STATUS OF WOMEN STUDENTS IN SCIENCE, MATHEMATICS AND TECHNOLOGY PROGRAMMES IN KENYAN UNIVERSITIES

BY

NJOROGE JOHN KAMAU

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DECLARATION

This Ph.D thesis is my original work and has not been presented for a degree in any other university or any other award.

DATE 27.10.2014

NJOROGE JOHN KAMAU
E83/10932/2006

SUPERVISORS

This Thesis has been submitted for examination with our approval as University Supervisors.

SIGNATURE ____________________________ Date 27.10.14

PROF. FREDRICK Q GRAVENIR
PROFESSOR,
DEPARTMENT OF EDUCATION MANAGEMENT, POLICY AND CURRICULUM STUDIES

SIGNATURE ____________________________ Date 27/10/1014

DR NOBERT OGETA
LECTURER,
DEPARTMENT OF EDUCATION MANAGEMENT, POLICY AND CURRICULUM STUDIES
DEDICATION

To my dear dad, Ephantus Njoroge Kamau, who he made sure that I went to school and became excited about life’s possibilities.
ACKNOWLEDGEMENTS

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I feel indebted not to thank my dear wife Regina and daughters Mercy, Joy and Linet for their patience and tolerance during trying periods of undertaking this scholarship. Antony D Bojana deserves gratitude for editing the final work.

Finally, I thank my brother Samuel Mwangi for his enormous contribution as a research assistant.
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<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>AIDS</td>
<td>Acquired Immune Deficiency Virus</td>
</tr>
<tr>
<td>AUSI</td>
<td>Austrian University Institute</td>
</tr>
<tr>
<td>CHE</td>
<td>Commission for Higher Education</td>
</tr>
<tr>
<td>DoF</td>
<td>Dean of Faculty</td>
</tr>
<tr>
<td>ECD</td>
<td>Early Childhood Education</td>
</tr>
<tr>
<td>EFA</td>
<td>Education for All</td>
</tr>
<tr>
<td>GDP</td>
<td>Gross Domestic Product</td>
</tr>
<tr>
<td>GEI</td>
<td>Gender Equity Index</td>
</tr>
<tr>
<td>GoK</td>
<td>Government of Kenya</td>
</tr>
<tr>
<td>HDI</td>
<td>Human Development Index</td>
</tr>
<tr>
<td>HIV</td>
<td>Human Immune Virus</td>
</tr>
<tr>
<td>ICRAF</td>
<td>International Centre for Research in Agroforestry</td>
</tr>
<tr>
<td>ICIPE</td>
<td>International Centre for Insect Physiology and Ecology</td>
</tr>
<tr>
<td>IMF</td>
<td>International Monetary Fund.</td>
</tr>
<tr>
<td>JICA</td>
<td>Japan International Cooperation Agency</td>
</tr>
<tr>
<td>JKUAT</td>
<td>Jomo Kenyatta University of Agriculture and Technology</td>
</tr>
<tr>
<td>KCCT</td>
<td>Kenya College of Communication and Technology</td>
</tr>
<tr>
<td>KCSE</td>
<td>Kenya Certificate of Secondary Education</td>
</tr>
<tr>
<td>KNUT</td>
<td>Kenya National Union of Teachers</td>
</tr>
<tr>
<td>MDGs</td>
<td>Millennium Development Goals</td>
</tr>
<tr>
<td>MSMEs</td>
<td>Micro, Small and Medium-Sized Enterprises</td>
</tr>
</tbody>
</table>
MoE       Ministry of Education
NEPAD     New Partnership for African Development.
NFE       Non Formal Education
OECD      Organization for Economic Co-operation and Development
R&D       Research and Development
SMASSE    Strengthening Mathematics and Science in Secondary Schools
SMTs      Science, Mathematics and Technology
TIVET     Technical, Industrial, Vocational and Entrepreneurship Training
UoN       University of Nairobi
USIU      United States International University
US        United States
UNDP      United Nations Development Programme
UNEP      United Nations Environmental Programme
UN        United Nations
UNESCO    United Nations Educational, Scientific and Cultural Organization
UNISA     University of South Africa
WB        World Bank
YWCA      Young Women Christian Association.
ABSTRACT

