DETERMINANTS OF THE CHOICE OF PHYSICS BY GIRLS AT SECONDARY SCHOOL LEVEL IN MAKUENI DISTRICT, KENYA.

BY

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DECLARATION

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

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This research project has been presented for examination with my approval as University Supervisor.

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DEDICATION

I dedicate this work to my daughters Jemima Syombua, Rachael Nzilani, Samantha Wayua and Prudence Nduku. Dedicating this work to them is a way of telling them that everything is possible.

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ABSTRACT

The study work reported here was conducted in Kenya among a sample of secondary school girls in Makueni district from Makindu, Kibwezi and Mtito-Andei divisions. The major objective of the study was to assess factors that determine the choice of physics by secondary school girls. Guided by the available and relevant literature on the choice of subjects, five research objectives were formulated. These sought to:

(i) determine whether more girls choose physics when they attend mixed schools than when they attend girls' only schools.

(ii) establish whether teachers attitudes to girls' interest in physics influence their choice of the subject.

(iii) establish whether female teachers of physics act as role models and thus attract more girls to opt for physics in Forms Three and Four.

(iv) examine the role of peer-group pressure on girls' choice of physics

(v) determine whether parents' level of education influence their daughters' choice of physics.

Using the ex-post facto Research Design and the research objectives, a questionnaire was prepared to collect data from Forms Three and Four girls including those taking the subject and those not taking the subject on 50-50 ratio. The collected data was analyzed using descriptive statistics that included percentages and frequencies. Data presentation was done using tables.

The findings of this study showed that:

1. The pure girls' schools had attracted larger numbers of girls to take physics in secondary school as compared with the mixed schools. Although there are many mixed schools in the study area offering physics (19) compared to only 3 girls schools offering the subject, these girls' schools had more girls doing physics than those attending mixed secondary schools.

2. Teachers' attitudes influenced girls' choice of physics. A larger group of girls confessed that they disliked physics teachers' attitudes to the subject's suitability for girls. But still, a smaller proportion of girls said they favoured the subject because of the subject teachers' attitude. However, the influence from the teachers is strong in making the subject be rejected by girls than in making it their favourite.

3. Female teachers do not seem to play an important role in attracting more girls to opt for physics in secondary school. This study has evidence that although the majority of the girls in the study area had no bias for teachers of physics of particular sex, yet a significant group of girls identified males as their favourite teachers of physics.

4. The peer-group does not play a very significant role in influencing girls to choose or reject physics. This study has identified a personal decision by the girls themselves as the most important determinant in their decision to opt for the subject or reject it. Other factors responsible for this decision to study physics or

not included the influence from teachers, parents and other members of the extended family.

5. The education level attained by mothers was identified in this study as playing an important role in influencing the choice of physics by their daughters compared to that of their fathers. As the mothers' education levels rose so did the chances of their daughters choosing physics.

ABBREVIATIONS

G.N.P.:	Gross National Product
K.C.S.E.:	Kenya Certificate of Secondary Education
K.N.E.C.:	Kenya National Examination Council
S.S.L.E.	Secondary School Leaving Examination
T.I.Q.E.T.:	Totally Integrated Quality Education and Training
T.S.C	Teachers' Service Commission
H.M.I.:	Her Majesty's Inspectorate
M.O.E.S.T.:	Ministry of Education, Science and Technology.

CHAPTER ONE

INTRODUCTION

1.0. Background of the study

For many years, the proposition that educational expansion promoted, and in some cases even determined the rate of overall Gross National Product (GNP) growth has remained unchallenged (Todaro, 1977). The implication of this assertion is that one of the major components in developing a nation is the development of its human resources. This view was supported by the committee appointed to look into the development of education in Eastern and Southern Africa. The committee declared that: "It is the human resources of a nation which determine the character and pace of its social and economic development" (Tembo 1985).

The logic behind all this seems straightforward in that developing countries like Kenya to a large extent lack supply of skilled and semi-skilled manpower. This manpower is especially essential if Kenya is to attain its goal of being an industrialised nation by the year 2020 (Republic of Kenya, 1999). For this to be achieved, both men and women have to provide the requisite skills.

However, many times when parents take their children to secondary school, they never pause to wonder what they want their daughters and sons to do later in life after school. In most cases they do not offer them any guidance on what career options are available in the job market and the necessary subject combinations for those careers. Thus in secondary schools, these children may not be aware, and many may not care what subject combinations will make them play what role in

the society. Consequently, there is the tendency for many of them to ignore the subjects they are told by their peers are 'hard' and thus fall back to the seemly 'softer' options. Another cause of this misguided choice results from gender consciousness, whereby many students opt for subjects they think are suitable for their gender. Physics is the subject that seems to suffer heavily from this avoidance through misinformation and gender consciousness among other factors that were examined in this research work.

Republic of Kenya (1999) in a report called Totally Integrated Quality Education and Training (TIQET) recognized the tremendous efforts made by the government of Kenya to improve girls' education, including affirmative action in the expansion of facilities to enable girls study science and technical subjects. As students join Form Three they choose the combination of subjects they wish to study for their Kenya Certificate of Secondary Examination (K.C.S.E.). At this time the process of subject choice is a 'crucial point' in the school careers of pupils (Ball, 1981). This is because decisions made by the pupils, their teachers and parents clearly have implications for their lives, which reach far beyond the limits of schooling.

Choice. as a concept tends to be regarded highly in our democratic society. Allowing students to choose the subjects they study gives them more 'ownership' of their curriculum and reduces the likelihood that they will be alienated by an over-prescriptive curriculum (Salisbury and Riddel, 2000). However, choice can be a problem when the individuals responsible for making choices are overly influenced by the traditional attitudes (Kelly, 1981). Kelly says that this leads to

many girls choosing to study 'girls' subjects' and thereby limiting their choices for future careers. This, Kelly calls channeling and not choosing as students are herded into pre-determined paths.

In a study carried in Britain, it was discovered that subjects in which female students were a clear majority were home economics, religious studies, modern languages, English language, literature and social studies. In fact more than two-thirds of students taking these subjects were female (Salisbury and Riddell, 2000). In another study done in 1972 by Sarah and Spender, a sex specific curricula had subjects deemed appropriate for boys and for girls. Girls' subjects frequently mentioned were catering, needlework, clothes design, dancing, human biology, jewellery and mother craft. Boys' subjects were identified as engineering, gardening, woodwork, metalwork, technical drawing, building, navigation, physics with chemistry, rural science, pottery and surveying. Options were not officially closed, but it was only occasionally that a member of a "wrong" sex was admitted. This second study was also done in Britain.

Closer home, this pattern has been observed. For example, in 2003, out of 1031 candidates in Kericho District who took the subject in K.C.S.E. examination, only 221 were girls (Daily Nation Correspondent Wednesday, April 14th, 2004).

Nationally, fewer girls opt for physics and chemistry, as noted by Prof. George Saitoti, the Minister for Education, Science and Technology. While releasing the K.C.S.E. results in February, 2003, the Minister noted that girls formed only 28.26 percent of those who took physics nationally while boys formed the rest, that is 71.74 percent (Aduda, Thursday, February 27th 2003:2). Given options,

few students take physics and chemistry. Yet these subjects are fundamental in their future career prospects. Our economic and technological advancement is predicated on cadres with scientific and computing skills, which can only be achieved through effective secondary schooling. This includes studying the sciences.

The result is that even when one looks at students' enrolment in post-secondary courses, it is discovered that female students are outnumbered by male students in the more technical and technology oriented programmes (Ndede-Amadi, 2004). A study conducted at the University of Nairobi and Jomo Kenyatta University of Agriculture and Technology found that women were under-presented in courses that could open gates to science careers (Ramani, Saturday, February 16th 2002 Special Report p.1). The data in Tables 1 and 2 show enrolment in various science based departments and faculties in the 2000/2001 academic year.

Table 1: University of Nairobi 2000/2001 Academic Year Per Gender Enrolment

FACULTY/ DEPARTMENT	YEAR OF STUDY											
	1st		2nd		3rd		4th		5th		6th	
	M	F	M	F	M	F	M	F	M	F	M	F
Agriculture												
Agriculture	75	18	64	71	79	25	93	17	-	-	-	-
Food Science	21	6	23	5	21	9	17	7	-	-	-	-
Range Management	20	3	16	5	14	5	24	5	-	-	-	-
Architecture												
Architecture	24	4	22	2	23	26	1	25	3	-	-	-
Building Economics	23	3	27	2	21	9	23	7	-	-	-	-
Design	10	11	18	20	12	7	15	15	-	-	-	-
Engineering												
Civil	40	7	60	8	53	6	66	5	59	3	-	-
Electrical	51	3	39	4	72	5	65	8	58	3	-	-
Mechanical	43	0	47	3	75	3	48	1	58	3	-	-
Survey	21	4	23	1	20	3	23	3	16	1	-	-
Agriculture	29	3	26	2	29	2	38	3	24	1	-	-
Medicine												
Medicine	63	37	65	37	98	57	83	27	83	27	-	-
Institute of Computer Science												
Computer Science	39	3	38	1	31	3	29	10	137	17	11	1
Pharmacy												
Pharmacy	37	13	20	37	21	19	18	17	10	13	67	-
Dental Science												
Dental Surgery	13	8	18	8	12	9	9	6	8	4	56	35

Table 2: JKUAT 2000/2001 Academic Year Per Gender Enrolment

FACULTY DEPARTMENT	YEAR OF STUDY											
	1ST		2nd		3rd		4th		5th		6th	
	M	F	M	F	M	F	M	F	M	F	M	F
Agricultural Engineering	31	1	32	1	28	1	17	4	27	6	-	-
Food science Technology	14	10	18	8	15	5	14	7	-	-	-	-
Horticulture	28	11	17	9	26	7	30	8	-	-	-	-
Architecture	10	6	15	2	17	4	13	2	14	3	18	4
Civil Engineering	28	5	31	4	35	5	25	0	28	4	-	-
Electrical Engineering	20	3	34	3	32	3	27	1	28	8	-	-
Mechanical Engineering	20	0	33	1	35	1	35	0	24	1	29	0
Computer Science	21	1	18	0	-	-	-	-	-	-	-	-

Source: Ramani, East African Standard, Saturday, February 16th 2002. Special Report p.

The results in Tables 1 and 2 show that in the 2000/2001 academic year;

(i) No female student was admitted to study mechanical engineering against a combined population of 63 men.

(ii) Women are fairly represented in those departments, which do not require physics as an entry requirement. These are the departments in the health sciences. Indeed, they out-number men 1:1.13 in nursing.

