major player in industrialization, only equalled by Chemistry, but even chemical industries must have strong engineering section for service and maintenance, yet engineering companies do not necessarily require chemical aspects within them. As such, any aspect of industrialization cannot take place without the knowledge of Physics since all structural components of industries are engineering-based. In fact, industrialization implies the use of science and technology to produce goods at some affordable price. Technology in itself, is the scientific study and use of applied sciences, such as engineering, and the application of the same to practical tasks in industries (Hornby, 1995). Physics is, therefore, a major requirement for advancement in any engineering course or activity.

From the foregoing, it is evident that Physics is useful in almost every aspect of life. If however, most students drop the subject at the earliest opportunity they get, it implies that those students are cut off from a very wide field of employment opportunities. Besides, the need for industrialization by 2020 implies that we should be producing

manpower to jumpstart the process right now. This is because industrialization is not an event that can be performed at once, but rather it is a process or activity that takes time. It is, therefore, a concern that while the government is planning for massive use of science and technology in about fifteen year's time, the very people who should be driving the process are shying away from the key subject necessary for industrialization. This, therefore, implies that for successful industrialization as projected by the Government of Kenya, something has to be done to either reverse the trend, or at least stop further departures from the subject by secondary school students.

Apart from the generally low enrolment and poor performance in Physics by the few who enrol in it, more female students tend to opt out of the subject than male students. A study by Eshiwani (1985) found that girls start shying away from science subjects before their third year of secondary education. According to this study, more than 72% of the girls and 68% of the boys do not study science subjects beyond form two. However, since the current education curriculum in Kenya requires that a student studies at least two science subjects out of the three, many students prefer to drop Physics. This study sought to investigate this trend.

In Kenya during the period from 2001 to 2005, Physics has been done by less than 30% of all the registered candidates (KNEC, 2002; 2003; 2004; 2005; 2006). For example, in 2001, 28.3% students registered for Physics, while 27% of students registered in 2005. Before 2000, it was mandatory for all secondary school students to enrol in Physics, under either of Physical Science or Pure Science. As a result, all students were studying Physics. Biology and Chemistry, on the other hand, have been recording close to 90% of

all registered students in the same period in the country. It is not clear what makes most candidates shy away from Physics as opposed to its competitors in the same group (KNEC, 2000; 2001; 2002; 2003).

At the provincial level, Garissa District, North Eastern Province, where Central Division is situated, very few students take Physics as their subject of choice. In some schools in this region, Physics is taught up to the compulsory level only. At the district level, the number of Physics candidates reduces greatly due to various reasons. One of the reasons is that Garissa District has very few schools. At the time of this study, the district had eight secondary schools with students up to form four. A new ninth school had students only up to form three. In some of these schools, no candidate had ever opted for Physics in the previous four years. In essence, only four out of the eight schools provide candidates in Physics in alternating years within the district (NEP Examinations Office, 2001; 2002; 2003; 2004).

1.3 Statement of the Problem

The research problem addressed in this study was that the number of students enrolling for Physics in KCSE examinations in Garissa secondary schools has been very low since the option of choosing any two science subjects from Physics, Biology and Chemistry at this level was introduced in 2000. Most students opt for Biology and Chemistry in this category (KNEC 2001; 2002; 2003; 2004; 2005; 2006). This situation is depicted in the following Table 1.1.

Table 1.1: Students Registration in Physics in KCSE in NEP by Gender (2001-2005)

Year	Provincial Candidature	Physics Enrolment	% of Provincial Candidature	No. of Girls	No. of Boys	% of Boys	% of Girls
2001	1791	54	3	4	50	92.59	7.41
2002	1344	52	4.9	0	52	100	0
2003	1213	43	3.5	4	39	90.7	9.3
2004	1354	56	4.1	4	52	92.6	7.4
2005	1598	81	5.1	13	68	83.95	16.05

Source: Kenya National Examinations Council, 2001; 2002; 2003; 2004; 2005; 2006

From Table 1.1, it is evident that the provincial Physics candidature in NEP falls within 3.0% to 5.1% of all students sitting KCSE in the province in the period considered.

Besides, the few students who eventually register for Physics perform dismally in it. However, the main factors contributing to this trend are not clearly understood (Orodho, 1996). This, therefore, limits the ability of educational stakeholders to improve the number of students registering for Physics who can later on take part in preparing the country for industrial take-off. It is against this background that it becomes necessary to examine the contributing factors so that the trend is reversed, or else be contained to a minimal level. This is necessary in view of the fact that Physics is a subject whose application encompasses many aspects of life: It is the main subject necessary for technical development, which is currently a major goal for the developing country like Kenya, which has declared to be industrialized by the year 2020 (Republic of Kenya, 1996). Many simple domestic activities like heating, cooling, or storing food apply the knowledge of Physics for operation. However, many students drop the subject when they have an option of choosing other subjects against Physics. Besides, the few students who eventually opt for the subject perform poorly in it. This means that the main drivers of industrialization, who are the young, school-going generation, do not acquire the skills necessary for industrial revolution. It would be quite difficult to attain industrialization if

the current trend is left to continue as it is. This background therefore, supports the need to find the factors responsible for the situation in order to arrest it.

1.4 The Purpose of the Study

The purpose of this study was to determine factors contributing to low enrolment of students in Physics at secondary school level in Central Division, Garissa District, Kenya. This is in view of the fact that at the national level, the number of Physics candidates constitutes less than 30% of all KCSE candidates and in North Eastern Province, Physics candidates constitute on average only 0.1% of provincial candidature in KCSE. Physics enrolment is, therefore, very low compared to its competing subjects, but much lower in North Eastern Province. It was, therefore, necessary that the circumstances surrounding the low enrolment in the subject relative to enrolment in the other science subjects be investigated in order to come up with strategies of reversing the trend, or at least reduce the effects of the responsible factors or conditions, hence the need for this study. Based on the available literature on the possible variables that may affect the enrolment of students in subjects, the objectives of the study were as outlined in the following section.

1.5 Objectives of the Study

The specific objectives of this study were:

i) To investigate the effect of previous students performance profile in Physics on student enrolment in Physics in upper secondary school classes.

ii) To find out how the characteristics of teachers of Physics affect the number of students enrolling for Physics in form three and four, and later registration for KCSE.

iii) To evaluate the effect of other personnel who interact with students, such as other teachers not teaching Physics, laboratory technicians, students peers and so on, on enrolment in Physics in forms three and four, and subsequent registration for KCSE.

iv) To determine the extent to which school-related practices in relation to science subjects, such as school examination policies, affect enrolment in Physics at forms three and four, and subsequent registration for KCSE.

v) To find the extent to which availability of physical facilities in a school affect students enrolment in Physics.

vi) To evaluate the effect of students gender characteristics on students choice for or against Physics for study in form three and four, and later registration for it in KCSE.

1.6 Research Questions

To find the possible contributing factors to low enrolment in Physics in upper secondary school classes, the study was guided by the following questions:

i) What effect does the previous students performance profile in Physics have in determining the number of students who register for Physics in succeeding years?

ii) In which ways do the characteristics of teachers of Physics affect the number of students enrolling for Physics in forms three and four?

iii) How do the other personnel such as other teachers not teaching Physics, laboratory technicians, students peers and so on, who interact with students affect the students decision to drop or opt for Physics?

iv) How do school-related practices in relation to science subjects, such as school examination policies, affect the number of students who register for Physics in upper secondary school classes?

v) What effect does the adequacy or inadequacy of the necessary physical facilities have on enrolment in Physics?

vi) What is the effect of the students gender on the student's choice of Physics in form three and four, and subsequent enrolment for the same in KCSE?

1.7 Research Assumptions

In this study, the following assumptions were made:

a) All secondary school students in Kenya are taught according to the same syllabus for the same period of time before being presented for examinations in their final grade.

b) All students have equal chances of studying any one of the three subjects by being provided with the stipulated duration of learning period per week and other

relevant facilities such as textbooks and the like. In other words, all the three subjects are given equal treatment as far as provision of learning facilities is concerned, and selection in form three.

c) All the respondents would be cooperative and willing to provide reliable responses.

1.8 Limitations of the Study

This study had several limitations. In the first place, the observed lack of preference for Physics is a new phenomenon that emerged in 2000, hence little literature is available. The requirement that students opt for any two science (or all the three) subjects in form three and four is a recent decision, having first been effected in the year 2000. Literature close to this situation had to be borrowed from those available on science and Mathematics in general, and especially on performance. Second, the number of sample schools taken was rather small. Whereas Garissa Central Division had five secondary schools at the time of the study, from which one could draw samples, the researcher was limited to the four schools that were located within the municipality. These were the only schools that could be easily accessed. The fifth school was located quite far away from Garissa town, with no boarding facilities such as lodges for visitors. Further, the region has high security risks and one has to hire armed escort whenever one ventures beyond a radius of five kilometres from the town centre. It was, therefore, difficult to study schools situated outside the municipality.

1.9 Delimitations of the Study

The study confined itself to students and teachers in public secondary schools. The students included in the sample were those in forms two and three only, while sample teachers included teachers of Physics in each of the schools, heads of science department and the schools Headteacher. However, the actual sample consisted of only those students and teachers found in the school at the time of the study only. Further, the study focussed on school-based situations only as seen from the objectives, and was not concerned with community-based situations that may have some influence in the occurrence of the problem under study.

1.10 Significance of the Study

At the moment, many students drop Physics in secondary school level after form two, which is the compulsory level. However, Physics is a subject that is very useful in many aspects of life and should not therefore be left to die, as it seems to be happening. This study is, therefore, significant in that it will provide data on factors responsible for low enrolment in Physics in Garissa District in particular, and in the country at large. The factors found in the locale may be similar to those operating in other parts of Kenya. The identified factors would enable education policy makers and other stakeholders to strategize on improving the enrolment level in Physics by students in secondary schools particularly in Garissa District, as the factors found in Central Division can be generalized for the district. The findings will be of particular significance to practising teachers of Physics, teacher educators and administrators who are the main players directly in touch with the students who eventually opt for the subject at their upper secondary school classes. This will go a long way in helping Kenya move closer to achieving industrialization by the year 2020, as is the current government's slogan.

1.11 The Theoretical Framework

The study was based on Skinner's (1985) Motivational Theory of Learning. In this theory, the argument was that students motivation to undertake a task depends on expected reward. A positive perceived reward induces positive motivation and the student works hard, hence high achievement. A perceived negative reward leads to negative attitude and low achievement.

With regard to the current study, a student will be more motivated to opt for a particular subject if the expected reward (good performance, leading to higher chances of future employment etc) is higher in the particular subject. There are various indicators that may lead the student to believe that rewards in a particular subject are easier to attain than in others given the prevailing circumstances at the time the student is making his/her choice. Such indicators include performance by previous students in the subject, availability of teachers in the subject, subject teachers' relationship with the students (teacher characteristics) etc. These indicators directly lead to the variables that constitute the conceptual framework, explained in the following section and the illustration attached.

1.12 The Conceptual Framework

As given in the Figure 1.1, the variables that affect the students choice of a subject include performance in the subject by previous students, availability of teachers as well as other intra school factors. Theses factors are interrelated such that when they are favourable, there will be more students enrolling but when unfavourable, fewer students enrol in the subject. The factors contributing to poor performance in a subject would generally contribute to low enrolment in the subject. If there are adequate human resources such as subject teachers in a school, students are expected to perform well in the subjects. The same apply for physical resources. However, a shortage of the same would lead to poor performance in the subject. Given that previous poor performance contributes to low enrolment, the end result is that fewer students will enrol for subjects in which students consistently do not perform well. On the other hand, more students would enrol in subjects where previous students have been performing considerably well. The general trend is, therefore, that when there are more positive outcomes of the various causative factors affecting enrolment in a subject and specifically Physics, more students would enrol in it, but fewer enrol if there are more negative outcomes.

1.13 Definition of Operational Terms

Content Analysis: This refers to the metHoD of discussing issues arising from a given enquiry in which the issues found within specific research themes are isolated and discussed

Correlates: The association or interrelationship between various variables

Enrolment: the number of students registered for a subject or a course

General Science: This was a single science paper that tested all aspects of science without distinguishing whether Physics, Chemistry or Biology. It used to be offered at O-Levels in Kenya before the introduction of the 8-4-4 system of education.

Indicators: The symptoms or signs of the possibility of an event occurring

Industrialization: The process of conversion raw goods to goods ready for consumption

Jua Kali: A Kiswahili phrase (meaning hot sun) used to describe a series of activities that involve manual application of science and technology to produce goods that would have been otherwise manufactured more expensively at modern factories.

Lower Secondary: The forms one and two classes of secondary school classes in Kenya.

Manpower: Labour, especially which used to produce something industrially

Physical Science: This is the subjects Physics and Chemistry combined to form a single paper. The two subjects are taught and examined separately, but the results given as a single paper- physical science. Candidates

registering for physical science also register for Biological science as opposed to Biology.

Public Schools: Schools that are funded and run by the Government

Pure Science: These are science subjects namely Physics, Chemistry and Biology, in which Physics and Chemistry are examined separately as individual subjects.

School Administration: The people charged with the day-to-day running of particular schools. Such people include the Board of Governors, P.T.A; schools principals and their deputies, heads of departments and masters on duty. The duty master is however a very temporary administrator and does not form part of the sample in this study.

Science Subjects: The subjects Physics, Chemistry and Biology only, which are taught in secondary schools in Kenya. This definition therefore does not include other smaller branches of sciences such as Agriculture, Home science or the other sub-branches like botany, zoology, electronics etc that are usually learnt at higher levels.

Subject Clustering: This is a metHoD used by KNEC and schools to guide their students on which set of subjects they can opt for depending on the groups in which the subjects are situated. For example, schools can decide that a student can opt for either History or Geography among group three subjects, but not both or none.

Upper Secondary: This refers to forms three and four classes in secondary schools in Kenya.

CHAPTER TWO

REVIEW OF RELATED LITERATURE

2.1 Introduction

This chapter looks at the available information concerning the subject under the study. It starts by reviewing conceptual literature on the study - the current situation in the topic under the study. At this stage, previous years' student enrolment in Physics at the Kenya Certificate of Secondary Education examinations right from the national level to the district in which the study locale is situated is reviewed. At the provincial level review, the performance in the subject is also looked at, with a view to identifying if the performance in the subject could be a contributing factor to the eventual low enrolment in succeeding years. The same treatment is repeated in the district under study i.e. Garissa District. Finally, the chapter reviews empirical literature-the available information on science education in general, and narrows down the available information to Physics as a subject. Literature on Physics as a separate subject, isolated from the other science subjects is very scarce. It, therefore, has to be looked at from the information available about science as a whole.

Besides the general enrolment at the provincial and district levels, the chapter also isolates male students from their female counterparts so as to visualize whether there is any gender disparity within the students who enrol in the subject. The same is done on the literature available at Garissa District. All the stated information is given in tabular form so as to be easily visualized. In general, the review was conducted under the following sub headings:

i). Global enrolment trends in science subjects

ii). Literature on national enrolment

iii). Literature on provincial enrolment

iv). Provincial enrolment by gender

v). Enrolment at Garissa District

vi). Literature on physical resources

vii). The role of Mathematics in learning Physics

viii). Literature on girls attitude towards Physics

2.2 Global Enrolment Trends in Science subjects

Student enrolment in science subjects has always been low whenever there is an option of dropping science subjects (Dekkers, Laeter & Malone, 1991). In situations where the subjects, and especially Physics, are compulsory, many students are forced by circumstances to opt for it. A study in China found that year 12 science students reported that they "have to learn Physics because it is a testing subject"; few knew the value of Physics for future career; and few thought "Physics is interesting" (Ren, 2002). The term "a testing subject" implies that the subject is compulsory therefore, the students were compelled by circumstances to learn it. Female students tended to have more negative perceptions of Physics, in terms of career and academic goals, than did male students (Ren, 2002).

Literature reveals that senior secondary students decisions about taking Physics seem to be based on a comprehensive consideration of a long list of factors which influence their

decision making. The factors could be roughly grouped into two categories: 'external' reasons which concern influences from outside, such as family, school and science teachers, peers, mass media and the society, and 'internal' reasons which are related to students perceptions and experiences of school science (Zheng, 2007). External reasons and internal reasons seem to combine to exert a comprehensive influence on students enrolment decisions. In Australia, a decline of favourable attitudes towards science was consistently found as students progress through secondary grade levels (George, 2000; Rosier & Banks, 1990; Lyons, 2005). This may imply that students enrolment in Physics decision was based on the interaction between external reasons and a small part of internal reasons. A study in Australia found that the interviewees generally described very similar experiences and conceptions of school science (Lyons, 2005). The science proficient students who chose physical science did not describe a more, or less, attractive picture of their school science experiences than did those who did not chose it. Therefore, the author argues, "The physical science students considerations were less about interest and enjoyment, and more about what these courses represented in terms of post-school options" (Lyons, 2005:306).

In three Western countries (Sweden, England, and Australia), Lyons (2006) found that high school students reported remarkably similar experiences of school science, in relation to the transmissive pedagogy, decontextualized content, and unnecessary difficulty of school science. Lyons (2006) argues that the experiences of students in the three countries provide important insights into the widespread declines in interest and enrolments in high school and university science courses.

In many counties the world over, there is an aspect of choice with regard to the selection of science subjects in secondary schools. In other words, science is not compulsory. In Australia, the study of science is not compulsory at the upper secondary level (years 11-12). At this stage, science is taught as a Public Examination Subject (PES) or as a School-Assessed Subject (SAS). The majority of students at year 12 study PES subjects that enable them to meet entry requirements and/or selection criteria for tertiary courses at universities. Otherwise, students have an option of studying the PES, SAS or none at all depending on the courses they hope to pursue at higher levels (Dekkers, Laeter and Malone, 1991). However, the proportion of secondary school students enrolled in PES science subjects as compared to the total number of year 12 students has been declining over a period of many years in the same place (Dekkers et al. 1991). The PES science enrolment data include all science subjects of Biology, Chemistry, Geology, Physics and all Alternative Science subjects, and many students take more than one science subject at the this level. Enrolments in Physics and Chemistry have declined between 1992 and 1995 to 17.4% for Chemistry and 21.5% for Physics. The following Figure 2.1 shows student enrolment trends in year 12 in secondary schools in Australia in 2000-2004.

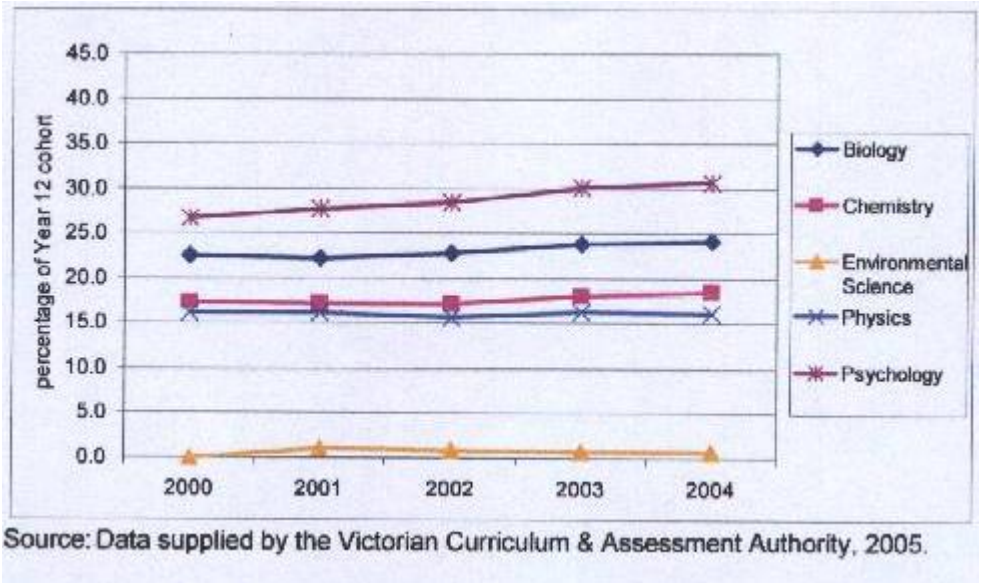

Figure 2.1: Percentage of Year 12 Students Enrolling For Science Subjects in Australia (2000-2004)

From Figure 2.1, it is observed that students Physics enrolment in Australia is the lowest compared to the number of students enrolling in Chemistry and Biology. The subject is ranked second lowest in student enrolment to Psychology that is classified in the same group with the science subjects.

While the decline in student enrolment in both Physics and Chemistry appears similar, there is a greater decline in enrolment in Chemistry than in Physics. The major difference between the two subjects is gender imbalance. The average proportion of females studying Chemistry over the past decade has been 43.5% compared with 28.0% for Physics (Dekkers et al. 1991). Although student enrolment in Physics is generally low, a look at female students enrolment in the subject reveal that majority of female students prefer enrolling in Biology, followed by Chemistry, while Physics is chosen by

a very small proportion of female students. This information is provided in the following Figure 2.2.

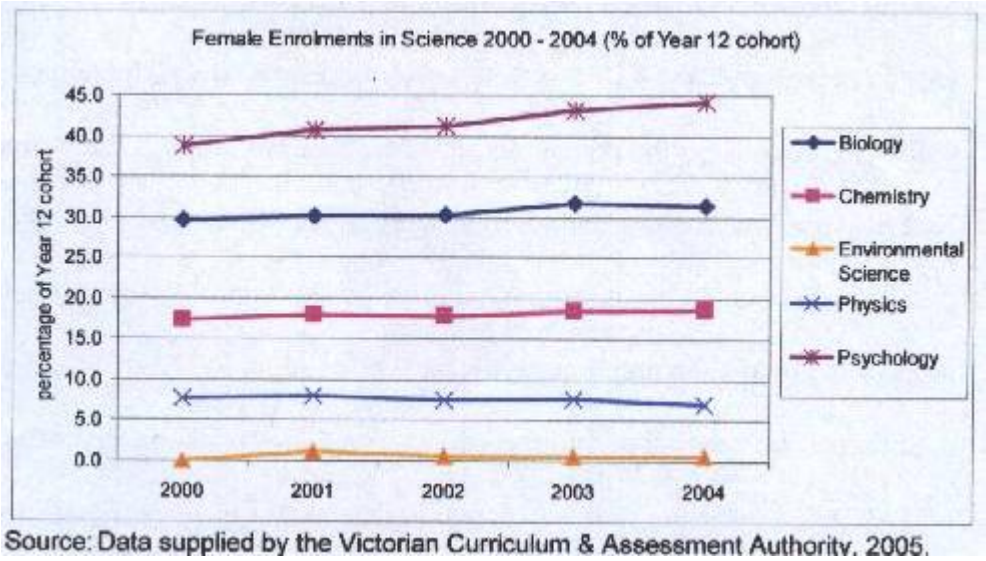

Figure 2.2: Percentage of Year 12 Female Students Enrolling For Science Subjects in Australia (2000-2004)

From Figure 2.2, it is evident that most females enrol for Biology, at a percentage of about 30.0%, followed by enrolment in Chemistry at about 18% while female enrolment in Physics fall under 10% (about 7.5%).

Various reasons have been advanced for the decline in student enrolment in Physics by various researchers. School and science teachers have been identified to exert important external influences on students' decisions about taking Physics through providing students with learning environment and career information (Crawley & Black, 1990; Lyons, 2005; Nashon, 2003; Cleaves, 2005; Munro & Elsom, 2000; Woolnough & Cameron, 1991). Some other external reasons often reported include: peers' attitudes

towards science (Panizzon & Levins, 1997; Talton & Simpson, 1985), the history of the local labour market (Munro & Elsom, 2000); and the influence of mass media and society (Lyons, 2005; Munro & Elsom, 2000). Internal reasons seem to be reported more intensively in various studies. Students early science learning experiences and perceptions of school science were found to be influential in students Physics enrolment decisions (Hoffmann, 2002; Miller, Parkhouse, Eagle & Evans, 1999; Munro & Elsom, 2000). Positive attitudes have been associated with interest in, and enjoyment of, science among secondary school-aged students (Miller et al, 1999).