The purpose of the study was to carry out an in-depth analysis of status of women students in terms of performance in science, mathematics and technology programmes and flow from one academic year to another compared to that of their male counterparts in Kenyan public and private universities. The study was also to establish if access to resources is same as that of male students. The theory used in this study was Liberal feminism. It is rooted in the tradition of 16th- and 17th-century liberal philosophy, which focused on the ideals of equality and liberty. The liberal conception of equality was based on the belief that all men had the potential to be rational and that any inequality had to be justified in rational terms. Liberal feminists argue that the inequality of women and men cannot be justified on rational terms and trust that rational men can be convinced of the folly of perpetuating that inequality. The research design used in this study is ex post facto. The term ex post facto according to Landman (1988) is used to refer to an experiment in which the researcher, rather than creating the treatment, examines the effect of a naturally occurring treatment after it has occurred. The study was carried out in 3 Kenyan public and 3 private universities: namely Nairobi, Kenyatta, Jomo Kenyatta University of Agriculture and Technology, Aga Khan, Mt Kenya and Catholic Universities. After coding, organizing observations systematically, the researcher proceeded to process data with aid of computer statistical package for social sciences (SPSS). To establish whether there is any significant difference between men and women in performance and access to learning resources Chi-square statistical test was done. The researcher also used the Wilcoxon – Mann – Whitney Test. This test is a non-parametric analog to the independent t-test and is used when one does not assume that the dependent variable is a normally distributed interval variable (one can only assume that the variable has at least ordinal). Moi, Kenyatta, Jomo Kenyatta and Nairobi seem to be the only universities with fully fledged facilities to comfortably handle SMTs programmes. Adequate qualified personnel remain the number one factor that hinders the full rolling out of SMT programmes besides the expensive equipment in both public and private universities. It is also very clear that in lower levels of education tier boys outdo girls in SMTs in terms of performance. However, at university level, men and women perform equally well. Contrary to general misconception that transition of women is not at same the rate as men, the study has shown that the difference is insignificant. The study has also established that there is no correlation between gender and preference of SMT programmes at university level. Government should set aside lots of capital to equip the SMTs facilities at all the universities.
CHAPTER ONE
INTRODUCTION

1.10 Background to the Problem

In 2008, the OECD report described women as one of our most underutilized resources: better use of women's capacity could increase economic growth, reduce poverty, enhance societal well-being, and help to ensure sustainable development throughout the world [Gender and Sustainable Development. Maximising the Economic, Social and Environmental Role of Women (OECD, 2008a)]. The report also suggested that focusing on women in development assistance could lead to a more rapid and pro-poor economic growth than “gender neutral” approaches, where individuals rather than women are the target group. This issue has also been highlighted by the OECD Development Assistance Committee (DAC) Network on Gender Equality, in reference to the gender issues enshrined in the 2005 Paris Declaration on Aid Effectiveness and the 2008 Accra Agenda for Action (OECD, 2008b).

In addition to this, education of women has many spillover benefits which include the following; first, it promotes per capita income growth because increasing the share of women with secondary education by 1 per cent boosts annual per capita income growth by 0.3 per cent on average (Dollar and Gatti, 1999). The amount of education acquired by workers, (whether men or women), has an important impact on labour market experience. The most direct way that education affects the labour market experience of workers is by increasing their productivity and earnings. The more education individuals acquire, the better they are able to absorb new information, acquire new skills, and familiarize
themselves with new technologies. By increasing their human capital, workers enhance the productivity of their labour.