Commenting on patterns of choosing subjects, Herz et al. (1991:45) have this to say:

> Curricula should be streamlined to avoid or reduce overload from non-essentials and to focus on the main priorities including Mathematics and science for girls as well for boys. In almost every country women study less mathematics and sciences than men. Research shows that this reflects a subtle interaction between traditional attitudes on what women 'should study' and the options for study offered to women and girls.

It has been argued that one reason why so few girls study physics is that they tend to be less confident than boys of their own ability and less likely to choose difficult subjects (Kelly, 1981). However, this explanation is less convincing with respect to languages which are difficult subjects performed better by females than males (Makau, 1997). It is not just that science is male dominated, but that in some way it is seen as masculine. Consequently, girls tend to reject physics as part of a desire to become and be seen as feminine (Hammersley and Hargreaves, 1983).

The problem of neglecting the sciences among female students seems to be done with the connivance of education experts and officials. These include authors and publishers of textbooks. Every writer and every publisher of schoolbooks has cultural and political beliefs and advocates these. As a result, some writers give

the women in their textbooks the traditional female roles as mothers, cooks, and care givers while the men are given superior roles as engineers, drivers and carpenters to name a few. For example, in Hallo Children, a key reference English book for standard one, while Mr. Kamau drives a bus, Mrs Kamau stays at home to mind the family (Morgan and Wandera, 1975). This book series runs from standard one to standard three with this kind of stereotyping. It is very much in use in our schools today. The latest reprinting was done in 2003. This gives the children a wrong picture because they start to believe that there are roles preserved for men that women cannot touch. The trend should be a more scientific based curriculum to enhance women's greater participation in national development (Kinyanjui, 1987). This is necessary in order to enable girls face the sciences with confidence by overcoming the sex-role stereotypes found in textbooks (Owino, 1987).

However, the problem is that most planners, policymakers and educators in Kenya think that once there is adequate provision of trained teachers and learning resources, then equal education opportunity is spread out between boys and girls. Even among the highly educated researchers and educationists, understanding the implication of sex role ideology on girl's educational aspirations and career choices has been elusive (Gachukia, 1994).

Unless serious steps are taken to address the effects of sex-role ideology on the education of girls, then gender discrimination in education is likely to continue. Gender stereotyping in textbooks and other educational materials was also presented to the Koech Commission as being responsible for limiting girls'

expectations and reinforcing negative self-perception (Republic of Kenya, 1999). This is called the hidden curriculum (Doll, 1992). The effects of the hidden curriculum are seen when subtle implications are explicitly understood by those taking part in a lesson. For example, when children read about Mr. Kamau driving a bus, they understand that drivers, especially of commercial vehicles should be men. Thus girls withdraw any aspiration for this career. They also begin to see their role as being at home to mind the family with the husband as the breadwinner. In textbooks that schools use, more references are made to boys than to girls. They also tend to stereotype sex roles: Boys are leaders, active, courageous; Girls are mothers, helpful, subordinate (Sexton, 1976). Walford (1980) analysed science textbooks in Britain. He found that of the illustrations in physics textbooks in use in schools, 80 percent showed males only. When women did feature, they were either nursing or cleaning.

Choice is a common feature of each national curriculum. The element of choice is somehow limited because in primary schools and in the first two years of secondary education, all children must continue to study similar subjects. By allowing choice of subjects at the 14 – 16 ages by which time they are in form three, the national curricula provide the opportunity for pupils to make gender biased subject choices (Salisbury and Riddell, 2000).

This shortcoming has a major effect on girls' future employment opportunities as it hinders women's access to better paying jobs (Herz et al. 1991). In all this, girls are subtly or openly persuaded that traditionally masculine subjects such as the hard sciences and mathematics are not for them (Spender, 1982). This issue is of

great concern especially because qualifications in these subjects are often necessary for access to prestigious and highly remunerated careers (Francis, 2000). On the other hand, young men seem to have advantage in the labour market because of their bias towards the sciences and technical subjects. In fact girls are said to opt for low status and low paid feminine jobs to do as they bridge the gap between leaving schools and marriage, and may stop working for good (Salisbury and Riddell, 2000). Priority should therefore be given to teaching more science especially physics in order to create a labour force that is adequate and appropriate for our national needs and one that can at the same time compete in world labour market.

Failure by girls to link schoolwork and career aspirations is brought out by a study carried in two Nairobi schools in 1994 by Obura. In that study 4 percent of pupils in a girls' school said that they had chosen to study electricity because it reinforced or supported their learning in physics, which they were interested in. But boys in another school chose home science because they said that the best chefs in international hotels are men. Consequently, 12 percent of the boys opted for home science. They did not do this because of mere interest. Rather they were connecting schoolwork with the world of work. Obura (1994) concluded that boys had found and identified role models in the world of work and that they were single-mindedly pursuing this career pattern.

If the problem of low rate of choice of physics by girls is given adequate attention, then there is a chance that corrective measures can be initiated to increase the numbers of those who opt for this crucial subject. Physics will enable

more girls and women to became engineers, pilots and mechanics. These are well paying careers which will give women economic empowerment to make important decisions on issues that concern them. This calls for an understanding of the key factors that make girls to ignore this subject. The choice for this study was prompted by observation by the researcher that physics was especially not very popular among girls in Kenya's secondary schools. The researcher was therefore interested in finding the reasons behind this unpopularity for physics as a subject of study at secondary level of education.

1.1. Statement of the problem

The Kenya National Examination Council (K.N.E.C.) administers the Kenya Certificate of Secondary Education (K.C.S.E.) examination to students who have completed four years of secondary education. Specific performance in particular subjects is used as the yardstick for selection and placement in various post-secondary institutions, which include colleges, polytechnics and universities. Many middle-level colleges like polytechnics offer mainly science-based courses. Examining their entry requirements, one discovers that about half the courses require those who have done physics. These courses include all engineering courses (like mechanical engineering, electrical engineering, civil engineering and surveying), aviation technology, draughtsmanship, plumbing and laboratory technology. The universities have faculties and departments which offer technical and technology based courses. Many of these courses have physics as a required subject. Here the courses include engineering, dentistry and radiology. Therefore, it is important that more girls do the sciences and especially physics in upper

secondary school as a preparation for training for careers in the sciences and technical subjects.

1.2. Purpose of the study

The primary task of this study was to investigate the factors that inhibit the majority of girls from studying physics at secondary school level. The dependent variable for this study was the choice of physics by girls in Forms Three and Four in Makueni district in 2004.

1.3. Objectives of the study

In order to fulfill the purpose of the study, five research objectives were identified. These sought to:

i) determine whether more girls choose physics when they attend mixed schools than when they attend girls' only schools.

ii) establish whether teachers' attitudes to girls' interest in physics influence their choice of the subject.

iii) establish whether female teachers of physics act as role models and thus attract more girls to opt for physics in Forms Three and Four.

iv) examine the role of peer-group pressure on girls' choice of physics.

v) determine whether parents' level of education influence their daughters' choice of physics.

1.4. Research Questions

On the basis of the study objectives, five research questions were formulated as follows:

1. Is there any difference in the numbers of girls who choose physics from the girls' only schools vis-à-vis from the mixed schools?
2. How does teachers' attitude influence girls' choice of physics?
3. What role do female teachers of physics play in attracting more girls to opt for the subject?
4. What is the influence of peer- group pressure on the choice of physics by girls?
5. How does the education level attained by parents influence their daughters' choice of physics?

1.5. Justification of the Study

Most of the available literature on studies in the choice of physics by girls are based on studies in the developed countries and thus very few have been conducted in the less developed countries like Kenya. At the same time, available literature tends to concentrate on performance in subjects among them physics and neglects the process of the choice of subjects. The researchers here are only interested in those who opt for the subject despite their small number compared to those who take the humanities, for example history. This study on the other hand is interested on those who opt for physics as well as those who do not. One never fails to notice the occasional comments in newspapers on girls neglecting the subject. In the light of a keen interest in promoting science education to aid in industrial development, means and ways have to be devised to increase the number of those who can take this subject among especially the girls.

1.6. Limitations of the Study

The following were identified as limitations of this study:

i) The main limiting factor arose from the design of the study. The research design is ex-post facto; a design which has limitations in that the researcher cannot control the independent variables as their manifestations have already taken place (Cohen and Manion, 1994).

ii) Although many factors may be responsible for determining the choice of physics by girls in Makueni district, only five of them were selected for this study.

iii) Since the study was limited to girls in Forms Three and Four in Makueni District, the findings and generalisation of the study will only be limited to the study area.

iv) There are no pure boys' schools in the study area.

1.7. Scope of the Study

The study area consisted three educational (and three administrative) divisions. These were Makindu, Kibwezi and Mtito-Andei. The study groups consisted of Forms Three and Four girls who had enrolled for physics in 2004 and others who had not enrolled in the subject in the two classes in the same year on a fifty-fifty ratio. Some schools were pure girls' schools while others were mixed schools. All respondents were drawn only from those schools that offered the subject in Forms Three and Four. This area had 22 schools that offered physics in the two upper secondary school classes.

1.8. Significance of the Study

Since education is recognised as being important in preparing the youth for a future role in nation building, the results of this study are likely to be beneficial in the following ways:

First, it is expected that the findings of this study will enable the government of Kenya to realise its commitment to making Kenya an industrialised nation by the year 2020. Girls and women with the necessary scientific and technical skills will play an important role in providing the requisite skills.

Secondly, the findings will be useful to parents who have had to undergo the pain of seeing their daughters going through school and graduating to unemployment without realising that the problem is poor choice of subjects.

Thirdly, the findings of this study will also help the girls to break the yoke of subjugation placed on them by the society. This is because over the ages women have been pushed to taking lowly paid careers.

Finally, it is anticipated that the findings of the study will be useful to the teachers of physics who have had to content themselves in teaching skeleton classes in Forms Three and Four as the majority of students 'run' to other subjects.

1.9. Definition of Significant Terms

Physics: The branch of science concerned with the nature and properties of matter and energy. The subject matter of physics as distinguished from that of

chemistry and biology includes mechanics, heat, light and other radiation, sound, electricity, magnetism and the structure of atoms.

Single Sex Schools: Type of schools where either boys or girls are given the opportunity to learn exclusively of the other sex. They are either called girls' or boys' schools.

Co-educational Schools: Schools where boys and girls learn together. They are commonly called mixed schools.

School Administration: The day to day running of schools by principals, head teachers, deputies and other teachers given the authority by the Teachers' Service Commission (T.S.C.) or delegated by those given the author.

Choice: Freedom given the rational to opt for what is of interest to them or reject what they dislike and thereafter accept the resultant consequences.

Affirmative action: The practice or principle of treating disadvantaged groups of people favourably in order to bring them to the same level with the rest. Affirmative action is also called positive discrimination.