Students, who enjoyed their learning experience in junior science and achieved good results in science, were found to be more confident in their abilities and more likely to enrol in Physics (George & Taylor, 2001). Students self-perception of own competency in science and Physics was accounted as an important internal reason explaining students Physics enrolment decision as well. Hoffman (2002: 452) stated, 'in explaining the interest in Physics as a school subject, the best predictor is the concept a student has about his or her confidence in good performance. In addition, competency in mathematics also seems to be a key factor in students Physics related decisions. Students who had competency in prior mathematical knowledge were found more likely to be potential Physics students (Nashon, 2003). Finally, students perception of the value of learning Physics for their future life, in terms of university or career aspirations, was suggested to play a major role in their enrolment decisions (Crawley & Black, 1990; Fullarton & Ainley 2000; South Australia, 2006; Wood & De Laeter 1986). Thus, a combination of factors influences students' decisions on enrolment in Physics.

2.3 National Student Enrolment in Kenya Certificate of Secondary Education

The current system of education in Kenyan secondary schools requires that a student be examined in at least seven subjects in form four. These subjects are classified into groups: group one, two, three and four. Group one subjects constitute Mathematics, English and Kiswahili (KNEC, 2005), and they are compulsory. The second group of subjects comprises Physics, Chemistry and Biology. From this category, according to KNEC policy on subject selection criteria, a student has an option of choosing any two of them, or all the three subjects. In other words, a student sitting for the final grade examination must register for at least two subjects from this category, but can also opt for all the three subjects. The third group of subjects constitute of what are commonly referred to as the humanities. They include History and Government, Geography and the Religious Studies, which are Christian, Islam and Hindu. A final grade student is expected to choose one or two subjects from this category. The fourth group of subjects constitute of what are commonly referred to as technical subjects. These include Agriculture, Home science, Business Studies, Computer Studies, Power and Electricity, Woodwork, Metalwork and the foreign languages. A final grade student may take only one subject from this category, especially those students who would like to have more than seven subjects in their final examinations, or none from here (KNEC, 2005).

On admission in form one, a student is exposed to all the group one subjects, all group two subjects, all group three subjects and any one or more of group four subjects, depending on the school preferences. This situation remains so until the end of form two. At the beginning of form three, the student selects seven; eight or nine subjects

according to his/her preferences (KNEC, 2005). In other words, the student specializes at the start of form three by dropping some of the subjects initially studied in forms one and two. The selection is done according to the procedure given earlier on.

It has been noticed from previous examinations that most students prefer to opt for Chemistry and Biology when choosing the two subjects from group two. This trend has been there since 2000, when the Ministry of Education, Science and Technology decided to reduce the minimum number of examinable subjects from eight to seven. At the same time, a combined subject referred to as physical science which constitutes Physics and Chemistry was done away with. Students were also allowed the option of either taking all the three subjects or just two of them (KNEC, 2005).

In the Kenya Certificate of Secondary Education examinations of 2004, 217,211 candidates registered for the form four examinations, but only 57,525 candidates registered for Physics (KNEC, 2005). The other subjects in the same category i.e. Chemistry and Biology had an enrolment of 210,655 and 197,168 respectively. This gives a percentage of 97.0%, 90.8% and 26.5% of students opting for Chemistry, Biology and Physics respectively. Similar trends have been noted in earlier years. The enrolment ratios in other years on the three group two subjects have shown similar figures. The following Table 2.1 shows the relative enrolment nation-wide for the three subjects between the years 2001 and 2007 (KNEC, 2007).

Table 2.1: National Students Enrolment in Science Subjects (2001-2007)

		Subjects					
		Physics		Chemistry		Biology	
Year	Total Enrolment	Enrolment	%	Enrolment	%	Enrolment	%
2001	191,209	54,151	28.3	179,022	93.6	174,705	91.4
2002	194,133	53,561	27.6	184,578	95.1	174,684	90.0
2003	203,414	56,010	27.5	195,910	96.3	183,666	90.3
2004	217,211	57,525	26.5	210,655	97.0	197,168	90.8
2005	255,256	68,856	27.0	249,653	97.8	231,326	90.6
2006	243,453	72,299	29.7	236,831	97.3	217,675	89.4
2007	276,239	83,162	30.1	267,719	96.9	248,519	90.0

Source: KNEC, 2002; 2003; 2004; 2005; 2006; 2007

According to the enrolment figures indicated in Table 2.1, Physics enrolment has remained below 30.0% in all the years under consideration. Within the same period, enrolment in the other two competing subjects i.e. Chemistry and Biology, has stabilized at about 90% (see Table 2.1), with Chemistry emerging as the most preferred subject of the three. While it is generally understood that the poor performance in the science subjects would make candidates avoid them when given a chance, it is not clear why the candidates generally avoid Physics more than the other two science subjects. The three subjects are given the same status during subject selection, but the students tend to prefer Chemistry or Biology to Physics, with more students opting for Chemistry. This study therefore sought to find out the reasons why students avoid Physics, while preferring to enrol for Biology and Chemistry, as indicated by the national examinations body reports (KNEC, 2001-2007).

Beside the fact that Physics is minimally enrolled for by students throughout the country as depicted in Table 2.1, there are discrepancies in enrolment among the various provinces in Kenya. The few students who register for the subject are not uniformly distributed throughout the country, with some provinces providing a very small fraction of national Physics candidature. The following Table 2.2a depicts the Physics enrolment scenario in Kenya between the period 2001 to 2005, by province and gender in Physics in each of the eight provinces in Kenya (KNEC, 2006).

Table 2.2a: National Students Enrolment in Physics by Province and Gender (2001-2005)

Years	Gender	National Physics enrolment by gender	Provinces							
			Coast	Central	Eastern	Nrb	RVP	Western	Nyanza	NEP
	Boys	38,034	2139	8478	6632	2276	8248	3630	6581	50
2001	Girls	16,117	796	4992	3306	928	3083	1477	1531	4
	Total	54,151	2935	13470	9938	3204	11331	5107	8112	54
	Boys	38,337	2016	8281	6417	2327	8157	4007	7120	52
2002	Girls	15,184	689	4558	2881	942	2906	1659	1549	0
	Total	53,561	2705	12839	9298	3269	11,063	5666	8669	52
	Boys	40,006	2075	8548	6560	2435	8745	3961	7643	39
2003	Girls	16,004	833	4436	2860	908	3595	1784	1584	4
	Total	56,010	2908	12,984	9420	3343	12,340	5745	9227	43
	Boys	40,676	2205	8467	6870	2670	9757	4381	7922	52
2004	Girls	16,851	856	4205	3192	1022	3941	2007	1624	4
	Total	57,527	3061	12,627	10,062	3692	13,698	6388	9546	56
	Boys	49,655	2797	9345	8188	2905	11,777	5319	9256	68
2005	Girls	19,201	1120	4455	3443	1167	4699	2371	1933	13
	Total	68,856	3917	13,800	11631	4072	16,476	7690	11,189	81

Source: Kenya National Examinations Council, 2001; 2002; 2003; 2004; 2005; 2006

From Table 2.2a, it is evident that Rift Valley and Central Provinces provide the highest percentage of Physics candidates, while Coast and North Eastern Provinces provide the least. However, the situation in North Eastern Province (NEP) is very serious as the total

Physics candidature has never reached 100 in any one of the years considered. This situation can be better observed in a percentage enrolment table, as given in the following Table 2.2b.

Table 2.2b: National Percentage of Students Enrolment in Physics by Province and Gender, (2001- 2005)

Years	Gender	% of Physics enrolment by gender	Provinces							
			Coast	Central	Eastern	Nrb	RVP	Western	Nyanza	NEP
	Boys	70.2	5.6	22.3	17.4	6	21.7	9.5	17.3	0.13
2001	Girls	29.8	4.9	31	20.5	5.8	19.1	9.2	9.5	0.02
	Total	100	5.4	24.9	18.3	5.9	20.9	9.4	15	0.1
	Boys	71.6	5.3	21.6	16.7	6.1	21.3	10.5	18.6	0.14
2002	Girls	28.4	4.5	30	19	6.2	19.1	10.9	10.2	0
	Total	100	5.1	24	17.4	6.1	20.7	10.6	16.2	0.1
	Boys	71.4	5.2	21.4	16.4	6.1	21.9	9.9	19.1	0.1
2003	Girls	28.6	5.2	27.7	17.9	5.7	22.5	11.1	9.9	0.02
	Total	100	5.2	23.2	16.8	6	22	10.3	16.5	0.08
	Boys	70.7	5.4	20.8	16.9	6.6	24	10.8	19.5	0.1
2004	Girls	29.3	5.1	25	18.9	6.1	23.4	11.9	9.6	0.02
	Total	100	5.3	21.9	17.5	6.4	23.8	11.1	16.6	0.1
	Boys	72.1	5.6	18.8	16.5	5.9	23.7	10.7	18.6	0.14
2005	Girls	27.9	5.8	23.2	17.9	6.1	24.5	12.3	10.1	0.07
	Total	100	5.7	20	16.9	5.9	23.9	11.2	16.2	0.12

Source: Kenya National Examinations Council, 2002; 2003; 2004; 2005; 2006

From Table 2.2b, it can be seen that the percentage enrolment in North Eastern Province percentage is far below 1% in all the years, the highest percentage being 0.14% for boys in 2002 and 2005. This situation, therefore, calls for an investigation into the causes of such dismal students enrolment in Physics in the province.

Apart from the general low enrolment in the subject as seen in Table 2.1, a comparison of enrolment between males and females also shows rather skewed preferences. For

example, according to KNEC (2000-2003), in 2001, out of the 88,418 female candidates, 16,117 sat for Physics, representing 18.2% of the girls. In the same year, 38,034 boys sat for the subject in the same year out of the total male registration of 102, 791. This represented 37% of the boys. The following year (2002), 90,584 female candidates registered for KCSE; but only 15,184 opted for Physics, representing about 16.8% of the girls. In the same year, 37.1% of the boys registered for the subject. The number of girls taking Chemistry and Biology in the same year was 86,783 and 86,134 respectively. About 96% and 95% of the female candidates therefore, studied these subjects. In 2003, 16,004 girls opted for Physics, 91,478 opted for Biology while 89,995 of them opted for Chemistry. The following Table 2.3a shows KCSE enrolment by gender between the years 2001 and 2007.

Table 2.3a: Students Enrolment in Science Subjects by Gender Nationally (2001-2007)

	Total National Enrolment		Total Physics Enrolment		Total Chemistry Enrolment		Total Biology Enrolment	
Year	**Boys**	**Girls**	**Boys**	**Girls**	**Boys**	**Girls**	**Boys**	**Girls**
2001	102,791	88,418	38,034	16,117	95,470	83,552	90,209	84,496
2002	103,549	90,584	38,377	15,184	97,795	86,783	97,795	86,134
2003	109,014	94,400	40,006	16,004	104,432	91,478	93,711	89,955
2004	116,572	100,639	40,676	16,851	112,434	98,221	100,844	96,324
2005	137,838	117,418	49,655	19,201	134,244	115,409	119,125	112,201
2006	129,071	114,382	51,123	21,376	124,932	111,969	109,863	108,065
2007	150,127	126,112	59,506	23,767	144,229	122,532	127,516	118,395

Source: Kenya National Examinations Council, 2002; 2003; 2004; 2005; 2006; 2007; 2008

From Table 2.3a, it is clear that whereas the number of girls enrolling for either Biology or Chemistry is almost equal to that of boys, the difference in enrolment is greatly pronounced with respect to enrolment in Physics. For instance, in 2005, 134,244 boys enrolled for Chemistry while, 115,409 girls enrolled for the same. The difference in Biology enrolment in the same year was even smaller. However, 49,655 boys enrolled in Physics against 19,201 girls in the same period (2005). The difference in Physics enrolment by gender is quite large, and can be better visualized from the following percentage enrolment table extracted from KNEC reports from 2001 to 2007 (KNEC, 2002; 2003; 2004; 2005; 2006; 2007; 2008).

Table 2.3b: Percentage of Students Enrolment in Science Subjects by Gender (2001-2007)

Year	Total enrolment National		Percentage of enrolment physics		Percentage of enrolment Chemistry		Percentage of enrolment Biology	
	Boys	Girls	Boys	Girls	Boys	Girls	Boys	Girls
2001	102,791	88,418	37	18.2	92.9	94.5	87.8	95.6
2002	103,549	90,584	37.1	16.8	94.4	95.8	85.5	95.1
2003	109,014	94,400	36.7	17	95.8	96.9	86	95.3
2004	116,572	100,639	34.9	16.7	96.5	97.6	86.5	95.7
2005	137,838	117,418	36	16.4	97.4	98.3	86.4	95.6
2006	129,071	114,382	39.6	18.7	86.7	97.9	85.1	94.5
2007	150,127	126,112	39.6	18.8	96.1	97.2	84.9	93.9

Source: Kenya National Examinations Council, 2002; 2003; 2004; 2005; 2006; 2007; 2008

From Table 2.3b, it can be seen that whereas over 90.0% of the girls opt for both Chemistry and Biology, less than 20.0% of them opt for Physics. This figure falls well below the national percentage registration in Physics, which averages 27.0% (Table 2.1).

Apart from the low enrolment, the results produced by the few that opt for the subject is quite wanting (KNEC, 2002; 2003; 2004; 2005; 2006). It is not clear what effect the results in the subject have on student enrolment in subsequent years. This effect therefore, forms part of the objective of this study, i.e. to find out the effect of performance in the subject on future enrolment in the subject, and if any, the kind of effect it has on future students' enrolment.

2.4 Provincial Students Enrolment in Physics in KCSE

The data available from the North Eastern Provincial Director of Education's (NEP PDE) office indicate that North Eastern Province had a total of twenty-three public secondary schools at the time of this study, with an enrolment of students up to form four. North Eastern Province was made up of four districts of Garissa, Wajir, Mandera and Ijara District, in which the above schools were spread over (NEP Examinations Office, 2006). Of these schools, four are girls schools; two are mixed while the remaining seventeen are boys schools. However, two other girls schools have recently been started in Wajir District, but they had not as yet presented any candidates for final examinations and do not therefore form part of this review.

The total KCSE enrolment in form four has been ranging between 1200 and 1600 (NEP Examinations Office, 2001; 2002; 2003; 2004; 2005). But, in 2001, the enrolment went

slightly beyond 1600 mainly due to a large carry-over from the 2000 candidates whose results were cancelled due to some examination irregularities. Within the same period, the national enrolment in KCSE has ranged between 191,000 and 256,000. The provincial enrolment has therefore, been around 0.63% of national enrolment within the period. Whereas almost all the students have been enrolling in Chemistry and Biology, the number enrolling in Physics has hardly reached 6% of provincial candidature (the highest being 5.1% in 2005, when 81 students registered for the subject) in any given year.

In the year 2001, 54,151 students sat for Physics in their final examinations nation-wide. In the same year, 54 candidates sat for Physics at KCSE in North Eastern Province. This represents about 0.1% of the national enrolment in Physics. This percentage is very low, implying that whereas Physics is resented by many students in Kenya, the resentment is worse in NEP. As seen earlier, North Eastern Province provides 0.63% of total number of candidates. If the same ratio was to be maintained as far as enrolment in Physics is concerned, then the province should have presented 0.63% of 54,200 candidates. This gives a figure of about 340 candidates who are expected to have enrolled in Physics in the whole province. But only about 15% of this number actually registered for the subject. For a clearer picture of the situation in the province, we consider the following table, which shows the national enrolment versus North Eastern Provincial enrolment in the years 2001 to 2005 (KNEC, 2002; 2003; 2004; 2005; 2006).

Table 2.4: National Student Enrolment in Physics Compared To North Eastern Provincial Physics Enrolment (2001-2005)

Year	Total national enrolment	Total NEP provincial enrolment	Total Phys enrolment	Provincial Physics enrolment	% of total national candidature	% of national Physics enrolment
2001	191,209	1,791	54,151	54	0.94	0.1
2002	194,133	1,344	53,561	52	0.69	0.097
2003	203,414	1,213	56,010	43	0.6	0.077
2004	217,211	1,354	57,524	56	0.58	0.097
2005	255,256	1,598	68,856	81	0.63	0.118
2006	238,684	1,528	72,299	93	0.64	1.286
2007	273,504	1,723	83,162	105	0.63	1.263

Source: Kenya National Examinations Council, 2002; 2003; 2004; 2005; 2006; 2007

As seen from Table 2.4, the Physics enrolment in North Eastern Province is far below the proportion exhibited by the total number of candidates that the province provides for the national examinations in each of the years considered. The actual number of candidates registering in Physics is about one tenth of what is expected from the province. This gives an indication that other than the general issues that make candidates from all over the country to avoid Physics, there may be other issues that are specific for this province alone. This study therefore, apart from setting out to find the general issues leading to low enrolment in Physics country-wide, also sought to find out the specific issues that affect this particular province more than the others.

Within the province itself, there are serious fluctuations from school to school as far as registration in Physics in the final grade is concerned. There are some schools that did not present Physics candidates at all during the period 2001 to 2005. Some schools presented single candidates within the five years. However, the other two competing subjects i.e. Chemistry and Biology, were well represented throughout the period. The following Table 2.5 shows the relative enrolment in the three science subjects from 2001

to 2005 in North Eastern Province, as extracted from NEP KCSE examination report, 2002-2006.

Table 2.5: The Relative Students Enrolment in Physics, Chemistry and Biology in North Eastern Province (2001-2005)

Year	Total enrolment	Subjects					
		Physics	%	Chemistry	%	Biology	%
2001	1,791	54	3.01	1782	99.50	1758	98.16
2002	1,344	52	3.87	1342	99.90	1308	97.32
2003	1,213	43	3.54	1192	98.27	1206	99.42
2004	1,354	56	4.14	1338	98.8	1339	98.9
2005	1,598	81	5.07	1594	99.74	1555	97.31

Source: Kenya National Examinations Council, 2002; 2003; 2004; 2005; 2006

From Table 2.5, it is evident that whereas the percentage enrolment in Biology and Chemistry is well above 97% in the whole period, the percentage enrolment in Physics is below 5% throughout except in 2005 when of the percentage students enrolment in Physics went to 5.07%. Besides, it can also be seen that Chemistry is the most preferred subject, being registered for by well over 98% of all the students in the five years considered. The preference for Chemistry tends to agree with the national trend, where more students register for Chemistry and Biology, but Chemistry being registered for by the greatest number of candidates (Table 2.3 a and b, page 20). This, therefore, raises a major question: What makes Physics to be so unpopular with students? The study set out to find the situations on the ground that contribute to the lack of interest among students for Physics.

Apart from the low enrolment in the subject as indicated by the Table 2.5, the achievement in the subject by the few who register for it is also found wanting. Table 2.6 shows a comparative performance by students in the three subjects between 2001 and 2004 in North Eastern Province.

Table 2.6: Comparative Students Performance in Science Subjects in NEP (2001-2005)

Year	Subject	Entry	Grades											
			A	A-	B+	B	B-	C+	C	C-	D+	D	D-	E
2001	**Phy**	**54**	**-**	**-**	**2**	**1**	**1**	**1**	**4**	**7**	**5**	**15**	**12**	**6**
	Chem	1782	1	2	6	12	24	38	51	49	74	242	631	652
	Bio	1758	5	7	34	48	58	68	62	103	98	342	504	429
2002	**Phy**	**52**	**-**	**-**	**-**	**1**	**2**	**1**	**5**	**3**	**4**	**8**	**17**	**11**
	Chem	1342	4	5	9	12	19	34	42	54	54	186	463	460
	Bio	1308	2	4	13	17	35	68	48	79	81	285	384	294
2003	**Phy**	**43**	**-**	**1**	**-**	**3**	**3**	**3**	**2**	**5**	**3**	**6**	**9**	**4**
	Chem	1192	10	11	7	20	25	36	39	47	65	203	368	361
	Bio	1206	1	9	16	28	59	55	83	103	102	324	288	138
2004	**Phy**	**56**	**1**	**3**	**1**	**-**	**2**	**7**	**4**	**6**	**4**	**12**	**10**	**6**
	Chem	1338	7	12	9	25	30	65	74	94	118	295	403	206
	Bio	1339	17	34	75	97	115	110	81	123	78	266	210	133
2005	**Phy**	**81**	**2**	**0**	**2**	**7**	**8**	**5**	**6**	**8**	**11**	**17**	**13**	**2**
	Chem	1594	9	10	19	25	41	57	75	83	117	321	518	319
	Bio	1555	15	25	46	80	96	119	144	173	152	369	253	83

Source: Kenya National Examinations Council, 2002; 2003; 2004; 2005; 2006

From Table 2.6, it is evident that majority of candidates have been scoring between D and D- grades. To visualize the performance in a clearer way, the grades can be put into three categories i.e. from grade A to B, from B- to D+, and finally from D to E. The first category is used to represent the high achievement, the second category for the moderate achievement while the third category represents the failure grades. Besides the information given in the previous table, the percentage of candidates who scored

respective grades can also be calculated. This summary is given in Table 2.7, based on the KNEC reports of 2002-2006.

Table 2.7: Summary of Student Performance in Science Subjects in NEP (2001-2005)

Year	Subjects	Grades					
		A to B	%	B- to D+	%	D to E	%
2001	Phys (54)	3	5.56	18	33.33	33	61.11
	Chem (1782)	21	1.18	236	13.24	1525	85.58
	Bio (1758)	48	2.73	389	22.13	1275	72.53
2002	Phys (52)	1	1.92	15	28.85	36	69.23
	Chem(1342)	30	2.23	203	15.13	1109	82.63
	Bio (1308)	36	2.75	311	23.78	961	73.47
2003	Phys (43)	4	9.30	16	37.21	19	44.19
	Chem(1192)	48	4.03	212	17.79	932	78.19
	Bio (1206)	54	4.48	402	33.33	750	62.19
2004	Phy (56)	5	8.93	23	41.07	28	50.00
	Chem (1338)	53	3.96	381	28.48	904	67.56
	Bio (1339)	223	16.65	507	37.86	609	45.48
2005	Phys (81)	11	13.58	38	46.91	32	39.51
	Chem (1594)	63	3.95	373	23.40	1158	72.65
	Bio (1555)	166	10.68	684	43.99	705	45.34

Source: Kenya National Examinations Council, 2002; 2003; 2004; 2005; 2006

From the summarized Table 2.7, it can be seen that the high achievers' grades are scored by less than 10.0% of the students in all of the three subjects, except in only two occasions i.e. for Biology in 2004, where 16.7% of the candidates scored the high grades, and in Physics of 2005, with 13.6%. However, the high achievement in Physics is due to the few candidates who sat for it, hence enabling a high score of just four students to represent a rather high percentage pass. The moderate grades i.e. from B- to D+ are scored by between 15.0% and 41.0% of the candidates, with the highest concentration of candidates lying on the failure grades of D to E. The percentage of students within this grade lies from 39.0% to more than 85.0%.

The summary confirms that performance in science subjects is generally poor. The table seems to imply that Physics is performed better than the other two competitors, that is Biology and Chemistry, except in one occasion, in 2002, where it was poorly done. This illusion can be attributed to the small number of candidates sitting for the subject. This then implies that a single B obtained by one candidate out of, say, 40 candidates, is a far higher percentage as compared to, say, 10 candidates getting grade B out of say, 1000 candidates. However, the number registering for Physics is too small to be effectively compared to that registering in either Biology or Chemistry.

