SOCIO-CULTURAL FACTORS INFLUENCING THE PARTICIPATION AND PERFORMANCE OF GIRLS IN SCIENCE AND MATHEMATICS SUBJECT IN PRIMARY AND SECONDARY SCHOOLS.

By

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Declaration

This Project Paper Is My Original Work And Has Not Been Submitted For A Degree To Any Other University.

13/11/2001

Mary Njeri Nyabera

Date

This Project Paper Has Been Submitted For Examination With My Approval As A University Supervisor

13/11/2001

Professor Collette Suda

Date

Dedication

To my parents who worked so hard for me to get an education and whose positive attitudes towards my participation and good performance in science and mathematics, I always took for granted but not anymore after this study.

To my husband Bob, and wonderful children, Elizabeth, Sophia and Michelle for their daily prayers and encouragement. Without their financial and moral support, this study would have been difficult to complete.

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List of abbreviations

PFA	PLATFORM FOR ACTION
KCSE	KENYA CERTIFICATE OF SECONDARY EDUCATION
KCPE	KENYA CERTIFICATE OF PRIMARY EDUCATION
FEMSA	FEMALE EDUCATION IN MATHEMATICS AND SCIENCE IN AFRICA
CEDAW	CONVENTION ON ELIMINATION OF DISCRIMINATION AGAINST WOMEN
USA	UNITED STATES OF AMERICA
KACE	KENYA ADVANCED CERTIFICATE OF EDUCATION
JAB	JOINT ADMISSION BOARD
FAWE	FORUM FOR AFRICAN WOMEN EDUCATIONALISTS
NICS	NEWLY INDUSTRIALISED COUNTRIES
SMASSE	STRENGTHENING OF MATHEMATICS AND SCIENCE IN SECONDARY SCHOOL EDUCATION.
PARA.	PARAGRAPH.

Abstract

This study mainly focused on socio-cultural factors influencing the participation and performance of girls in science and mathematics subjects at primary and secondary levels. These are the subject areas where differences in participation and performance between girls and boys are the most obvious.

The study specifically sought to find out if parents', teachers' and students attitudes influence the participation and performance of girls in these subjects. It also sought to find out if the educational materials especially text books are gender biased and if so, how they influence the participation and performance of girls in science and mathematics.

This study was based on secondary data.

The study revealed that parental attitudes determine which child goes to school and which one is given moral and financial support to participate and perform well in science and mathematics subjects. Parents believe that the major role of a woman is wife and mother, hence, girls do not need science and mathematics subjects. These attitudes negatively influence the participation and performance of girls in these subjects.

Girl students hold the attitude that they do not need a rigorous formal education in science and mathematics because, all they aim for is to marry well and to be wives and mothers Due to these negative attitudes, they put in very little effort towards science and mathematics subjects hence, few participate and perform and well in the examinations. Even male students have a negative attitudes to girls studying science and mathematics subjects which they consider a male domain.

Teachers' attitudes have perhaps the most significant implications for girls participation and performance in science and mathematics subjects. Their attitudes influence the girls performance in these subjects. Some teachers think that boys are more intellectually gifted

than girls. They often play the role of reinforcing the stereotypical expectations instilled by parents and society.

This study revealed that textbooks, particularly science textbooks are gender biased and in favour of boys and men. They portray women in their nurturing and passive roles in relation to men and have failed to give recognition to women scientists. They misrepresent the world and act to reinforce gender stereotyping patterns. They are imaging forming, shape attitudes and act as socializing agents in terms of knowledge about people and their relationships, over and above that of pure academic and technical knowledge about these subjects. When girls use such text books they fail to be encouraged to participate and perform well in science and mathematics subjects.

In schools, there are fewer female teachers than males in science and mathematics subjects especially in higher primary classes and in secondary schools. Hence the girls lack role models to identify with. The fact that more male teachers teach science and mathematics only helps to prove that science and mathematics are masculine subjects. Lack of role models negatively influence the participation and performance of girls in science and mathematics.

The study revealed that parents, teachers, boys and girls themselves have a negative attitude towards girls participation and performance in science and mathematics subjects. Lack of role models and gender biased textbooks also negatively influence the attitudes of girls towards these subjects.

Chapter One

1.0 INTRODUCTION

Education has been recognized as a cornerstone of economic and social development. It is the basic pillar of an effective development of human life. It is a human right and an essential tool for achieving the goals of equality, development and peace (PFA para. 69). It is viewed as the basis of literacy and is central to all development activities; it empowers human beings (Kenya Country Gender Profile 1996, Okumu & Gachuki 1996).

Among its other attributes, education particularly that one of science and mathematics is an economic force that together with land, labour, capital and managerial capacity contributes to the social and economic growth and development of nations. Indeed, it is precisely why it has been given priority in the countries of the North, that they have been able to forge ahead in industry (Tsuma 1998).

In actual fact, there has been a great concern in the USA that poor science and mathematics preparation on a broad scale in public schools will handicap the United State's economic development relative to its principal competitors in the future (Wadi and others 1990). Therefore, the importance of education in general and particularly that of science and technology in human and industrial development cannot be over emphasized (Chibule 1999).

Developed countries with only 17% of the worlds population dominate the field of science and technology, with 95% of all research and development being executed by them. In contrast, developing regions of the world (where 70% of world population live) possess only 3% of the world research and development capacity, in this the African situation is even dismal (UNESCO 1999). This particularly hurts the ability of African countries to absorb new technologies that increase productivity. It also hurts countries in developing their own appropriate innovations to solve production problems (Wadi and others 1990).

The countries which have shown the greatest advances in technology creation and adaption in recent years, are those with the highest ratios of scientists and engineers (Wadi and others 1990). Scientific knowledge is a necessary ingredient for economic growth (Zymelman 1990). Unfortunately, throughout the formal education in Kenya and the rest of Africa, girls continue to be underrepresented in mathematics and science subjects (Njenga 1999).

Low achievement of girls in science and mathematics and unfamiliarity with basic technical concepts are critical weaknesses throughout the developing world. A great deal of evidence from around the world indicates that gender inequality undermine the effectiveness of development policies in fundamental ways (King and Mason 2001). Kearney (1996) states that, development problems will remain unsolved until the status of women is raised (Kearney 1996). Another study estimates that:

> "If the low income countries of South Asia, Sub-Saharan Africa and the Middle East and North Africa had started with the gender gap in schooling that East Asia had in 1960, and had closed that gender gap at the rate achieved by East Asia from 1960 to 1990, their income per capita would have grown 0.5 – 0.9 percentage faster per year …….. even for Middle and Upper income countries with higher initial education levels an increase of one percentage points in the share of women with secondary education is associated with an increase in per capita income of 0.3 percentage points" (King and Mason 2001 pg--7).

Education is a principal means to empower women so that, they realize their potential and assume their individual responsibility in the development process (Kearney 1996). Therefore, investing in formal and non-formal education and training for girls and women, especially in science and mathematics subjects, with its exceptionally high social and economic return, has proved to be one of the best means of achieving sustainable development and economic growth that is both sustained and sustainable (PFA Para 6a).

1.1 Statement of the Problem

A major challenge facing Kenya is that with a rapidly growing population, agricultural-based production as currently practised is unlikely to lead to appreciable sustainable development to alleviate poverty (Republic of Kenya 1998). This has put the Kenyan government under intense pressure to find solutions to the persistence of poverty in Kenyan society.

The government has come to the conclusion that transforming the economy from an agricultural based one to a newly industrialized country by the year 2020 will be the solution. The private sector is expected to take the existing opportunities and initiatives to invest in production and supply of goods and services, as well as, marketing them both locally and internationally. The sector is expected to obtain appropriate technology and develop efficient production that will bring about a competitive export oriented industrial and service sectors (Republic of Kenya 1997). Experiences from the Newly Industrialized Countries (Nics) have also shown that industrial development is a sure way of eradicating poverty. Nics are involved in high-tech manufacturing and sophisticated industrial exports.

One of the problems that the country will face in its industrialization process is lack of adequate human resource (Republic of Kenya 1997). The current changes in the world economy suggest that a strong preparation in science, mathematics and technology will be increasingly indispensable to improved productivity and sustainable human development. If Kenya's vision of industrialization is to be achieved, there must be adequate human resource comprised of both women and men to contribute significantly to the economic progress in our nation (Gui1996).

Despite the efforts made by the Kenyan government, one is obliged to admit that considerable work still remains to be done to eliminate disparities between women and men in several areas of education and especially of science, mathematics and technology. Comparing and analyzing differences in boys' and girls', men's and women's achievement in science and mathematics subjects and careers across the country, one discovers that there is a serious problem in the participation and performance of girls in education, particularly in science and mathematics subjects. It is in this area, the consequences of sexually related stereotypes are most evident (Mariro 1999).

The girls' performance in these science subjects is not as good as that of boys. In the 1989 KACE examinations the achievement of the majority of the girls in mathematics and sciences was very low. Very few girls obtained grade C and above in mathematics and physics. In mathematics only 10% obtained A, 14% B and 17.5% C. In physics 11% obtained A, 3% B and 7% C (Njenga 1999). (KACE is the exam that was previously done at the end of six years of secondary school education cycle). In 1993 KCPE examinations,184,849 (46.4%) girls sat for the exams compared to 213,587 (56.4%)boys. Only 18% of the girls attained A to B- in mathematics compared to 30.5% of the boys. In science and agriculture only 16.5% of the girls obtained A to B- compared to 37.2% of the boys.