Public Secondary Schools: Schools which receive teachers from the government through the Teachers Service Commission (T.S.C.) and whose needy students are eligible for grants in the form of bursaries from the government.

Private Secondary Schools: In this study this category of schools refers to schools established by private individuals and private organisations with the aim of making profits or offer education to the youth. Many charge exorbitant fees.

Occupation: A job or employment.

Electives: Subjects in the curriculum, which are open to choice by students for instance geography, history, biology as opposed to compulsory subject like Kiswahili, English Language and mathematics.

Stereotyping: A fixed set of ideas about what a particular type of person is like or should do.

Teaching Aids/Resources: This will be used as a general term to include books, libraries, laboratories and so no.

Home Environment: In this study home environment will refer to parents' level of education.

Parental Encouragement: This falls under the broad heading of home environment and will be used to refer to payment of school fees, parents taking time to discuss with their daughters what they are doing in school and what they want to become in the future.

Career Aspirations: In this study this term is taken to refer to the preference that learners have for a particular occupation such as teaching, engineering among others.

CHAPTER TWO

REVIEW OF RELATED LITERATURE

2.0. Introduction

This chapter contains a review of the literature that is related to the determinants of the choice of physics by girls in secondary schools. Some of the determinants that are known to influence choice of subject combination by girls are the co-education of boys and girls; teachers' attitudes towards girls' interest in subjects; the presence of women teachers as role models; the influence of peer-group pressure and parents' level of education.

One important task to the youth is preparation for adult life. It is at this time when children are given education in preparation for their role in community building as adults. In the past, the youth in Africa were given traditional education by their seniors. These included parents and other members of the extended family and the community at large. The curriculum was informal and skills were passed and taught through apprenticeship. Skills taught included economic (like looking after cattle), social (like reproductive health and communal life), leadership and military skills.

However, colonialism in Africa brought with it formal education into the continent. As a result, preparation for adult life is now done in schools. Employed teachers provide this service. Preparation for future life is done in various ways, for example, through acquiring literacy, acquiring communication skills as well as through leadership opportunities given the student body as class monitors and

prefects. These leadership opportunities prepare the youth for leadership roles as adults in the world outside school. But the most important role played by schools is to prepare the youth to be future workers in the formal (public) and informal (private) sectors of a country. As they learn from pre-primary through primary to secondary levels of education, the youth are accorded an opportunity to prepare themselves for future career choices at the university and other training colleges. Therefore the choice of subjects that learners make in secondary schools determines the career opportunities available to them after secondary school education.

2.1. The co-education of girls and boys and the choice of physics by girls.

The Koech Report (Republic of Kenya, 1999) says that the commission received evidence that many Kenyans prefer to separate girls from boys at the secondary school level. Yet others said that girls and boys should learn to live and interact with each other at all levels of education, just as they would in the home. But the report adds that investigations revealed that girls perform better when they are on their own. This finding would tend to justify the continuation of single sex schools and streaming by gender in some subjects of the curriculum. This observation by the commission puts emphasis on the fact that when boys and girls learn together, girls are disadvantaged. This disadvantage is manifested in poor performance. As a result of poor performance in assignments and end of term examinations they end up dropping some key subjects, physics included.

The commission thus recommended the separation of boys and girls in schools or where not possible single streaming in some subjects.

Sadker and Sadker (1991) observed that because as opposed to males, most females tend to be less aggressive and assertive in asking and responding to questions or expressing their views or taking the lead in practical activities, they tend to be sidelined and dismissed by the teachers (with connivance of male students) as lacking in ability. As a consequence the full potential of most female students is not developed. This leads to many girls dropping some science subjects because of minimal participation where boys can even do the three electives: Physics, Chemistry and Biology.

All cultures promote one set of behaviour for boys and a separate set for girls. Children generally learn their socially acceptable roles by the time they are five years old, but teachers, parents, authority figures and the media often continually reinforce these roles throughout their life cycle. These traditional roles can be harmful to both men and women. This fuels gender bias called sexism (Storey, 1992). The socialization of children along traditional gender roles was said to disadvantage girls when they are expected to perform as well as boys and to share equipment and facilities with them (Republic of Kenya ,1999). Some parents may be willing to send girls to co-education schools for a few years, but having girls' schools available can be important once girls reach puberty (Herz et al. 1991).

Research from several countries shows that girls tend to perform better in a variety of subjects ranging from languages to mathematics if they attend girls'

only schools, especially at the secondary level (Herz et al. 1991). In a study conducted by Kathryn A. Riley in Britain in 1980-1981, it was found that in a mixed girls' school called Greenvale, the hidden curriculum through the schools' "choice mechanism" of subjects perpetuated male dominance in science subjects. The effects of the schools' hidden curriculum and specifically this 'choice mechanism" was that by the time female students had reached their fifth year in secondary education (form five), only two girls were taking physics (Riley, 1994). One inimical effect when boys and girls learn together is that girls are not likely to be as willing as boys to join in open class discussions. They may go as far as choosing to withdraw from answering questions (Hammersley and Hargreaves, 1983). The problem is that without answering and asking questions there is little learning. This puts girls in a disadvantaged position when they learn together with boys especially after puberty, which happens to be the secondary school level.

Sexed class registers encourage stereotypes (Salisbury and Riddell, 2000). This is the practice whereby boys and girls are listed separately on the same page but boys from top downwards while girls are listed from bottom upwards. This enforces the view in girls that they are second-class members in class. This is exacerbated by the fact that teachers generally begin by calling boys then girls in roll calls.

One negative influence on the career aspirations of girls when they learn with boys is that the girls are made aware that there are jobs and careers not open to them. In a study carried in the 1980's (Sarah and Spender, 1988) it was found out that according to boys, girls can not be engineers, computer personnel, train

drivers, doctors, dentists or lawyers, although these boys had met these female professionals. It is these attitudes from classmates that have pushed many girls to avoid aspiring for these careers and to an extend to avoid those subjects that prepare one for the high paying careers.

It has been shown that many pupils do not study a balanced curriculum, that there are wide differences between the curricula studied by pupils in different schools and between pupils in the same school and that curriculum choices made by the less able and girls are likely to be fairly restricted (Smith and Tomlinson, 1989). This calls for school managers to offer a larger number of subjects to students as a way of diversifying the curriculum offered in their schools.

Sexual harassment at times becomes an impediment to girl's education in co-educational schools. Sexual harassment is not confined to uninvited groping and grabbing but extents to a range of interactions where boys exert power over girls and consequently deny girls rightful access to educational resources (like teachers' time, classroom space and play areas), freedom of expression and perhaps most damagingly, reinforce in girls the submissive and sex-object roles into which they are socialised by the family, the media and so on (Burchell and Millman, 1989).

2.2. Teachers' Attitudes To Girls' Interest In Physics

Arnot (1982) pointed out that schools are not free from blame on reinforcing sex role stereotypes. These are manifested in teachers' attitudes, which reproduce patterns of gender inequality, grounded on sex role ideology. In this they enforce the traditional role of some subjects being the preserve of boys and being out of

"reach" to girls. They thus discourage them from such subjects like physics or fail to kindle their interest in it. Campbell (1980) goes ahead and says that some courses, such as technical education have been stereotyped "masculine" and this discourages girls from pursuing them, even when they are doing well in them.

Teachers' attitude to girls' interest in physics and the sciences is brought out clearly by Sadker and Sadker (1991), who observed that most science teachers dismiss female students because they are less aggressive and less assertive in asking and responding to questions or expressing their views. This ends up alienating them from performing well in the sciences or makes them drop some of those subjects altogether. Makau (1997) says that one of the characteristics to be examined concerning the choice made by girls in physics is on how supportive are physics teachers' views on students' participation in science education as preparation for a future career. This shows that the choice made by students will depend on support they receive from their teachers. If this support is lacking like when female students are ignored by their physics teachers, then the number of those to do the subject can dwindle.

Teachers' attitudes and behaviour affect pupils' subject choices in different ways. Some students will choose a subject just because they like the teacher and this may or may not have significance for gender differences in the choice of subjects (Salisbury and Riddell, 2000). Further, according to these two editors some teachers may have their own attitudes about the suitability of their subject(s) for boys and girls, which they express in a number of overt and covert ways. For example, a study of option choice in one school demonstrated the use of sexist jokes and body language designed to discourage female students from choosing

that subject (Salisbury and Riddell, 2000:124). The result is that in classroom, experiences of different areas of the curriculum may still differ for boys and girls because of the attitudes and behaviours of teachers. The problem of teacher-induced passivity in class would seem to be particularly acute among female students in mathematics and science lessons and technical fields of study (Obura, 1994). Teachers do sometimes communicate to girls that they are less welcome, less interesting or less likely to do well in some subjects (Hammersley and Hargreaves, 1983).

2.3. Female Teachers of Physics As Role Models To Girls

Anderson (1971) investigated the relationship of teacher's sex and course content to the pupils' perception of their classroom environment. The result of the study was that the teacher's sex in its interaction with course content revealed a statistically significant effect on classroom learning environment. Therefore the sex of the teacher is important if learning is to take place effectively.

Child-centered learning, the fad in today's teaching of the curriculum positions the female teacher as a benevolent overseer of a landscape of elemental and natural goodness. She serves as an empathetic facilitator of the learners' evolution (Todd, 1997). Consequently, one important way to inspire more girls to do physics is to encourage more women to teach the subject in secondary schools.

Nevertheless, very little has been done to deliberately increase the number of female teachers in non-traditional courses. Most teachers of technical, mathematics and science subjects are male, hence girls have few role models in

schools to inspire them. The absence of women becomes more apparent as one goes higher up the academic ladder (Makau .1989 and Obura 1994). In some setting, girls must be taught by women. In others parents strongly prefer that girls must be taught by women. Evidence suggests that shortage of female teachers can inhibit girls' school attendance especially at the secondary level (Herz et al. 1991).

There is evidence that teachers are more attached and concerned for boys and more often reject girls. This applies to teachers of both sexes. However, the trend is more among male teachers; the chance, for example, that a boy will be recipient of his teachers' concern is twice that of a girl if the teacher is a woman, but ten times greater if the teacher is a man (Woods and Hargreaves, 1992). Therefore, because male teachers spend a lot of energy and time on boys because they have a predilection to them, female teachers are better placed to teach girls. However, female teachers at times can act as an impediment to girls' attempts to break from the role assigned traditionally to them by the society. This happens when in schools girls strive but are discouraged by female teachers from choosing non-traditional subjects (Riley, 1994).

2.4. Peer-Group pressure and Its Effects on Girls' Choice of Physics

The weakening of the family today and the advent of the modern school is partly a cause, and partly a consequence of the strengthening of the peer group. The peer group therefore exerts a very strong influence to the youth today. Such influence may help or impede their academic achievement, depending on the values of the group and the effectiveness of the mechanism for social control

exercised by the group over its members. The peer group thus affects the academic achievement and educability of a child (Datta, 1984).