2.5 Provincial Student Enrolment in Physics by Gender

As already stated, of the twenty-three schools with students in classes up to form four in NEP, four are pure girls schools while one is mixed. Of these five schools with girls, in 2001, only one such school in Garissa District presented candidates for examination in Physics (NEP Examinations Office, 2002). The said school had only four candidates. In 2002, none of the schools had a single girl registering for the subject. In 2003, four girls from the earlier school in Garissa District registered for Physics while in 2004, a different school in the same Garissa District offered four candidates for Physics examination. In 2005, there were three girls from one school in Mandera District, in addition to 2 and 7 girls from the two girls schools in Garissa District (NEP Examinations Office, 2002; 2003; 2003; 2004; 2005; 2006). This was a major improvement on female enrolment in Physics in the province given that previously, Mandera District never provided any female student for Physics for KCSE. The overall female enrolment in Physics in the province also improved considerably. The following

table presents a simplified comparison of male and female candidates enrolling for Physics in the five years considered in North Eastern Province.

Table 2.8: Student Registration in Physics in KCSE by Gender in NEP (2001-2005)

Year	provincial candidature	Physics enrolment	% of provincial candidature	No. of girls	No. of boys	% of boys
2001	1791	54	3	4	50	92.6
2002	1344	52	4.9	0	52	100
2003	1213	43	3.5	4	39	90.7
2004	1354	56	4.1	4	52	92.6
2005	1598	81	5.1	13	68	84

Source: Kenya National Examinations Council, 2002; 2003; 2004; 2005; 2006

From the summary in Table 2.8, it is evident that although the enrolment in Physics is generally low, to the female students, it is almost an anathema. While it is very grave for less than 5.0% of students from a whole province to register for a subject whose practical application in daily life is overwhelmingly great, it is even graver to have just four female students from the same province registering for it. This called for a study to find out what relationship exists between the students and the subject that makes the students to drop the subject like a hot pan. This study tried to find out the factors that combine to discourage the students from the subject, more so the female students.

2.6 Student Enrolment in Physics in Garissa District

At the time of this study, Garissa District had nine schools with students up to form four. These were Garissa High, County High, NEP Girls, Umusalama Girls, Balambala, Dadaab, Modogashe and Bura secondary schools. The nine schools presented various

numbers of Physics candidates for KCSE at various periods between 2001 and 2005. The following Table 2.9 presents the enrolment situation in Garissa District from 2002 to 2005. However, in any one given year, not all the nine schools presented candidates in the paper, with some schools presenting one or two candidates in only one of the four years between 2001 and 2004, while one never had any candidate at all during the period.

Table 2.9: Student Enrolment in Physics in Garissa District (2002-2005)

School	School type	No. of Physics candidates in KCSE per year				
		2002	2003	2004	2005	Total
Garissa High	Boys boarding	9	10	14	8	41
Balambala	Boys boarding	-	-	2	-	2
Umusalama	Girls day	-	-	4	7	11
Sankuri	Boys boarding	2	1	-	4	7
County	Boys boarding	13	6	3	7	29
Dadaab	Boys day/boarding	-	-	1	-	1
Modogashe	Boys day/boarding	-	-	-	-	-
Bura	Boys boarding	1	-	-	-	1
NEP girls	Girls boarding	-	4	-	2	6
Total		25	21	24	28	98

Source: Kenya National Examinations Council, 2002; 2003; 2004; 2005; 2006

From Table 2.9, it is observed that one school did not present any Physics student for KCSE in the entire period considered. Two schools had one student each in the four years while another one had two students in only one of the years. Two boys schools have been consistent in presenting Physics students for KCSE throughout the period. The only two girls schools in the district presented female students for KCSE in alternate years, though none had any Physics student in 2002 KCSE, while both had a few students sitting for Physics in 2005 KCSE. Thus, female enrolment in Physics is much lower than that of boys. The two girls schools in Garissa District are the only

schools in the province that registered female students for Physics in the whole of North Eastern Province from 2002 to 2004. The other districts within the province, namely Wajir and Mandera (as well as the recently created Ijara District) did not provide any female Physics candidates at all, though they have girls schools (the only secondary school in Ijara district is a mixed school). The result is that whereas Physics enrolment is quite low in the district, it is at its worst on the female candidates both at the district level to the entire province (NEP Examinations Office, 2002; 2003; 2004; 2005; 2006). Although Garissa District presents very few Physics candidates in KCSE, the candidates from here represent more than half of the entire provincial enrolment in the subject (NEP Examinations Office, 2002; 2003; 2004; 2005; 2006). It is until 2005 that the first girls school outside Garissa District presented its first three students for examination in form four, i.e. Moi Girls School, Mandera.

2.7 General Literature on Science Education

2.7.1 The General Empirical Literature

The low enrolment in Physics in secondary schools is not an entirely new phenomenon. According to Eshiwani (1985), the low enrolment in physical science is partly due to the Mathematics involved in the subjects (subjects here refer to both Physics and Chemistry, as physical science is a combination of the two). The Mathematics makes it difficult for most students, and even more so in female students. Besides this, cultural and social factors have been found to discourage girls from doing physical science courses. According to Erikson and Lynda (1984), until the age of ten years, the difference in achievement in Physics or science in general between boys and girls is not significant,

but only after this age that the difference becomes significant. In general, the variables that have been attributed to poor achievement in the physical sciences include previous primary school achievement, student's attitude towards science, student's social background, teachers, school practices and policies, parental influence, student's self-confidence, mathematical abilities as well as sex-role stereotyping and socio-cultural issues on the female students.

2.7.2 The Role of Textbooks in Physics

Physics textbooks in a classroom give a student direct experience, visual aids and instructions. The content and sequence of the content in a textbook contributes to the suitability of the textbook to the student using it. In all, the textbook gives general content of the course and usually provides solved examples and questions to give direction and guidance to the understanding and application of Physics principles and concepts. Some textbooks have test papers at the end of a topic or chapter to test the mastery of the topic and its application. Textbooks also cater for individual pace as the individual studies on his/her own and hence independent pace of study. However, Kathuri and Pals (1983) aver that the effectiveness of textbooks depends on how they are used in the learning process in combination with other factors. The availability of textbooks on their own is not a sufficient condition for good performance in a subject, but rather their effective use.

A study on the use of science textbooks in England showed that most students, especially in 'A' level, used textbooks as independent and unsupported surrogate teacher.

This was however minimal in the 'O' level (Newton, 1984). This implies that students should be provided with relevant textbooks to support the teacher's work.

To the teacher, a textbook is useful for further reading, for preparing lesson plans, diagrams, illustrations, exercises and even instructions to be given to students. Thus, one problem encountered by the learner due to lack of textbooks is that it hampers the in-depth learning process of the subject. Reading the "proper" textbooks enhances learning of Physics and thus unavailability of these textbooks impairs the process of learning. To fulfil its functions as a surrogate teacher and provider of supplementary reading, the textbook being available, the student must play his/her role by adopting "good"' reading habits. This makes the student self-dependent in acquiring knowledge and skills (Newton, 1984). The relevant authorities (parents or schools) should not only provide textbooks to students, but also ensure that they are the proper and relevant ones.

2.7.3 The Role of Mathematics in Physics

Performance in Physics is greatly improved if positive attitudes are encouraged in terms of relatedness of topics in other subjects like Mathematics (Magiri, 1997). The link between Physics and Mathematics is a strong one. According to Nashon (2003), competency in mathematics is a key factor in students Physics related decisions. Students who had competency in prior mathematical knowledge were found more likely to be potential Physics students. In fact, some topics in Mathematics and Physics are so similar that they should be mentioned by both the teachers of Mathematics and those of Physics, with reference to the fact that the topic 'Linear Motion' in Physics is the same as

the one in Mathematics. Physics widely applies Mathematics in such areas like resolution of vectors, projectile motion, forces in inclined planes and several others.

In Physics, formal relations take the form of mathematical formulae or equation. That is to say, a formula is an expression of formal relations among constructs. A process of abstractions arrives at such constructs from common and recurrent features of a given class of events in nature. By appealing to a set of formulae, a physicist is able to undertake both extensive and intensive investigations of various logical relations among constructs without the burden of each time looking at the individual events from which the constructs were abstracted. In a very important sense, therefore, this use of formulae constitutes a saving of mental (as well as physical) energy. It provides for an economical use of mental effort, and to an extent, this is generally true of any formulae in Physics. However, in their assessment of scientific explanations, Physics students tend to treat mathematical relations as symmetric entities, i.e. they do not distinguish between dependent and independent variables (Embeywa, 1985). Probably this lack of mathematical conception of explanation is a contributory factor to poor performance in Physics. Mwangi (1983) found that the students' attitudes, aspirations and time devoted to Mathematics determine performance in Physics.

Lerner (1989) stresses that Physics, having a big proportion of mathematical formulae, should be taught like Mathematics with all efforts being made to ensure that the mathematical expressions introduced by the teacher of Physics are not ambiguous, and have a direct relation with the physical world and the immediate environment of the

student. According to Bitter (1963), Physics is boring only if one does not understand what it is all about. It is like listening to a speech in a language that one does not know, but in fact it is a most exciting activity. This statement by Bitter implies that in order to make Physics interesting to the learners, it is important to make them understand what the subject is about. This can be achieved by relating the subject with the daily occurrences and activities within the learners' environment.

Towards this end, Orodho (1996) states that Mathematics scores are better predictors of achievement in science and Physics in particular, than in Chemistry. This statement from Orodho is a clear indication that there is a positive relationship between performance in Mathematics and performance in Physics. It follows that Physics students should have a good knowledge of Mathematics and where possible, teachers of Physics should also teach Mathematics to ensure that the students are well-prepared to handle the mathematical aspects in Physics. Where this is not possible, then the teacher of Physics should start by first teaching the particular Mathematical concept necessary in the area, before embarking on the actual Physics knowledge to be imparted. This ensures proper link between the two subjects and an easier application of the necessary Mathematical skills.

The boredom aspect of Physics is sometimes attributed to the mathematical language used to express certain concepts and principles. Like any other language, Mathematics has symbols and words, with greater emphasis in the symbols. Physics mostly employs equation notation in presenting the important abstract general truth in the physical

situations. This description is unlike the exact photographic reproduction neither of reality, nor in any sense a record of moving picture. Equations are notations that represent abstraction and reality. A physical law, mathematically described, reveals certain general essentials, not just any one particular sequence of events. But it can be used to describe and predict actual physical events (Bitter, 1963).

Thus, mathematical expressions are important in Physics in that they provide numerical shorthand for making concise and precise statements. It should be borne in mind that mathematical operations are not important aids to reasoning in that no new knowledge is obtained from the mathematical manipulations, but from observations made in form of data or assumptions.

Mathematics application to Physics has often led teachers of Physics to complain about their students' inadequacy in Mathematics. It is worth noting that to communicate and think, we do not have to rely wholesale on the use of symbols and algebraic processes (Lewis, 1972), but the symbolic statement of a principle should be translated into words for better understanding. For better learning, the mathematical expressions should be put into suitable words for the learner, especially beginners of Physics for a sound and firm background in the subject. To a beginner, a foreign language requires translation to his/her own language. Similarly, mathematical statements require translation to simple language of thought, words and sentences.

2.7.4 Integration of Physics Knowledge to Daily Life

Whenever teaching a Physics lesson, it is vital for teachers to note that, to make the subject interesting and comprehensible, the Physics knowledge learnt should have an application in daily life. Otherwise, the student might find the subject unrelated to life and hence a subject which answers certain magical questions, rather than issues related to daily occurrences in life.

According to Swift (1983), Physics should be made relevant to the society in which the student lives. Teaching students through appropriate stages of understanding can achieve this, that is, starting from the familiar ideas and then build on to new ones. Thus, we tend to use the word 'energy' boldly rather than 'entropy', which is rarely used. The first concept is as difficult as the second, but common use of the first word has taken fear out of it from the students (Lewis, 1972).Therefore, beyond the sense of familiarity comes a different quality of understanding. When suddenly the patterns seem to fit together, the theories and postulates are seen to enlighten facts, and then the whole issue becomes reasonable.

In everyday activities, more than one concept of Physics is combined for an application, and thus the reason why the students should be encouraged to participate in projects for exhibition in school and Science Congress competitions. To enhance and appreciate the relevance of Physics education in daily life, the students should be exposed to areas where there is wide application of Physics principles. Such areas can be industries,

electrical power generation stations, unique structures of bridges, roads, buildings and so on.

In schools where science apparatus are scarce, teachers could improvise and use simple apparatus under correct circumstances and teach the required idea without necessarily using sophisticated equipment. For example, tin cans are far cheaper than laboratory beakers, but they can help students to relate to the equipment (Lewis, 1972).

In general, assigning students projects can enhance learning of Physics to a majority of learners. This is because the practical way of learning involves thinking as well as handling the materials and equipment (Zheng, 2007). Therefore, students should be assigned projects to perform, other than the regular laboratory practicals that they should regularly perform. The use of laboratory is supported by the first IEA (1988) Science Study, which notes positive effects of reported laboratory use in three of four less industrialised countries.

2.7.5 Girls Attitude Towards Physics

Other researchers have found that girls attitude towards science in general, and Physics in particular, has been bad. This affects the readiness of the student to learn Physics. An attitude is a mental and neural state of readiness, organized through experience, exerting a directive or dynamic influence upon the individual's response to all objects and situations with which it is related (Munguti, 1984). From this definition, it is obvious that the attitude of the student plays an important role in learning. It determines direction

and action of influence. Thus, girls' attitude towards science in general and Physics in particular determines the extent to which the girl will go on learning the subject, amongst other variables (Voss, 1981). If the attitude of the female student is negative, then this will adversely affect their learning of the subject. It is imperative that teachers of Physics should inculcate good attitude in the learners towards the subject so as to make them ready to learn the subject.

Research in Kenya and outside on the students attitude towards science subjects has shown that girls generally have a negative attitude towards physical science and especially Physics. Comber and Keeves (1993) found that more female students register for Biology than for Physics. They also found that females have more positive attitude towards biological sciences than physical sciences, while the converse is true for boys. This attitude has affected the learning of Physics as girls' interests in Physics lessons, when Physics is made compulsory, are at their lowest. The consequences are poor achievement in examinations and low self-confidence in the subject. This partly explains why when there is an option of dropping Physics at any stage in education; most girls would drop the subject like hot coal. Twoli (1986) explains this difference that Biology deals with life processes to Physics that deals with non-life issues.

Researchers have found that the right hemisphere of boys brain matures faster and is larger than that of girls, while the left hemisphere of the brains of girls matures faster and is relatively larger than that of boys (Comber & Keeves, 1993). The right hemisphere of the brain is responsible for mathematical computation and spatial ability

i.e. thinking in three dimensions. Due to this factor, girls are slightly more disadvantaged than boys, thus requiring more practical approach of teaching than boys.

According to Eshiwani (1985), most girls in Kenya's secondary schools lack self-confidence in sciences, and especially in Physics. These variables i.e. attitude and self-confidence, are important for a students success in any subject. This is because learners who are sure that they can learn advanced materials are more likely to attempt to learn them and the more they attempt, the more likely they can learn them (Reyes & Padilla, 1985). Therefore, for girls to succeed in science in general, and Physics in particular, they need to have positive attitude towards science, positive self-confidence and self-determination.

2.8 Review Summary

The review was on global trends on factors influencing students' decisions to enrol in Physics, or not to, the current situation on enrolment and performance in Physics in secondary schools in Kenya, as well as other information available that has been written by previous researchers like Comber and Keeves (1993), Reyes and Padilla (1985), Eshiwani (1985), Voss (1981) and others, relating to student enrolment in Physics.

The review shows that science subjects are not compulsory in many countries in the world, especially in the final grade, but is taught up to at least year 10 (equivalent of the Kenyan form two) and confirms that indeed student enrolment in Physics in secondary schools is low whenever there is a choice between Physics and other science subjects

like Biology and Chemistry. In the Kenyan situation, student enrolment in Physics has been very low compared to Chemistry and Biology. No explanation was available for causes of the low enrolment in Physics, but they can only be inferred from poor performance. These causes may however not necessarily be assumed to be so without investigation, as causes of poor performance may not necessarily be enough causes for low enrolment, but probably just part of the reasons. It is however probable that the factors that contribute to students' poor performance in Physics could also lead to students low enrolment for subsequent years. The absence of explanations for low enrolment in Physics in comparison to Biology and Chemistry provides the gap that this study aimed at filling. Thus, the study explored the possible factors that repel students from Physics but push them towards Biology and Chemistry.

There is adequate literature showing the possible contributing factors to the problem of poor performance in Physics by students. The possibility of poor performance contributing to low enrolment was observed. However, in Garissa District, the enrolment is so low that it points to a possibility of other factors beyond poor performance and the factors experienced in other parts of the country, or a much worse situation of the same. Therefore, there is a gap of knowledge on the reasons for low students enrolment in Physics, as well as the gravity of the Physics enrolment situation with regard to the identified possible causes of poor performance. This necessitated the search for the causes of low enrolment in the specific setup, snd the level of gravity of the situation in the particular district compared to other parts of the country, that worsen the situation here. The reasons formed a basis for recommendations for action.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Introduction

This chapter discusses the procedure that was used in the study. It states the type of study that was carried out, the locale of the study, the target population and sample selection, research instruments that were used in the study, as well as the way the instruments were administered. It also explains how the data were organized and analysed.

3.2 Design of the Study

This study adopted a descriptive survey design. Descriptive survey designs are used in preliminary and exploratory studies to allow researchers to gather information, summarize, present and interpret them for the purpose of clarification (Orodho, 2004). Descriptive survey determines and reports the way things are (Gay, 1981). Further, this type of research also attempts to describe such things as possible behaviour, attitudes, values and characteristics of persons, a number of objects or events (Mugenda & Mugenda, 1999).

In view of the purpose of a descriptive research study, Good, (1983) notes that such a study design helps to secure evidence on existing situations and conditions and to identify standards or norms with which to compare, present and hence plan for a way forward. In addition, descriptive research studies help in formulating the next step to take from the current situation. Descriptive study also assists in collecting generalizable

information from any human population whether homogenous or heterogeneous (Robson, 1993).

Since the data about the main objectives of this study (low enrolment in Physics vis-a-vis Biology and Chemistry) do not exist (Orodho, 1996), descriptive survey design was the appropriate one as the study intended to look at the facts on the ground and report them as they were.

3.3 Locale of the Study

The study was undertaken in the Central Division of Garissa District. This location was chosen because, whereas enrolment in Physics in upper secondary school is low throughout the country, the situation in the entire North Eastern Province is extremely bad. The total number of students sitting for Physics in KCSE has never reached 6% of all the provincial candidature from 2001 to 2005, with the highest having been in 2005 in which 81 students (5.07%) sat for the subject. The situation is so bad that in some cases, all students in a district fail to register Physics candidates for the final examinations e.g. in Mandera District in 2001(NEP Examinations Office for 2001).

At the national level, the number of students who register for Physics in the entire North Eastern Province has stagnated at 0.08% to 0.12% of the national enrolment in Physics. Table 2.2 a and b and 2.5 depict these situations at the national and provincial levels. This scenario, therefore, means that whereas the Government may be addressing equity and efficiency issues in education in the entire country, this may not be achievable within the region. The region lags far behind the rest of the country and to bring it to the

same level with the rest of the country, the underlying issues responsible for the lag must be identified. The research study done in the region would help yield the reasons behind the trend in the region, and therefore recommend possible ways of containing it. Garissa District, being the closest district in North Eastern Province from Nairobi, was the most easily accessible to the researcher. This ease of accessibility of a study locale is in accordance to Singleton; Straits, and Mcallister (1988), who argue that the ideal setting for any study should be easily accessible to the researcher. Thus, Garissa District, being the most accessible district to the researcher among all the districts of North Eastern Province, was the ideal setting for this study. The following is a map of Garissa District, the district in which Central Division is located.

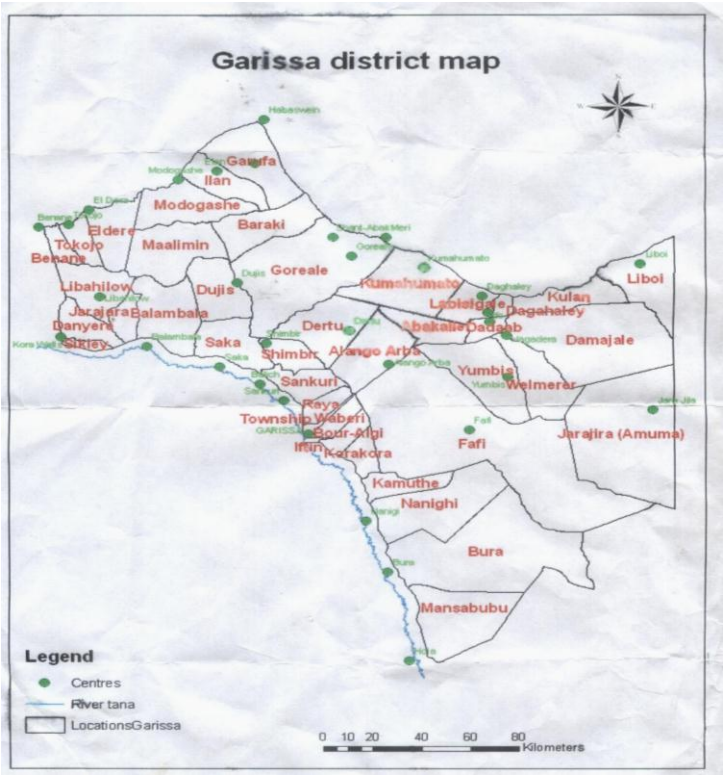

Figure 3.1: Garissa District Map

Source: Garissa District Development Plan, 2005

3.4 The Target Population

The target population in this study consisted of a total of 673 forms two and three students, all teachers of Physics, all heads of science departments and headteachers of the four selected secondary schools in Central Division, Garissa District. This was also the accessible population.

Form two students were selected because they were expected to be considering their science subject choices in the following year and were therefore expected to be in a position to state what they would like to opt for, and explain reasons for their decision. They could also explain the prevailing condition of learning Physics as compared to Biology and Chemistry. Form three students, on the other hand, were selected since they had just selected their preferred subjects, dropping Physics in the process (only students *not taking Physics* were selected). They were therefore in a good position to explain what prompted them into making the choices they made.

Teachers of Physics sometimes shape the perception and learning of Physics among the students in school. They were included in the sample to give the prevailing circumstances with regard to the teaching and learning of Physics. The heads of science departments were in the group as Physics falls directly under their charge, and their action is important during the learning of sciences as well as during the selection of science subjects. The headteachers of schools were selected because they are in charge of learning processes in school, including how subject selection should be conducted. Whatever students and/or teachers decide must be endorsed by the headteachers,

otherwise the teachers' or students' decisions would be in vain. Hence headteachers' view with regard to Physics is necessary.

3.5 Sample Selection Procedure

There were two main sampling units: schools and students. The targeted teacher respondents, being very few, were all included in the sample. Garissa Central Division had five secondary schools with students up to form four at the time of the study. All the targeted schools in the study were provincial schools and consisted of three boys schools and two girls schools. Four of these schools, including the two girls schools and two boys schools' were purposively selected for the study using proximity to the researcher as the only criteria for selection. This was necessary since one of the schools was located quite far from the town centre and could not be easily accessed. Purposive sampling allowed the researcher to consider the most accessible schools in which to carry out the study.

Of the four schools studied, the first two were boys schools while the other two were girls schools. The schools were given arbitrary identities A, B, C, and D corresponding with the order in which the schools were studied. The fifth school, being too far away from Garissa town, did not form part of the study sample. This was because to reach this school required a half-day's travel from Garissa town and several days' stay at the school's neighbourhood, yet the neighbourhood has no boarding facilities for visitors. A lot of expenses on hiring security and boarding services would have been required if this school was to be studied. Due to its inaccessibility, the school was excluded from the

study sample. As such, only the four schools within Central Division were included in the study.