In 1993 K.C.S.E. examinations a total of 140,426 students sat for these exams. The girls were 59,810(42.6%)and the boys were 80,616(57.4%). Mathematics is a compulsory subject so all the girls and boys sat for this examination but only 3.1% of the girls obtained A to B- in mathematics compared to 7.7% of the boys. Only 15% of the girls enrolled in physics and only 7.4% of these managed to get A to B-. 25% of the boys enrolled for physics and 17.9% obtained A to B-. In all the science subjects the boys attained better grades than the girls (Okwach n.d).

The performance at K.A.C.E. then, and K.C.S.E. now, currently determines the enrollment at the university in various faculties. The poor performance makes girls to be grossly underrepresented in post-secondary science/mathematics based courses at the university and other tertiary institutions. In 1993 and 1995, only 28.6% and 23.7% respectively of the enrollment in National Polytechnics were women and majority of these women enrolled in art based subjects (Republic of Kenya 1998, Njenga 1998). Even in agriculture, an occupation dominated by women (according to statistics 70% of the food requirements in Kenya are produced by women and in rural areas 80% of the agricultural activities are carried by women), the enrollment of females is as low as 1% of all the students (Njenga 1999). (It is important to note that, out of about sixty-two courses offered at the local public universities, in nineteen of them mathematics is a prerequisite for admission. To qualify for enrollment in all the other courses, mathematics is given as one of the subjects to have passed in (JAB 1999/2000)).

The above figures indicate that women have not yet broken the gender barrier in the participation and performance of science and mathematics subjects as well as in scientific careers. Therefore, as in most other developing countries, women in Kenya lag behind men in the amount of education and training they receive in science and mathematics subjects (Ridker 1994).

Because of the poor performance of girls in science and mathematics subjects, few girls and women will be ready to participate in industrialization. And if the present status of employment in industries continues, then industrialization will only increase gender inequalities in the country. Presently, wage employment reveals that women are significantly under employed in the industrial and service sectors where the growth rates are much higher (Njenga 1999, Evers 1993). In 1990 only 21.0 percent of the workers in wage employment were women and only 10.7 percent women were in manufacturing (Njenga 1999).

With industrialization, the nature of the job market will change even further, and women and girls can no long rely on the traditional limited range of occupation. There will be an increase in numbers of technical occupations and women will continue to suffer from unemployment unless they have the ability to access science and mathematics education (Hübner 2001).

Countrywide, women have a low visibility in key management and decision-making positions in general but particularly in the economic and in science and technology sector (Mengech1994). This fact lowers the opportunity for professional participation by women in all spheres of life and particularly in the Kenya's vision of industrialization.

> "In transition economies, women have limited impacts on establishing new laws, institutions and policies, as they remain underrepresented in new decision-making structures especially at national level"(Hübneer 2001 pg 25).

Women in Kenya make up slightly more than half of the Kenyan population and deserve to share fully in planning and implementation of development policies so that when major and far reaching reforms are introduced they are involved in this decision making. This position will enable women to control and promote policies which take women into consideration. This is especially important in the field of science and technology, which contribute significantly to industrialization and to the level of economic progress of Kenya (Gui 1996, Mariro 1999).

These gender inequalities in participation and performance in science and mathematics subjects and careers is one of the challenges to sustainable human development. Men and women have equal responsibilities in meeting this challenge. Therefore, the study of sciences and mathematics subjects at all levels is needed by both women and men in order to take an active role in technological and industrial development in Kenya.

This study therefore investigated the socio-cultural factors influencing the poor participation and performance by girls in science and mathematics subjects.

1.2 Justification of the Study

Why is it important to increase female education in science and technology?
Apart from the equity argument, it is now evident from accumulated evidence that when women receive low levels of education, it hinders economic development and reinforces social inequality (Wadi and others 1990). Gender inequalities hinder development, and societies that practice gender discrimination pay a high price in terms of poverty and slower or no economic growth and development. Therefore gender is a development issue (King and Mason 2001).

While the nations of the world increasingly need to make the most of all the possibilities available to them, for the purpose of promoting sustainable development, the unutilized human potential represented by women is a sign of intolerable wastage (Chabaud 1970, Chibule 1999, Unesco 1999).

There is evidence indicating nations with higher levels of female enrollment in the past, today show higher levels of productivity than countries that have not achieved as high enrollment levels for girls like Kenya. Different types of expertise from both women and men can be associated to produce a new synergy which is able to have an enhanced impact in resolving problems at hand (Bellew and King 1991). There is no country developed enough not to need the other half of its human resource. The reason that Kenya is underdeveloped could be that it under-utilizes its human resource.

Because of women's multifaceted contribution to family and community and professional lives, women have emerged as vital actors in the search for sustainable human and social development. This could hold the key to the future because, it implies the realization of human potential and its productive utilization. There is need for an environment where women can expand their capabilities and opportunities for both present and future generations (Kearney 1996).

As Kenya moves from an agricultural-based economy to industrialization by the year 2020, the technical knowledge requirement will increase. It is obvious that Kenya needs more scientists and engineers to provide the necessary skills to cope with problem of industrialization by the year 2020 (Onsongo 1990). Human resource training is one of the areas that Kenya has to invest in, to generate social and economic growth because there will be need for more and better educated women and men, particularly in science and mathematics' education at all levels. Kenyan's goal of industrialization will only be achieved through the contribution of both women and men (Republic of Kenya 1998, Kearney 1996). These women and men will develop and apply emerging technologies appropriately to meet local and international demands.

So, it is only logical in an age dominated by science and technology, that attention should be drawn to the poor representation of women in science and mathematics subjects if they are going to be part of the development process in Kenya. Women are central to any development process (Chibule 1999). Therefore, it is vital to improve the scientific and technological literacy among women and girls (UNESCO 1999).

Currently, the gender disparities in science and technology are unacceptably high; there is need to address this imbalance proactively, not only because it is right to do so, because if we do not, we will simply not have adequate human resource to deal with the problems that we will encounter in the our attempt to industrialize (Prof. Takemwa 1999, Mariro 1999).

If the level of scientific and technological output is to be achieved, Kenya cannot afford to leave more than 50% of its population, that is women out of the development process. And leaving them out will deny Kenya a substantial input in industrialization. Women scientists must be seen as a part of badly needed human resource base in Kenya. The importance of science and mathematics subjects and careers makes it imperative that the entire human resource potential for Kenya be tapped for economic and social development. As such, they must have the same access to scientific subjects and career opportunities as their male counterparts.

Despite all the positive impacts that women would have on sustainable development a combination of factors have prevented women from participating and performing well in science and mathematics subjects and careers and this will limit their ability to participate in the Kenyan vision of industrialization by the year 2020.

For developing countries like Kenya to make full use of their human resources, the bias and backlog of discrimination must be overcome. Such discrimination not only prevents women from achieving complete self-fulfillment as human beings, it also impedes the progress of society (Chabaud 1970). Discriminatory practices are not only unjust, but a flagrant wastage of valuable expertise which is vital for all nations (Kearney 1996). Kenya and many developing countries have to pay particular attention to girls education in science and mathematics, because it may not expand quickly enough, without special attention to community, family, school and political barriers that impede girls' participation and performance in these subjects.

The study unveiled the socio-cultural factors that have contributed to poor participation and performance of women and girls in science and mathematics subjects. It was important to identify the causes of these discriminations before the situation can addressed. To accomplish gender parity in science and mathematics subjects, planners and policy makers need reliable information on the underlying reasons for the low participation and performance in science and mathematics subjects (UNESCO 1999).

1.3 Research objectives

Generally, this study sought to examine out of school and in-school socio-cultural factors that influences the participation and performance of girls and women in science and mathematics subjects.

Specific Objectives

The specific objectives were:

1. To investigate the role of parental attitudes, aspirations and level of education (especially that of the mother) on the participation and performance of girls and women in science and mathematics subjects.

2. To investigate the effects of students attitudes on the participation and performance of girls in science and mathematics subjects.

3. To examine if teachers' attitudes influence the participation and performance of girls in science and mathematics subjects.

4. To analyze the effect that gender biased science and mathematics textbooks have on the participation and performance of girls in science and mathematics subjects.

5. To investigate whether lack of role models in science and mathematics careers influences the participation and performance of girls in these subjects.

Research Questions

This study sought to answer the following questions.

1. What is the role of parental aspirations, attitudes and level of education (especially those of mothers) in the participation and performance of girls and women, in science and mathematics subjects and careers?

2. Do students attitudes towards science and mathematics subjects play a role in the participation and performance of girls in these subjects ?

3. Do teachers attitudes influence the participation and performance of girls in science and mathematics subjects?

4. Are gender biased science and mathematics textbooks influencing the participation and performance of girls in these subjects?

5. Does lack of role models in scientific careers influence the participation and performance of girls in science and mathematics subjects.

CHAPTER TWO

2.0 Literature Review

The literature review looked at social and cultural barriers that affect girls in the participation and performance of science and mathematics subjects.

Although women in Kenya make up 51% of the population, a growing literature documents the incidence of gender discrimination in education (Njenga 1999). Throughout their entire life cycle, women's daily existence and long-term aspirations are restricted by discriminatory attitudes, unjust social and economic structures, lack of resources that prevent their full and equal participation in development. They have long been and continue to be victims of every burden imaginable, especially those related to prejudices, traditions and stereotypes (Thiam 1999, PFA para. 38).

This operates at many levels; in the household cultural norms and expectations often operate to the disadvantage of girls who want an education, especially beyond the elementary level. External pressures like the introduction of school fees have resulted in families opting to keep sons rather than daughters in school. In schools themselves girls are often offered a different and inferior curriculum and are subjected to bias in selection procedures as well as unconscious or conscious discrimination from teachers (Tsuma 1998, Njenga 1999, Henevald and Odaga 1995).