The stage at which national curricula allow choice of subjects for public examination is when children are most susceptible to peer-group pressure (Cole, 1989). Bearing in mind both the general pattern and the significant expectation, it seems that sex role learning plays a significant role in informing pupils' attitudes to science. Sex role differentiation, it appears is centrally important in switching girls off the physical sciences. If the physical sciences' activities are seen as inappropriate for girls, then in refusing and rejecting them, the girls have a useful device for signalling their own gender identity. As a girl rejects science, she puts pressure on others to do the same to show that they too are feminine (Riley, 1994). This is peer pressure.

Peer-group pressure makes many girls not to do particular courses if their friends do not take them as well. As a result, peer-group pressure further influences children's attitudes to what are boys' subjects and girls' subjects, and creates situations in which it is very difficult for individuals not to conform to the norm of their gender (Herz et al. 1991). Many times, girls wishing to do what are considered boys subjects meet hostility from their peers. For example, at Greenvale there were only two girls taking physics in the 5th year when the research mentioned earlier done by Riley was conducted (Riley, 1994). A girl called Yvonne reported that the other pupils said that the two did physics only to be with boys (Riley, 1994). For a girl, a choice of science may lead to sanctions from her feminine peer group and from boys (Haggerty, 1995).

The influence of the peer group is so strong that it becomes increasingly important in children's lives – eventually competing with and even eclipsing parental influence (Haggerty, 1995). Indeed, the peer group erodes parental influence. Many times parental advice is ignored in place of that from peers (Riley, 1994). This is not hard to understand. When children first arrive in school, they may be traumatized at the situation they find themselves in if they have no contacts among their peers. But once they have made friends and gained access to childhood culture, they must be careful not to annoy or offend their friends or they find themselves alone again (Woods and Hammersley, 1992). Thus to understand the dynamics of the youth, one must understand that they form a homogeneous group with its own rules and regulations which are not to be breached unless one is to risk hostility from the members including being ostracized. The youth have what Woods and Hammersley (1992) call "children's culture".

Science is a useful resource for signaling identity, for signaling femininity (Hammersley and Hargreaves, 1983). Peer group pressure therefore influences children's attitudes to what are boys' subjects and girls' subjects, and these create situations in which it is very difficult for individuals not to conform to the norm of their gender (Salisbury and Riddell, 2000).

2.5. Parents' Level Of Education

Machyo (1995) conducted a research in Kenya and discovered that parental expectations played an important role on the career and educational aspirations of their children and that further, the educational level attained by parents is influential in determining the career choices that their children make. Several

studies suggest that parental schooling promotes their children's schooling. A study conducted in Brazil in the 1980's found that an additional year of parental schooling linked to an additional 0.11 to 0.4 years of child schooling in urban areas and 0.14 to 0.39 years of child schooling in rural areas (Herz et al. 1991). Young (1985) argues that students see their parents as role models and that parental encouragement or discouragement influences non-traditional career choices. Thus, advice from parents may enforce existing gender stereotypes about what are considered appropriate male and female careers (Salisbury and Riddell. 2000).

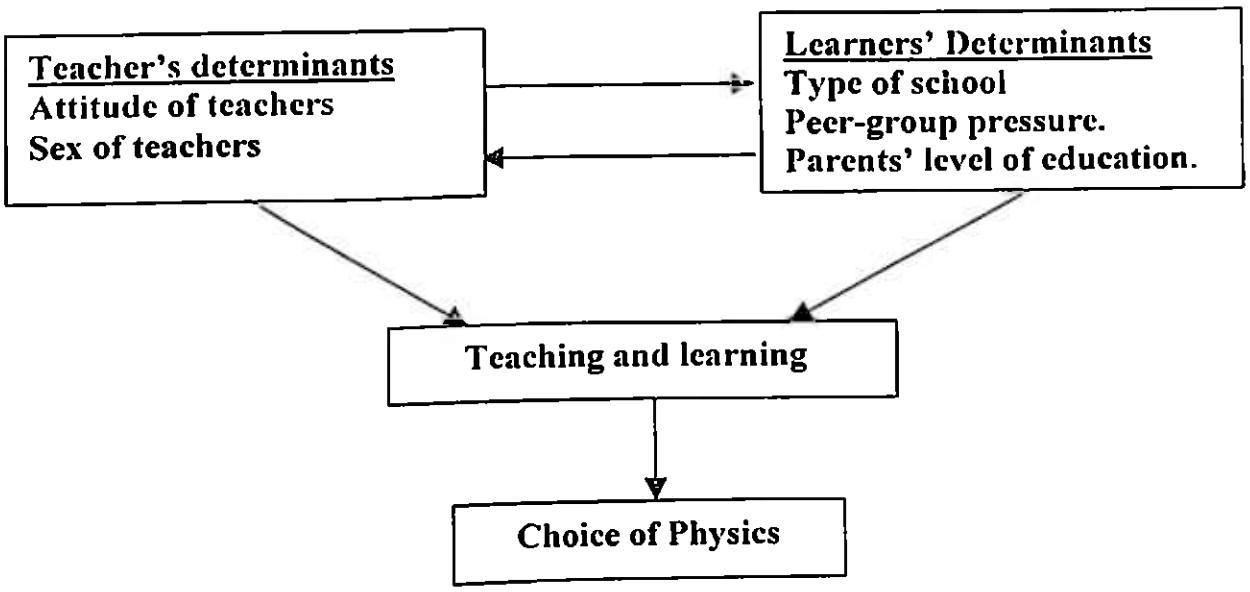
Many parents keep away from their children's school activities and work. There are a number of factors responsible for this. One is that parents are sometimes embarrassed by their own lack of literacy. either because English. the media of instruction in many schools is not their first language or because they failed in school (Noble and Bradford, 2000).

In attempting to make a connection between choice of physics and the levels of education attained by parents. Makau (1997:14) posses these two questions

i) How is the educational level reached by mothers related to their children's performance in S.S.L.E. (Secondary School Leaving Examination) physics?

ii) How is the education level reached by fathers related to their children's performance in S.S.L.E. Physics?

2.6. Conceptual Framework on determinants of choice to study physics by Girls at Secondary Level of Education



In the conceptual framework above, it is shown that the choice of physics by girls emanates from both teachers and the learners themselves. The teachers' determinants are: attitude of teachers and the presence of female teachers. The learners' determinants are the type of school (Mixed or single sexed), peer-group pressure and finally parents' education levels. The process of teaching and learning reinforces these determinants as girls learn in Forms One and Two. In Form Three they decide to choose or reject Physics.

2.7. Summary of Literature Review

The review of the relevant literature seems to suggest that the co-education of boys and girls, the attitude of teachers, the presence of female teachers, peer-group pressure and the education levels reached by parents influence the choice to do or not to do physics by girls. The study investigated the influence of these factors on the choice of Physics by girls at secondary level in Makueni District.

CHAPTER THREE

RESEARCH METHODOLOGY

3.0. Introduction

This chapter describes the research methodology adopted for this study. It contains research design, target population, sample size and sampling methodology, research instruments, a brief description of the research questionnaire, instrument validity, reliability of the questionnaire, data collection procedures and data analysis techniques.

3.1. Research Design

This study used the ex-post facto research design. This is the type of design that involves testing out the possible antecedents of events that have already taken place and cannot be manipulated or engineered by the investigator (Cohen and Manion 1994). Kerlinger (1986) has defined the ex-post facto research as in which the researcher starts with the observation of a dependent variable in retrospect to its possible relationship and effect on the independent variables. This research design was used to examine the determinants of the choice of physics by girls in Makueni district.

The suitability of the ex-post facto design for this study is because it involves studying events or situations that have already taken place. Choice of physics by girls had already taken place as they were in Forms Three and Four while at the same time the factors responsible for this status quo could not be manipulated. This is the type of research called Historical Research (Best, 1977). This type of

research involves investigating, recording, analyzing and interpreting the events of the past for the purpose of discovering generalizations that are helpful in learning from the past, understanding the present and to a limited extent, in anticipating the future.

3.2. Target Population

In this study samples were taken from the population of Forms Three and Four female students including those taking and those not taking physics on a 50:50 ratio. Records available in the District Education Office at Wote showed that the study area had twenty-two schools that offered physics from Form One to Form Four. Three of these schools were pure girls' schools while 19 were co-educational.

There were 135 girls in pure girls' schools taking physics and 122 girls in co-educational schools also taking physics. Because of the 50:50 ratio consideration, 135 girls who did not take physics from the pure girls' schools and 122 from the co-educational schools were added to those taking physics in their respective categories. This means that from the pure girls' schools there was a target population of 270 girls and from the co- education schools was a target population of 244 girls.

3.3. Sample Size and Sampling

The sample for the study was selected from Forms Three and Four female students learning in schools that offered physics in Forms Three and Four in the study area. Because there were only 3 girls' schools and 19 co-educational

schools offering physics in Forms Three and Four, both stratified sampling and purposive sampling were adopted to select samples in this study.

Formula for determining sample size for research by Krejcie and Morgan (1970)(see appendix 2) show that from the 19 mixed schools which offered physics, 18 schools were to be selected for this study while because there were only three pure girls' schools, all were to be involved in this study. This is purposive sampling because of the small number involved. Using the same formula by Krejcie and Morgan (1970), a sample of 159 girls from the pure girls' schools out of 270 was drawn while from the co- educational school a sample of 148 girls out of 244 was also be drawn.

Table 3 below shows the sample for this study.

Table 3: Sampled student population in secondary schools by type of school.

School Type	No. of girls	Out of	Percentage
All girls	159	270	51.8%
Co-educational	148	244	48.2%
Total	**307**	**514**	**100. 0%**

3.4. Research Instruments

The questionnaire formed the main research instrument in this study. One questionnaire was used to collect data from those taking physics and those not taking the subject

The questionnaire was designed to elicit from the students responses on what determined their choice or rejection of physics. This was in connection to the co-

education of boys and girls, the attitude of teachers, presence of female teachers, peer- group pressure and the education levels attained by the learners' parents.

The questionnaire was divided into two parts. These were A and B. Part A was used for gathering students' bio-data. Part B in turn solicited for information on the determinants of the choice of physics by girls. On the co-education of boys and girls, information sought included: answering questions, asking questions, whether they faced discouragement from boys, reaction from boys and fellow girls when they give wrong answers in class, whether they believed that physics is a subject fit for girls, whether boys involved them in their discussions, and whether they believed that there are boys' subjects and girls' subjects.