As stated earlier, the targeted student population was 673 students. According to Gay (1987), for a descriptive research with small populations like the one in this study, 20% of the population is required (though 10% is the minimum for studies with large populations). In this study, a sample of at least 20% of the population, which is 135, was needed from the student population, i.e. from form two and form three students in the four secondary schools in Central Division of Garissa District. In form three, *only* those students *not registered* for Physics, who are usually over 90%, were considered for sampling. However, a sampling strategy that provided a higher figure than the 135 students was adopted. This was in order to take care of discrepancies that could arise during the study, such as in the case where many students avoided responding to an item in a questionnaire. As such, 30% of student population in each class was selected, considering only the students found in class on the day of the study.

Systematic random sampling procedure was used to get the required sample from the student population, using the class register of respective class streams. The procedure requires that the population to be sampled be arranged in some order, a sampling fraction, k, determined by dividing the population size by the required sample (Nwana, 1981). By picking on a position between 1 and k, subjects are selected after every k^{th} item in the group. For instance, suppose a sample of ten pupils is needed from a class population of 30 pupils. The sampling fraction becomes 3 i.e. (30÷10). Any student

occupying position 1 to 3 can be picked as the starting point, after which every 3rd student is selected. Systematic random sampling procedure was preferred given that students names are usually arranged in order by their roll numbers in the class registers. Where this was not the case or where registers could not be easily obtained, it was easy to create order by guiding the students in counting themselves in class. Using the roll numbers of students in the first stream in school A and with a sample fraction of three, the first student in the register was selected after which every third student in the roll was selected until the last student in the register. The selection therefore had the students in positions 1, 4, 7, 10 etc up to the last student who satisfied this criteria. The sampling fraction used in this study was 3 (i.e. 30% of students required, $100/30 \approx 3$).

The same metHoD was used in the second stream, except that this time the first student selected was student number two. The sample here was 2, 5, 8, 11 etc up to the last student in the register who satisfied this criterion. In the last stream, the selection started from the third student in the stream. This order depended on the class whose register became available first, and not necessarily that stream A had to be sampled first. The same procedure above was repeated in all the other three schools, thus yielding a student sample total of 223 students.

The other respondents - teachers of Physics, heads of science department and headteachers were not sampled as they were either one (school heads and heads of departments) or up to three (the highest number of teachers of Physics was three in two of the schools), and were therefore all taken. The sample size was as given in the following table.

Table 3.1: Summary of Students and Teachers in the Study

School	Total Population		Total Sample taken		Teachers of Physics	Head teachers	HoDs
	Form two	Form three	Form two	Form three	All Males		
A (Boys)	76	83	24	24	3	1	1
B (Boys)	124	101	39	36	3	1	1
C (Girls)	97	101	30	30	1	1	1
D (Girls)	49	42	20	20	2	1	1
Total	346	327	113	110	9	4	4

Source: Developed By the Researcher from the Sample Selection Plan

From Table 3.2, the total sample consisted of 223 students drawn from a student population of 673 students, nine teachers of Physics, four heads of science departments and four headteachers. The student sample had 100 girls (44.8%) drawn from the two girls schools, and 123 boys (55.2%) from the two boys schools.

3.6 Research Instruments

According to Kathuri et al (1993), interview schedules are the most suitable instruments for conducting research as they enable the researcher to get information without omissions or distortion of facts. However, when the study sample is large, it is difficult and very expensive to conduct interviews. Other metHoDs such as the use of questionnaires and focused group discussion become necessary. This is because questionnaire studies are generally much less expensive or time consuming, as they do not require specialised people to administer (Wiersma, 1985). Nkpa (1997) states that the use of questionnaires is a very popular metHoD of data collection in education and in behavioural sciences in general, due to the relative ease and cost effectiveness with which they are constructed and administered to large samples, while Walker (1985) observes that the use of questionnaires offers considerable advantages in administration,

and presents an even stimulus to large numbers of people simultaneously and provides the investigator with a relatively easy accumulation of data.

This study employed three types of instruments to collect data. These were questionnaires, interview schedules and focused group discussion guides. Interview schedules were used to obtain data from headteachers, heads of science departments and teachers of Physics. They were used because the investigation followed a rigid procedure seeking answers to a set of pre-conceived questions through personal interview (Orodho, 2004). Wiersma (1985) states that interview schedules have the advantage of being a flexible measurement device. It provides flexibility in that the interviewer can pursue the response with the individual and can ask for an elaboration or redefinition of the response if it appears incomplete or ambiguous. The response may also reveal factors or feelings the interviewer may choose to pursue and probe, or it may reveal things that would not be touched on in a questionnaire. The researcher developed two sets of interview schedules: one was used on headteachers while the other was used on both the head of science departments and the teachers of Physics under them.

To obtain data from students sample, the researcher used both questionnaires and focused group discussion (FGD) guides. The questionnaires were used to obtain mainly quantifiable data from both form two and form three students. As such, two types of questionnaires were developed i.e. questionnaires for form two and those for form three students. In form three, only those students *not registered for Physics* for examination in form four were interviewed. Students registered for Physics were not included in the

study since the study was to find out the reason why students drop Physics, yet those registered for Physics had not dropped and therefore could only explain why they opted for Physics. This, however, was not an objective of the study. Since the schools studied were all of homogenous type, it was easy to see the gender status of the respondents. This was necessary as it was possible that some of the factors that were investigated could be observed more on female students than on male students.

Focused group discussion guides were used to obtain information that required some elaboration, explanation or further probing from students. The focused group consisted of eight to twelve members who were interviewed collectively (Mwiria & Wamahiu, 1995). According to Mwiria and Wamahiu (1995), focused group discussions are best suited for obtaining data on group attitudes and perceptions. Since the study aimed at finding out why more students opt for Biology and Chemistry than Physics, which is related to attitude towards Physics and students' perception about the subject, FGD was the most suitable instrument. However, FGD may not give quantifiable data, hence there was need to administer questionnaires to the same students as well. The researcher constructed the focused group discussion guide to aid in asking questions to the students. Two sets of such discussion guides were constructed: one for form three students and the other for form two students. The form three students were required to give as many reasons as possible, which made them drop Physics after form two (*only* those students *not taking Physics* in form three were in this sample). On the other hand, the form two students were required to state the science subjects they would prefer to take after form two, and reasons for not taking Physics if so said. Both classes were

required, through a series of questions, to describe the circumstances surrounding the teaching and learning of Physics in their school. For every question, the responses were agreed upon by consensus among the respondents, through the guide of the researcher.

3.7 Piloting of Research Instruments

To ensure validity and reliability of the questionnaires developed, a pilot study was carried out on them. Piloting involves the administration of research instruments to subjects that are similar in all aspects, to the subjects that will be eventually studied. The pilot subjects should be within the same environment as the actual study subjects. The research instruments are then adjusted according to how the pilot subjects responded, whether they responded according to the intentions of the questions, or if the questions appeared unclear and thereby misleading the respondents. The instruments used in this study were piloted in a school in Garissa Central Division that at the time had students up to form three only. This school was then omitted from the sample during the actual study. The instruments were administered personally by the researcher himself.

Piloting assists in determining ambiguities in the questionnaire items and also determines whether the instrument would elicit the type of data anticipated as well as to lead to a meaningful analysis of the final data to be collected. Piloting is, therefore, performed to enable necessary adjustments to be done on the parts of the questionnaires that appear ambiguous to the respondents. Ambiguous questions were revisited and adjusted accordingly.

3.7.1 Validity of Instrument

According to Gay (1981), validity refers to the degree to which an instrument measures what it is supposed to measure for a particular purpose and a particular group. The instruments in this study were expected to find out reasons that make students drop Physics when they move from form two to form three. The reasons were sought from both teachers and learners of Physics. For the instruments to be valid, each of the instruments was expected to ask questions whose response could form a reason that affects the teaching and learning of Physics. The instruments for this study were therefore validated through application of content validity, which is determined by expert judgement. Gay (1992) identified that content validity is a matter of judgement by the researcher and professionals, and has no specific formula for determination. This study established validity of the instruments first by seeking views of lecturers who are not the researcher's supervisors, as well as by seeking expert advice through discussions with researcher's supervisors, observations, comments and suggestions by the same.

3.7.2 Reliability of Instruments

Reliability refers to the degree to which an instrument consistently measures whatever it is meant to measure, and is expressed numerically, usually as a coefficient (Gay, 1981). Split-half coefficient of internal consistency and correlation of Spearman Brown Prophecy Formula was applied to calculate the coefficient to determine the reliability of the instruments (Gay, ibid). Split-half is a type of reliability based on the coefficient of internal consistency of a research instrument. It divides the instrument into two equal comparable halves, in terms of even and odd numbers after it has been administered. In

this study, split-half technique of correlation was applied for the respondents separately, whose formula is:

$$R_{\text{total test}} = \frac{2r_{\text{split half}}}{1+r_{\text{split half}}}$$

Each student's scores were ranked. The scores for even and odd numbered items were then added separately for the two sets of responses. A reliability value of .82 and .84 was obtained for form three and form two students questionnaires, giving an average reliability coefficient of .83. This value of the reliability coefficient was considered good enough for this study as explained by Gay (1992).

3.8 MetHoD of Data Collection

To collect the data from the field, the researcher obtained a letter of introduction from the department and used it to obtain a research permit from the Ministry of Education. The researcher then went to the field of interest, which were four schools in Garissa Central Division. The researcher went to the selected schools, notified the administration of his intentions and requirements, then made appointments for the day he was to conduct the study, especially on students. The researcher administered the instruments personally to the subjects as he could not afford a research assistant due to his financial limitations.

To obtain information from the students, the researcher gathered all the form three and form two students sample students in one class and administered respective questionnaires to all of them. The sample was then split into their respective classes

(form two students separated from form three students) then divided the sampled students from each of the classes into groups of eight to twelve participants in accordance with the requirements of data collection by FGD (Mwiria & Wamahiu, 1995), depending on the sample size in each of the schools and classes. Thus, for each sample of students from each class, the sample was divided into two groups and the two groups interviewed separately. For example, if in one class in a given school the sample, say, of form two was 21 or 16 (for triple and double streamed schools), the sample was divided into two groups of 10 and 11 for a sample of 21 students, and two groups with eight students each for a sample of 16 students. The two groups were then interviewed separately, but each group asked the same set of questions. The researcher ensured that the two groups from the same classes in a given school were interviewed on the same day and within a short span of time between the two discussions. Meanwhile, the researcher interviewed the teachers and administrators on the same days on which he collected information from the students, but at different times. The teachers were interviewed individually whenever they were available, while the students had to be interviewed during their out of class periods, that is, just after lunch or in the evening after classes.

3.9 Data Analysis

The study employed descriptive statistical techniques to analyse quantitative data obtained from the study (Nwana, 1981). That is, their mean, median and mode were found where possible. A table of frequency distribution was prepared whenever the data necessitated, and percentage occurrence of each of the responses to a particular question

calculated. Qualitative data were analysed by thematic and content analysis (Orodho, 2005). This entailed an analysis of the main themes found in the study as well as the analysis of the contents within the themes present. The results were then tabulated and graphs drawn from the data for ease of interpretation so as to easily visualize the various results as given by the respondents. Excel computer programme was used to generate graphs that were used for data presentation (UNESCO, 2005). Finally, triangulation of the responses given by the various respondents was performed - responses on similar themes or objectives, emanating from different respondents were compared to find if the various respondents concurred on various issues or not, and if not, the possible reasons for the observed discrepancies. The most common responses were, therefore, considered to be the most prevalent in determining the enrolment of students in Physics. All these analyses procedures were then followed by a discussion of each particular item in the questionnaire in view of the responses given by the respondents. The discussions were along the research questions that were formulated from the objectives of the study.

CHAPTER FOUR

DATA ANALYSIS, PRESENTATION AND DISCUSSION OF FINDINGS

4.1 Introduction

This chapter presents the findings of the study by analysis. The findings are reported according to the research questions that were formulated from the objectives of the study. The analysis was done by considering each of the research questions, giving the results of the study on that particular question and then discussing the results. The study employed descriptive statistics to analyse quantitative (numeric) data obtained from the study. The mean and mode of the data were determined, tables of frequency distributions prepared and the percentage occurrence of each of the responses to particular questions calculated and presented. Qualitative data were analysed by thematic analysis - an analysis of the themes found in the study, and by the analysis of the contents within the themes presented (content analysis). The results are tabulated for ease of interpretation and visualization. Finally, triangulation of the responses given by the various respondents is performed - responses on similar themes or questions, emanating from different respondents were compared to find if the various respondents concur on various issues, such as whether there is any compulsory science subject in the school or not, and if not, the possible reasons for the observed discrepancies. Where possible, the results are presented in the form of figures on the respective themes, in which graphs of various forms are used for the presentation.

4.2 Effect of Students Performance Profile on Physics Enrolment

The first research question was: What effect does the previous students' performance profile in Physics have in determining the number of students who register for Physics in succeeding years? This question was discussed by all the respondents - forms two and three students, the teachers of Physics as well as the school headteachers.

According to the students, performance profile was one of the major reasons for dropping Physics. There was a consensus that the results of the previous Physics students were always poor, an indication that even if the current students registered for it, theirs would not be any different from those of the previous students. To the students, opting for Physics was a sure way of failing in the subject in particular, and the entire examination in general. Therefore, the students who "dared" register for Physics only took it as their eighth subject (note that the minimum number of subjects for KCSE registration is seven, the eighth one therefore is just an additional subject that has no effect on overall performance if failed, but significant if passed). The following Table 4.1 gives students performance profile in Physics for the years 2002 - 2005, compared to performance in its competing subjects i.e. Biology and Chemistry in school A. The schools have been coded as schools A, B, C and D in order to maintain anonymity.

Table 4.1: Students Performance Profile in Science Subjects for School A, 2002-2005

			G R A D E S														
	Subject	**Entry**	**A**	**A-**	**B+**	**B**	**B-**	**C+**	**C**	**C-**	**D+**	**D**	**D-**	**E**	**X/Y**	**M.S**	**M.G**
	Phys	13	-	-	-	1	-	1	-	2	-	2	6	-	1	3.7	D+
2002	Chem.	83	2	1	-	-	2	3	4	6	11	17	26	9	2	3.5	D
	Bio	70	-	1	-	2	2	7	3	5	4	23	15	7	1	3.8	D+
	Phys	6	-	-	-	-	1	1	1	-	1	-	2	-	-	4.8	C-
2003	Chem.	106	-	1	2	1	3	3	1	2	2	30	32	27	1	2.8	D
	Bio	103	-	1	2	3	8	3	12	13	8	27	22	3	1	4.3	D+
	Phys	3	-	1	-	-	-	-	-	-	1	-	-	1	-	4.8	C-
2004	Chem.	115	-	1	-	2	2	2	8	5	12	22	34	27	-	2.7	D
	Bio	114	1	3	6	10	8	7	6	9	7	18	13	26	-	4.3	D+
	Phys	7	-	-	-	-	1	-	-	-	1	1	4	-	-	2.1	D-
2005	Chem.	114	1	-	-	-	2	4	4	4	7	19	41	33	-	2.6	D
	Bio	115	-	2	2	5	9	7	9	19	14	25	14	6	-	4.5	C-

Source: NEP Examinations Office, 2002; 2003; 2004; 2005; 2006

School A depicted in Table 4.1 was a boys school. From Table 4.1, Physics was in the first place registered for by very few students in school A: 13, 6, 3 and 7 from 2000 – 2005. In 2002, whereas performance in both Biology and Chemistry started from A and A-, that of Physics started from grade B, with the highest concentration of students being at grades D (2 students) and D- (6 students). The situation deteriorated further in 2003 where Physics grades started from B- (1 student), while two students scored D-. Both Chemistry and Biology scores started from A- in the same year. In 2004, only three students registered for Physics, out of which two passed with grades A- and D+, while the third got grade E. Chemistry grades started from A- while Biology started from grade A plain. In school A, it was clear from the headteacher, the head of science department, the subject teachers as well as the students that previous performance in

Physics was relatively poor compared to Biology and Chemistry. In fact, the students in form two stressed that they would only take Physics after selecting their first seven subjects, then add Physics so that even if they failed it, it would not have much effect on their overall grade. When it was pointed out by the researcher to the subject teachers and the headteacher (separately) that the mean grades in Physics for all the years in which the results were available were always a pass grade and almost always above the mean grade in both Biology and Chemistry, both teachers and the headteacher explained that high mean grades had almost no effect on students views on the subject. This is because, according to the teachers, the students see the grades at individual level since they look at their performance individually and not jointly. In fact, most students do not even consider subject mean grades, but personal performance in the subject. Besides ignoring the mean grades in many cases, it is only a handful of students who may just have scored average grades, who end up raising the mean grade due to the few number of students enrolling in the subject. A good example of this is the case of three students who sat for Physics in 2004, with one getting grade A-, the other D+ while one got E. The two who passed raised the mean grade to C-.

The situation depicted in school A was not an isolated case since similar results were found in the other schools. The following Table 4.2 shows performance profile in science subjects in school B.

Table 4.2: Students Performance Profile in Science Subjects in School B, 2002-2005

					G	R	A	D	E	S							
Year	**Subject**	**Entry**	**A**	**A-**	**B+**	**B**	**B-**	**C+**	**C**	**C-**	**D+**	**D**	**D-**	**E**	**X/Y**	**M.S**	**M.G**
	Phys	9	-	-	-	-	1	-	2	-	3	2	1	-	-	4.4	D+
2002	Chem.	111	-	-	2	4	5	11	10	7	6	21	32	11	2	4	D+
	Bio	111	-	-	4	5	8	12	9	10	14	23	16	8	2	4.6	C-
	Phys	10	-	1	-	2	2	1	1	1	-	2	-	-	-	6.9	C+
2003	Chem.	107	5	-	1	6	6	5	9	5	7	18	25	14	2	4.5	D+
	Bio	107	1	2	6	8	13	8	10	7	9	22	12	6	3	5.1	C-
	Phys	14	-	-	1	-	1	4	2	3	1	1	-	1	-	5.8	C
2004	Chem.	115	1	2	2	2	8	14	11	9	18	24	21	4	-	4.5	D+
	Bio	115	3	5	21	18	11	15	8	9	3	15	7	-	-	5.1	C-
	Phys	8	-	-	-	-	4	1	1	-	-	2	-	-	-	6.6	C+
2005	Chem.	116	1	1	2	3	8	4	12	11	8	27	30	9	-	4.1	D+
	Bio	116	8	11	12	12	15	12	5	17	3	11	7	3	-	7.1	C+

Source: NEP Examinations Office, 2002; 2003; 2004; 2005; 2006

Table 4.2 has a similar scenario with that depicted in Table 4.1 for school A. Like school A, school B was a boys school. The number of registered students in Physics is low; Physics grades start below those of Chemistry and Biology in all the years, but the Physics mean grade is better than, or equal to those of Biology and Chemistry. The good mean grades in Physics here could not attract more students for the same reasons found in school A. That is, the students look at the individual performance rather than the general performance. In fact, by the time the results are released to the students in school, the subject mean grades are not there. They are calculated much later by the subject teachers and forwarded to the heads of Department for onward transmission to the headteacher's office for compilation. By the time the process is fully completed, the students have no further interest in the examination results, as they already know what they wanted to know- the performance by previous students. Therefore, subjects' mean grades have almost no role to play in determining the enrolment in the subject in subsequent years.

It was found from both teachers and the headteacher that the students from this school who opted for Physics were those who were good in Mathematics. This gave the other students a message that only those who performed well in Mathematics could register for Physics. Given that many students in the particular school were not sure of their position in Mathematics, they tended to opt for the other science subjects (Biology and Chemistry) rather than register for Physics that was so related to Mathematics. This situation was even graver in the two girls schools studied, as depicted in the following Table 4.3 for school C.

Table 4.3: Students Performance Profile in Science Subjects in School C, 2002-2005

Year	Subject	Entry	Grades														
			A	A-	B+	B	B-	C+	C	C-	D+	D	D-	E	X/Y	M.S	M.G
	Phys	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
2002	Chem.	66	-	1	2	1	1	-	2	4	2	15	29	9	-	3	D
	Bio	66	-	1	1	2	2	7	2	5	8	18	14	6	-	4	D+
	Phys	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2003	Chem.	90	-	-	-	-	1	2	4	4	8	16	38	16	1	2.6	D
	Bio	90	-	-	-	1	4	7	10	12	13	23	16	3	1	4.1	D+
	Phys	**4**	**-**	**-**	**-**	**-**	**-**	**-**	**1**	**1**	**-**	**2**	**-**	**-**	**-**	**4.3**	**D+**
2004	Chem.	89	-	-	-	-	2	2	3	4	8	25	37	9	-	2.6	D
	Bio	72	-	2	1	6	8	5	8	13	8	8	9	4	-	4.1	D+
	Phys	**7**	**-**	**-**	**-**	**1**	**-**	**-**	**-**	**1**	**-**	**4**	**1**	**-**	**-**	**4**	**D+**
2005	Chem.	82	1	-	1	3	6	3	10	3	24	14	1	-	-	3.3	D
	Bio	83	3	4	3	5	3	6	8	11	6	24	10	-	1	5.3	C-

Source: NEP Examinations Office, 2002; 2003; 2004; 2005; 2006

Table 4.3 has rather peculiar information. It presents the performance profile of one of the girls schools in the study, school C. In the first place, the school had just a few students registered for Physics in only two of the years, 2004 and 2005. Second, Physics grades started much lower than those of Chemistry and Biology. The grades started from C in 2004 while those of Chemistry and Biology started form grades B- and A-

respectively. Out of the four students who registered for Physics in 2004, two passed with grades C and C- (which are moderate passes), while two failed, both getting grade D plain. In 2005, seven students registered for the subject, out of which one scored a B plain, another got C-, four got D plain while the last scored D-. Though the mean grade was D+, in the students view, five out of the seven Physics students failed, an indication of surety of failure should one attempt to opt for Physics. Hence the majority of students are discouraged from opting for it. This scenario actually discouraged other students from registering in the subject.

The situation in the other girls school, school D, was even worse. The following Table 4.4 shows the situation of school D, the second girls school in the study.

Table 4.4: Students Performance Profile in Science Subjects in School D, 2002-2005

			Grades														
Year	**Subject**	**Entry**	**A**	**A-**	**B+**	**B**	**B-**	**C+**	**C**	**C-**	**D+**	**D**	**D-**	**E**	**X/Y**	**M.S**	**M.G**
	Phys	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
2002	Chem.	77	-	-	-	-	1	2	2	4	4	18	30	16	1	2.3	D
	Bio	77	-	-	-	-	-	3	5	8	5	18	21	15	-	3.1	D+
	Phys	4	-	-	-	-	-	-	-	-	-	-	2	2	-	1.5	D-
2003	Chem.	60	-	-	-	-	-	-	-	2	4	7	24	21	2	1.9	D-
	Bio	62	-	-	-	-	-	-	1	1	6	27	17	8	2	2.6	D
	Phys	Not graded due to examination irregularity in this year.															
2004	Chem.	Not graded due to examination irregularity in this year.															
	Bio	Not graded due to examination irregularity in this year.															
	Phys	2	-	-	-	-	-	-	-	1	-	1	-	-	-	3	D
2005	Chem.	95	-	-	1	-	1	1	5	1	2	14	41	29	-	2.3	D-
	Bio	93	-	-	-	2	1	-	7	8	10	27	23	9	-	3.1	D-

Source: NEP Examinations Office, 2002; 2003; 2004; 2005; 2006

From Table 4.4, we notice that school D had no student registered for Physics in 2002. It however registered four students in Physics in 2003. All these students failed in the subject, with two of them getting grade D- while the other two got grade E, a total

failure. These results would repel any would-be student who hoped to attempt the subject. In this school, both the individual grades as well as the mean grades discourage students from the subject. According to the students from this particular school, the performance in the subject by previous students discouraged them from registering in it as most of those who tried previously ended up failing. However, the few (in form two) who still hoped to register in Physics specifically stated that they would only register for it after completing their compulsory seven subject slots, then register for Physics as an extra eighth subject. The number of students enrolling in Physics in the two girls schools confirms that indeed the number of female students enrolling for Physics is much lower than that of boys, where school C had four, seven or none, while school D had two, four or none.