Many women face particular barriers because of various socio-cultural factors in addition to their gender. Often these factors isolate or marginalize them. Despite the fact that Kenya ratified CEDAW in 1985, discrimination in girls' access to education and especially in the scientific and technological field persists. Women are denied their human rights to education, vocational training, employment and are excluded from decision making processes in scientific areas (PFA para. 31).

The major gender issue in science is that, there are implicit obstacles that prevent girls from participating and performing well in science and mathematics subjects that do not affect the boys. They are implicit because, the passage of legislation and guidelines to eradicate discrimination has meant that scientific and technological education is by outward appearance as open to women, as it is to men. And if these explicit obstacles have been removed, then what can explain the low numbers of girls and women, participating and performing well in science and mathematics subjects? (UNESCO 1999, Sheridan (n.d.))

Therefore, the objective of this literature review is to highlight the socio-cultural factors that influence girls participation and performance in science and mathematics subjects in primary and secondary schools in Kenya.

2.1.1 History of Female Education in Kenya.

Non-traditional education was introduced to Kenya through the missionaries and colonialists (Tsuma 1999). There was much resistance to these colonial schools in the very early days and the idea of sending children, particularly girls to these "enemy" schools was unheard of (Henevald and Odaga 1995).

When the local communities finally accepted the women's education, the education was used to promote domesticity in women. They were taught to be good housewives and mothers. The aim was to provide good wives for the male clerks and mission boys (Heneveld and Odaga 1995, Kwamboka 1995, UNESCO 1999).

In the process, the notion of the Kenyan woman as a dependent housewife and mother confined to the home was introduced into the local communities culture. The Western patriarchal view ignored the central value of the Kenyan woman in the public and economic spheres of society (Henevald and Odaga, 1995).

> "A new tradition was established for transmitting humility, low ambition and systematic underestimation of girls and women's ability in cognitive achievement, social attainment and capacity to work in the public sphere" (Henevald and Odaga 1995 pg. 7).

Also, colonialism introduced taxes and wage employment, which drew the men away from their homes and families to work (Henevald and Odaga 1995). The colonialists policies and practices discouraged married women to join their husbands due to shortage of houses, while single women were not allowed to live in urban cities for fear of encouraging prostitution (Tsuma 1998).

With the moving away of the men to urban areas, the women were given the heavy burden of taking care and providing for the families without the contribution of the man. This also established a tradition of employing men in the public sphere while women were restricted to the home (Tsuma 1998).

In Henevald and Odaga (1995), they examine why the first educated women were not the first generation of African women professionals, unlike the first generation of educated African men who became the first generation of African men professionals. The reason given is that:

> "The type of education received by women, and limitation in career choices afforded, forms a large part of the answer, as does the effectual and legal restrictions on employment" (Henevald and Odaga 1995 pg.7).

For women who received western education, there were few choices. They were concentrated in the professions that made them better nurturers; nursing, education, primary teaching and of course prepared for marriage (Henevald and Odaga 1995).

The choices persist, and the same socio-cultural factors that influenced the participation and performance by girls in science and mathematics subjects and careers then, remain the same to day.

After discriminatory policies set gender inequalities in motion, gender neutral policies by the government were sufficient to maintain established patterns of gender inequalities thus, the gender gap in science and mathematics subjects persisted.

2.1.2 Parental Attitudes

There are still many communities in Kenya with a strong belief that the major role for a woman is to be a mother and a wife (Njenga 1999). This attitude is a source of ingrained prejudicial attitudes towards girls who are interested in science and mathematics education (Okwach 1995).

Socio-cultural attitudes determine how much resources and priority is attached to children. They govern which child the parents or families are going to invest in to pursue education. Parents' perception of the prevalence of girls' education in science and mathematics subjects is governed by prevailing gender ideologies. Gender ideologies can be explained as the behaviour and expectations society has of women and men (Henevald and Odaga 1995, Okwach 1995).

In society, a gender division of labour exists that allocate women all household roles. Irrespective of women's position in society, married or not, they have remained in charge of the reproduction of household (Ever 1993). This socio-cultural perception about the role of women in society will determine which gender of the child their parents will invest in and encourage in participating and performing well in science and mathematics subjects.

Parents see the role of women as being defined only in marriage and sometimes worry about wasting money on the education of girls, who are likely to get pregnant or married off before completing school (Henevald and Odaga 1995). They also reason that the rates of return from the education of a girl are low. They tend to judge the value of education by the returns from the labour market. Once the girls get married, they become a part of another family and the rates of return is low (Henevald and Odaga 1995, Ridker 1994).

Nearly all parents in a subtle ways teach their boys and girls, that boys are superior to girls and they alone can accept a position of leadership. This forces the girls to internalize the idea that boys are leaders and girls are followers. This socialization later translates into the attitude that, its men who are involved in development and that it is they who can manage science and mathematics subjects (Tsuma 1998). Gender division of labour is constituted at a number of different levels. It is not restricted to intra-household or family relations, it also encompass the wider economic context within which men and women carry out productive activities (Gachuki and Okumu 1996).

Formal education in Kenya is linked to employment opportunities in the labour market. Unfortunately, the labour market culture reflects the societal gender expectations. It accords women a low status or excludes them completely, employing men who supposedly need the job to fulfill the role of a 'breadwinner' ((Henevald and Odaga 1995,Mengech 1994). Sometimes, women's withdrawal from the labour market is seen as a remedy for massive male unemployment and cuts in labour costs due to maternity and child benefits(Hübner2001)

Even where a woman and a man have the same education and work experience, women continue to have limited opportunities and earn less than men in the labour market (King & Mason 2001). Research has shown that African ideologies of competency are closely related with socio-cultural ideologies of gender roles. This in turn has defined the capacity – building requirements of women and in practice has dictated the level of demand of their skills. Sometimes, even when a woman is included in a committee, the idea is not so much because she is seen as the most suitable for the job, but in order to serve female participation (UNESCO 1993).

In a study of three parastatal organizations, it was clear that organizational demand and utilization of women and men skills are different. Although the bosses were convinced that there is no sexism, they admitted considering other factors other than capability in allocating tasks to the female employee. They considered the marital status, number of children and their ages since according to them (the bosses), this is her job description number one. This problem is caused by gender stereotyping (Mengech 1994).

They also argued that femininity is incompatible with assertiveness because apart from loosing the femininity these women also become impossible to manage at home

(Mengech 1994). There is a general apprehension among the people that educated and assertive women do not make controllable, obedient and subservient wives and are a threat to tribal practices (Henevald and Odaga 1995, Mengech 1994). The general feeling is that the labour market has a duty to maintain the domestic gender hierarchies according to the traditional cultural values otherwise society would disintegrate.

In any ethnic group in Africa, a typical African woman has no status. They lack power to make important decisions on matters affecting her life and those of her family (Okwach 1995). When they are young they are under the control of parents and society, when they are older and married, husbands and society control them. Educated women are considered difficult to control by parents, future husbands and society (Henevald and Odaga 1995,Mengech 1994).

Because of the gender division of labour, girls spend a lot of time on chores and other production activities such as, marketing. This reduces the time and energy they spend in school, affecting their participation and performance in science and mathematics subjects (Henevald and Odaga 1995).

Topics in science and mathematics subjects are arranged in hierarchical style so that one concept builds on the previous one. The foundations of the principles that run through concepts in mathematics and physics are laid down very early in the subject. It is also an accepted practice in nearly all schools that science and mathematics subjects are taught in the early part of the morning. This means that those students who get to school late, miss out on components of these subjects and in time find it difficult to follow or understand new topics as they are introduced in the subjects (Femsa Dissemination Report No. 12 n.d).

Not only do they go to school late, girls tend to leave school earlier than boys to assist with household and farm chores including care of younger siblings (Ridker 1994, Mariro 1999, Vena Journal 1992). This makes girls miss out on any tuition given after school, negatively affecting their participation and performance in education and especially in science and mathematics subjects.

Parents also feel that scientific careers take too long and want shorter training periods for their daughters. In certain regions, it is thought that the basic education received in primary school is enough to meet a girl's educational needs. Some parents think that girls do not need to learn science and mathematics, since their time will be taken up by household chores. They can learn these household activities at home from their mothers (Thiam 1999). Learning household chores will help them meet the cultural requirements for marriage (Ridker 1994).

Parents do not want to expose their daughter to perceived risks of attending school after puberty (Ridker 1994, Henevald and Odaga 1995). The parents fear the girls getting pregnant and they remove them from school as they approach puberty.

> "The great problem is school pregnancy. We struggle to raise school fees for them (daughters) but they disappoint us. This influences us to give priority to the boys" (Henevald and Odaga 1995 pg. 36).

Despite all the above reasons as to why parents do not encourage their daughters to stay in school, research has proved that parental aspirations are highly correlated to education level. Parents who are educated value formal education. Therefore, they not only take their children to school, they also pay all the dues. This ensures that their children do not miss school unless they are sick. They also encourage their children to study and excel in examination. Children from such families often perform better in school than their counterparts who do not receive financial and moral support (Njenga 1999).

Basirika and Manyire (1997) did a study in Uganda indicating that, in the schools where parents were involved in school activities, the promotion of academic programmes and extra curriculum activities, good academic performance was achieved by both boys and girls. This increases their chances of taking part in science and mathematics subjects.

2.1.3 Mother's aspiration, her level of education and economic status.

From research, it has been established that given the mothers' responsibilities in socializing the next generation they have a lot of influence on the participation and performance of their daughters in school and in science and mathematics subjects.

Parental aspirations, particularly those of mothers have a significant influence on the participation and performance of girls in school (Njenga 1999). Eshiwani (1983) showed that parental encouragement of girls studying science at university, had come primarily from 60 percent of mothers rather than from fathers who were only seven percent when it came to encouraging their daughters to pursue science and technology studies.