On the attitude of teachers, information sought was on the inspiration or lack of it to students from their teachers to take physics. On female teachers, information requested was on the sex of their teachers of physics, whether they preferred a male or female teacher for the subject and the reasons for the preference of the teacher's sex. On peer-group pressure, information requested was on whether their close friends influenced them to take physics. Finally, on education of parents, information sought included education level reached by the girl's parents as well as their occupations.

3.5. Instrument Validity

The validity of the questionnaire to collect the desired data was pre-tested. This involved piloting the questionnaire. For the pilot study 30 students were sampled for the purpose of the pre-test. From each of the three educational divisions were sampled five girls who took physics and five who did not take the subject. These

students were not involved in the main study. Pre-testing involved fifteen girls taking physics and fifteen not taking the subject from all the three divisions leading to a total of thirty girls. Simple random sampling was used to select the respondents for the pilot study. The pilot study was meant to identify ambiguous or unclear questions.

3.6. Reliability of the Questionnaire

Roscoe (1969) states that the split-half method during the pre-test can be used to establish the internal consistency (coefficient of the test). This involves splitting the instrument into to two; one half of even-numbered items and the other of odd-numbered items. The correlated result value provides the internal consistency of each half. that is. the degree to which the two halves of the test are equivalent or consistent in terms of items. The coefficient is obtained through the Pearson Product Moment Formula. To obtain the full reliability of instruments. the Spearman Brown Prophecy Formula was used. thus:

$$\text{Reliability of the entire test } R2 = \frac{2 \text{ (reliability of 0.5 test) (r)}}{1+\text{(reliability of 0.05 test) (r)}}$$

(Tuckman. 1978)

3.7. Data Collection Procedures

The research started with the researcher seeking and obtaining permission to conduct research from the Ministry of Education, Science and Technology. Once the research permit was obtained. the researcher visited the selected schools to make an appointment for administering the questionnaire.

3.8. Data Analysis Techniques

Data analysis was done using descriptive statistics, which included percentages and frequencies. The analysis was based on the research questions formulated in Chapter One to guide the whole study.

CHAPTER FOUR

DATA ANALYSIS, PRESENTATION AND INTERPRETATION

4.0. Introduction

The chapter analysed data and presented the findings on the basis of the objectives of the study.

4.1. Questionnaire return rate

To satisfy the objectives of the study, data was collected from the respondents through questionnaires, which were administered in 22 schools – where 148 girls from the co-educational schools and 159 in pure girls schools were expected to fill in and return them. Thus, a total of 307 questionnaires were administered in this study. Out of these, 112 girls from the co-educational schools and 124 girls from the pure girls' schools returned their dully-filled questionnaires. This formed a total of 236, which represented a return rate of 75.7 percent from the co-educational schools and one of 78.0 percent from the pure girls' schools. Overall, the return rate was 76.9 percent, which the researcher felt to be adequate. According to Treece and Treece (1977) a questionnaire that produces 75 percent response rate is sufficient for analysis. These results are summarized in Table 4.

Table 4. Questionnaires Return Rate

Type of School	Number of students	Number of Questionnaires sent	Number of Questionnaires returned	Percentage
Pure girls'	550	159	124	78.0 %
Co-educational	898	148	112	75.7 %
Total	**1448**	**307**	**236**	**76.9 %**

4.2. Background Information About the Sample and their demographics

This study investigated determinants in the choice of physics by girls in Makueni District. A total of 236 Forms Three and Four girls participated in the study. Some 118 of these were enrolled in physics while 118 were not taking the subject. The majority of the girls who were studying physics were from girls' schools while the rest were in co-educational schools. This information is presented in Table 5.

Table 5. Enrolment of girls in physics by type of school

Type of School	Number of Schools	Number of Girls who take physics
Pure girls	3	135
Co-educational	19	119

The 3 pure girls' schools had 135 girls taking physics while the mixed schools had 119 girls also taking the subject. On teachers. 3 schools had female teachers of physics while the remaining 19 schools had male teachers of physics. This information is presented in Table 6.

Table 6. Distribution of teachers of physics by sex

No. of schools with female teachers of physics	No. of schools with male teachers of physics	Total number of schools
3	19	22

4.3. Answering the Research Questions

Question 1. Is there any difference in the numbers of girls who chose physics from the girls' only schools vis-à-vis from the mixed schools?

This question was derived from the theoretical framework which argues that the type of school attended by a girl, whether a pure girls' school or mixed is important in determining the girl's choice of physics. Results analysed from students' responses to the questionnaires indicate that there is indeed a difference in the number of girls who opted for physics from the pure girls' schools and the mixed schools. The analysis is presented in Table 7.

Table 7. Enrolment of girls' in Physics in Co-educational and pure girls' schools

Type of School	Total girls' enrolment	Enrolment in physics	Percentage
Pure girls'	550	135	24.6 %
Co-educational	898	122	13.6 %
Total	**1448**	**257**	**17.8 %**

From the data presented in Table 7. it was found out that there were 135 girls in pure girls' schools taking physics and 122 in co-educational schools also taking the subject. Further examination shows that the pure girls' schools offering physics in Forms Three and Four were three compared with 19 mixed schools offering the subject. Finally, the pure girls' schools had a total enrolment of 550 students (all girls of course) while the mixed schools had a total enrolment of 898 girls. In terms of percentages, the pure girls' schools offer physics to 24.6 percentage of the girls in the two upper classes while the mixed schools offer the

subject to 14.0 percentage of their female students in the two classes. The above figures show that both types of school do not provide ideal conditions for girls to take physics. 257 out of 1448 (that is 17.8 percentage) is a low enrolment for a subject which is as important as physics. But in this. the pure girls' schools are better off in enabling more girls take physics.

Another revelation is that majority of students did not study physics Irrespective of the type school attended. This area has a total of 30 schools and only 22 schools taught physics in Forms Three and Four. This means that 8 schools did not teach the subject at least in Forms Three and Four. Of these, 7 were co-educational and one was a pure girls' school. These eight schools had 318 girls enrolled in them. This means that 318 girls were denied the opportunity of taking this crucial subject.

Conversely, from the pure girls' schools 415 girls did not take the subject out of 550 while from the co-educational schools, 776 girls did not take the subject out of a total of 898. This means that in the study physics was not done by 75.5 percent in the pure girls' schools and 86.4 percent in the co-educational schools. This information is presented in Table 8.

Table 8. Girls' enrolment in the two types of schools in comparison to the total enrolment in the study area.

Type of School	Not enrolled in Physics	Out of	Percentage
Pure girls'	415	550	75.5 %
Co-educational	776	898	86.4 %

The study of unbalanced curriculum by girls. a situation in which more girls tend to study the arts and the languages than the sciences is perhaps not the only problem that exists between the two types of schools in the study area. Hostility from the other students is another very serious problem. Tables 9 (a) and 9 (b) show that girls in both pure girls and co-educational institutions experienced one form of hostility from both boys and fellow girls though boys were the worse offenders. Therefore because girls are likely to suffer more hostility from boys, going to co-educational institutions exposes them to higher forms of hostility which might lower their performance in particular subjects, eventually dropping them if they are electives, physics included.

Table 9 (a). Hostility from boys in co-educational schools

Response	Frequency	Percentage
Yes	13	27.1 %
No	35	72.9 %
Total	48	**100.0 %**

The table above shows that from the mixed schools 35 out of 48 girls (72.9 percent) did not face hostility the boys while 13 girls (27.1 percent) faced hostility from the boys.

In turn. Table 9(b) shows that 30 girls out of 41(73.2 percent) attending mixed schools did not face hostility from fellow girls while 11 girls (26.8 percent) faced hostility from fellow girls .

Table 9(b). Hostility from fellow girls in co-educational schools

Response	Frequency	Percentage
Yes	11	26.8%
No	30	73.2 %
Total	**41**	**100.0 %**

On girls attending pure girls' schools, results in Table 10 shows that 42 of them (72.4 percent) did not face hostility from fellow girls while 16 girls (23.6 percent) faced the problem from fellow girls.

Table 10. Hostility of girls from fellow girls in pure girls' schools

Response	Frequency	Percentage
Yes	16	23.6 %
No	35	72.4 %
Total	**48**	**100 .0%**

The information in Tables 9 (a). 9 (b) and 10 shows that there is more hostility directed towards girls who attend mixed school is with most of it coming from the boys.

This study also established the existence of boys' and girls' subjects in the study area. These are subjects that students tend to choose on the basis of their sex. This has led to the arts and languages to be termed feminine subjects while the sciences are termed masculine. But when asked if they believed that there are boys and girls subjects, only 1.8 percent of the respondents said that they believed that there were boys and girls' subjects while 98.2 percent said that they did not have this belief. These results are presented in Table 11.

Table 11. Girls' belief in the existence of boys and girls subjects

Response	Frequency	Percentage
Yes	4	1.8 %
No	227	98.2 %
Total	**231**	**100.0%**

However, when asked to identify the subject they like the least many girls showed preference for the arts and languages. The results are as presented in Table 12.

Table 12. Girls' worst subjects

Subject	Frequency	Percentage
Chemistry	60	25.8 %
History	23	9.9 %
Agriculture	16	6.8 %
Biology	6	2.6 %
Mathematics	47	20.2 %
English	12	5.2 %
CRE	7	3.0 %
Geography	16	6.8 %
Commerce	16	6.8 %
Physics	26	11.2 %
Kiswahili	4	1.7 %
Totals	**233**	**100 .0%**

The analysis in Table 12 shows that chemistry is the least liked subject by many girls with (25.8 percent) followed by mathematics (20.2 percent) and then physics (11.2 percent). Biology, a science is one of the liked subjects by being chosen by 2.6 percent of the respondents as their worst subject and coming second to

Kiswahili. which was identified by only 1.7 percent of the girls as their worst subject.

The least bad subjects happen to be history (9.8 Percent). Agriculture and geography (both at 6.9 percent), commerce (6.8 percent). English (5.2 percent), C.R.E (7 percent) and Kiswahili (1.7 percent). It is therefore safe to conclude that in the study area, girls subjects are Kiswahili, biology, C.R.E., English, Agriculture, Geography and History.

Question 2. How does teachers' attitude influence girls' choice of physics?

In analysing reasons given by girls on which subjects they disliked and why. it was discovered that teachers play an important role in the rejection of subjects by girls. Of the 236 girls in the study, 37 of them representing 15.7 percent gave reasons related to teachers' attitudes. Their responses are summerized in Table 13.