The current number of students who registered for Physics in forms three and four in the schools studied varied from school to school. Some schools showed an improvement in enrolment, while others stagnated, or retarded further. This information is provided in the following Table 4.5.

Table 4.5: Current Physics Enrolment in Form Three and Four in the Four Schools, 2006

School	Type of school	2005 KCSE enrolment	2006 Form four	Percentage change	2006 Form three	Percentage change
A	Boys	7	5	-28.6	18	260
B	Boys	8	19	137.5	25	31.6
C	Girls	7	8	14.3	4	-50
D	Girls	2	2	0	0	-100

From Table 4.5, it can be seen that, although the Physics enrolment is still low, there is some improvement especially in schools A and B, which are both boys schools. School C seems to have some improvement as well especially in form four, though at a lower percentage. However, the fact that there is improvement in these cases cannot be ignored. The two girls schools still have a fluctuating tendency, though school C is achieving some form of stability. The school with a major problem in Physics was school D where the Physics candidature is retarding further, with no student in form three currently taking Physics. The performance profile may have contributed to this situation considering that in the results shown in Table 4.4 for 2003, all the four students registered for Physics failed, while in 2005, of the two students who registered for Physics, one passed while the other failed. It is, therefore, possible that this drastically affected subsequent students' views of Physics.

The information from Tables 4.1 to 4.4, and corroborated by both students and teachers, confirmed that indeed subject (Physics in this case) performance profile greatly affect the number of students enrolling for it. The poor performance in the subject by the few who enrolled in it would discourage any would-be student in any subject. In the case of Physics in the study locale, the performance profile has a negative effect since in any one year, the number of students who failed is more than those who passed. Although this is also true of the other subjects with which Physics compete (Biology and Chemistry), the situation in the latter two was not as conspicuous as there are still many other students who pass in the two subjects. A student would therefore consider himself/herself in the category of the students who passed the subjects (Biology and

Chemistry), and therefore opted for them rather than Physics where only very few or none passed. Besides, the student has no choice but to register for at least two out of the three subjects. The student therefore registers for subjects that appear to be "the lesser devil". Thus, Physics performance profile reduces the number of students opting for Physics. However, the improvement in enrolment in the first two schools in Table 4.5 can be attributed to the fair performance in Physics as seen from the mean grades of Physics in the years considered. It is not obvious that all the students who registered for Physics in form three would end up registering for it in form four as some may still drop it considering that all those registered for Physics in the four schools took it as an eighth subject.

The extent to which school performance profile affected student enrolment in Physics was examined on both students and teachers. Form two students were asked to list down the subjects that they would like to drop after form two, while form three students (*not registered* for Physics) were asked to give reasons why they dropped Physics. Students who stated that they would like to drop Physics were further asked to give reasons for dropping Physics and not any other subject. Since this study was concerned with the reasons for dropping it, only questionnaires in which the subject to be dropped was identified as Physics were considered for the following analysis. From Table 4.6, 68 form two students stated that they would like to drop Physics, while a total of 44 would like to retain it either through taking all the three science subjects, or by dropping one of either Biology or Chemistry. These 68 students were the only ones whose questionnaires qualified for further analysis regarding why they would like to drop

Physics. Since the responses from both form three and form two students revolved around the same issues, the analysis of the responses on this question was done together for 68 forms two and 113 form three students. The following table represents all the reasons given by both form three and form two students for choosing to drop Physics (form two students), or for dropping Physics (form three students). The total number of questionnaires that remained for this analysis, after removing the 44 form two students who opted to retain Physics in forms three and four were 181.

Table 4.6: Students Reasons for Not Taking Physics

S/no.	Reason	Number of students	Percentage
1.	Poor performance by self/previous students	156	86.2
2.	Too much Mathematics	134	74
3.	Physics selected with Geo/Hist/Com;	95	52.5
4.	Discouragement by various people	83	45.9
5.	Bio/Chem compulsory/Physics optional	81	44.8
6.	Fewer practical compared to Bio/Chem	68	37.6
7.	Syllabus not covered	59	32.6
8.	Not handling equipments in the lab	54	29.8
9.	Problem with taking notes	48	26.5
10.	Physics is difficult compared to Bio/Chem	35	19.3
11.	Career not Physics related	24	13.3
12.	There is only one teacher in the school	15	8.3

The information in Table 4.6 is expressed graphically in the following Figure 4.1 for ease of interpretation:

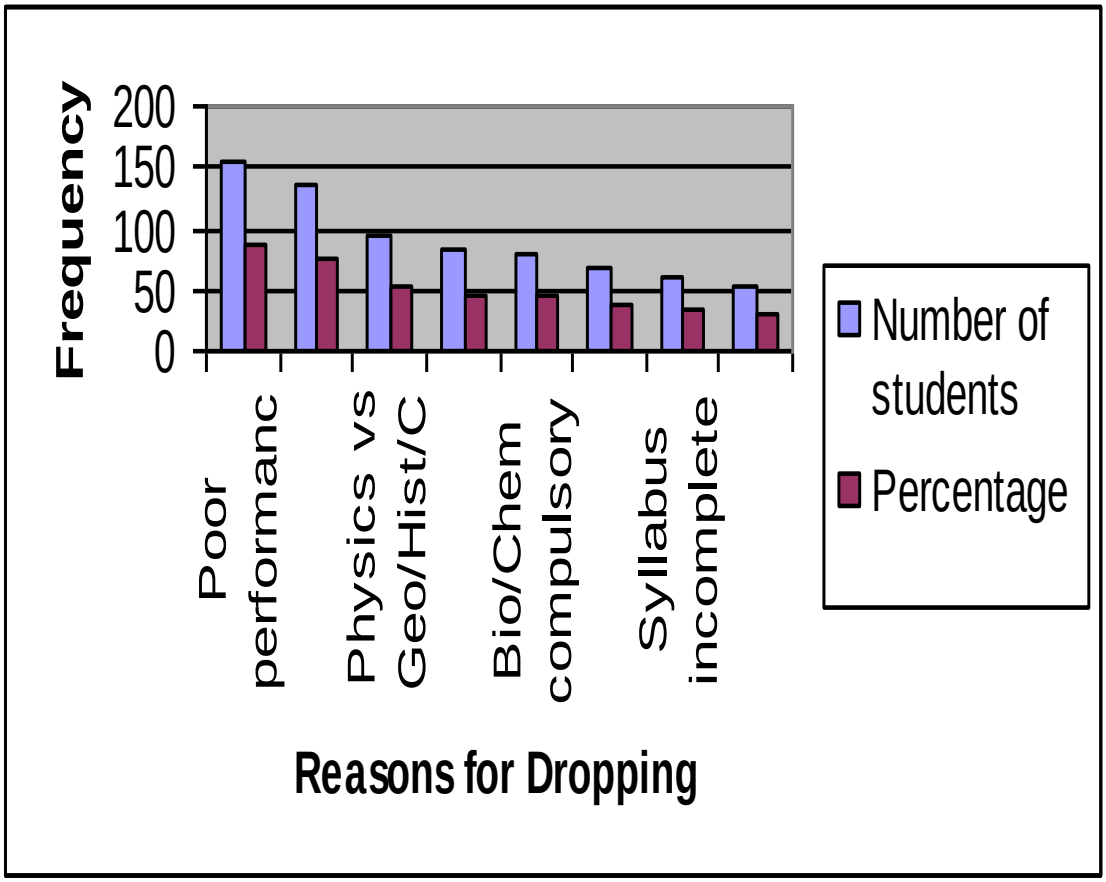

Figure 4.1: Students Reasons for Not Taking Physics

As seen from Table 4.6 and Figure 4.1, the single most prevalent reason for students dropping Physics was poor performance in the subject, identified by 86.2% of the respondents. Performance, according to the students' responses, had an effect in two ways- performance by previous students as reflected by KCSE results, and performance in class by the responding student himself/herself. Since these two are closely related, the two were put together for the purpose of analysis and ended up as the main reason for students dropping of Physics.

Teachers of Physics also identified performance by previous students as one of the main reasons for students opting out of Physics. This reason was second to the belief by

students that Physics is hard (in the teachers' view). The reasons for low enrolment, identified by teachers, are given in the following Table 4.7.

Table 4.7: Teachers' Views for Low Enrolment in Physics

S/no.	Reason	Frequency	Percentage
1.	Difficulty to students	8	88.8
2.	Poor performance by previous students	4	44.4
3.	Has a lot of calculations, students fear Mathematics	3	33.3
4.	Poor students attitude	3	33.3
5.	Selection criteria that has Chem & Bio compulsory	3	33.3
6.	Grouping with humanities during selection	2	22.2
7.	Students discouraged by non-Teachers of Physics	2	22.2
8.	Peer influence	1	11.1

The reasons in Table 4.7 are presented in the following Figure 4.2 for comparison purposes.

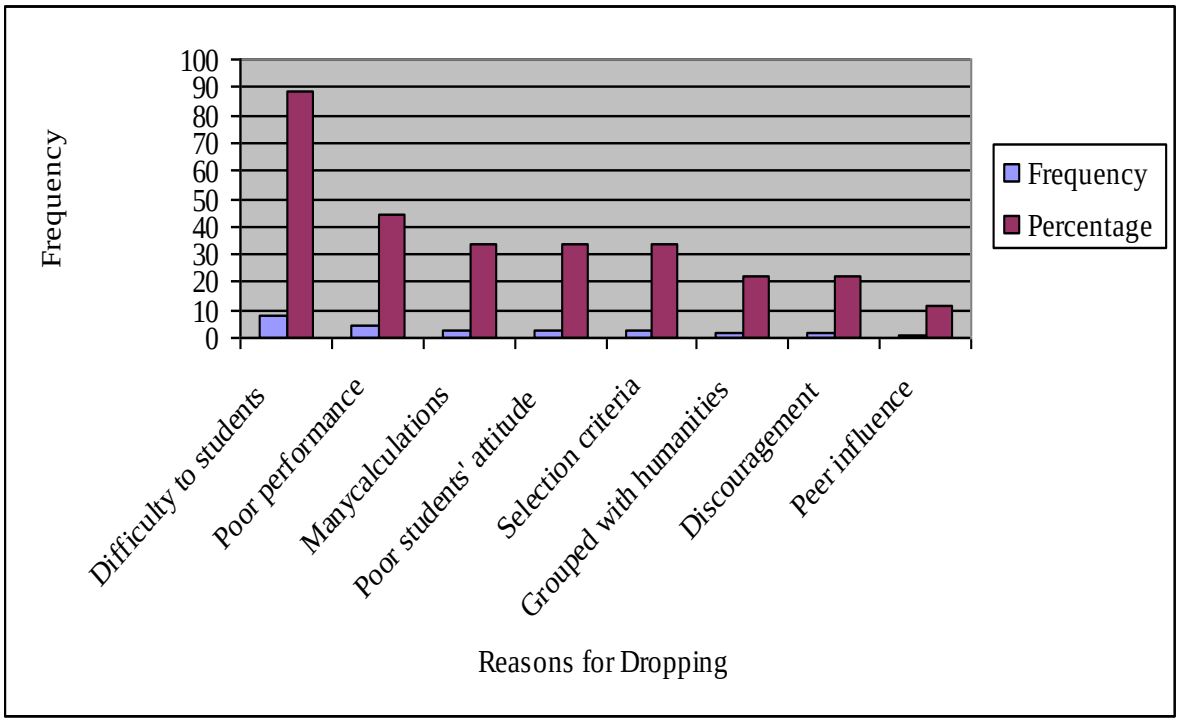

Figure 4.2: Teachers' Views for Low Enrolment in Physics

From the Table 4.7 and Figure 4.2, it can be seen that poor performance was the next major reason given for low enrolment in Physics, after the difficulty nature of the subject (according to the teachers). This response was given by 4 teachers (44.4%), who agreed with the students opinion, which put performance as the number one reason for opting out. A total of 186 students (86.2%) gave performance as the reason for dropping Physics. From Table 4.7, it emerges that in the teachers' views, the main cause of low enrolment in Physics is the belief by students that Physics is a hard subject. This response was given by almost all the teachers interviewed, i.e. eight out of the nine teachers (88.8%). This was however contrary to the students view, in which the difficulty in Physics as a reason for not choosing Physics was rated 10th, with only 35 students (19.3%) giving this as the reason for dropping Physics. This implies that teachers already believe that students fear Physics because it is difficult, yet this is not a major reason. This teacher-belief may therefore affect the way they teach since they might not put much effort on the teaching process, assuming that the students already fear the subject.

Despite the discrepancy between students and teachers in terms of the major reason for dropping Physics, an aggregation of the reasons for low enrolment by the students and teachers showed that poor performance was the main reason for low enrolment. The following table, produced from Tables 4.6 and 4.7, present these results together with the percentage of each category of respondents that gave this as a reason for students not registering in the subject.

Table 4.8: Reasons Given By Students and Teachers for Students Dropping Physics

S/no.	Reason	% of Teachers	% of Students	Average Percentage
1.	Poor performance	44.4	88.1	66.25
2.	Too much Mathematics	33.3	75.7	54.5
3.	Grouping with humanities	22.2	53.6	37.9
4.	Bio/Chem compulsory, Physics optional	33.3	45.8	39.55
5.	Physics more difficult than Bio/Chem	88.8	19.8	54.3
6.	Discouragement by various people	22.2	46.9	34.55

The results on Table 4.8 on students' and teachers' reasons for dropping Physics are presented in the following Figure 4.3.

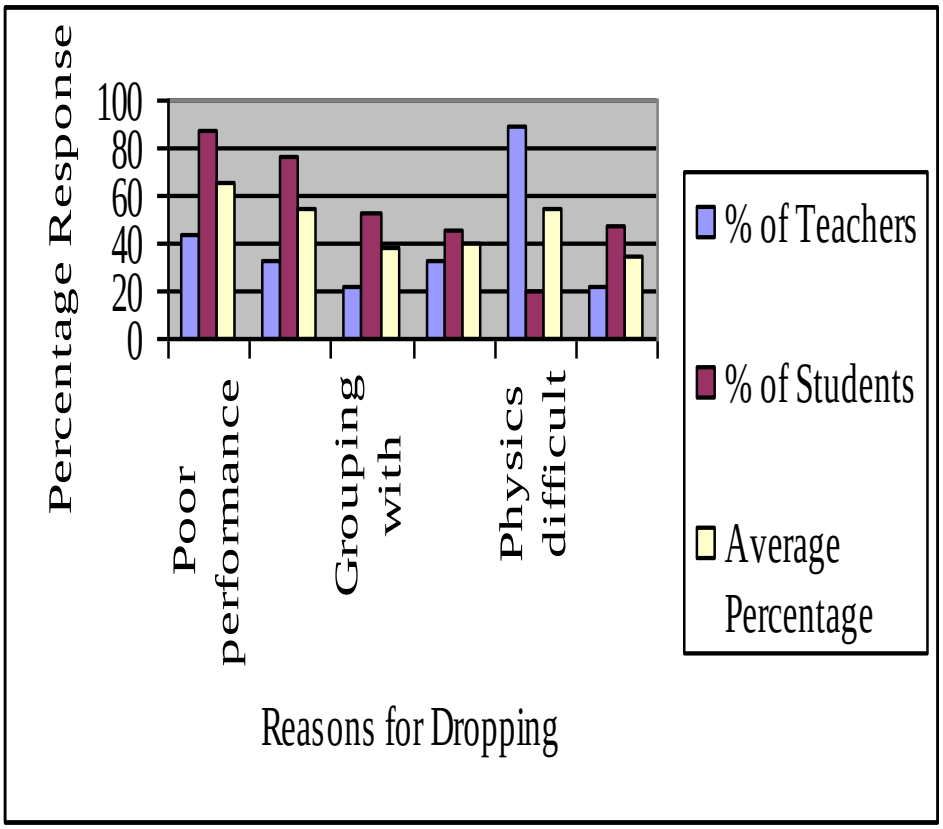

Figure 4.3: Students and Teachers' Reasons for Students Dropping Physics

From Table 4.8 and Figure 4.3, it can be seen that whereas to the students, poor performance is the main reason for dropping Physics, teachers have the view that the students perception of Physics as being difficult is the major reason for dropping Physics. The difficulty of the subject, according to the students, is the least important reason for their dropping of Physics. The previous performance in a subject emerges as the most important reason for dropping Physics, with a combined average percentage of 66.25%. Thus, the previous performance in Physics is a major cause of low enrolment in the subject.

4.3 Effect of the Characteristics of Teachers of Physics on Students Enrolment in Physics

The second research question was: In what ways do teachers of Physics' characteristics affect the number of students enrolling for Physics in forms three and four? The teachers of Physics' characteristics looked at in this question included the teacher's qualification, age, availability, experience, duration of work in the current station, the level of business in the school (measured by the number of lessons per week and other responsibilities the teacher has), as well as the level of teacher interaction with the students in relation to the subject. Under the level of teacher interaction, such things like teacher encouragement to the student or lack of it, teacher's concern and follow-up on students progress as well as the teacher's initiative to ensure that the students understood the Physics itself, its importance in the world of employment and general application and hence the need to register for it, even if it is just as the eighth subject, were investigated. Information emanating from this question is discussed below.

A total of nine teachers of Physics were found in the four schools studied. Schools A and B had three teachers each, designated as numbers 1, 2 and 3, school C had just one teacher, while school D had two teachers. The teachers' ages ranged from 25 to 45 years. It is important to note that all teachers of Physics were male in all the schools studied. The information on these teachers' qualifications, age and experience are given in the following Table 4.9.

Table 4.9: Demographic Information on Teachers of Physics

School	Teacher no.	Age bracket	Period at station	Qualification	Experience	No. of lessons/wk.	Responsibility
A	1	40-45	17 years	B.Ed	17 years	25	HoD
	2	35-40	5years	B.Ed	5 years	22	None
	3	35-40	5 months	B.Ed	8years	24	None
B	1	35-40	9 years	Dip.Ed	9 years	16	HoD
	2	35-40	8 years	B.Sc.+ PGDE	8 years	24	None
	3	25-30	3 years	Dip.Ed	3 years	20	None
C	1	30-35	4 years	Dip.Ed	4 years	28	HoD
D	1	40-45	15 years	Dip. Ed	15years	12	HoD
	2	35-40	3 years	Dip.Ed	10 years	22	None

From Table 4.9, it is evident that all the teachers were trained with at least the minimum academic qualifications for a secondary school teacher, i.e. Diploma in Education. In fact, of the five teachers with diploma, three were already pursuing degree courses during school holidays. All the teachers of Physics had at least three years experience, with only one of the teachers having been transferred to the current station five months earlier.

The Physics teaching force in all the schools studied was found to be fair and satisfactory. Two of the schools had three teachers of Physics; one had two while

another had one teacher of Physics who was also the head of science department. The total number of lessons per week per teacher ranged from 12 to 16 for HoDs, and 24 to 28 for the other teachers (except for the only teacher of Physics in school C, who was also the departmental head, with 28 lessons). The lesson distribution was therefore seen as fair and could not be said to contribute to low enrolment of students in Physics in upper classes. But there was a case where a teacher of Physics who was also the head of science department had only 12 lessons while his fellow teacher of Physics colleague had 22 lessons per week, a rather disproportionate distribution. As such, the teacher availability, at the time of the research, was not an issue of concern, save for one school (school C), which had only one teacher of Physics with a total of 28 lessons. However, the headteacher of schools A and B stated that lack of teachers of Physics had been a major problem in the previous three years, which could have spilled over to the students currently in form four as they may not have had a good foundation in Physics in forms one and two. But in general, teacher of Physics availability was not a problem at the time.

According to the headteachers and heads of science departments, there has been no problem with teacher availability, at least in the last four years. This was even evident from the interview with the teachers, where it was found that most teachers had been in the same station for at least three years. There was only one exception where a teacher had served for just five months in the current station. However, in the said case, there had been two other teachers of Physics in the same school; therefore the students here were well catered for in Physics.

Although the teachers' ages varied from 25 to 45 years, from the interview with the headteachers, heads of science departments and students, there was no evidence that the teachers' ages had any effect on the their performance in class, and therefore on students enrolment in Physics in form three and four. The students generally viewed the teachers as they are, and there was no time at which they viewed the teacher by age.

From the above discussion, there was no evidence to link teacher qualification, age, availability (teachers were always available), experience, duration of work in the current station, and the level of business in the school (measured by the number of lessons per week, and other responsibilities the teacher had, which were all fair) with students enrolment in Physics. However there were evidences that linked the level of teacher interaction with the students (teacher encouragement to the student or lack of it, teacher's concern and follow-up on students progress, as well as the teacher's initiative to ensure that the students understood Physics well, its importance in the world of employment and general application and hence the need to register for it, even if it is just as the eighth subject) with students enrolment in Physics.

It was found that where the teacher was actively involved in encouraging the students to pursue Physics, the students were more willing to register for the subject. Such teachers were even found to be involved in advising and encouraging the students even during subject selection period. These teachers were found to be particularly interested in the progress of their subject, a situation that appeared to be replicated in their own students in the current classes. A look at the previous enrolment in the subject showed

progressive increase in enrolment, an indication that the teacher involvement was the major contributing factor to this trend. This particular scenario was found in school C, where both the subject teacher and the students separately confirmed the teacher's personal concern for the subject. The teacher was involved in all issues to do with the subject, and took personal initiative to ensure that those students who wanted to register for Physics were not negatively influenced. The results of the teacher's efforts could be directly observed from the increase in Physics enrolment in the current classes. In this school, eight students had registered for Physics in form four, while form three had four students. Previously, there used to be a maximum of four students in either form three or form four, but not in both classes at any one time. That is, Physics enrolment in form four used to alternate: a few students (two or three) in one year, then none in the following year. The major improvement was that the school now has Physics students in both form four and form three at the same time, with eight in form four and four in form three, a major improvement where both form three and form four classes had Physics students.

As opposed to the situation where the teacher of Physics was close to his students and was actively involved in encouraging students to pursue Physics, a circumstance was found where a teacher taught students up to form two third term and in the following year, the teacher did not even try to find out who or how many were willing to proceed with Physics to form three. On interview, it appeared that the teacher was happier to have fewer lessons by teaching form one and two only, hence little workload. A case was found where the students in form three (at the time of the study) stayed for the first

one month (January) without being attended to by the teacher of Physics who assumed that no student would register for the subject. When finally the teacher went to find out, the students had already decided not to register for the subject since they had already lost a month. Some students confirmed this as the reason why they did not register for Physics. As a result, no student registered for the subject in the specific year, a fact that can be attributed to, among other things, the teacher's lack of concern with the students in relation to his subject. This situation was found to occur in school D. This school had only two students in form four enrolled for Physics, while none was enrolled for Physics in form three at the time.

From the foregoing, it is evident that the level of involvement of the teacher of Physics with students in relation to Physics, other than just the normal teaching/learning sessions, greatly influences the number of students enrolling in the subject. If the teacher shows concern on subject progress and works with students to achieve the same, the student enrolment increases. But if the teacher just teaches officially as he/she is supposed to do without any further concern after class, such as encouraging students to pursue Physics, the students would likewise lose interest in the subject, thus drop it in the earliest opportunity.