Mother's ability to give effective guidance contributed more towards the sustainability of females than males in school. A study done by Kazente (1995) in Uganda indicates that females who had joined university received guidance from their mothers and especially when they came from fatherless or polygamous families.

The chances that a daughter has of going to school and participating in science and mathematics are also determined by her mother's education level. Science is the study of nature. A mother who has studied science is the child's educator and she can introduce scientific explanations to the unexplained puzzles and events of the world in which a child finds herself or himself . Hence, the science-oriented mother could enhance in the child, scientific thinking and reasoning in order to be able to solve problems (Obura1991).

In research done by Njenga (1999), all girls in her sample of university graduates had literate parents. In particular all mothers had at least reached Std. III. This was not the case with men in the sample. A good number of them had mothers who were illiterate. This corroborates the evidence that educated mothers play a significant role of ensuring better education for their daughters. Also, women who are educated give birth to less children. Non educated women normally have large families meaning that perhaps the eldest one or two children (probably boys) will be sent to school. The rest will be used as cheap labour for the family (Henevald and Odaga 1995).

Mothers' socio-economic variables influence the mathematics performance of students more than their fathers' socio-economic variables (Ikefuluni 1997, Kasente 1995). A study done in Uganda by Basirika and Manyire (1997) proved that female pupils whose parents were also significantly more educated, and their mothers were more represented amongst the professional and business occupations were more than the male pupils.

In conclusion, a mother's lack of education, lack of aspiration for her daughter and lack economic independence, negatively influences the participation and performance of girls in education and particularly in science and mathematics subjects. Parents' attitudes towards girls in science and mathematics subjects, negatively influences their participation and performance in these subjects.

2.1.4 The Students' Attitudes

Students' attitudes survey in Kenya, and other African countries show that both male and female students have low expectations of female achievement in school and of career prospects in science and mathematics areas (Henevald and Odaga 1995).

In these African communities, girls and women are so influenced by tradition that even high-achieving students may abandon their future plans so as not to neglect their traditional role in the home (UNESCO 1993). Most girls believe that once you find yourself achieving so much like being a doctor or scientist, it becomes hard to get someone to marry you. An economically independent wife would be a threat to her husband's authority (Tsuma 1998, Henevald and Odaga 1995).

This could give the reason why some girls do not seem to be strongly committed to excel in science and mathematics subjects and thereafter establish a career for themselves (Kearney 1996). Many girls and women tend to downplay their particular skills and abilities (Daba and others 1997).

Also, insults such as only ugly women can be good in science and mathematics or that they are masculine or may be threatened with never getting husbands can discourage girls from participating in science and mathematics subjects (Mboya 1997). Women fear that, because they find remaining single shameful (Henevald and Odaga 1995). Hence, girls are unwilling to participate in subjects that are considered masculine (Leo-Rhynie 1999).

Girls also hold the attitude that they do not need to go through the formal and vigorous education of science and mathematics subjects, as all they aim for is to marry well to be wife and mother (FEMSA Dissemination Report No. 9). They believe that technical subjects and careers like engineering and architecture are for boys who are expected to be breadwinners (Njenga 1999, Mariro 1999, Henevald and Odaga 1995). In this way, women are perpetuating their own solely reproductive roles (Mengech 1993).

The majority of the girls who participate and perform well in science and mathematics subjects opt for careers either in medicine, dental surgery, and nursing. Medicine and the related careers are considered more suitable because it is closer to the reproductive role of a woman as a nurturer (Njenga 1999, Henevald and Odaga 1995).

Self-fulfilling prophecy as the girls put less effort in the sciences, they fail to perform well and this is taken to mean they are not able to do science (Mboya 1997, Femsa dissemination report No. 9). A study done in Guinea shows that although primary school pupils showed few gender stereotypes in the first grade, by fifth grade both boys and girls subscribed to gender stereotypes that generally favoured boys and that girls internalized self-images of inferiority (Henevald + Odaga 1995, Ndimbirwe 1995).

Also, in a study done in Hong Kong, Japan, New Zealand and Singapore, eighth grade girls reported significant lower self perception than boys in the same grade, about doing well in science unlike fourth grade girls. This only proves that the poor participation and performance in science and mathematics subjects by girls is not biologically but socially determined (UNESCO 1999).

e, women and girls and society at large have blindly accepted some of practices under the pretext of culture. Traditional values and customs ght to girls and women, boys and men in a way that have made girls y and submissive. On the contrary men and boys have been taught to and assertive (FEMSA n.d.).

es after a certain age, girls are not expected to look men directly in the xpected to appear humble and respectful before the men. This attitude nt socialization of gender has a number of effects. It makes it difficult lly benefit from the participatory and discovery methods that are because they will be reluctant to ask questions, participate fully in work in groups with members of the opposite sex (Femsa n.d). A in a co-educational school stated that:

us African men, we are the ones who do things, and ladies come rds, and maybe that is why they (girls) behave like that in class. They do things such that the boys are the one who volunteer to do things. sually sit there and record the results of the experiments and they do the experiments themselves"(Henevald and Odaga 1995 pg. 44).

participation in scientific experiments has a negative effect on f girls in science and mathematics subjects.

is that, because girls are expected to be obedient and are socialized ys and men are in some ways their superiors, many are vulnerable to sexual harassment and abuse and they lack confidence, skills and such situations (Femsa 1997). This leaves the girls with few choices. op out of school or give in and engage in sex. This kind of behaviour pregnancy more often than not marking the end of a girl's schooling ervald 1995, Femsa D. R. No. 9). A study on school girl pregnancy in tes that an annual average of approximately 10,400 girls leave school egnancy (Henevald and Odaga 1995). This drop-out decreases the of scientists and technologist to satisfy the needs of a country whose rialization.

s' perceptions and attitudes lead to gender inequality in the d performance of science and mathematics subjects. The students, ts and the community harbours stereotyped expectations of girls and ght to join. Giving the girls very little encouragement to excel in such reers.

2.1.4 Teachers' attitudes

pectations by teachers have also contributed to low participation and girls in education (Njenga 1999). In fact, literature suggests that des, behaviour and teaching practices have perhaps the most cations for female participation and performance in school. A study ne the influence of family background and school factors on pupils ement scores, found that there are larger effects of school factors on d performance of girls in science and mathematics subjects (Wadi)).

' attitudes to their girl students are a reflection of the broader societal e role of women in society and academic capacity of girls (Henevald 995). Teachers often play the role of reinforcing the stereotypes nts and communities.

ers and eventually boys and girls believe that boys have better irls in science courses, girls are educated differently than boys and ely encouraged to pursue scientific and technical studies (UNESCO is evidence that a teacher's encouragement is important to the r choices (Leo-Rhynie 1999).

servations in Kenya and other African countries, teachers paid more s than to girls or completely ignored girls (Henevald and Odaga 1995,

e teacher was observed on several occasions allowing girls to sleep out his lessons while another would ask the class to applaud when a ve a correct answer but not when the correct answer was given by a no merely got a" thank you" or "correct /good" from the same r"(FEMSA (n.d) Dissemination report no.9, pg 9).

ation in treatment is most evident in science and mathematics subjects Teachers do not encourage girls to take part and persevere when ces.

le students were found to be less active in mixed classes as boys were d to ask questions more in class; and to be called upon by teachers to questions or to help in experiments" (Wasanga 1997 pg. viii).

ne by Femsa (n.d), teachers ask girls to baby-sit and run errands for nd outside school hours. Teachers just like mothers help perpetuate ision of labour belief unconsciously or consciously.

done by Kasente (1995), she found out that there were anti-female mong some female teachers. Authoritarian behavior and nasty re indicative of an underlying hostility between some female teachers udents. This not only caused failure of participation by female students insolence among males.

society, parents, teachers and students (girls and boys) have low of female students, this reinforces and supports low girls' academic and high-dropout rates in science and mathematics subjects (Henevald 995).

2.1.5 Educational materials

textbooks is dual in nature. They contain pure academic and technical bout a subject and also knowledge about the world in general. For n arithmetic book, apart from learning how to add and subtract, the t the same time learn about what people do, how they relate to one uthors try to paint the world as real as possible to the students. The n textbooks is inhabited by women, men, girls and boys. Therefore, present a gendered picture of the world to the girls and boys using nd Masinjila 1997).

a prominent source of information, particularly in Africa where books ew (Obura 1991, Kabira 1994). They are symbolic to modernity, the elopment. Textbooks are rare, durable and are used by students for a t is possible that these textbooks act as socializing agents in the lives ping them form images and shape attitudes about the world they live).

these curricular and teaching materials especially text-books, remain to a large extent and are rarely sensitive to the needs of girls and cience curricular in particular are very gender biased. Science text- elate to women's and girls daily experience and fail to give recognition entists (PFA para.75). Women and girls are nearly invisible in n in agriculture where women are very productive and contribute much evald and Odaga 1995).

a developing countries women play a central role in the production and of food resources hence to nutrition, community health and poverty nga 1999, Kearney 1996). The contribution has yet to be fully agriculture textbooks. A study done by Obura (1991), the farmers in men.

esenting the real world, these texts promote the received wisdom that t competent, active citizens and deprive schoolgirls of positive role e the attempts to remove gender bias from textbooks, the tendency to in nurturing, passive roles in relation to men presists (Henevald and ljenga 1999, Kabira 1994).

by Kabira (1994) on gender analysis of science school textbooks states

en are not only under represented in mathematics and industrial tion in textbooks analyzed but they are also represented through age as dependants, house-keepers, engaged in food production and they are extravagant and idlers who like gossiping. Men are presented dependent, owners of property, breadwinners, careful and generous, nindful of other people's welfare" (Kabira 1994 pg 13).

in these textbooks is that science and mathematics are male subjects. nd school curricular act to reinforce gender stereotyping patterns hence ne participation and performance of girls in science and mathematics ira 1994, Okumu and Gachuki 1996).