Table 13. Reasons why teachers make girls not to like physics

Reasons	Frequency	Percentage
I do not like the teacher	8	21.6 %
The teacher is boring	7	18.9 %
The teacher is not good in what he teaches	4	10.8%
There is a big gap between the teacher and students	3	8.1 %
The teacher is not good in what he teaches	5	13.5 %
The form 1 teacher did not promise success at end of course	2	5.4 %
The teacher does not attend classes	2	5.4 %
The teacher is not serious in his work	2	5.4 %
The teacher likes harassing students	2	5.4 %
The teacher does not explain well	1	2.7 %
The teacher is brutal	1	2.7 %
Total	**37**	**100.0 %**

In condemning subjects as their worst, failure by students to like particular teachers' was given as

teach. Others were teachers distancing themselves from their students, lack of good teachers, and teachers not promising success at the end of the learners' secondary school course. The rest were teachers not explaining well, teachers not attending classes as well as teachers harassing students and, to the extreme, teachers being brutal to the girls.

On the other hand, teachers teaching well, girls liking teachers, teachers being lively in their work, teachers being free with the students (being accessible), and finally, teachers being social to their students were given as reasons for girls liking particular subjects, physics included. These findings are contained in Table 14.

Table 14. Reasons why teachers make girls to like subjects

Reasons	Frequency	Percentage
Teacher teaches well	8	28.6%
Teacher encourages me	7	25.0%
I like the teacher	5	17.9%
The teacher is lively (does not bore)	4	4.3%
Teacher is free with me	2	7.1%$
Teacher is social	2	7.1%
Total	**28**	**100.0%**

From the information presented in Tables 13 and 14 it is evident that teachers' attitudes to girls play an important role in girls' liking or dislike of various subjects.

However, it is noted that only a small proportion of girls indicated that teachers told them that physics was a difficult (hard) subject. Their responses are presented in Table 15.

Table 15. If teachers tell girls that Physics is "hard"

Response	Frequency	Percentage
Yes	21	10.4 %
No	201	89.6 %
Total	**222**	**100.0 %**

Information in Table 15 shows that 10.4 percent of girls in the study area had been told by their teachers that physics is a ' hard' subject. However, the majority of the girls preferred to study biology compared to physics and chemistry. The data on students' preferred subject of study is presented in Table 16. The table shows that 39 girls (59.1 percent) saw biology as their favourite subject while 15 (22.7 percent) saw physics as their favourite subject and 12 (18.2 percent) elected chemistry as their favourite subject in the curriculum

Table 16. Choice of the sciences as favourite subjects to girls

Favourite subject	Frequency	Percentage
Biology	39	59.1 %
Physics	15	22.7 %
Chemistry	12	18.2 %
Total	**66**	**100.0 %**

The results in table 16 mean that due to curriculum regulations that a student take at least one science subject for KCSE, many came to see biology as their saviour on this rule. The information in table 16 also shows that many girls had come into

grasp with the reality of the job market where the emphasis today is on the sciences and technology. As a result 66 girls out of 236 identified the sciences as their favourite subjects. This represented a 27.9 percent liking for the sciences by girls in the study area.

The results in Tables 13, 14 15 and 16 have indicated that the attitude of teachers towards girls can lead the girls to choose a particular subject or reject it. Negative attitude from physics teachers in the study area made many girls to drop the subject.

Question 3. Do female teachers of physics influence girls' choice of physics?

While many respondents, that is 73 girls (62.9 percent) did not have preference for the sex of the physics teacher to teach them, a good number of 24 girls. representing 20.7 percent preferred male teachers. 19 girls (16.4 percent of the respondents) said that they preferred female teachers for the subject. Table 17 shows students' preference for the sex of their physics teacher.

Table 17. Students' Preference of teachers by sex

Preferred sex of physics teachers	Frequency	Percentage
Male	24	20.7 %
Female	19	16.4 %
Either Sex	73	62.9 %
Total	**116**	**100.0%**

The results in table 16 reveal that the majority of students' (62.9percent) had no preference

for teachers of physics by sex. Rather, they were ready to be taught by teachers of either sex. On those who preferred their teacher of physics to be of particular sex, 20.7 percent chose male teachers while 13.4 percent preferred female teachers. On the basis of this finding, female teachers of physics are not as popular as their male counterparts. The data in Table 18 shows reasons why girls prefer to be taught by male teachers of physics.

Table 18. Girls Reasons for preferring male physics teachers

Reasons	Frequency	Percentage
Males teach well	6	25.0%
Males are ever serious	2	8.3%
Males are punctual in class attendance	2	8.3 %
Females become angry quickly	2	8.3 %
Males are good at explaining	2	8.3 %
Males are very encouraging	1	4.2 %
Males understand females better them females understand fellow females	1	4.2 %
The subject is done well by males than female	1	4.2 %
Males are hardworking, females lazy	1	4.2 %
Males are more used machines than women	1	4.2 %
Females discourage	1	4.2 %
Male teachers are nice	1	4.2 %
Males are devoted to teaching the subject and carry out experiments	1	4.2 %
Female teachers are very proud and cannot assist in physics because of their pride	1	4.2 %
Males talk in a loud voice and do not bore	1	4.2%
Total	**24**	**100.0 %**

Data from Table 18 show the reasons given by girls for preferring male teachers as including: males teach well, are punctual in class attendance. female teachers are quick to anger, males are good at explaining are encouraging. understand females better, the subject is performed better by males. males are hardworking. are more used to machines, females discourage. males are nice males are devoted to teaching the subject, females are proud, and finally, males talk in a loud voice and do not bore.

Table 19 shows why some girls prefer to be taught physics by female teachers.

Table 19. Girls' Reasons for preferring female physics teachers

Reasons	Frequency	Percentage
I can be free with a female teacher, which can raise my interest in physics	6	31.7 %
Females could act as role models to many girls thus encouraging them in physics	5	26.3%
You can approach a female teacher anywhere. anytime and students won't think badly of you.	2	10.5%
Females are more learned in mathematical calculations	2	10.5%
Females teach slowly so that you understand	2	10.5%
Females give wide examples	2	10.5%
Total	**19**	**100.0%**

The reasons given by girls for liking female teachers include: freedom between female teachers and female students. female teachers of physics acting as role models to girls, being approachable to girls. females being more learned in mathematical calculations, females teach slowly so that learners understand and finally female teachers give wide examples.

There are 3 schools in the study area that have female teachers of physics. The rest (nineteen) are taught the subject by male teachers. Table 20 shows that there are 133 girls in Forms Three and Four in those schools taught by female teachers while there are 823 in schools by male teachers. Out of the 133 in schools taught by female physics teachers, 22 chose physics while in the schools taught by male teachers of physics, 245 out of 823 girls opted for the subject. This represents 16.5 percent choice of physics by girls in schools taught by females and 29.8 percent in schools taught by males.

Table 20. Total number of girls that chose physics from schools taught by males and females

Teachers' sex	Frequency	Out of	Percentage
Females	22	133	16.5%
Males	245	823	29.8%
Total	**267**	956	

The information presented in table 20 is a testimony that female teachers cannot attract girls to opt for the subject in large numbers as their male counterparts can. They are to a large extent rejected by the girls. Thus male teachers are better placed to attract more girls to opt for physics in the study area.

Question 4.What is the influence of peer group pressure on the choice of physics by girls?

When girls were asked to state the person responsible for the choice of physics, their responses were as presented in Table 21.

Table 21: Person responsible for the choice of physics

Person	Frequency	Percentage
Teachers	13	12.0 %
Friends	12	11.0 %
Parents	3	2.8 %
Self	79	72.5 %
Others	2	1.8 %
Total	**109**	**100.0 %**

Table 21 shows that the girls themselves are the most important determinant in their choice of physics. Thus a personal decision is responsible for 72.5 percent for those who chose physics. Teachers account for 12.0 percent while friends. representing the peer-group account for 11.0 percent. Others. here representing siblings, neighbours and religious leaders account for 1.8 percent in influencing girls in choosing physics. In the case of those girls not taking physics, the persons responsible for rejecting the subject are presented in Table 22.

Table 22. Person responsible for the rejection of physics

Person	Frequency	Percentage
Teachers	13	11.1 %
Friends	20	17.1 %
Parents	4	3.4 %
Self	75	64.1 %
Others	5	4.3 %
Total	**117**	**100.0 %**

The results in Table 22 show that again the girls themselves are the determining factor in the rejection of physics. A personal decision is responsible for 64.1

percent in rejecting physics. But the influence of friends (the peer-group) is stronger in influencing the rejection of physics than it was in influencing the choice of the subject. The peer-group is responsible for 17.1 percent in those who rejected the subject. Teachers account for 11.1 percent in the rejection of the subject. Parents made 3.4 percent of their daughters to reject physics. Others are responsible for 4.3 percent in the rejection of physics.

Therefore from the information presented in Tables 21 and 22 it clear that the peer-group plays a modest role in the choice or rejection of physics. In both cases decision by the girls themselves plays the leading role in choosing or rejecting the subject.

Question 5. How does the education level attained by parents influence their daughters' choice of physics?

The analysis in Table 23 shows the education levels attained by parents of girls taking physics in the study area.

Table 23. Education levels attained by parents of girls taking physics

Levels of Education	Father	Percentage	Mother	Percentage
No formal education	4	3.8	3	2.7 %
Primary	24	22.6	36	32.4%
Secondary	31	29.3	37	33.4%
Diploma	17	16.0	14	12.6%
Degree	11	10.4	7	6.3%
I don't know	19	17.9	14	12.6%
Total	**106**	**100.0%**	**111**	**100.0%**

Table 23 shows that the education attained by mothers is important in determining the choice of physics by their daughters. 6.3 percent of mothers with daughters taking physics had degrees while 12.61 percent had diplomas. Looking at the lower levels, 2.7 percent of mothers with girls taking physics had no formal education. On the side of fathers, girls taking physics had 10.4 percent of their fathers having attained a degree level of education and 16.6 percent having diplomas. Table 24 shows the education levels of parents of daughters not taking physics

Table 24. Education levels attained by parents of girls who did not take Physics

Levels of Education	Father	Percentage	Mother	Percentage
No formal education	2	1.9%	1	10.0%
Primary	20	18.7%	26	23.9%
Secondary	42	39.3%	44	40.4%
Diploma	14	13.1%	9	8.3 %
Degree	17	15.9%	3	2.7 %
I don't know	12	11.2%	16	14.7 %
Total	**107**	**100.0 %**	**109**	**100.0 %**

Girls not taking physics had 15.9 percent of their fathers having degrees and 13.08 percent having attained diploma level of education. In comparison, 2.8 percent of mothers with daughters not taking physics had degrees while 8.3 percent had diplomas.