4.4 Effect of Other School Personnel on Student Enrolment in Physics

The third research question was: To what extent do other teachers (non-teachers of Physics), laboratory technicians and other people that students interact with, affect the students decision to drop or not to opt for Physics? The personnel considered in this

objective included only those school personnel that students interact with in the course of their life in school, other than their teachers of Physics. Such people include the other subjects' teachers, - those who are not teachers of Physics, schools' headteachers, laboratory technicians/assistants and the students in other classes, mainly those students in forms three and four who had already made their subject selections (students peers).

To start with, the headteacher, other subjects' teachers and heads of science departments interact with students before and during official registration of subjects for form three and four. Some of these people played various roles during the period, some of which include advising students for or against opting for Physics. However, in many cases, the learners were left on their own to decide whether to opt for Physics or not. The following Table 4.10 illustrates the roles played by the various people in advising students on whether to register for Physics or not, during subject selection in the various schools studied, as given by the learners in those schools.

Table 4.10: Students Views on Teachers' Role During Subject Selection

Schools	Subject teachers	Other teachers	HoDs	Headteachers
School A	No role, they teach who ever chooses Physics	Not concerned	No role	No role, register the students they find
School B	No role	Maths teachers advice students to opt for Physics	Advice students to opt for Physics	Previous H/M discouraged due to failure. Currently no role
School C	Advice and encourage to take Physics	Careers master advice on Subjects and careers, hence encourage	Advices students to take Physics, he is also the teacher of Physics	No role
School D	No role, checks if there are Physics students at start of form three, if none, no comment.	Career master talk generally, not Physics in particular.	Advices form twos in 3rd term about selection. No further role	No role

From Table 4.10, it is seen that in all the schools, the headteacher does not play any role that is visible to the students, in relation to science subject selection. This tends to explain why there are various understandings regarding compulsory subjects in the various schools. The stands taken by the schools headteachers seem to be only known to them. Therefore, various people form their own opinions, which usually do not favour Physics as a subject. In school D, the teachers of Physics were particularly detached from the students. At the beginning of form three, the teacher of Physics simply waited for students opting for Physics to inform him about their intention. Failure of such information automatically implied that no student was interested in Physics and hence the teacher continued teaching form ones and twos. Since it is easier for the teacher to go to the students than the student looking for the teacher, the students take the easier

option- they do not go to the teacher and therefore do not opt for Physics. The particular school currently has two students taking Physics in form four and none in form three.

In the first place, according to the students, school headteachers' view towards Physics was not clearly discernible. This was evident due to lack of comment on the subject by three of the four headteachers whose schools were studied. Students in these schools had never heard their headteacher commenting on the subject at any one time. However, in one case (in school A), the headteacher was found to have encouraged students to register for the subject. There was considerable improvement in students registration in this school, with enrolment moving from thirteen students in 2002, six in 2003, three in 2004 and seven in 2005. The Physics enrolment in form four in 2006 was 5 students while that in form three shot to 18 students.

According to the teachers of Physics, the headteachers were major stumbling blocks to increased enrolment in Physics in form four. The reason why the headteachers appeared to resent a large number of Physics students in form three was that, according to the teachers, purchasing Physics equipments were very expensive especially for the purpose of KCSE examinations. Besides, some headteachers were found to resent a large number of Physics students allegedly because Physics practical equipments to be purchased during KCSE examinations are expensive. This assertion is misleading considering that most Physics equipments are long term assets to the schools as compared to laboratory chemicals used in Biology and Chemistry which have to be re-stocked throughout the years, more so towards examinations. A case was given by one of the teacher

respondents where at one time, every Physics candidate was required to have an instrument costing 1000/- (a milliammeter) for conducting KCSE examination practical. This, according to the headteachers (as they told teachers since this information was obtained from various teachers and not directly from headteachers), was very expensive considering that a single student was to consume a whole 1000/- in one item in a single subject. There was a case where the headteacher used to track the registration process to find out exactly how many students registered for Physics, from the teacher of Physics of the time. This enquiry, according to the teachers of Physics, was rather biased against a high number of students registering for Physics. Although there was no situation where a headteacher forced the reduction of Physics students already registered, the comments by the headteacher tended to be rather negative given that after the enquiry the said headteacher complained about the high cost of Physics practical apparatus. This scenario where the headteacher commented about the high cost of Physics equipment, coupled with the fact that most headteachers had not been heard commenting about Physics by the students, yet the subject was losing ground, tended to imply that either the headteachers do not care about what takes place in the subject, or are glad to have very few or no students registering for Physics at all. The headteachers, on the other hand, had their own reasons for low enrolment in Physics, none of which included their own role (i.e. the headteacher's role in the low enrolment).

The study targeted four headteachers, all of whom were interviewed regarding the situation of Physics in their schools. All the headteachers agreed that the student enrolment in Physics was low compared to that of Chemistry and Biology. The

headteachers gave various reasons that contributed to the low enrolment in the subject. These reasons are:

- Poor attitude of students towards the subject.
- Poor performance in national examinations by previous students.
- The mathematical nature of Physics (emphasizing that most students feared Mathematics and would drop it if an opportunity arose).
- Lack of exposure to the application of Physics in day-to-day life.
- Lack of role models, lack of teachers in the previous years.
- Lack or shortage of enough practical apparatus as well as poor time tabling.

With respect to time tabling, it was explained that in form three and four class timetables, Physics was blocked with geography and history, and sometimes with commerce as well. The students, under such circumstances, tended to opt for the subject that was viewed to be simpler among those blocked together. This tended to militate against Physics as it was considered the more difficult of all whenever it was blocked with any other subject. Thus, according to the headteachers, this blocking had to be stopped if Physics was to be treated equally with the other science subjects. It is important to note that whereas the selection criteria used in school emerged as a major contributing factor to the current state of enrolment in Physics, this was not mentioned by any of the four school heads. This could be due to the fact that the schools selection criteria were not understood in the same way by the students, teachers and headteachers in the four schools.

The other teachers who are not teachers of Physics were also found to play some role in students enrolment in Physics. Although there were isolated cases where some of these teachers encouraged students to register for Physics (usually individually and in private), most teachers were found to be discouraging the students openly. Phrases like "if you want to get 'E', take Physics" were common among teachers, and such statements were made in class for all the students to hear. At lower levels, teachers were said to comment to the learners: "Why are you struggling with a subject that will not help you after dropping it in form two?" This statement has an effect of socialising the learner to drop Physics as soon as an opportunity arises. Besides, the learner sees no reason of working hard on the subject, performs poorly in it and hence a bigger reason for dropping it when the chance avails itself.

Biology teachers were found to be fond of stressing that, "there is no course that combines Biology with Physics at higher levels". Whereas this may be true, such a statement made to students in view of the fact that most schools in the study had made Biology compulsory (at least in the students view), had an instant impact of repelling students from Physics, given that most schools had made both Biology and Chemistry compulsory, (discussed in section 4.5 of this document). The other subject teachers, mainly those of humanities, advised the students not to take all the three science subjects as this, according to these teachers, would take most of their time, hence leaving no time for the other subjects (implying this particular teacher's own subject). According to these teachers, studying Physics contributes to an overall poor grade in the whole examination. There was even a case where a teacher suggested in a staff meeting that Physics should be banned from forms three and four as it tended to reduce the school

mean grade. However, this suggestion did not succeed since on closer scrutiny, Physics was found to be having equal or even better mean grades than the other science subjects. However, the statement served to show how the other teachers view Physics.

The other students in upper classes were found to play negative roles in determining enrolment in Physics. In the first place, students in upper classes used to discourage their colleagues in lower classes from taking Physics. Such students used loose words like "the subject is difficult", "it has too much Mathematics", or "there are no reference books". A question asking students to list the categories of people who have ever discouraged them from continuing with Physics after form two gave students peers as the major source of discouragement. The following Table 4.11 gives the categories of people, as identified by the students, who discouraged them, as well as the frequency by which each category was mentioned by the students.

Table 4.11: The Level of Student Discouragement by Various People

Category	Frequency	Percentage
Non-Physic teachers	96	43.4
Colleagues (peers)	134	60.6
Teacher(s) of Physics	18	8.1
Relatives	105	47.5
Headteachers	0	0

Table 4.11 provides data for graphing, as in the following Figure 4.4.

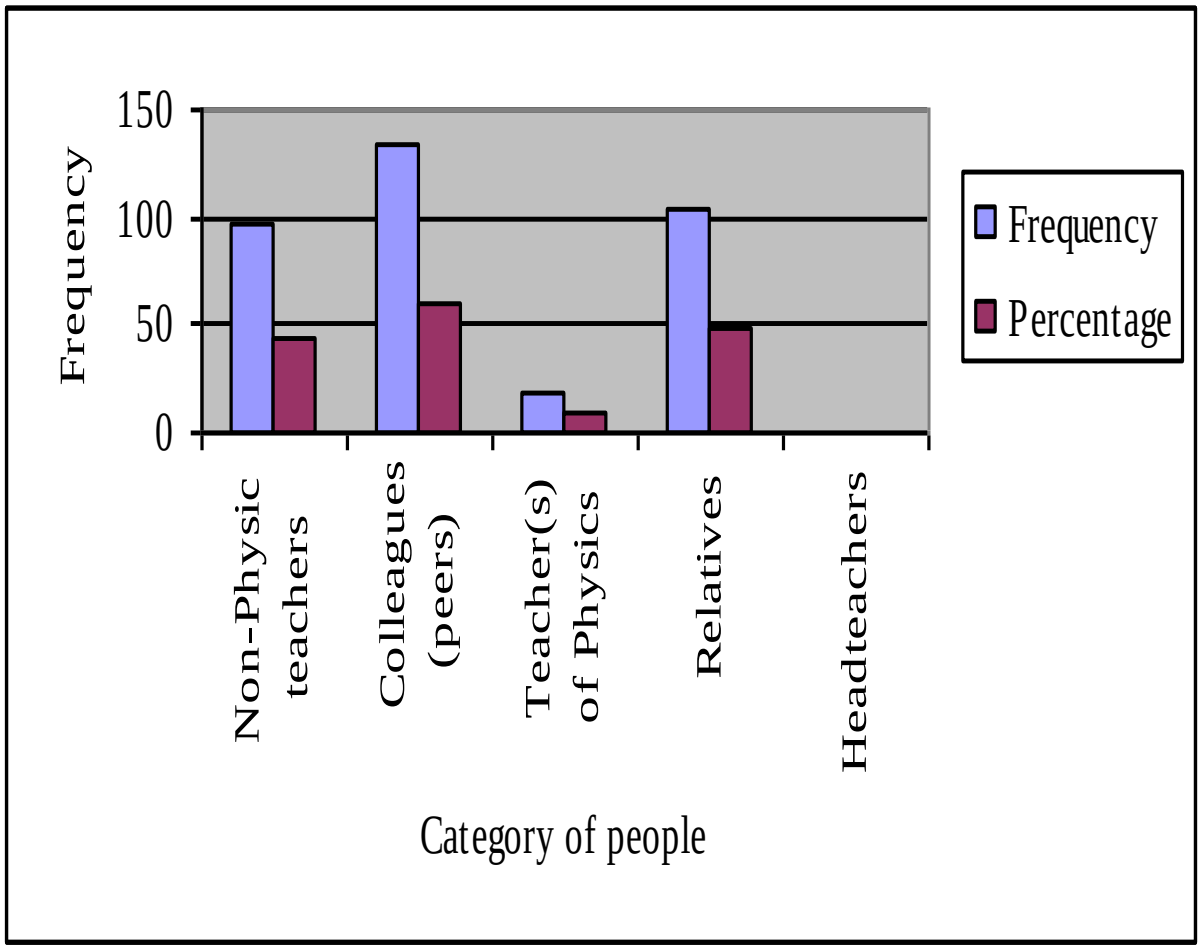

Figure 4.4: The Relative Discouragement of Students from Physics by Various People

From Table 4.11 and Figure 4.4, it is seen that students' colleagues led in the number of people who discouraged students from registering for Physics, with 134 students (60.6%0 having been discouraged by colleagues. The other teachers who are not teachers of Physics also discouraged students from registering for Physics, while none of the headteachers in any of the schools was found to have participated in discouraging students from taking Physics. Relatives were found to be the next most responsible in student discouragement against Physics after non-teachers of Physics. Whereas there is

nothing much that the policy makers can do to dissuade the students' relatives and students colleagues from their behaviour, at least the 'other' teachers can be sensitized against this practice.

The laboratory assistant did not appear to have much effect in determining student enrolment in Physics in the schools studied. Their only role was that in their absence, the teachers had to find time to go and arrange for practical sessions, leaving them with little time to test the accuracy of the results expected. At times, this led to the failure of experiments during actual student performance, thereby convincing the students even more that Physics is so difficult that even the teachers themselves were not sure, or could not get experiments right. One school in the study had no laboratory assistant, while the rest had one each.

4.5 Effect of School-Related Practices on Students Enrolment in Physics

The school practices considered in this study included the school examination policy with regard to optional subject selection, textbook policy (whether the school buys textbooks, or the students required to buy on their own), learning resources and equipment purchasing policy, teaching and learning processes etc. These practices may have an effect on the eventual number of students who opt to register for Physics.

With respect to school examination policy on selection of optional subjects, at least one science subject was made compulsory by the school administration in all the four schools studied. However, there were variations in responses from students, teachers,

heads of science departments and headteachers on whether both Chemistry and Biology were compulsory or just one of them. There was total agreement over the subject selection criteria among all the players in only one of the schools- school C. In this school students, teachers and the headteacher all agreed that indeed both Chemistry and Biology were compulsory in the school. In school A, whereas both students and teachers stated that Chemistry was compulsory in the school, the headteacher maintained that none of the subjects was compulsory at the time of the study. He was however quick to add that previously, up to 2004, both Chemistry and Biology used to be compulsory, but the policy was changed in 2004 and students given freedom to chose whichever subject they wanted. It appeared that while this may have been decided at the administration level, the decision may not have affected the teachers' and even students perception regarding the science subjects' selection criteria.

In school B, both the students and teachers agreed that Biology and Chemistry were compulsory in the school. However, the headteacher maintained that only Chemistry was compulsory, adding that all the students registered for Biology of their own volition. In school D, the students reported that both Chemistry and Biology were compulsory in the school, the teacher of Physics reported that only Chemistry was compulsory while the head of science department, who was also a teacher of Physics, as well as the headteacher, said that Biology was the only compulsory science subject. Thus, the school policy on compulsory subject was understood differently among the different players i.e. the students, teachers, head of science department and the headteacher. The

following Table 4.12 gives the understanding of the various stakeholders in the schools studied, regarding science subject selection criteria.

Table 4.12: Perception of Students, Teachers and headteachers on Science Subjects Selection Criteria

	No. of Teachers of Physics	Students Perception	Subject Teachers' Perception	HoD's Perception	Headteacher's Response
School A	3	Chemistry compulsory	Chemistry compulsory	Chemistry compulsory	No subject is compulsory
School B	3	Bio and Chem compulsory	Bio and Chem compulsory	Bio and Chem compulsory	Only Chem is compulsory
School C	1	Bio and Chem compulsory	Bio and Chem compulsory	Bio and Chem compulsory	Bio and Chem compulsory
School D	2	Chem compulsory	Chem. compulsory	Only Bio compulsory	Only Bio compulsory

From Table 4.12, it is evident that there is no agreement among the school stakeholders on exactly how the science subjects should be treated during subject selection. To the learners, their perception was that there was more awareness about the optional subject than the compulsory ones. Whenever they were asked about science subjects' selection criteria during focused group discussion, their first chorus response was that, "Physics is optional". The other clarification only came about after further probing to state the compulsory subject. This means that the fact that Physics is optional is more engraved in the learners' mind than the possibility that it can still be chosen alongside the other two science subjects.

The school examination policy regarding optional subject selection was found to negatively affect enrolment in Physics in that, given the various possible combinations of the science subjects, several students gave options that their schools did not support. The following Table 4.13 shows science subject combinations that form two students indicated they would like to pursue in forms three and four.

Table 4.13: Students Science Subjects Selection Projections for Forms Three and Four

Option	Number of students	Percentage
Physics and Chemistry	9	8
Biology and Chemistry	69	61.6
Physics and Biology	6	5.3
All the three	28	25
Total	112	100

The information in Table 4.13 is graphically presented in the following Figure 4.5 for easy interpretation.

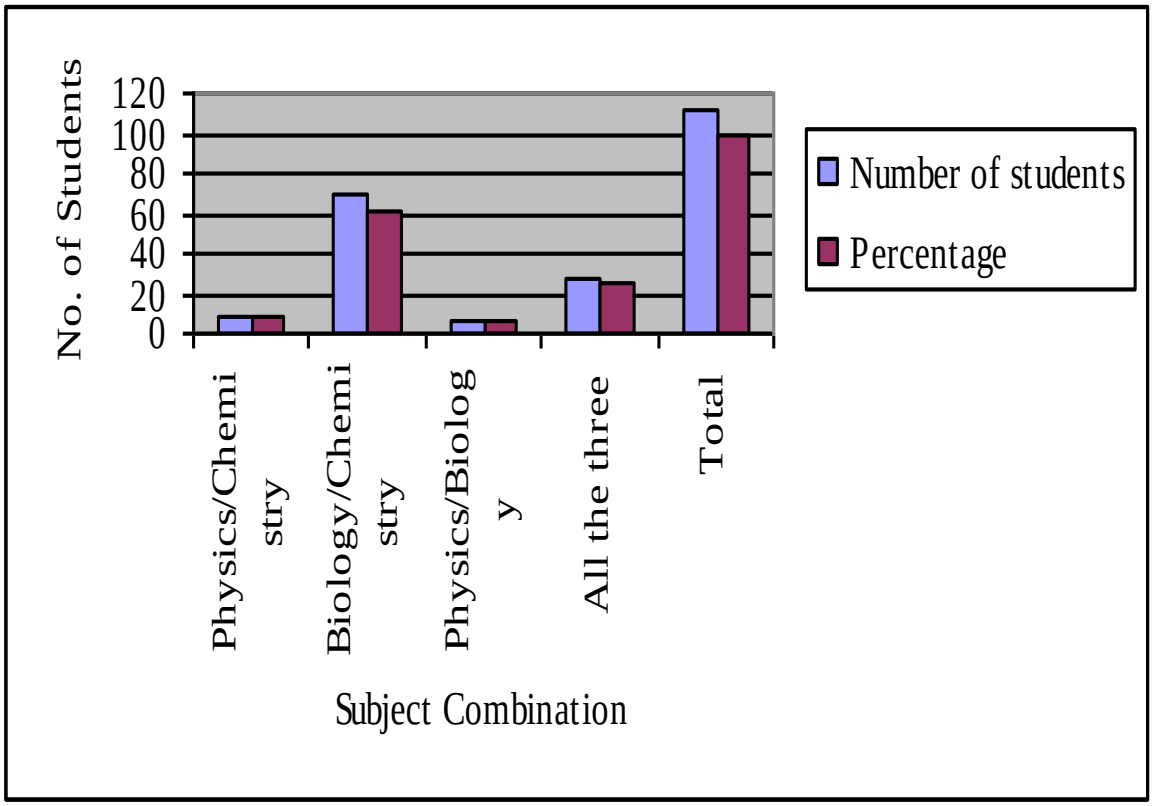

Figure 4.5: Students Science Subjects Combination Preferences

From Table 4.13 and Figure 4.5, it is clear that Biology and Chemistry are the most preferred combination of science subjects, leading with 69 (61.6%) students stating that they would opt for the two. The least preferred combination is that of Physics and Biology. However, a large proportion, 28 students (25.0%), would like to do all the three subjects, while only 9 students (8.0%) would opt for Physics and Chemistry. Given that students believe both Chemistry and Biology is compulsory, Physics and Chemistry option is practically non-existent in all the schools studied. It emerged during discussion with form three students in one of the schools that, the students had to opt for both Chemistry and Biology first as Physics was the only optional subject in the school. As seen earlier in this section, despite all the different perceptions about science subject options in the schools among teachers, students and, especially on the headteachers, as

far as the students were concerned, Physics was the only optional science subject. The students had to choose Chemistry and Biology first, then Physics at a later stage when they had already chosen their seven compulsory subjects.

While there is comparatively proportion of students (28 students, representing 25.%) willing to register for all the three subjects, this number was found to be interfered with by other subjects' teachers, discussed under other school personnel. By the time students actually select subjects, many would have been negatively influenced against taking Physics. Thus, it is not all the 28 students (25.0%) found in form two who register for Physics beyond this level as several opt otherwise by selection time.

Another message emanating from Table 4.13 is that Chemistry is the most preferred subject, as seen by the percentage of students opting for any combination containing Chemistry. The converse is true for Physics as there is lowest percentage of students wherever Physics is part of the combination. To further highlight students science subject preferences, they were asked to identify one of the science subjects that they would not like to study when given an option. Their results on this question are as given in the following Table 4.14.

Table 4.14: Percentage of Students to Drop Specific Science Subjects

Subject	Number of students	Percentage
Physics	68	60.7
Chemistry	6	5.3
Biology	7	6.3
None	29	25.9
No response	2	1.8
Total	112	100

The information in Table 4.14 is graphically presented in the following Figure 4.6:

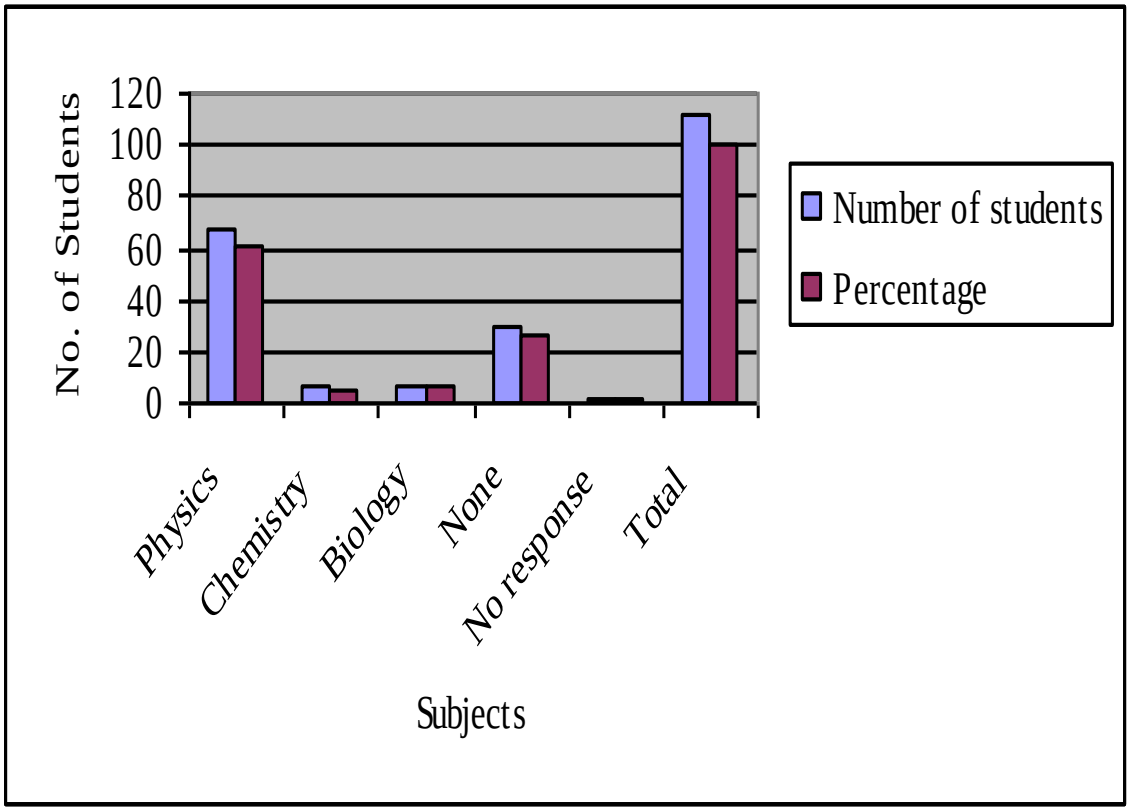

Figure 4.6: Percentage of Students to Drop Specific Science Subjects

From Table 4.14 and Figure 4.6, it is evident that a majority of students would like to drop Physics (68 students, 60.7%); while very few (6 students, 5.3%) would like to drop Chemistry. It is important to note that the number of students who did not want to drop any of the science subjects and would like to opt for all the three increased to 29 (25.9%) from 28 (25.0%) as shown in Table 4.13 earlier. The students would however not get such a chance due to the schools' examination policy.