) states that:

hidden messages in these textbooks help to construct success and in the school in general. The boys are motivated and the girls are ed to suffer helplessness in the classroom teaching. If for example a girl pages after pages before finding a character that presents her a role , she might feel that she is not as worth as the boys" (Kabira 1994 pg-

ot only do teachers' attitudes influence the girls' participation and in science and mathematics subjects in the school environment, the erials have tended to reflect cultural stereotypes (Okumu and Gachuki ara 74).

2.1.6 Lack of Role Models

s shown that, there are few girls excelling in science and mathematics ga 1999, UNESCO 1999 FEMSA dissemination report. No. 5, Mariro 999, UNESCO 1993 and Others). There is lack of role models in otivate girls to enroll and excel in science and mathematics subjects. In is lack of role models in the educational materials that they use.

ere are fewer female teachers than males in science and mathematics nsa n.d., Henevald and Odaga 1995) especially in higher classes mination Report No. 9). Therefore, the girls lack role models that they vith in school (Njenga 1999). The fact that more male teachers teach nathematics subjects only helps to prove that science and mathematics e career (Henevald and Odaga 1995).

Kasente (1995) disputes this theory of role models saying that:

ales at different levels of education have different models and females ally had different role models from males. The role models of the es who did not continue to the university were females without high in society. The qualities admired in the women were kindness, ming behavior and common respect. On the other hand, role models e females who went to the university were professional males admired rd work, ambition, courage, professionalism, popularity and commitment r work. Males who went to university and those who did not maintained ar pattern of role models. They all admired successful professional men cessful national and international male leaders. However, the pattern of odels in this study statistically disproved the frequently pedaled theory nore female teachers would attract more female students" (Kasente og 4).

er research reports have proved that, apart from providing positive role e girls, particularly in the rural areas, parents are encouraged to enroll in the schools where there are more female teachers than males. t ease about their daughters safety by the presence of female especially in areas where sexual harassment by males is rampant Odaga 1995).

Why do girls lack role Models?

including Kenya, have traditionally demanded that women assume l roles as wives, mothers and caregivers in addition to professional time a woman can remember, she is brought up to cook whereas brought up to be breadwinners (Golombok and Fivush 1994). This a major problem for women who wish to advance their careers in Kearney 1996).

she's married and the husband is transferred to another place, the is again forced to make choices between career and being a wife She may choose the family in accordance with societal expectations im (UNESCO 1999, Kazmaja n.d).

omen's career aspirations less seriously than men's, and equate and drive with unpleasant aggressiveness. Traditions and gender at are derived from the cult of domesticity, still condition male males (Barbara 1978).

ional women are victimized by the social attitudes and patterns of r that they themselves have internalized. They often lack confidence wn abilities and therefore fail to push success because it is a threat gender identity. Furthermore, the very patterns of behaviour and e encouraged in women may be counterproductive in the professional ness world" (Barbara 1978 pg -)

areer in the field of science and technology require a strong track ch – hence a huge investment of personal time is required. Women, e with young families are limited in the employment opportunities for lude inflexible working conditions and inadequate sharing by women, of family responsibilities (Gui 1996, UNESCO 1999).

vision of labour has contributed to the fact that in all spheres of chnological fields, women are underrepresented and play secondary the field of education where they make up the majority of the work less often to be found as heads of department, universities or tions (Kearney 1996). Hence the lack of positive role models for ientific careers.

2.1.7 Religion

rituality play a central role in the lives of millions of men and women; live and in the aspirations they have in the future. Religion may and to fulfilling women's and men's moral and spiritual needs and to ll potential in society (PFA para 24).

benefits religion can have in the lives of men and women in Africa, a proxy for cultural views about appropriate female roles (Henevald + Most religions have a patriarchal background and they propagate actices such seclusion of women and their low status (Henevald + wamboka 1995). Religion continues to be a source of hope and women despite the fact that men have misused it to have control women.

ially Islam, is usually associated with low female participation in ample, in North Eastern Province, only 9,695 female were in school ,519 male in 1994 (Okwach n.d.). The religion's perception is that to learn prayers. Some parents prefer Islamic education for their use they fear that western education promotes values and behaviour re contrary to cultural norms (Henevald + Odaga; 1995).

rn Kenya where most Muslims are found, the government had to nic curriculum to attract more female students by adding a trained ement religious education (Bellew + King 1991).

community, girls and young women's activities are governed by cial practices, that restrict their presence in public places and their males (Bellew + King 1991). This makes it difficult for girls to attend r work in groups with the opposite sex in scientific experiments.

posure of girls to formal education because of religious beliefs, and ranic curriculum sustains stereotype practices such as avoidance of athematics subjects, reduces the number of women exposed to thematics subjects and eventually science and mathematics careers 5, Bellew + King 1991).

wamboka (1995), Christianity is no different in lowering the self-fidence of girls in life. If women were enrolled in SDA schools, it was for wifely, domestic work and motherhood to provide wives for the . The early SDA church neglected women as far as education was is the case despite the fact that, the Bible teaches that all people en) were created equal, in practice women are usually are relegated ositions and are excluded from the church leadership.

ons hinder girls and women from participating and performing well in thematics subjects. They assume that nurturing roles do not require d science or a university degree (Okwach 1995).

2.1.8 Initiation

onies for girls are still important in some Kenyan communities. For asaai's, Kalenjins, Kamba's, Meru's, Kikuyu's and other tribes in province circumcise their girls. In these communities, these remonies are scheduled to take place during school holidays but gins earlier leading to absenteeism from school.

initiated, they perceive themselves and are also perceived as adults age. When they return to school, their attitude towards uncircumcised chers changes for worse. They are rude towards uncircumcised cially female teachers and they become undisciplined. The teachers, emale teachers are no longer in a position to advise or counsel them. Odaga 1995 pg. 23).

sm and indiscipline leads to a sharp decline in their academic hich eventually might lead them to drop out, barring them from taking , mathematics, technology subjects (Femsa Dissemination Rep. No.9 d and Odaga 1995).

2.2 Theoretical Framework

er Perspective, the study has shown that science contains a gender verall statistics indicate that the present involvement of women in athematics subjects and careers is limited, resulting in women working ery of science (Dormer 1996). Gender disparities persist in access, d performance of these subjects and careers.

eral perception that the sex of a human being brings with it particular predispose him or her to a particular role in society. Women are naturally suited for caring and reproduction, while men are naturally providers and protectors (Ostergaard 1992).

e gender division of labour between women and men, leads societies these divisions are pre-social and therefore fixed; that the gender ur is essentially the same for all human societies at all moments in the nas proved this wrong. Biologically based explanations for this division the unequal positions of women and men in society, fail to provide an anation for the wide and varied contribution that women make to e 1993).

and men than girls and women perform better in science and subjects and careers. This helps perpetuate the belief that boys and lectually better than girls and women in these subjects and hence the ciety to 'masculinise' scientific knowledge (UNESCO 1997).

ccurate data, and an objective picture of what prevents girls from well as boys in science and mathematics subjects, we have to look for n beyond biological reasons. The gender model views the participation nce of girls in these subjects, as being conditioned by non-biological as socio-cultural factors (Mosse 1993).

e gender perspective has attempted to explain this difference by looking ent socialization that boys and men, girls and women receive. seeks to fit individuals into society, by teaching accepted and alues, practices and ideas with the help of observation (Tsuma 1998).

reproduction, the roles assumed to be naturally suited for girls and assumed not to need much scientific education which is considered challenging and complex, hence associated with masculine values and mer 1996).

on of emotional or intellectual differences between women and men is gical conditioning that starts very early in childhood. This results in a n in dealing with stereotypical attitudes because men as well as women them uncritically since social pressures and expectations affect both s.

defines us and pre-exists us; we are born into it just as we are born ies at a level beyond our individual intentions" (Mosse 1993, pg.6).

rception of disadvantages by a deprived group (women) goes a long perpetuating those disadvantages (Tsuma 1998). And for this reason, and men tend to experience the gender we are born into as true, natural

Feminists argue that these false stereotypes are pitfalls for thought and lead to irrational actions. Furthermore, they argue that this gender division of labour, which is based on the biology of human reproduction, results in subordination of women by men (Mosse 1993).

The other assumption that has worked to the detriment of girls and women, is that they can achieve an equal footing with men only if there is an equality of opportunity (Chabaud 1970).

Chabaud (1970) and UNESCO (1997) argues that, if the principle of equality of girls and boys in the matter of education were really applied, it would mean, for example, access to primary education on an equal footing with boys and that they would have the same chances of completing their schooling. It would also mean that there would be great many more than there was in secondary school and tertiary level and that in practice, they would not be prevented by any regulations, prejudices or traditions from choosing freely the course of studies they wished to pursue.

In the minds of men and women, there exists no formal barriers to science and mathematics education and careers (UNESCO 1993, Erinosho 1997). This assumption that equal opportunity measures can redress the imbalances provoked through de-facto discrimination has made women continue to face systematic de-facto discrimination (UNESCO 1997). The Kenyan education system demonstrates that, even when a woman reaches high levels of education, especially in science and mathematics careers, they do not attain commensurate economic and political equality (UNESCO 1997).

Gender plays a major role in determining who goes to school, what subjects they participate in, how well they do and how far they progress.

> "The life experiences we will be exposed to, will be determined by our own gender. It may determine our access to education, to work, to the tools and resources needed for industrialization and our freedom of movement. It will definitely determine our sexuality, our relationships and our ability to make decisions. Our gender is perhaps the single most important factor in shaping

> who we become, what subjects we participate in and our achievements" (Mosse 1993 pg-4).