This failure by fathers' education levels to greatly influence the choice of physics by their daughters can further be attested to by the percentages of girls who said they did not know the education levels attained by their parents. Failure to know

the education levels of parents does not mean that these parents had no formal education. Rather, it may mean that there is a distance and lack of communication between the concerned parents and their daughters in matters educational. The chances of such parents influencing their daughter's' academic work remains minimal. That is why 17.9 percent of the girls who chose physics did not know the education levels of their fathers. But in the case of mothers this percentage drops to 13.2 percent. At the same time, 11.3 percent of the girls who did not take physics did not know the education levels of their fathers. This figure rises to 14.7 percent in the case of failure to know the education levels of their mothers. All what the above figures do is prove that it is the education levels reached by mothers which highly influence the choice of physics made by girls in the study area.

The information in Table 25 shows that 87 girls (37.5 percent) taking physics had parents working in the formal sector while 32 (13.8 percent) also taking physics had parents having informal occupations. On the other hand, 37 girls (15.9 percent) of respondents not taking physics had their parents working in the formal sector while 76 respondents (32.8 percent) not taking physics had their parents engaged in informal employment.

Table 25. Parents' occupations and choice of Physics by girls

Parents with	Formal employment	Non-formal employment	Percentage in formal employment	Percentage in non-formal employment
Girls taking physics	87	32	37.5 %	13.8 %
Girls not taking physics		76	16.0 %	32.8 %
Total	**124**	**108**	**53.5 %**	**46.6 %**

The above table shows that parents' occupations may determine the choice of physics by their daughters. This is made clear by the fact that 37.5 percent of parents of girls taking physics are employed in the formal sector where they are employed in the civil service, parastatals, private companies and as teachers, while only 13.8percent are involved in the informal sector where they earn a living in farming, business, politics and in other forms of self-employment. Concerning parents of girls not taking physics, 16.0percent have occupations in the formal sector while the bulk of them, 32. 7 percent are employed in the informal sector. Table 26 provides a breakdown of the occupations of parents of daughters taking physics.

Table 26. Occupations of parents of girls taking physics

Parent	With formal employment	Percentage	In informal employment	Percentage
Father	50	76.9%	15	23.1%
Mother	37	68.5%	17	31.5%
Total	**87**	**73.1%**	**32**	**26.9%**

The data in Table 26 shows that 50 fathers (76.9 percent) of girls taking physics had formal employment and 15 (23.1 percent) had informal employment. This corresponded with 37 mothers (62.5 percent) in the same category who had formal employment and 17 (31.5 percent) who were involved in non-formal occupations. Table 27 in turn provides a breakdown of the occupations of girls not taking physics.

Table 27. Occupation of parents of girls who did not take physics

Parent	Formal employment	Percentage	Non-formal employment	Percentage
Father	15	41.7%	21	58.3%
Mother	22	28.6%	55	71.4%
Total	**37**	**32.7%**	**76**	**67.3%**

The information in Table 27 shows that 15 fathers (41.7 percent) of girls not taking physics had formal employment and 21 (58.3 percent) had informal employment, while 22 mothers (28.6percent) had formal occupations while 55 (71.4) percent were engaged in informal occupations. The above tables show that more fathers than mothers of girls taking physics had formal occupations. Thus while fathers superior education levels may fail to influence choice of physics by their daughters, their occupations seem to do it.

4.4. Summary of the Major Findings of the Study

This study has established that the type of school that girls attend (whether pure girls' or mixed), teachers' attitude and the education levels attained by mothers greatly influence girls to take physics in Forms Three and Four. But the presence of females as teachers of physics, the peer group and the education levels attained by fathers do not play a significant role in attracting more girls into the subject.

CHAPTER FIVE

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.0. Introduction

The chapter has discussed the findings of this study, drawn conclusions and also made recommendations based on the findings of the study. This chapter begins with providing a brief review of the study.

5.1. Summary of the Study

This study was designed to investigate the determinants in the choice of physics by girls in Makueni District. Its specific objectives were: to determine whether more girls choose physics when they attend mixed schools or when they attend girls' only schools; to establish whether teachers' attitudes to girls influence the girls' choice of physics; to establish whether female teachers of physics act as role models to attract more girls to opt for physics in Forms Three and Four; to examine the role of peer-group pressure on girls' choice of physics and finally to establish the influence of parents' level of education to their daughters choice of physics.

A total of 22 schools and 307 girls were targeted for this study and whose identification was by simple random sampling. Finally 236 girls were available for this study. The research instrument was validated by carrying out a pilot study. Data was analysed by use of descriptive statistics such as frequencies, percentages and tables. Reports were made in descriptive form. The pertinent findings are discussed under each objective identified for the study.

The first objective intended to establish whether the type of school attended influenced girls in their choice to study physics. According to the findings of this objective more girls attending an all girls' school chose to study physics compared to those who attended co-educational schools. This finding is in harmony with that of Riley (1994) who observed that girls are likely to have higher aspirations and low stereotypical assumptions about the future if they attend single-sex schools. Further, in reflecting on their schooling, girls in single - sex schools reported that the single-sex schools encouraged good science and mathematics (Riley, 1994).

The choice of physics by girls in the study area largely following typical gender traditions of girls and boys subjects agrees with Barton and Walker's (1983) contention that secondary schools are conservative institutions by treating males and females as much more different than the outside world does. That is why the most commonly given reason for the excluding girls from boys subjects was that teachers refused to have girls in their class (Hammersley and Hargreaves, 1983). In the study area teachers do this by using covert and overt methods, which include telling girls that physics is hard in which there is no hope for them after Form Four. But there is hope for girls who attend girls' only schools. Arnot (2002) says that differences regarding type of school attended are critical to subject choice, especially in subjects such as physics, chemistry and other high-status 'academic subjects'. She goes ahead to make a strong case for single-sex schools. The Koech report (Republic of Kenya, 1999) further says that girls perform better when they are on their own. This observation is a plus for single-sex girls' schools as it implies that these schools enable not only the study of a

balanced curriculum but also that girls are likely to do well in them. This observation by the commission tends to justify the continuation of girls' only schools. Kibera (2002) says that factors militating against the education of girls include being in the same class with boys.

The second objective examined whether teachers' attitude influence choice of physics by girls. The results have revealed that they influenced the choice of the subject by girls. Thus 15.7 percent of girls stated that their dislike of physics as a subject was related to teachers' attitude towards it. However, a smaller proportion of girls of 11.9 percent said that they favoured some subjects because they liked the teachers who taught them. Thus teachers' attitude is stronger in influencing the rejection of subjects than in making subjects to be liked by girls. The difference is 3.8 percent. Educational research has identified important relationships between teacher and student differences and consequently between instructional style and learning performance (Sperry, 1972). For example, teachers hold differential expectations for various students (Brophy and Good. 1970). They do not treat all students alike in the classroom. Some students are called upon more frequently, asked more thought-provoking questions and reinforced more often. Such reinforced students opt for the subject taught by those teachers. How about those not so reinforced? Mwiria (2004) says that teachers create blocks in the minds of the less confident students. Kibera (2002) gives discouragement from teachers as being an important cause in making the education of girls difficult.

The third objective investigated whether female teachers influenced girls' choice of physics. The findings indicated that the majority of the girls (62.9 percent) who participated in the study said they had no preference for teachers of physics on basis of the teachers' gender. However, 20.7 percent of girls preferred to be taught by males while 16.4 percent preferred female teachers. To attest further the minimal influence of female teachers of physics in attracting more girls to the subject, 16.5 percent of girls learning in school taught by females opted for the subject while 29.7 percent chose the subject from those schools taught the subject by males.

Some of the reasons why students did not like female teachers were that they do not encourage them to work hard, and they are 'lazy', ' proud', as well as quick tempered. In contrast, girls preferred male teachers of physics because ' they teach well' are 'ever serious', 'encouraging' 'good at explaining' 'understand females' 'hardworking' 'are nice' speak in a loud voice and are not boring, all which endear more girls to male teachers of physics.

The preference of male teachers to female teachers is a clear testimony that the best teachers to popularise the subject among girls in the study area are males. Riley (1994) has concluded that female teachers can act as an impediment to girls' by discouraging those who attempt to strive and choose non-traditional subjects. Kelly (1981) has commented that women teachers of science may not be an acceptable or appropriate role model for female pupils. The image of a woman who has gone into science seems poor. This is because the curriculum is not viewed uniformly (even to teachers), its different areas have different gender implications (Hammersley and Hargreaves, 1983).

Fourthly, to get more insight into the determinants of the choice of physics by girls as a subject of study, respondents were asked to indicate the person who influenced them most in deciding to study physics. 72.5 percent of the girls indicated that they decided on their own, 12.0 percent cited teachers' influence, while 11.0 percent cited peers. Parental influence to their daughters' choice of physics was responsible for 2.8 percent while 1.8 percent attributed their choice to siblings, the extended family and neighbours.

The findings seem to suggest that girls decide on their own to study physics (72.5 percent). This was followed by friends (the peer-group) with 17.1 percent. Teachers were third in influencing students to reject physics (11.1 percent) followed by others (4.3 percent) and parents (3.4 percent) in that order.

This means that although the role of the peer group was not the leading cause in the choice or rejection of physics, it played an important role. This differs with observation by Pratt (1994) that the greatest influence on the people's behaviour are the words and actions of their peers.

However, the most discouraging observation here is the role played by teachers in the choice and rejection of physics by girls. In the choice of physics, teachers, whose duty is to ensure that they teach a balanced curriculum in their work stations influenced only 12.0 percent of the girls who opt for this subject in upper secondary school, leaving the majority of the girls (72.5 percent) to make their own decisions and choose the subject if they want to. In fact a teacher in one school had decided not to offer the subject in Forms Three and Four and was of the opinion that girls in the school could not understand physics. Failure by

teachers to provide guidance to girls denies them the opportunity to make informed decisions on subject choices.

The final objective investigated the influence of parents' level of education on their daughters' choice of physics. The educational level attained by mothers, as opposed to that of fathers, was found to be important in determining the choice of physics by their daughters in the study area. Girls who took physics had 6.3 percent of their mothers with university degrees while 12.6 percent had diplomas. The education levels of mothers of daughters not taking physics were lower compared to those above, where 2.8 percent of them had degrees and 8.3 percent had diplomas. 10.4 percent of fathers of daughters who took physics had university degrees and 16.0 percent had diplomas. 15.89 percent of fathers of daughters who did not take physics had degrees while 13.08 had diplomas.

Of a lot of importance is that group of girls who did not know the education levels of their parents. In this, of those who took physics, 17.9 percent did not know the education level of their fathers and 12.6 percent in the same category did not know the education level of their mothers. In the case of those who dropped physics, 11.2 percent did not know the education levels of their fathers and 14.7 percent that of their mothers. In total 29.1 percent did not know the education levels of their fathers and 27.3 percent that of their mothers. This ties with findings by Hammersley and Hargreaves (1983) that girls tend to know more about their mothers' educational background than their fathers', suggesting that mothers may constitute a more important reference in relation to their daughters' own (educational) plans.