Despite all the variations from the students, teachers of Physics, heads of science departments and headteachers on the status of Biology and Chemistry, two issues came out clearly in all the schools studied: the first is that in all the schools, Chemistry was

the compulsory science subject, at least in the students understanding. The second was that in all the schools, Physics was officially treated as the optional subject and was never selected at its rightful stage when both Biology and Chemistry were being selected. Instead, it was considered last, after the students had selected the first seven subjects as required by KNEC rules and regulations. Physics was then clustered with Geography, History and/or Commerce.

The above scenario has major effects on the selection of Physics after form three: the students in lower classes are socialised at very early stages that Physics is an optional subject and that a student does not need to put much effort on since it can be dropped at a later stage. This then makes the students not to put much effort on learning Physics at lower classes, hence contributing to students scoring low grades. Student's past performance in Physics was found to play a major role in dictating whether the student registers for Physics or not as the student moves to form three. Since the student starts scoring low grades at early stages, he/she would most likely opt out of the subject.

With regard to school textbook policy, students were required to buy their own textbooks in all the schools studied. School administrations only purchased reference books for teachers. In school B, class textbooks were bought for the core subjects of English, Mathematics and Kiswahili, while students were expected to buy their own reference books in all the other subjects. In view of this, there was no subject preference in relation to textbook purchase as Physics was treated just like Biology and Chemistry as well as the other humanities. Therefore, the school textbook policy was found to play

no role in determining the number of students enrolling in Physics. The subject is treated equally to its two competitors i.e. Biology and Chemistry.

Other than textbooks, it was found from teachers of Physics that the orders for Laboratory equipments that they make through their heads of departments were not usually fulfilled due to the general notion that Physics is optional and therefore registered for by very few students. The heads of science department, all of who were teachers of Physics themselves, corroborated this sentiment. Other reasons for not purchasing Physics equipment, as found from the Science Department heads, included the expensive nature of Physics equipments.

Students Note-Taking and Frequency of Practical Sessions

These two issues emerged as part of the school practices that affected the students science subject selection decisions after form two. Questions leading to these responses were posed to form two students in the four schools since in this class, Physics is a mandatory subject and the students could easily describe their situation at the time, as opposed to form three students who had already dropped the subject and could not recall some issues accurately. The students gave various metHoDs with which they obtained Physics notes, with varying frequencies. These metHoDs included:

- Copying directly from text books.
- Dictation and explanation by the teacher as students noted down.
- The teacher dictating notes to the students while writing difficult words on the board as he explains.

- Students obtaining notes in the form of handouts from the teacher.

These methods, together with their frequencies and difficulties encountered in each metHoD, are illustrated in the following Table 4.15.

Table 4.15: Ways by Which Students Got Physics Notes

Method	Frequency	Percentage	Problems Students Encounter
Copying from text books	30	26.8	Too few books, can't tell what to omit, unknown terms just copied
Dictation and explanation	33	29.5	No problem
Dictation and board	25	22.3	No problem
From handouts	24	21.4	Lack of explanations
Total	112	100	

The results on Table 4.15 emerged from FGDs per class, giving one particular metHoD per group. The group of 30 students who prepared their own notes from textbooks gave this as the major reason for their deciding to drop Physics. This particular group went ahead to clarify that they had no problem with the way they obtained Biology and Chemistry notes and therefore had no reason for dropping either of the two for Physics. However, 12 out of the 30 students in this group (40%) hoped to select Physics despite this problem, but would have preferred this metHoD of preparing notes to be changed so that they got summarized notes from their teacher. There was a second group of 24 students who used to get notes from handouts given by their teacher. Although the group had no major complaint regarding this metHoD, their main problem was that the notes lacked explanations. Although such handouts were usually given after a discussion of the particular topic with the teacher in class, new words seen in the handouts could not

be understood immediately. However, they would be quite comfortable if the handouts could be reviewed at a later stage.

The frequency of performing experiments emerged as a contributory factor to the enrolment of students in Physics. Besides, whenever there were such sessions, most experiments were performed by teacher demonstration, or at the very best, students were divided into large groups of about four to eight students. It was, therefore, not possible for all the students to participate in the arrangement of the apparatus. In view of these two, the students felt that they lacked adequate skills to perform Physics practical during their final examinations in form four. As such, majority of them opted to drop it. The following Table 4.16 gives the number of times form two students in each of the four schools had performed Physics experiments in the current term at the time of the study.

Table 4.16: Students Frequency of Physics Practical Sessions in Schools

School	Class	No. of times in the lab
A	All form 2 students	2
	2A	2
B	2B	3
	2C	4
C	All form 2 students	2
D	All form 2 students	2

From Table 4.16, it is possible to approximate the average number of times a student attends a Physics practical session as follows:

$$\text{No. of attendances} = \frac{\text{sum of sessions held}}{\text{No. of classes}} = \frac{15}{6} = 2.5 \approx 3$$

From Table 4.16, it is evident that the majority of students had attended two practical sessions only by the time of the study. Considering that this study was conducted between the 1st and 13th of July i.e. towards end-of-term examinations, it is probable that no more practical sessions would be held later by any one of these classes, or only one more at the maximum. This would therefore imply that on average, a student performed only three Physics experiments in one term. Besides the few practical sessions held by students per term, the students also complained that practical performance skills were never tested at any one time during form one and two as there were no experiments during examinations until form three third term when students were subjected to mock examinations. This tended to instil fear of the unknown to the students since they had nothing to gauge their capabilities on, while their senior colleagues who were in form three could not provide any clues till they reached form four. By the time the form three students reached form four and therefore in a position to explain what is entailed in practical examinations to the previous form two students (then in form three), the advice would have been overtaken by events as the former form two students would have reached form three and therefore made their subject selections.

From the foregoing, it is evident that school practices such as school examination policy, optional subject selection criteria, equipment purchasing policy, teaching and learning processes such as note-taking and practical session attendance, play major roles in determining the number of students enrolling in Physics, most of the time a negative role. It is therefore necessary to change some of these practices if the number of students enrolling for Physics is to increase. School textbook policy did not play any major role

since all the three subjects had an almost equal shortage of textbooks. None was preferentially treated. But laboratory equipment purchase policies tended to militate against Physics as Physics equipment were frequently ignored when ordered for.

4.6 The Effect of Physical Facilities on Students Enrolment in Physics

The physical facilities that affect the teaching and learning of Physics that were considered in this study included science textbooks, science laboratories, science practical equipments, and laboratory assistants/technicians.

As already seen in Section 4.5, Physics class textbooks were not provided for in all the schools studied. In this respect, all the three science subjects were at par with each other. In effect, the presence or absence of class textbooks had no effect in determining the number of students enrolling for Physics. The respective schools provided teachers' reference books only, while the learners were advised to purchase their own reference books. A spot check on whether the students made any attempts to purchase such books as advised by the schools showed that most students preferred buying non-science books to science books. Those who bought any science book preferred either Chemistry or Biology books. The reasons given for this was that, the students were not sure whether they would proceed with Physics to form three or not and besides that, Physics textbooks were more expensive than those of Biology or Chemistry. This later sentiment on the expense nature of Physics textbooks compared to those of Biology or Chemistry could not be immediately verified. The textbook situation (lack of them) affected the

preparation of Physics notes by the students as some teachers were found to teach and then advice students to make their own notes.

In school B, Physics textbooks purchased for use with the previous syllabus were available, but students hated them. According to the students, they could not tell what was in their current syllabus from what was not. Therefore they generally avoided using the old syllabus textbooks. In some cases class prefects were found to have acquired the right textbooks either through their teachers or from school libraries through their personal influence as prefects. In all the classes in the schools studied, no more than five Physics textbooks were found among the students. The text book to student average ratio was 1:10. Many of these text books were almost always acquired by the prefects using their own influences rather than through an equitable distribution in class by subject teachers. Despite this lack of textbooks, some teachers still expected students to make their own notes after teaching.

In effect, although the textbook situation was generally the same in Physics, Chemistry and Biology, their absence was disadvantageous to the students as the students only relied on teachers' notes. Where the notes were not given, students copied directly from the few text books available, or from colleagues who could access such books. This brought a problem in the sense that the students could not tell what to include and what to omit from the textbooks. As a result they tended to copy everything including diagrams. However, it can be inferred that since the three subjects suffered similar

shortage of text books, subject textbooks had no particular effect on the choice of science subjects as a student moved to form three.

All the schools studied had a science laboratory, with one (school B) with two laboratories. In the school that had two laboratories, one lab was designated to cater for both Chemistry and Biology, while the second lab was designated to cater for Physics. Three of the schools had laboratory assistants except school A, which did not have. Out of the three schools with laboratory assistants, school D had a Kenya Polytechnic trained technician, with certificate as a laboratory technician, the technician in school B was undergoing training at the same institution for the same level, while the technician at school C had no basic training in laboratory, apart from having obtained grade C in KCSE examinations. Among the three schools that had laboratory assistant, whether trained or not, the duties they performed were similar. However, the teachers in the school with a trained laboratory assistant appeared happier with their practical sessions as the laboratory assistant did most of the preparations in advance. In the school with two laboratories, one lab assistant used to serve both laboratories as the need dictated.

An area of differential treatment between Physics and the two subjects (Biology and Chemistry) was found in one of the schools that had two laboratories (school B). One lab was designated for both Chemistry and Biology while the other one was for Physics. The students expressed concern on the internal and external appearance of the two laboratories. Whereas the laboratory serving both Chemistry and Biology was well maintained i.e. clean, well arranged/organized and well equipped, the Physics laboratory

was left in a dilapidated condition! In the first place, the roofing was poorly done, was rusty even from the inside, and leaked when it rained. There were many broken desks and tables that lay in a haphazard manner, the unbroken desks were quite dusty, an indication of not having been used for a long time, and were not properly arranged. The storage cupboards were dusty and discouraged one from even attempting to open them. The students expressed concern that the pathetic situation, in which the Physics laboratory was left, discouraged them from registering for the subject since this was an indication of neglect of the subject.

The students' sentiments on the condition of the Physics Laboratory prompted the researcher to go and find out the situation personally. On checking, the students' assertions were found to be quite correct. Asked why the Physics laboratory was not well kept as the other laboratory was, the Laboratory assistant explained that there were very few experiments conducted in the said lab, and that most of the time he was in the Chemistry/Biology laboratory and rarely visited the Physics lab. When asked for reasons for such differences in the two laboratories, the HoD had no specific reason for the condition of the Physics laboratory, but mentioned that the school administration had decided to keep the broken chairs/desks/tables in the Physics laboratory, as it was not in use most of the time. This response corroborated the students verdict on the number of practical sessions they had in Physics per term, at least for this particular school. The students had stated that they attend more practical sessions in Chemistry and Biology than they had in Physics. As for the failure to repair the leakages from the roof, the HoD said that he had reported the situation to the office many times but so far it had not been

acted upon. However, lack of concern could be detected from the discussion, an indication that even the HoD was not bothered by the situation.

There were complaints by teachers in the school that had no laboratory assistant to the effect that a large proportion of their teaching time was consumed by preparation for practical lessons. Their practical lessons therefore had to be fitted at convenient times within the school timetable, when either the teacher had no preceding lesson, or after a break such as lunch break or morning break. The absence of a laboratory assistant therefore seemed to affect the learning of all the science subjects, not only Physics.

The main area of different treatment between the three science subjects was found in the laboratory equipment of the respective science subjects. In virtually all the four schools studied, there was evidence of inadequacy of practical equipments in Physics such as voltmeters, micrometer screw gauges, refractive glasses etc, as opposed to the equipments for Biology or Chemistry experiments. In all cases, there were complaints of shortage of facilities for effective class practical sessions. The teachers of Physics in all the schools confirmed that most practical sessions in Physics were reduced to teacher demonstration sessions as the students watched, or at best the students could be put into groups of five or more. Demonstration method of performing experiments was found to have a negative effect on students since it left students with no feel of the practical equipment and arrangements. The students corroborated the two modes of performing Physics experiments, and went ahead to cite them as one of the reasons why they never felt confident enough to register for Physics after form two. In cases where students

were put into large groups of more than five for practical sessions, the students expressed dissatisfaction with this metHoD as well; stating that in most cases, only one or two students in the group performed the experiment as the others just observed. They attributed this to the many disagreements that occurred among the students when all students in the group took part in the arrangement, leading to waste of time. The students said that the time allocated for the practical lessons was short and thus ended before the practical had been completed. It was also found that although the practical groups were not fixed and were formed afresh whenever necessary, the same students tended to dominate the groups wherever they were. In effect, the same students tended to perform class practical, while the same students were always observers. As such, practical skills were instilled in very few students in any one given class. Since the groups usually ranged from five to eight per class (of five to ten students each), the number of students practically conducting experiments was minimal as just two or three students in a group participated. This really minimized the number acquiring the necessary skills and the confidence in conducting Physics practicals, and therefore reduced the number of students willing to register for Physics. However, the few practical facilities were adequate for students who registered for Physics in forms three and four, as the students were usually very few. There was therefore no problem conducting Physics experiments in upper classes.

Due to the shortage of Physics practical equipment, the number of experiments performed within any one given term ranged between two to four in all the schools studied. The teachers resorted to explaining the experiments theoretically in class

without arranging for students to practically conduct them. Besides, there were never Physics practical examinations in forms one, two and three as there were not enough facilities to enable any examination experiment in the subject. This particular aspect-lack of practical examination in Physics at lower levels instilled fear of the unknown among the students, as they could not tell exactly how Physics practical examinations looked like. Many students thus conduct the first examination experiments in mock examinations in form four or, if organized by the district, mock examinations in form three. The students expressed anxiety of meeting "strange things during examinations", and therefore opted for Biology and Chemistry whose practical sessions were more frequent and more inclusive of all or most students.

Compared to Biology and Chemistry, it was found that the equipments for the two subjects were more abundant. The two subjects share similar equipment for many of the experiments, and at times similar chemicals are used in both. There was an organized way of replenishing the chemicals used in the two subjects. Two of the schools studied (A and D) bought their laboratory chemicals twice in a year i.e. at the beginning of first term and in the middle of third term when they ordered for fresh chemicals to be used in KCSE examinations.

The other two schools (B and C) bought laboratory chemicals three times in a year i.e. at the beginning of both first and second term, and then in third term during preparation for KCSE examinations. Chemistry and Biology equipments were bought or replenished ones a year in all schools, usually in third term during KCSE examination preparations.

Whatever was bought was ordered by the heads of Science departments after consulting with the Science subject teachers. However, Physics equipments were scarcely purchased. Asked why such purchases did not include Physics equipments, the teachers of Physics stated that all science teachers always made their respective orders at the same time and sent their orders to their head of department but they could not tell what happens to their requests ones they reached their departmental heads.

The heads of departments, on the other hand, all of who were teachers of Physics themselves, explained that to make the full order in a single list for the science department, they had to match every equipment or chemical with its price using the price list obtained from the dealers such as School Equipment Production Unit (SEPU), or School Equipment Centre. Such lists had to be reconciled with the funds available so as to buy only what were most needed. The equipments had to be scrutinized by both the headteacher and HoD in a forum. In many cases, most Physics equipments were deleted at this stage. The arguments here were the same: Physics had just a few students registered. It was therefore not necessary to spend so much for equipment that will be largely under-utilized. Citing both cost and number of students registered for Physics at the time the order was being made, most orders from the teachers of Physics ended up removed, while those for both Chemistry and Biology were mostly accepted. Hence, Biology and Chemistry were always more equipped for experiments than Physics.

From the foregoing, it was evident that the shortage of science textbooks hampered the learning of science subjects in general and Physics in particular. Students who had the

opportunity to buy reference science books bought Biology or Chemistry books most of the time, thus discriminating against Physics. Further, the skewed manner in which laboratory equipments were purchased in favour of Biology and Chemistry sent negative signals to students about Physics. Add the neglect meted to a Physics laboratory where it existed in isolation from the Biology and Chemistry laboratory and the situation becomes pathetic. These conditions combine to reduce the number of students registering for Physics in school in all the schools studied.

4.7 Effect of Students Gender on Choice of Physics after Form Two

Out of the four schools studied, two were girls schools (schools C and D) while the other two were boys schools (A and B). Of these, there were marked differences in the level of students enrolment in Physics both in the current students in forms three and four (as at 2006), as well as former students (before 2006) who had already sat their final examinations. In both cases, the number of Physics enrolment in girls schools was generally lower than that in boys schools. The following Table 4.17 gives Physics enrolment trends in each of the four schools studied by gender.

Table 4.17: Enrolment in Physics by Gender in the Past and Present (2006)

		Past Physics Enrolment In KCSE				Current Students Enrolment in Physics in Forms Three and Four, 2006		
School Code	Type of school	2002	2003	2004	2005	Form 3, 2006	Form 4, 2006	Total
A	Boys	13	6	3	7	18	5	52
B	Boys	9	10	14	8	25	19	85
C	Girls	-	-	4	7	4	8	23
D	Girls	-	4	-	2	0	2	8
		22	20	21	24	47	34	168

As seen from Table 4.17, girls schools have had the lowest enrolment, four students or less, and at times none at all in the girls schools. It can be seen that girls schools offer Physics candidates in fluctuating periods and not in all the years as exhibited by the enrolment in boys schools. The combined yearly Physics enrolment in national examinations in the girls schools' falls from 20% to 40%, though 40% was attained ones in the period, save for those in form four in 2006 who were yet to sit for the exams at the time of study. The total number of students who have ever studied Physics up to form three in one of the girls schools-school D, is 8, which is less than 4%. Comparatively, both boys schools had Physics candidates in all the years, with the enrolment increasing considerably high levels in the current form three.

From the observation, it is evident that the students gender characteristics play a role in determining enrolment in Physics, with less than 14% of girls having studied Physics up to form three from 2002-2006. Boys by far outnumber girls enrolment in all the years, with 131 boys (86%) having studied Physics up to form three in the same period. Thus, students gender characteristics affect enrolment in Physics.

4.8 Discussion of the Findings

The study was on the factors contributing to low enrolment of students in Physics at secondary school level in Central Division of Garissa District, Kenya. A number of factors were found to be contributing to this situation. In the first objective which sought to find the effect of previous students performance profile in Physics on the enrolment in the subject in subsequent years, it was found that the students performance profile affect future students enrolment in the subject. It was found that due to the previous students poor performance in Physics; many students avoided opting for the subject as they believed that they would likewise fail like the previous students. As such, majority of students opted for Biology and Chemistry, the subjects in which more students performed better. Further, students own performance in Physics in lower levels played a role in shaping the student's preference. Where the student's performance in Physics was persistently poor at lower levels, the student dropped the subject at the earliest opportunity possible. In the current situation, Physics performance has been poor, hence repelling students from it. This finding agrees with that of George & Taylor (2001), Hoffmann (2002), Miller, Parkhouse, Eagle & Evans (1999) and Munro & Elsom (2000), who found that students early science learning experiences and perceptions of school science were influential in students Physics enrolment decisions.

In the second objective, the study ought to evaluate the effect of other personnel with whom students interact, on students decision concerning their enrolment in Physics. In this objective, it was found that the teachers of Physics' behaviour has a bearing on the students decision to either drop or choose Physics for studies beyond form two.

Whenever teachers encouraged students to do Physics, showed some concern on the students' activities in relation to the subject, or played some other positive role with regard to the subject, more students enrolled for Physics. However, in situations where the teacher of Physics simply taught and left after the lesson, fewer students opted for the subject. This finding is consistent with the factors identified by Crawley & Black (1990), Lyons (2005) and Nashon's (2003), who identified science teachers to have external influences on students decisions about taking Physics through providing students with career information. It is therefore important that teachers of Physics take the initiative to market their subject to students at forms one and two so that by the time the students attained form three, they would be willing to enrol for the subject without much persuasion. Other characteristics of teachers of Physics, such as the teachers' age, experience and workload were found to have no effect on student enrolment in Physics.

The study also sought to find out the effect of school practices on students enrolment in Physics. Several school practices were found to have major effects on student enrolment in Physics. One such practice was the designation of Physics as the only optional science subject, which is not the correct position of the Kenya National Examinations Council. Most schools socialized their students to believe that both Biology and Chemistry are compulsory and students could therefore opt for Physics in addition to these two. Given that many students did not want to register for all the three science subjects, majority of them got satisfied by the two science subjects-Chemistry and Biology. The other school practice that had a bearing on students science subject selection was inequitable laboratory equipment, in which Biology and Chemistry were better equipped while

Physics had very few apparatus. This situation sent the wrong signal to students: that Physics is ignored so much that even students taking Physics after form two would be equally neglected. As such, since every student wants to be recognized rather than ignored, very few opted for Physics. Further, teachers of other subjects and students peers discouraged potential students from registering for Physics. The finding regarding students discouragement from taking Physics by their peers is in agreement with the findings by Panizzon & Levins (1997), and those by Talton & Simpson (1985), who found that peers' attitudes towards science greatly influenced students choice of the particular subject. In this case, the peers' attitude was mainly negative, hence discouraging prospective students.

The study also sought to evaluate the effect of students gender characteristics on their choice of science subjects. Towards this end, it was found that most female students opted for Biology and Chemistry, leaving a very small proportion registering for Physics. Whereas the enrolment of male students in Physics was generally low as well, the proportion registering for Physics was relatively higher than that of females who registered for Physics. This finding is consistent with the national trend where it was seen from the literature that girls constitute only 30% of students registered for Physics in each of the years considered. This finding is in agreement with the findings by John De Laeter and John Dekkers (2001), who found that the average proportion of females studying Chemistry over the past decade was 43.5% while that of females studying Physics was a paltry 28.0% for Physics. Thus, more male students enrol in Physics than do female students.

CHAPTER FIVE

SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.1 Introduction

This chapter gives the summary of the research findings, discusses them and draws conclusions based on the findings. The chapter also provides recommendations both on policy as well as on further research that needs to be carried out in order to eliminate, or at least reduce, most of the factors responsible for low enrolment in Physics in Kenyan secondary schools. This is in view of the major role that Physics as a subject plays in industrial development of a nation. The chapter starts by giving the summary of the research findings and discusses each of the findings as they are mentioned.

5.2 Summary of the Findings

On the basis of the objectives of the study, the study found that:

(i). The previous students' performance profile in Physics in a given school adversely affected the choice of the subject by the subsequent students. If the performance was good, more students choose the subject while if the performance was bad or has been consistently poor, fewer students tended to opt for it. Further, the students own performance in Physics in lower levels played a role in shaping the student's preference. Where the student's performance in Physics was persistently poor at lower levels, the student dropped the subject at the earliest opportunity possible. In the current situation, Physics performance has been poor, hence repelling students from it. This finding agrees with that of George & Taylor (2001), Hoffmann (2002), Miller, Parkhouse, Eagle & Evans

(1999) and Munro & Elsom (2000), who found that students early science learning experiences and perceptions of school science were influential in students Physics enrolment decisions

(ii). The levels of teacher interaction with the students had considerable effect on students enrolment in Physics. The teacher interaction parameters that were found to have effects on student enrolment in Physics include teacher encouragement to the student or lack of it, teacher's concern and follow-up on students progress, and the teacher's initiative to ensure that the students understood the Physics itself, its importance in the world of employment and general application and hence the need to register for it, even if it is just as the eighth subject. It was found that where the teacher was actively involved in encouraging the students to pursue Physics, the students were more willing to register in the subject. But where the teacher was not concerned, students tended to drop the subject. This finding is consistent with the factors identified by Crawley & Black (1990), Lyons (2005) and Nashon's (2003), who identified science teachers to have external influences on students decisions about taking Physics through providing students with career information.