Because of gender stereotypes, being female is negatively associated with participation and performance in science and mathematics subjects and careers.

Gender analysis calls attention to the subordinate state of girls and women in relation to boys and men in science and mathematics subjects and careers. The gender perspective has revealed that, there is no society in the world where men and women are treated the same or hold the same status in science and mathematics education (Mosse 1993). It also reveals that much of this education offered to girls, reinforces and heightens their sense of inadequacy as girls (USAID 1991).

Industrialization will remain a vision, unless the status of women is raised (Kearney 1996).Therefore, having concrete evidence at hand as to their status, is the starting point from which to measure the real situation of women. This would help in formulating policies and developing strategies to improve their status. Discriminations not only prevents women from achieving complete self-fulfillment as human beings, it also impedes the development of society (Chabaud 1970).

> "The status of a human being in a society is the basic factor determining whether or not they have equal opportunities in all domains ......what extent they will be equipped to participate in development" (Mosse 1993 pg-7).

If the status of women is not raised in Kenya, then they will not be equipped for industrialization.

A gender perspective also implies the need for men to become involved in understanding and supporting the changes in gender relations. This is necessary, if a more just and equitable balance is to achieved between the sexes and society (Mosse 1993). If women's gender identities change, then men's must change also, since, gender is about relations between men and women. It brings to light situations in which it is the men who are at a disadvantage. For example, in the Caribbean countries, the gender approach has called attention to the underachievement of boys in education (Leo-Rhynie 1999).

It is logical to conclude that a gender perspective recognizes that gender is an essential determinant of the life choices available to individuals in society. Development is about the choices that people have in their lives. From this perspective, stressing gender means emphasizing that empowering women as well as men is central to development. Thus, it becomes imperative to recognize the gender issues in science, in order to reduce gender inequalities in participation and performance in science and mathematics subjects.

Using this framework, the study investigated the socio-cultural factors that influence the participation and performance of girls in science and mathematics subjects in primary and secondary level. The study findings can also be used to persuade those who are sceptical about the role of gender in development and policy -making, that gender has an impact on development.

2.2.1 Hypothesis

Parents' attitudes influence the participation and performance of girls in science and mathematics subjects.

Students' attitudes towards science and mathematics subjects influence the participation and performance of girls in these subjects.

Teachers' negative attitudes towards girls influence their participation and performance in science and mathematics subjects.

The portrayal of girls and women in textbooks, influence their participation and performance in science and mathematics subjects.

Lack of role models in science and mathematics careers negatively influence the participation and performance of girls in these subjects.

Definition of terms

Gender: refers to the socially, culturally constructed roles and privileges and relations that identify someone as woman or man, boy or girl in a society.

Gender roles : these are the roles that are ascribed to a woman or man by society.

Sex roles : these are the roles derived from the physiological/ biological differences between a woman and man; they are constant and universal.

Gender stereotyping: refers to a psychological process that results from societal norms about women's and men's proper roles and the early socialization and practices that reinforces these norms. It results in an organized set of beliefs about the characteristics of all members of a particular group.

Gender discrimination: unfair and undesirable treatment of women and men, girls and boys caused by traditional bias and prejudices passed on from generation to generation.

Socialization : process of learning that introduces individuals to the society and incorporates them into it.

Attitudes: a more or less stable set of or disposition of opinion, interest or purpose involving expectancy of a certain kind of experience and readiness with an appropriate response

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CHAPTER 3

3.0 Methodology

The methodology chapter mainly deals with data collection procedures and methods of data analysis.

3.1.1 Sources of data

The study was based on secondary data from the Central Bureau of Statistics, Ministry of Science and Technology, the Examination Council and other research reports.

3.1.2 Methods of data analysis

Both quantitative and qualitative techniques of data analysis was used.
Quantitative analysis provided information on number of girls and boys in primary and secondary school, the number taking part in science and mathematics subjects and the number that pass well enough to proceed to tertiary institutions.

The researcher used charts and percentages to present the quantitative data. They were used because they communicate information more clearly and effectively than just numbers. Quantitative data analysis depended on availability of disaggregated data by gender.

Qualitative analysis was used to interpret the quantitative data. It revealed why girls and women perform poorly in science and mathematics subjects. Percentage tables were used where necessary.

Limitations

In general, data on school drop out rates by gender was unavailable or very sketchy, and that is why the researcher used primary and secondary school completion rates to give an idea of the school drop out rates.

CHAPTER FOUR

4.0 Study Findings

This chapter focuses on the status of girls participation and performance in science subjects and factors contributing to this poor participation and performance in these subjects.

4.1 Status Of Girls Participation And Performance In Science And Mathematics

Empirical evidence exists showing that the participation and performance of girls in examinations in science and mathematics is much lower than of boys.

Table1: Participation in KCSE 1993 examinations in science and mathematics by gender

Subject	No. Male	No. Female	Total
Maths	80,616 (57.4%)	59,810 (42.6%)	140,426
Biology	28,742 (20.5%)	19,890 (14.2%)	48,632
Physics	20,486 (14.6%)	9,058 (6.5%)	29,544
Chemistry	31,703 (22.6%)	20,252 (14.4%)	51,955
Physical Science	48,354 (34.4%)	39,254 (28.0%)	87,608
Biological science	48,893 (34.8%)	39,263 (28.0%)	88,156

Source: Adapted from Njenga (1997)

The number of girls(42.6%) attending secondary schools is lower than that of boys (54.4%). Poor enrolment of girls in secondary school ultimately affects the number of girls participating in science and mathematics. In the table above only 6.5% of the total number of students were females participating in physics compared to 14.6% of the boys. This means that the girls were less than half of the boys. Generally speaking the number of girls participating in science and mathematics subjects is lower compared to that of boys.Note: In the 8-4-4 education system, mathematics is a compulsory subject and every student is expected to participate fully both in primary and secondary level. That is why the number of girls who participated in mathematics in 1993 is higher than in the other science subjects.

Table 2: Performance In The KCSE 1993 Examination In Science And Mathematics By Gender:

Maths	Total	A To B	C+ To D+	D To E
Female	59,810 (42.6%)	1,826 (1.4%)	5,058(3.6%)	51,926 (37.0%)
Male	80,616 (57.4%)	6,215 (4.4%)	14,970 (10.7%)	59,431 (42.3%)
Total	140,426 (100.0%)			
Biology				
Female	19,890 (40.9%)	2,066 (4.2%)	6,723(13.8%)	11,201(23.0%)
Male	28,742 (59.1%)	4,452 (9.2%)	11,169 (23.0%)	13,121(27.0%)
Total	48,632(100.0%)			
Physics				
Female	9,058 (30.6%)	675 (2.3%)	2,750(9.3%)	5,633(19.1%)
Male	20,486 (69.4%)	3,657 (12.4%)	7,609(25.8%)	9,220(31.2%)
Total	29,544(100.0%)			
Chemistry				
Female	20,252 (39.0%)	2,120(4.1%)	6,750(13.0%)	11,383(21.9%)
Male	31,703 (61.0%)	4,407(8.5%)	11,986(23.1%)	15,310(29.5%)
Total	51,955(100.0%)			
Physical Science				
Female	39,254 (44.8%)	1,144 (1.3%)	8,034 (9.2%)	30,076 (34.3%)
Male	48,354 (55.2%)	2,778(3.2%)	14,245 (16.3%)	31,331(35.8%)
Total	87,608(100.0%)			
Biological Science				
Female	39,263 (44.5%)	2,148 (2.4%)	10,212 (11.6%)	26,903 (30.5%)
Male	48,893 (55.5%)	5,422 (6.1%)	16,441 (18.6%)	27,030 (30.7%)
Total	88,156 (100.0%)			

SOURCE:Adapted From Njenga (1999)

From the table above, one can see that apart from the low participation in science and mathematics subjects, their performance is poorer than that of boys. For example, only 2.3% of girls out of the total number of students that enrolled for physics managed to get A to B grades compared to 12.4% of the boys. In mathematics 1.4% of girls out of the total number enrolled for the subject, managed to A to B grades compared to 4.4% of boys. And this trend of boys doing better than girls in science and mathematics subjects, is observed in all the other science subjects.

4.2 Socio-Cultural Factors Influencing The Participation And Performance Of Girls In Science And Mathematics Subjects In Primary And Secondary Schools.

4.2.1 Parents attitudes

From the literature review, one can conclude that parents can be source of motivation for their daughters in the areas of science and mathematics. Unfortunately, most parents do not encourage their daughters to take active part in science subjects because they already have the attitude that girls do not excel in these subjects. They also believe that its more beneficial to educate boys especially when resources are limited. They argue that boys need education more than girls, because girls will get married and have someone to provide for her.

Table 3 Parental Preference For Educating Boy/Girl During Economic Difficulties

	Number	Percentage
Son	873	42.1
Daughter	170	8.2
Both	870	42.1
No Response	159	7.7
Total	2,072	100

Source: Okwach and Wamahiu; Household Based Factors And School Participation Of Girls.

The table above shows that 42.1% of parents prefer to educate the boys when the resources are limited compared to 8.2% who prefer to educate daughters
Most parents reason that educated boys will take care of them compared to girls who will get married and move away from home. Others convince their daughters to get married before completing school, to bring in dowry to help them out of their poverty. Most parents see the role of girls and women as being defined in marriage and worry about wasting meagre resources on girls who might get pregnant or married before completing school.

Therefore, weak economic position, together with cultural determined attitudes and expectations determines how much family resources are attached to the education of children.

4.2.2 Students attitudes

From research studies, female students believe that science and mathematics subjects are difficult and meant for boys. They have a less positive attitude and confidence towards science and mathematics than their male counterparts. The tables presented below show that girls perceive science and mathematics as less useful to them than male students. This was observed both at primary and secondary level.