5.2. Conclusions

The aims of this study were to investigate determinants of the choice of physics by girls in Makueni District. Students formed the only source of data. Their responses were analyzed for the purpose of concluding this study.

The study has established that:

(i) The co-education of boys and girls lowers the chances of girls opting for physics in Forms Three and Four

(ii) The attitude of teachers towards girls plays a fairly important role in making many girls drop physics. Many of the girls opted for biology in order to fulfill the requirement of taking a science subject in upper secondary school

(iii) Female teachers of physics in the study area do not act as role models which would have led to their promoting the choice of physics by girls in the study area. In fact, male teachers make more girls opt for the subject in this area

(iv) The peer-group does not play a very important role in the choice (or lack of it) of physics. Rather, the girls themselves have been identified by this study as the most important determinant in the choice or rejection of physics

(v) Mother's education level plays an important role in influencing their daughters' choice of physics.

5.3. Recommendations

The following are recommendations emerging from this study:

(i) Equity of opportunity and outcomes in the education of girls and boys requires differential provision of education for girls at least during secondary level of education. This calls for educating girls in girls' only

schools if they are to benefit adequately from studying a balanced curriculum, especially in increased numbers in physics.

(ii) Schools should have a functional careers department to provide useful information on labour market trends so that students make wise decisions in choosing subjects so that they do not make decisions based on which subjects they like, find easy, is done by their friends or is taught by a teacher they like or dislike. Choice of subjects should be made based on where one hopes to fit in the labour market in the future. This is very important.

(iii) The government should make effort to provide qualified teachers of physics to teach this subject. Many school in Makueni District are taught physics by form four leavers. Others have not employed anyone to teach the subject.

(iv) Mixed schools should consider the option of single streaming to allow girls to study on their own classrooms and thus avoid discrimination, harassment and dominance of the learning process by the boys.

5.4. Suggestions for Further Research

The following are suggestions for further research emanating from this study:

(i) Replication of the same study in the other divisions of Makueni District so as to enrich the data bank for the Ministry of Education.

(ii) A study of these determinants in the choice of physics by girls but with data from the boys as well.

(iii) A study of other objectives which include choice of careers by girls and the occupation of parents and how they influence choice of physics by girls in Kenya.

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APPENDIX 1

QUESTIONNAIRE FOR STUDENTS

THIS IS NOT AN EXAMINATION. NO MARKS OR CERTIFICATES WILL BE AWARDED.YOUR IDENTITY IS NOT NECESSARY. PROVIDE HONEST ANSWERS.

Dear student, as this is not an examination there are no wrong or right answers, good or bad responses. Each completed questionnaire will be confidential. Only collective data will be analysed. Indicate your answer by filling the blank or where necessary by ticking one option only.

PART A:

BACKGROUND INFORMATION.

1. Class you are in.....
2. Type of school
   - ☐ All girls
   - ☐ Co- educational (boys and girls)
3. If your school is co educational, are there single stream classes for girls only?
   - ☐ Yes
   - ☐ No
4. Do you take physics
   - ☐ Yes
   - ☐ No

5. Indicate your sex:

☐ Female ☐ Male

6. Indicate your parents' level of education.

Level of education	Father	Mother
No formal education		
Primary		
Secondary		
Diploma		
Degree		
I do not know		

7. What level of education would your parents like you to achieve? Tick appropriately.

☐ Primary

☐ Secondary

☐ Diploma

☐ Degree

8. What is / was your father's occupation?

_____

9. What is / was your Mother's occupation?

_____

PART B

1. (a). On average, how many times a week do you answer questions verbally in class?

☐ Not at all unless prodded by teachers.

☐ Between 1 and 5 times.

☐ Between 6 and 10 times

- ☐ Between 11 and 15 times
- ☐ Between 16 and 20 times
- ☐ Above 21 times

(b). On average. how many time a week do you ask questions verbally in class

- ☐ Not at all unless prodded by teachers.
- ☐ Between 1 and 5 times.
- ☐ Between 6 and 10 times
- ☐ Between 11 and 15 times
- ☐ Between 16 and 20 times
- ☐ Above 21 times

2.(a). Do you feel uncomfortable / shy when answering questions in class?

- ☐ Yes
- ☐ No

(b). Do you feel uncomfortable / shy when asking questions in class?

- ☐ Yes
- ☐ No

3. (a) Do you face hostility from other students when you ;

(i) ask questions?

- ☐ Yes
- ☐ No
- ☐ Not applicable

(ii) answer questions?

- ☐ Yes
- ☐ No
- ☐ Not applicable

(b) (i) Do you get hostility from the boys?

- ☐ Yes
- ☐ No
- ☐ Not applicable

(ii) Do you get hostility from the girls?

- ☐ Yes
- ☐ No

☐ Not applicable

(iii) Do you get hostility from both boys and girls?

☐ Yes

☐ No

☐ Not applicable

c) If yes what form is the hostility?

_____

_____

_____

(d) (i) What is the reaction of boys when you provide a wrong answer in class?

_____

_____

_____

(ii) What is the reaction of girls when you provide a wrong answer in class?

_____

_____

_____

(e) How does hostility affect your participation in class?

_____

_____

_____

4. Do you believe that physics is a subject that is suitable for girls?

☐ Yes

☐ No

5. Do boys involve you in discussions on physics? Tick appropriately

☐ Yes

☐ No

☐ Not applicable

6. (a) Do you believe that there are subjects for boys and subjects for girls?

☐ Yes

☐ No

(b) If yes which subjects do you think are the suitable for girls?

_____

_____

(c) Which do you think are the suitable subjects for boys?

_____

_____

7. (a) Concerning girls who lead in end term examinations. why do you think they perform well?

_____

_____

(b) Give your views about boys who lead in academic performance at end term examinations.

_____

_____

8. Who is holding the following positions in your school? Tick appropriately.

(i) Head prefect	☐ Boy	☐ Girl
(ii) Games captain	☐ Boy	☐ Girl
(iii) Class prefect	☐ Boy	☐ Girl

9. Do / did teachers tell you that physics is a 'hard' subject for you? Tick appropriately

☐ Yes

☐ No

10. Do teachers tell you that physics is a subject suitable for:

(a) Boys only:	Yes ☐	No ☐
(b) Girls:	Yes ☐	No ☐
(c) Both boys and girls:	Yes ☐	No ☐

11. Do teachers tell you that physics is not applicable to career options available to; tick appropriately

(a) Boys:	Yes ☐	No ☐
(b) Girls:	Yes ☐	No ☐
(c) Both boys and girls:	Yes ☐	No ☐

12. Do / did teachers tell you that it is not easy to pass in physics in K.C.S.E.?
tick appropriately

Yes ☐ No ☐

13. Do / did teachers tell you that you can easily pass in physics in K.C.S.E.?
Tick appropriately

Yes ☐ No ☐

14 (a) Do teachers tell you that you can be better than they were in physics when they were students?
Tick appropriately

Yes ☐ No ☐

(b) Do teachers tell you that you cannot be as good as they were in physics?
Tick appropriately

Yes ☐ No ☐

15. (a). While you were in forms one and two. did teacher(s) of physics encourage you to
opt for physics in form three? Tick appropriately

Yes ☐ No ☐

(b). Explain your answer.

_____

_____

16. (a) On what basis in your school do students choose physics in form three

_____

_____

(b) In your school, is there a careers master / mistress?

Yes ☐ No ☐

17. (a) who is your physics teacher?

Male ☐ Female ☐

(b) If you had a choice, which physics teacher would you prefer?

Female physics teacher ☐

Male physics teacher ☐

Either sex ☐

(c) Explain your answer

_____

_____

18. Who influenced you most to take or not to take physics? Tick appropriately.

To take physics	Not to take physics
Teacher _____	Teacher _____
Friends _____	Friends _____
Parents _____	Parents _____
Self _____	Self _____
Others (specify) _____	Others(specify) _____

19. Why did you choose physics?

_____

_____

20. What careers can people who take physics join?

_____

_____

21(a). List one quality of your favourite teacher.

_____

(b). (i) Do you like the subject he / she teaches?

Yes ☐ No ☐

(b) (ii) If yes, what subject is it?_____

22. (a) Which is your worst subject?_____ _____

(b) Why is it your worst subject?

_____

_____

23. (a) What is your favourite subject?_____

(b) Why is it your favourite subject?

_____

_____

24. Give your views on how schools can encourage girls to choose physics as a subject of study for K. C. S.E.

_____

_____

_____

Thank you for your co-operation

MUNGUTI STEPHEN

APPENDIX 2

Table for determining Sample size from a given population.

N	S	N	S	N	S
10	10	220	140	1.200	291
15	14	230	144	1,300	297
20	19	240	148	1.400	302
25	24	250	152	1.500	306
30	28	260	155	1.600	310
35	32	270	159	1.700	313
40	36	280	162	1.800	317
45	40	290	165	1.900	320
50	44	300	169	2.000	322
55	48	320	175	2.200	327
60	52	340	181	2.400	331
65	56	360	186	2.600	335
70	59	380	191	2.800	338
75	63	400	196	3.000	341
80	66	420	201	3.500	346
85	70	440	205	4.000	341
90	73	460	210	4.500	354
95	76	480	214	5.000	357
100	80	500	217	6.000	361
110	86	550	226	7.000	364
120	92	600	234	8.000	367
130	97	650	242	9.000	368
140	103	700	248	10.000	370
150	108	750	254	15.000	375
160	113	800	260	20.000	377
170	118	850	265	30.000	379
180	123	900	269	40.000	380
190	127	950	274	50.000	381
200	132	1.000	278	50.000	382
210	136	1.000	285	100.000	384

Note: N population size

S sample size

Source: R. V. Krejcie and D. Morgan, " Determining Sample Size for Research Activities" Educational and Psychological Measurement. Vol. 30 No. 3 1970 P. 608.

APPENDIX 3

LIST OF SAMPLED SCHOOLS

MAKINDU DIVISION

Ikungu Secondary School

Makindu Secondary School

Ngaakaa Secondary School

Nguumo Secondary School

St. Anne's Kiboko

Moi Girls'

Syumile Secondary School

KIBWEZI DIVISION

Kalulini Secondary School

Kiaoni Secondary School

Maikuu Secondary School

Masaku Ndogo Secondary School

St. Joseph Girls'

St. Mary's Girls'

St. Peter's Thange

Utithi Secondary School

Kisayani Secondary School

MTITO-ANDEI DIVISION

Darajani Secondary School

Iiani Secondary School

Joanna Chase Secondary School

Kathekani Secondary School

Muthingiini Secondary School

Yumbuni Secondary School