(iii). Within the school environment, two categories of people negatively influenced students enrolment in Physics. These were mainly the other subjects' teachers (those who were not teachers of Physics), and the students in other classes (students peers), mainly those students in forms three and four who dropped Physics. These people discouraged the students from registering for Physics by

their verbal communications with regard to Physics. The students are the main culprits in this. Headteachers play almost no role in subject selection and, therefore, have no effect on student enrolment in Physics. The laboratory technicians/assistants, where available, also have no effect on student enrolment in Physics. However, where they are not available, the effect is that the teacher of Physics spends more time preparing for Physics practical sessions, hence no time for testing the accuracy of the results beforehand. The finding regarding students discouragement from taking Physics by their peers was in agreement with the findings by Panizzon & Levins (1997), and those by Talton & Simpson (1985), who found that peers' attitudes towards science greatly influenced students choice of the particular subject. In this case, the peers' attitude was mainly negative, hence discouraging prospective students.

(iv). The number of boys enrolling for Physics was higher than that of girls in the schools studied. Although all schools studied were either boys only schools or girls only schools, (there were no mixed schools in the region) the total number of boys registered for the subject at any one year in KCSE, was always higher than the number of girls registered for it. This finding was consistent with the national trend where it was seen from the literature that girls constitute only 30% of students registered for Physics in each of the years considered. This finding was in agreement with the findings by John De Laeter and John Dekkers (2001), which found that the average proportion of females studying Chemistry over the past decade was 43.5% while that of females studying Physics was a paltry 28.0% for Physics.

(v). The common practice in schools in which schools treat Physics as the only optional subject among the three science subjects is a major contributing factor to low enrolment in Physics. The fact that Physics is selected with non-science subjects reduces the chances of students registering for Physics as, in many cases; the learner would have been performing better in the other subject than in Physics. This criterion portrays Physics as the only subject that can be dropped among the three science subjects, while the truth is that all the three are optional, students only required to select any two of them or all the three subjects. The options that schools tend to adopt are either that Chemistry or Biology is compulsory, or both are compulsory. In all cases, Physics is taken to be optional either officially or unofficially within the student population. Since it is the students who select subjects, their views count most, and this view was found to be that Physics is optional. This goes along the finding by Woolnough & Cameron (1991), who identified the school environment to have great external influences on students decisions about taking Physics through providing students with learning environment.

(vi). All schools studied did not provide textbooks for their students. Instead, students were advised to buy reference materials on their own. However, most students preferred to buy non-science textbooks to science books. Of the few who were found to have bought some science textbooks, Biology and Chemistry books were more preferred to Physics text books. This situation hampered the learning of Physics more than the other two science subjects as there were very few Physics reference materials in all the classes studied.

(vii). Shortage of Physics practical equipment in the laboratories, as was the case in all the four schools studied, had a negative effect on registration in Physics. Besides, the general neglect with which Physics is treated sends wrong signals to the student fraternity. The student views the subject as a neglected one and would not therefore like to be associated with it. This finding is consistent with those of Orodho (1996), who found that there is a significant positive relationship between students scores in sciences and availability of resources. Since the scores affect enrolment in the subject, it follows that what affects students scores affects their chances of enrolling in the subject. It is also in agreement with the first IEA science study, which noted positive effects of laboratory use on performance (Lewin, 1992). A similar study by Lockheed and Komenan (1989) also found a positive relationship between laboratory use and preference for a subject. It follows that where practical equipment are scarce, there are very few experiments performed and hence less enthusiasm. If a student is confronted with the option of choosing between one of the science subjects with more practical work, the student will be more enthusiastic to opt for the one with more practical sessions than one with less. In this study, students were found to perform more practical work in both Chemistry and Biology than in Physics. This contributed to lower enrolment in Physics than in either Chemistry or Biology.

(viii). The relationship between Physics and Mathematics affects enrolment in Physics, and mostly negatively. This is in view of the fact that most students do

not perform well in Mathematics in secondary schools and would like to drop it if given a chance. However, Mathematics is compulsory for all students registering for KCSE examinations. As such, since there is no chance for dropping Mathematics, the learner drops Physics as a substitute for Mathematics. Students viewed registration in Physics as taking double Mathematics and therefore double problems or double chances of failing in the final examinations. Therefore, they decide to drop Physics to 'reduce the chances of overall failure', as they put it. This finding is in agreement with that of Nashon (2003), who found that competency in mathematics, is a key factor in students Physics related decisions. Students who had competency in prior mathematical knowledge were found more likely to be potential Physics students. Orodho (1996) agrees, stating that Mathematics scores are better predictors of achievement in Physics than Chemistry (or Biology). This then means that a student who sees oneself as weak in Mathematics cannot opt for Physics.

(ix). The method in which students acquired Physics notes affected their understanding of those notes and thereby their performance in the subject. Students who were provided with notes by their teachers during lesson time had no problems with understanding them as they had opportunities to ask difficult aspects of the notes. Students who either copied notes from textbooks or got them from teachers' handouts had problems with either explanations, or difficulty in accessing the few books available.

5.3 Conclusions

Following the findings enumerated above, it can be concluded that various factors combine to influence the number of students enrolling in Physics in forms three and form four and hence in KCSE examination. Many of the factors found to influence enrolment in Physics are within the school environment that can be tackled at the school level by the school authorities. The control of these factors mainly requires identification of the said issues and coming up with strategies to reverse or minimize the practices that are detrimental to higher enrolment, while encouraging and re-enforcing practices that can increase enrolment. Specifically, the following conclusions were made from the study:

(i). School-related practices, specifically schools' examination policy with regard to science subject selection, are skewed in favour of Biology and Chemistry. The same applies to the process of purchasing laboratory equipments.

(ii). Previous students performance profile in Physics affects future students enrolment in the subject.

(iii). The Physics teacher's level of involvement with students in such ways as explaining the usefulness of studying Physics affects the number of students enrolment in Physics. When the teacher is very concerned about the students, the students get encouraged and more opt for the subject.

(iv). Several people, within the school environment, discourage students from opting for Physics. These include students peers and teachers of other subjects. Only teachers of are left to encourage (or not to) the students to enrol in Physics.

(v). The presence or absence of physical facilities in a school affects student enrolment in Physics. In this case, availing Physics equipments was not given the same treatment as Biology and Chemistry equipments were.

(vi). Students' gender affects a students choice of Physics. More males enrol for Physics than females, although the overall proportion of males enrolling for Physics was still minimal. A much smaller proportion of females enrol for Physics.

5.4 Recommendations

On the strength of the main findings and conclusions drawn above, a number of recommendations were made, aimed at improving students achievement and hence enrolment in Physics, considering that achievement or performance was found to be a main contributor to student enrolment in Physics. The recommendations are grouped into two categories- policy and further research recommendations.

5.4.1 Policy Recommendations

i) Schools should be made to adhere strictly to the KNEC regulations as pertains to registration and learning of science subjects. All science subjects should be treated equally in terms of lessons allocation per week. Designating Biology and Chemistry as compulsory while Physics as optional should be stopped. In fact, every school should be compelled to register some of their students in Physics. Schools headteachers should take up the role of encouraging students to register for Physics so as to boost their morale to take the subject.

ii) Teachers of Physics should explain the importance of studying Physics, including the various careers available in the field of Physics. They should be involved in encouraging students to opt for the subject. They should also strive to ensure that the few students who enrol in Physics perform well in their examinations. This is to ensure that the good performance attracts future candidates to enrol in the subject, since performance profile was found to adversely affect future enrolment in Physics.

iii) Girls in secondary schools should be encouraged to change their attitudes towards science, and be encouraged to perform more Physics practicals. This would give them more confidence and hence more would opt to enrol for Physics. They should be sensitized about the equality among females and males in all aspects of life, including ability to excel in all sciences, Physics included.

iv) The other subject teachers i.e. those not teaching Physics should be sensitized against making negative statements about Physics as these statements repel students from the subject. Teachers should be advised to either encourage students to register for Physics by enlisting the various opportunities available through Physics, or avoid talking ill of it at all. Careers Masters should stress the importance of Physics for future studies on technology related fields, and the need for technology in the development in Kenya, and to students future development.

v) Schools should have a textbook policy in which they purchase a certain proportion of relevant Physics books for use by the students, apart from teachers' reference books. Teachers of Physics should advise on the need to buy the

necessary Physics books. This is necessary since students were found to prefer buying non-science text books to science books, while those who bought some science books avoided buying Physics books.

vi) Schools should purchase laboratory equipment equitably for all science subjects without discrimination whatsoever. Where Physics laboratory is separate from that of Biology or Chemistry, all should be properly maintained, rather than leave the Physics laboratory in poor state while the other is well kept. This would help in levelling the perception for all science subjects. Teachers should aspire to make optimal use of laboratory facilities by exposing students to individual practical exercises.

5.4.2 Recommendations for Further Research

a. This study was conducted in just one division of one district in Kenya. It is, therefore recommended that similar studies be carried out in several other districts in all the eight provinces. If the findings of these studies are similar, then a national policy should be formulated, such as those recommended above. If there are differences, region-specific policies should be formulated to tackle regional issues individually.

b. This study concentrated on intra-school influences only, and did not look at the extra-school influences such as religion, social, cultural and ecological variables. The study did not have the capacity to cover these external school factors due to the constraints identified in chapter one. It is therefore recommended that a study be conducted that encompasses both intra as well as extra-school influences.

Extra-school influences found to affect enrolment in Physics should then be tackled alongside the influences identified above.

C. The research was carried out in a region where mixed schools are a rare occurrence. As such, all schools studied were single sex schools. It is, therefore, recommended that a further research should be carried out that encompasses mixed sex schools in order to find if there is any difference in female enrolment (and/or performance) when they study together with the males in the same schools and/or classes.

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APPENDICES

Appendix 1: Form Two Students Questionnaire

This questionnaire is to help the researcher gather information on the teaching and learning of Physics in secondary schools. Your responses will be treated with utmost confidentiality and will not be disclosed to anybody in relation to the person who stated the response. To ensure the same, do not write your name or any other form of identity anywhere on this form. Give your responses in the spaces provided. Where alternative responses are given, mark your choice by putting a tick [✓] in the box next to the appropriate answer.

Part A: Contextual and Personal Data.

1. Name of your school _____
2. Your sex Male [ ] Female [ ]
3. Status of your school i.e. (1) mixed boarding [ ] (2) mixed day [ ]

   (3) Boys boarding [ ] (4) Girls boarding [ ] (5) Boys day [ ]

   (6) Girls day [ ] Any other type (specify) _____
4. Your class stream, e.g. form 2A, 2B, 2west, 2Blue etc._____.

Part B: Pertinent Issues Section

1. Which of the following combination of science subjects do you intend to select for your studies in form three and four.

(a) Physics and Chemistry [ ] (b) Biology and Chemistry [ ]

(b) Physics and Biology. [ ] (c) All i.e. Physics, Chemistry and Biology [ ]

2. Which one of the above science subjects would you NOT like to study at all, and would drop as soon as you got an opportunity? _____

3. Give reasons why you would **NOT** like to study the subject identified in qn. 2 above. _____

_____

_____

4. Name any person/people who have ever advised you on whether to register for Physics or not, in upper classes from the following options:

   (i). Your fellow students [ ]

   (ii). Your teacher of Physics [ ]

   (iii). Other teachers who are not teacher of Physics [ ]

   (iv). Your Headteacher [ ]

   (v). Your parents [ ]

   (vi). Other people (specify them _____

5. Of the people you have mentioned above, specify the nature of the advice they gave you. That is, did the person encourage or discourage you from registering for Physics in form three and four?

Those who encouraged you	Those who discouraged you
6. _____	_____
_____	_____
_____	_____
_____	_____

7. Name any careers (jobs) that you know about, that one can get after learning Physics up to form four or above. _____

_____

_____

8. Identify the gender of your current teacher of Physics.

   Male [ ] Female [ ]

9. What is your opinion about the way your current teacher of Physics teaches you?

   He/she teaches (i) Very well [ ] (ii) Well [ ] (iii) Fairly [ ]

   (iv) Poorly [ ] (v) Very poorly. [ ]

10. State the highest score and lowest score you have ever attained in any one of the Physics exams or continuous assessment tests in form two this year.

    Highest score: _____ out of _____ Lowest score_____ out of ____

11. What metHoDs does your teacher use in giving you Physics notes?

    (i). Dictation of notes by the teacher [ ]

    (ii). By copying them on the chalk board [ ]

    (iii). You copy yourself from class textbooks [ ]

    (iv). Giving handouts to the students [ ]

    (v). Other metHoDs (specify)_____

12. What problems do you experience while taking the notes?

    _____

    _____

13. How often does your teacher of Physics check your notebooks?

    (i) Once a week [ ] (ii) Twice a month [ ] (iii) Rarely [ ]

    (iv) Never at all [ ] (v) Others (specify)_____

14. State all Physics textbooks you have used in the school since you joined it._____

    _____

    _____

    _____

15. Do you have other Physics materials other than the class textbooks specified above? Yes [ ] No [ ]

16. If your answer above is yes, name the other Physics materials you have used in or outside class. _____

    _____

    _____

17. Of the books you are currently using in class, specify the ratio in which you share them from the following options: (i) Individually [ ] (ii)Two students per book [ ]

    (ii) Three students per book [ ] (iii) Four students per book [ ]

    (iv) Five students and above per book [ ]

18. How many laboratories do you have in your school? _____

19. How many times have you been to the laboratory for practical lessons in Physics this term? (i) Ones [ ] (ii)Twice [ ] (iii) Three times [ ]

    (iv) Four times or more [ ] (v) None [ ]

20. If your answer in question 18 above is (v) None, then state the number of time you have been to the laboratory for Physics practical this term_____

21. What is the longest duration you have ever stayed without a teacher of Physics allocated to your class or stream? (i) Never [ ] (ii) 1 month [ ] (iii) 2 months [ ]

(iv) 1 term [ ] (v) 1 Year [ ]

22. State the highest and lowest score you have ever attained in **Mathematics** in any of the exams or continuous assessment tests you have done in form two.

Highest score_____ Out of _____ Lowest score_____ out of_____

Appendix 2: Form Three Students Questionnaire

This questionnaire is to help the researcher gather information on the teaching and learning of Physics in secondary schools. Your responses will be treated with utmost confidentiality and will not be disclosed to anybody in relation to the person who stated the response. To ensure the same, do not write your name or any other form of identity anywhere on this form. Give your responses in the spaces provided. Where alternative responses are given, mark your choice by putting a tick [✓] in the box next to the appropriate answer.

Part A: Contextual and Personal Data.

1. Name of your school _____
2. Your sex Male [ ] Female [ ]
3. Status of your school i.e. (1) mixed boarding (2) mixed day (3) Boys boarding (4) Girls boarding (5) Boys day (6) Girls day
4. Your class stream, e.g. form 3A, 3B, 3west, 3Blue etc._____.

Part B: Pertinent Issues Section

1. You are currently studying only two science subjects i.e. Biology and Chemistry after dropping Physics; give personal reasons that made you drop Physics after form two.

_____

_____

_____

2. Apart from your personal decision of not proceeding with Physics to form three, mention any other person or people who may have discouraged you or encouraged you to take Physics at form three, from the following choices: Your fellow students, your teacher of Physics, other teachers who are not teachers of Physics, your headteacher, your parents, other people (specify them), according to the order below:

Those who encouraged you	Those who discouraged you
_____	_____
_____	_____
_____	_____
_____	_____

3. Supposing you were given an option of taking all the three science subjects, would you have opted for all the three subjects? ☐ ☐
4. What would you like to become after school? _____
5. State any careers (jobs) that a person who studies Physics up to form four or above can join. _____
6. Did you learn Physics in form one and two? (i)Yes [ ] (ii) No [ ]
7. Tick the gender of your previous form two teacher of Physics.

   Male [ ] Female [ ]
8. State your views regarding the teaching approaches of your previous teacher of Physics. The teacher used to teach:

   (i) Very well [ ] (ii) Well [ ] (iii) Fairly well [ ]

   (iv) Poorly [ ] (v) Very poorly [ ]

9. During the choice of subjects, is there any science subject that was grouped together with any other non-science subject? (i) Yes [ ] (ii) No [ ]

10. If your answer to the above question is 'Yes', then specify which of the science subjects was grouped together with which other non-science subject. _____

11. Was there any directive from the school regarding on which subjects were to be taken after form three? (i) Yes [ ] (ii) No [ ]

12. If your answer is Yes, specify the directive that was given regarding subject selection_____

_____

_____

13. Were you ever told by your teacher of Physics not to choose Physics after form two? Yes [ ] No [ ]

14. Did your form two teacher of Physics choose the students to register for Physics after form two and who should not? Yes [ ] No [ ]

15. Did your form two teacher of Physics ever encourage you to choose to study Physics after form two? Yes [ ] No [ ]

16. (a) Were you ever told of the importance of studying Physics during form one or two? Yes [ ] No [ ].

    (b) If your answer above is “yes", who told you? _____

    _____

16. Suppose you had a say while in form two, what would you have liked changed in order that you choose to study Physics further? _____

Appendix 3: Form Two Students Discussion Guide

1. What are the group two subjects' selection criteria in your school?
2. Is there a compulsory science subject in your school? If so, specify the compulsory subject.
3. What would you like to become after school?
4. What is your opinion about the way your current teacher of Physics teaches you? (Very well, well, fairly, poorly, very poorly).
5. How do you get Physics notes? That is, do you make your own notes, or given by the teacher? If given, how? (Dictation by the teacher, the teacher copying on the chalkboard, you copy from class textbooks, the teacher gives handouts etc).
6. What problems do you experience while taking the notes?
7. Does the teacher check your notebooks? If so, how many times have your books been checked this term?
8. State all the Physics textbooks you have ever used since you joined this school in form one.
9. How many laboratories do you have in your school? If several, are they designated by subject?
10. Have you ever been to the lab for Practical lessons in Physics this term? If so, how many times?
11. How do you conduct Physics practicals in the lab i.e. do you perform them individually, as a group or the teacher demonstrates alone?
12. Do you consider the Physics equipments in the lab to be enough or not enough?

13. what else can you say about the laboratory and the way you conduct Physics and the other subject practicals in general?
14. Have you ever stayed without a teacher of Physics for a consecutive period since you joined the school? If so, for how long?
15. Do you enjoy your Physics lessons? Explain whichever response.
16. What would you like to be done/changed in Physics so that you can enjoy learning it even better than it is now?

Appendix 4: Form Three Students Discussion Guide

1. What are the group two (sciences) selection criteria in your school?
2. Is there a compulsory science subject in the school?
3. Of the three science subjects, you opted to drop Physics and not any of the other two, give reasons for dropping Physics.
4. Is there anybody in school or elsewhere, who ever advised you on whether to take Physics at higher levels or not? If so, specify the person/ people, and the nature of advice given. (Colleagues, teacher of Physics, other subject teachers, your, headteacher, your parents or any other person).
5. During subject selection process, is there any science subject that was grouped against any non-science subject? If so specify the non-science subject that was grouped against which science subject.
6. Were you ever told/taught about the importance of Physics at any stage in form one or two?
7. Was your teacher of Physics involved in deciding who among you should register for Physics and who should not during subject selection at form two? If so, to what extent?
8. Did your teacher of Physics advice you on whether you should take Physics or not at higher level? If so what was the nature of the advice?
9. What role does the administration play in subject selection?
10. Did your school principle give any comment to you about Physics at any one time? If so, what was the nature of the comment?

11. State your views regarding the way your previous teacher of Physics used to teach you. (Very well, well, fairly, poorly, very poorly).
12. Did you ever attend any Physics practical session in the lab during form two?
13. How were you conducting Physics practicals, individually, in groups of, say 5 people or the teacher used to demonstrate as you watch?
14. What would you like changed in the current organization of Physics so that more students can register in Physics?
15. What other issue can you say about the teaching and learning of Physics that you have ever experienced while in the school?

Appendix 5: Headteachers' Interview Schedule

1. Headteacher's duration of service as the Head of the school_____
2. Headteacher's teaching subjects _____
3. Total number of teachers in the school_____
4. Total no. Of science teachers in the school_____
5. Total no. Of Teachers of Physics in the school_____
6. Number of streams in the school per class_____
7. Do you consider the current staff size adequate? _____ If inadequate, state the subjects with shortage_____

   _____

   _____

8. Current no. Of Physics students in: Form 3_____Form 4_____
9. What do you think contributes to the current enrolment state? _____

   _____

   _____

   _____

10. How has the previous performance of students in KCSE been generally? _____

    _____

    _____

    _____

    _____

    _____

    _____

11. In your view, does the previous performance in the subject have any effect on enrolment? _____ If so, how? _____

_____

_____

_____

12. In your view, what role does the teacher of Physics play in the enrolment situation? _____

_____

_____

13. What are the school subject selection criteria for group three subjects (i.e. Physics Chemistry and Biology)?_____

_____

_____

_____

14. Other than the above criteria, are there any other restrictions on the no? Of students registering for Physics? _____.If so, specify the restrictions._____

_____

_____

_____

15. Is there any science subject that is clustered together in the school with a non-science subject? _____ If so, which other subject is clustered with which science subject?_____

_____

16. How many laboratories do you have in the school? _____. If several, are they designated per subject? _____. If designated, specify each. _____

_____

_____

17. Do you have a laboratory technician? _____If so, how many? _____

18. In your view, how adequate are the facilities in the lab for a full class experiment?_____

_____

_____

19. What is the school policy on textbook purchase i.e. does the school provide students with books or the students are required to buy their own?

_____

_____

20. If the school provides textbooks, at what ratio are the books shared among the students?

21. What would you recommend that can be done to the current organization of Physics at any level e.g. KNEC, syllabus etc, so that Physics can attract more students?_____

_____

_____

_____

_____

_____

Appendix 6: Teachers of Physics and HoD Science's Interview Schedule

1. Academic qualification _____
2. Teaching subjects_____
3. Teacher's age or date of birth
4. Teaching experience in years_____
5. Period of teaching in the current station _____
6. Period of holding the position (HoDs only)_____
7. Current no. of lessons per week_____
8. How many science teachers do you have in the department? (HoDs only)_____
9. Of the above teachers, how many are Teachers of Physics in the department? (HoDs only) _____
10. How many functional laboratories do you have in the school? _____
11. What is your view on the adequacy and availability of laboratory equipment in the school?_____

    _____

    _____
12. How many students are currently taking Physics in: form three _____ form four?_____
13. In your view, what are the possible reasons for the current state of Physics enrolment in forms three and four?_____

    _____

    _____

    _____

14. What role does the administration play in the students' subject selection especially those of group three? _____

_____

_____

_____

15. Is there a specific school regulation that must be considered when the students are selecting subjects for form three? _____ If so, what is the regulation?

_____

_____

_____

16. During subject selection in form three, is there any non-science subject that is clustered together with a science subject? _____ If so, specify which non-science subject is clustered with which science subject.

_____

_____

17. What roles do you as the subject teacher/ HoD play when students are selecting the subjects? That is, do you play any role in deciding on the number of students who should register for Physics? _____

_____

18. What would you recommend that should be done to the current organization of Physics at any level e.g. KNEC, syllabus etc, so that Physics can attract more students? _____

_____