At the primary level 37.6% of the girls felt that mathematics is useful to them compared to 52.4% of the boys, while at form four only 49.4% of the girls felt mathematics is useful to them compared to 69.0% of the boys. In both primary and secondary schools, more boys than girls felt that science and mathematics subjects are useful to them. More girls felt that languages and homescience subjects are more useful to them than boys. Only 25.8% of the boys felt that homescience subject is useful to them compared to 54.5% of the girls in form four. In the primary level, 88.4% of the girls felt that the homescience subject is more useful to them compared to 25.7% of the boys

Table 4: **Subjects Useful To Boys And Girls By Form Four**

Subject	No. Of Girls	% Girls	No. Of Boys	% Boys
Maths	77	49.4	107	69.0
Chemistry	76	48.7	99	63.9
Physics	75	48.1	126	81.3
Biology	91	58.1	90	58.1
English	83	53.2	46	29.7
Kiswahili	63	40.4	40	25.8
H/Science	85	54.5	40	25.8
Geography	44	28.2	35	22.6
Music	52	33.3	41	22.6
No. of Students	156		155	

Source: Wasanga C; The Attitude Towards Science Among Primary And Secondary School Students In Kenya

Table 5: **Subjects Useful To Boys And Girls By Standard Eight**

Subject	No.Of Girls	Girls %	No. Of Boys	Boys %
Maths	71	37.6	98	52.4
Science and Agriculture	112	59.3	130	69.5
Art &Craft	38	20.1	72	38.5
G.H.C	48	25.4	70	37.4
English	72	38.1	47	25.1
B. Education	47	24.9	59	31.6
Music	44	23.4	45	24.2
C.R.E	45	23.8	36	19.3
H/Science	167	88.4	48	25.7
Total	189	100	187	100

Source: Wasanga C; The Attitude Towards Science Among Primary And Secondary School Students In Kenya

One can conclude that both boys and girls students feel that science subjects are more useful to boys than to girls in standard eight and form four. This study also revealed that the reasons given for the usefulness of these subjects were very stereotypical. The major reason why the girls indicated that home science was useful was that, it helped them in their domestic work. They indicated that science subjects were not useful in domestic work hence, the negative attitudes towards science and mathematics subjects. The boys felt that the science subjects would be more useful to them in the future when choosing careers. Career choices were based on stereotypical expectations of the society, about the appropriate careers girls and boys should choose.

Table 6: **Career Considerations By Gender**

Career	Females %	Males %
Nursing	35.2	1.3
Secretary	27.0	0.0
Engineering	4.1	52. 0

Source: Adapted from C. Wasanga ,1997

Nursing and secretarial work is considered appropriate for girls more than boys because they are closer to their reproductive role as a nurturers and helpers, whereas the engineering careers are considered masculine. 35.2% of the students felt that nursing was appropriate for women as compared to only 1.3% who felt that it was suitable for males. 52.0% of the students indicated that engineering was suitable for males as compared to only 4.1% who said it was suitable for females.

In tertiary institutions today, gender-stereotyping is so apparent in the courses that boys and girls choose. Girls continue to choose the courses that enhance their domestic skills leaving the scientific based careers to the boys.

A look at students' enrolment in Kenya polytechnic by course and gender reveals serious gender disparities. In the electrical and electronic engineering courses the number of female students(4.4%) is extremely low compared to the number of males (94.6%). The female students opted for institutional management (catering) where they were 84.4% of the students enrolled for that course.

Table 7: **Students Enrolment In Kenya Polytechnic By Course And Gender 1998.**

Course	Male	Female	Total	%Female
Electrical & Electronic Engineering	625	29	654	4.4
Building And Civil Engineering	515	27	542	5.0
Applied Science	575	380	955	39.8
Business studies	263	370	633	58.5
Graphic Arts	329	148	477	31.0
Institutional Management(catering)	61	331	392	84.4
Survey &Mapping	278	61	339	18.0
Information And Liberal Studies	125	82	207	39.6
Computer Studies	118	56	174	32.2
Total	3,521	1,493	5,014	29.8

Source:Ministry Of Education, Science &Technology. Educational Statistical Booklet. Nairobi. Fawe October 2000

Table 8: **Students Enrolment In Public Universities By Selected Courses And Gender, 1998/1999**

Course	Male	Female	Total	% Female
Education	8,749	5,289	14,038	37.7
Arts	3,658	1,910	5,478	34.9
Commerce	1,162	506	1,668	30.3
Agriculture	2,530	833	3,363	24.8
Engineering	2,435	244	2,679	9.1
Medicine	729	237	966	24.5
Science	3,677	1,000	4,677	2104
Total	22,850	10,019	32,869	30.5

Source:Ministry Of Education, Science &Technology. Educational Statistical Booklet. Nairobi. Fawe October 2000

There is a wide gender gap in the enrolment of university students with only 30.5% of the total student population as women. Looking at the figures above, it clearly confirms that women do not enroll in science and especially engineering. As shown in the above table only 9.1% of women students enrolled in engineering in 1998/1999 academic year. It is also important to note that, even in education and art based courses the male students were still more than the female students.

4.2.3 Teachers' Attitudes

This study has revealed that, teacher's behaviour, attitudes and teaching practices have the most significant implications for female achievement and attainment in science and mathematics. Despite the fact that there is no scientific evidence to support that boys are more capable of performing well in science and mathematics than girls, some teachers are of this opinion.

Classroom studies have found that nearly all teachers tend to use positive reinforcement more often for boys than girls. Even the quality of reinforcement differed. The boys receive a more enthusiastic reinforcement while the girls received a lukewarm or no reinforcement at all. Teachers also tended to ask the boys questions which needed explanations, while the girls were asked recitation questions where they just needed to memorise and recall without understanding. Research has shown that teachers are not even aware of the fact that they harbour such negative attitudes towards female students. These attitudes are a reflection of the attitudes of the broader society in which teachers and students function.

Teachers attitudes regarding girls ability become an important factor because, when it comes to choosing subjects at secondary school level, teachers often advise or force students not to choose sciences but choose the subjects they feel they should be doing.

Teachers sent girls on errands forcing them to miss lessons. This gives the girls the impression that these subjects are not important in their lives or that the teachers felt they (girls) were not capable of doing well and therefore wasting time attending these classes. When the girls cannot cope with these attitudes from teachers, parents and society as a whole, they stop participating in these science classes and eventually drop out.

The following table gives an idea of the drop out rates in primary and secondary schools.

Table:9 **Primary School Completion Rates By Gender,1988-1996**

		% Completing Std 8	
Year In Std 1	Year In Std 8	Girls	Boys
1981	1988	39.20%	47.40%
1982	1989	43.20%	47.90%
1983	1990	40.50%	45.70%
1984	1991	41.60%	46.40%
1985	1992	48.20%	44.7%
1986	1993	42.20%	44.50%
1987	1994	43.00%	44.60%
1988	1995	42.10%	43.00%
1989	1996	43.50%	45.10%

Source: Okwachi Abagi; Status Of Education In Kenya: Indicators For Planning And Policy Formulation Dec.1997

Except in 1991 where the completion rate of girls (46.4%) was more than that of boys (41.6%), in all the other years more boys completed primary school compared to the girls. Despite the fact that completion rates for boys is on the decline, it is still higher than that of the girls. This means that more girls than boys drop out of school before completing standard eight thus reducing the potential pool of girls who could participate in science and mathematics subjects. Also, the small number that remain in the school tend to be directed away from science and mathematics subjects by the attitudes of the teachers.

Table 10: **Secondary Completion Rates By Gender,1989-1996**

Year In Form 1	Year In Form 4	Female	Male
1986	1989	78.90%	89.70%
1987	1990	86.00%	86.70%
1988	1991	77.90%	78.50%
1989	1992	85.00%	82.30%
1990	1993	66.60%	70.70%
1991	1994	81.90%	82.30%
1992	1995	78.20%	76.20%
1993	1996	94.90%	95.80%

Source: Okwachi Abagi; Status Of Education In Kenya: Indicators For Planning And Policy Formulation Dec.1997

In secondary school, the completion rate for boys is higher than that of girls, except in 1992 where 78.2% of the girls completed compared to 76.2% of the boys.
Therefore, more girls than boys drop out of school before completing primary and secondary education reducing the number that would take part in science and mathematics subjects. This coupled with the fact that the enrolment rate for girls is lower than the boys only makes the participation of girls in these subjects worse.

4.2.4 EDUCATIONAL MATERIALS

In text-books, males and females are generally represented in terms of names, nouns and pictures. This might appear gender neutral but, when they are put under the gender microscope for in-depth analysis, the general conclusion is that text-books are very gender biased. They have a bias towards boys and men. They portray them as independent, breadwinners and property owners, while women are portrayed as dependent, house-keepers, mothers and wives. They show a stereotyping of men and women and the accepted roles they are expected to perform Women are portrayed as nurses, lower classes teachers, stewardesses and secretaries, while men are portrayed as doctors, pilots and engineers. Text-books perpetuate the societal belief about gender roles, therefore, acting as socializing agents. These text-books also use gender biased language such as house-wife, craft-man, mankind and others. These messages are passed on to the text-book user who internalizes them without ever noticing the gender bias. In science textbooks the message passed on to the students is that science and mathematics are male subjects.

4.2.5 Lack of role models

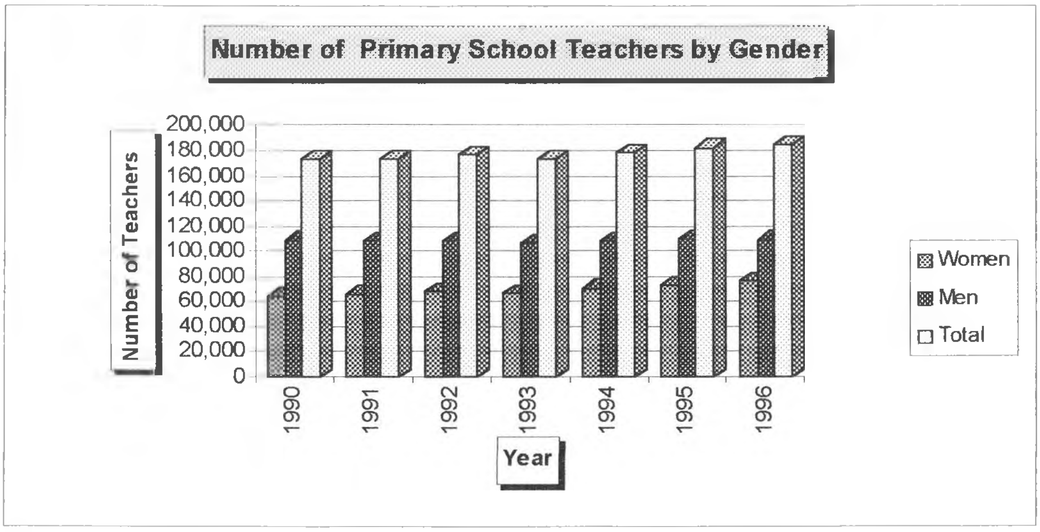
Research has shown that the presence of role models and presence of female teachers has been found to encourage parents to enroll their children in school. Especially where sexual harassment and gross misconduct by male teachers is common, the presence of female teachers is a source of comfort and peace of mind for the parents. Yet in 1990-1996 only 39% of teachers at primary level were women

Table 11: **Number Primary Teachers by Gender,1990-1996**

Year	Women	Men	Total	%Women
1990	64,508	108,609	173,117	37.3
1991	65,625	107,745	173,370	37.9
1992	68,105	108,255	176,360	38.6
1993	66,872	106,305	173,177	38.6
1994	70,361	107,736	178,097	39.5
1995	72,672	109,303	181,975	39.9
1996	75,892	108,501	184,393	41.2

Source:Okwachi Abagi; Status Of Education In Kenya :Indicators For Planning And Policy Formulation.

Fig.1: Primary school teachers by gender 1990-1996



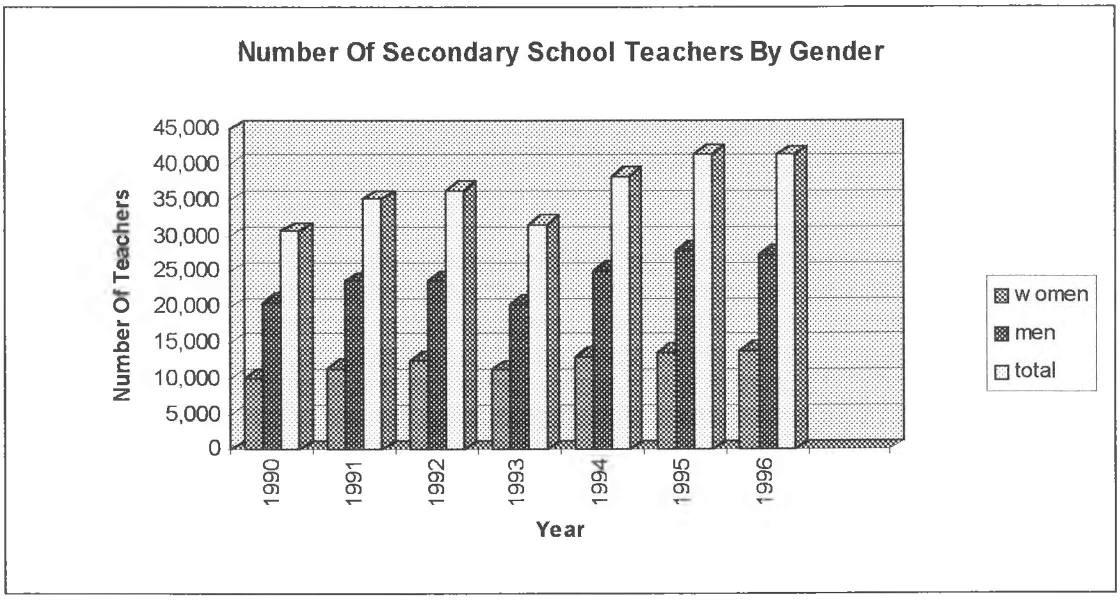
As shown in the above figures, there has been an increase in the number of female teachers but a gender parity has yet to be achieved in the teaching force. This means that girls continue to lack role models right from primary school.

Table 12: **Number of secondary school teachers by gender,1990-1996**

year	women	men	total	%women
1990	9,930	20,691	30,621	32.4
1991	11,458	23,639	35,097	32.6
1992	12,504	23,833	36,337	34.4
1993	11,247	20,410	31,657	35.5
1994	13,082	25,225	38,307	34.2
1995	13,582	27,902	41,484	32.7
1996	13,946	27,334	41,280	33.8

Source: Okwachi Abagi; Status Of Education In Kenya :Indicators For Planning And Policy Formulation

Figure3: Number of secondary school teachers by gender,1990-1996



Source:Okwachi Abagi; Status Of Education In Kenya: Indicators For Planning And Policy Formulation

From the table above the data shows that gender disparities are even more glaring when one looks at the secondary school teaching force. Despite the fact that research has proved that students taught by female teachers had more confidence in learning science, stereotyped science as a male domain less frequently and liked science more, from 1990-1996, the number of female teachers has not increased significantly. In 1990 and in 1996 only 32.4% and 33.8% respectively of the teachers were female. It is important to have a balanced proportion of women and men teachers at every level of the education system to improve the participation and performance of girls in science and mathematics subjects.

Chapter 5

5.0 CONCLUSIONS AND RECOMMENDATIONS

5.1 CONCLUSIONS

The study investigated the socio-cultural factors that influence the participation and performance of girls in science and mathematics subjects at primary and secondary level. The study highlighted the poor participation and performance of girls in these subjects in both primary and secondary schools. It revealed that the following socio-cultural factors contribute to this poor participation and performance.

The girls have internalized negative attitudes towards science and mathematics. The society also does not encourage them to take up these subjects in schools. The parents, teachers and the other male students think that girls are not capable of performing well in science and mathematics.

The teachers encourage girls to take courses that enhance their domestic skills and the boys are encouraged to take the more challenging subjects like science and mathematics. Teachers, more often than not believe that the most important role of girls and women is as mothers and wives hence there is no need for scientific education for them.

The general conclusion is that these attitudes by parents, teachers, students and society have a profound influence on students' perceptions and attitudes towards science and mathematics and that this in turn affects their level of participation and performance. With this kind of attitude, when girls fail to perform well in these subjects, the parents and society are not concerned at all.

Fortunately, these inequalities, although persistent are not inevitable if the rhetoric by the government was followed by concrete strategies to improve their participation and performance in these subjects. The following recommendations are suggested.

5.2 Recommendations

- There is need for gender awareness raising among parents, teachers and students. The parents should be sensitized about the advantages of educating and encouraging the girls especially in science and mathematics subjects.

- When parents do not understand the importance of education, it is very hard for them to support girls psychologically and financially when they are in school, so there should a directive from the government for parents to send their girl children to school or else face the law. The government should work with the community leaders (made up of women and men in equal numbers) to achieve this. A more balanced presence of women and men in decision making positions would be needed to give gender equality a more prominent place on the community and national level.

- The government and private companies should promote the women scientists who have become successful in these careers. These women can be a tool to desensitizing the girls from a science and mathematics phobia.

- The special contribution made to development by highly qualified female scientists must be constantly emphasized.

- Parents should be advised to allocate household duties equally among boys and girls. This would leave enough time for girls to complete their homework.

- The government should provide better infrastructure, safe water and fuel in rural areas to reduce the time required to carry out household chores, often considered female tasks to enable girls to go to school and concentrate.

- Teachers should encourage girls to participate in science and mathematics. It would be important if teachers are gender sensitive.

- Gender sensitive female teachers should be encouraged to teach science and mathematics subjects in primary and secondary schools in order to serve as role models to the girls.

- Teachers should encourage all children right from lower primary to perform well in science and mathematics, since attitudes start developing at primary school level.

- Where parents cannot afford to educate their daughters, the government should offer full scholarship to help them complete their education up to the highest level possible. More resources should be used on girls pursuing science and mathematics subjects and careers to reduce the gender disparities in these areas.

- The Ministry of Education should recommend textbooks only after the books have been approved by gender specialists to be gender neutral and / or sensitive.

- Curriculum developers should either be trained to recognise gender issues in science and mathematics or work closely with gender experts.

- It is important for everyone to know that there is no gender difference in overall intelligence. A gender awareness campaign is necessary to undo all these different attitudes towards girls and boys that the society harbours.

- Findings from research should be made available to teachers, parents, students, policy makers and curriculum developers.

- Measures to help girls overcome these socio-cultural barriers must be adopted. Girls should be given guidance and counseling on the importance of participating and performing well in science and mathematics subjects and careers. They should be aware that they must make the effort themselves to participate and perform well in all subjects.

- In all the policy making stages, a gender equality perspective must be integrated by policy makers. Policies must reflect that girls are not just another interest group, but half of the population that educational policies are supposed to address.

- Most important there is need to transform an excessively male dominated society through structural transformation, to create a more egalitarian society where there is provision of equal rights and equal opportunities for girls and boys in all areas of life. Sex differences should not be used to discriminate against girls.

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