Second, it increases women's labourforce participation rates and earnings. Providing an extra year of schooling for girls beyond the average boosts eventual wages by 1,020 per cent (Psacharopoulos and Patrinos, 2002). Further education may also contribute to raising the quality of the labour force and hence increased productivity within a lifespan. For a family, women's paid employment is often viewed as only added advantage. The reality is different. In highly paid, responsible positions, or those engaged in entrepreneurial activities have helped to build family houses, pay children's fees and look after the family's wellbeing. Researchers and development workers now confirm that women spend more of their income on their families than men do, thus strengthening their case for acquiring paying jobs (RoK, 2007a). The Kenya Integrated Household Survey, (2007) showed that 61 per cent of household entrepreneurs in Kenya are women.

Third, it lowers infants and child's maternal mortality rates: An additional year of female schooling reduces the probability of child mortality by 5 to 10 percentage points (Schultz, 1993). Again, an additional year of schooling for 1,000 women helps prevent two maternal deaths (UNICEF, 2003). Education also protects against HIV and AIDS infection: Ugandan females with secondary education are three times less likely to be HIV positive than those with no education (DeWalque, 2004). Subsequently in the long run education often affects the quality of life in ways not thought about or recognized. Apart from the effect of education on increased earnings (hence, money available to
spend on healthcare and likelihood of having employer-provided health benefits), persons with higher levels of education tend to have better health than those with lower levels. Individuals with high levels of human capital have made an investment in themselves, an investment that they protect by taking preventative measures to increase the probability of better health. Annual checkups, mammograms, and regular exercise can all be viewed as investments in the maintenance of human capital.

Forth, it creates intergenerational education benefits which include reduction of fertility rates. Each additional year of formal education completed by a mother translates into her children remaining in school for an additional one-third to one-half year (Filmer, 2000). The fertility rate of a woman drops by almost one birth when she gains four additional years of education (Klasen, 1999). Studies have revealed that there is an inverse relationship between education of women and size of her family (Schultz, 1993).

Fifth, it empowers women as educated ones are likely to participate more in household and national decisions and take a stand for themselves, to reduce their vulnerability to domestic violence and promotion of good governance (Barro, 1999; Sen, 1999). A stable and democratic society is impossible without a minimum degree of literacy and knowledge on the part of the citizens and without widespread acceptance of some common set of values. Education can contribute to both (Friedman, 1962). Most educated societies cannot vote in an autocratic leader or tyrant. Additional education enlightens the society about their civil rights and factors that make a good leader. Educated leaders are...
also a benefit to society because they are better placed to make second and well-informed decisions concerning governing of people and the general running of a country.

Finally, education enables women to reject adverse cultural practices. For example in Egypt, women with secondary education are four times more likely to oppose the practice of female genital mutilation (El-Gabaly, 2006).

The earnings of more educated people are almost always well above average although the gains are generally larger in less developed countries. The study shows that returns to education in Africa are higher than for other world regions. Again, large number of studies from all over the world shows that educational returns for an additional year of schooling are positive and range from 5% in developed countries to as high as 29% in developing countries (Psacharopoulos, 1994). This is well-illustrated in figure 1 overleaf.
In spite of this many benefits, in Kenya's the education system has been characterized by gender disparities (MoE, 2007). Achievement of gender equity and equality on education has been a major development issue and a goal in its own right. Towards this goal, the government developed the Gender and Education Policy, which provides a comprehensive framework of principles and policies that will be pursued in order to achieve gender equity and equality (Republic of Kenya, 2007c). This is already bearing fruit particularly in higher education levels where in 2004 female students made up 36 percent of those enrolled but rose to 40.1 percent in 2008 (RoK, 2009).

Source: Tembon and Fort, (2008)

Fig 1: Typical Age Earning Profile

In spite of this many benefits, in Kenya's the education system has been characterized by gender disparities (MoE, 2007). Achievement of gender equity and equality on education has been a major development issue and a goal in its own right. Towards this goal, the government developed the Gender and Education Policy, which provides a comprehensive framework of principles and policies that will be pursued in order to achieve gender equity and equality (Republic of Kenya, 2007c). This is already bearing fruit particularly in higher education levels where in 2004 female students made up 36 percent of those enrolled but rose to 40.1 percent in 2008 (RoK, 2009).
The Kenya’s Vision 2030, which is the country’s development blueprint, aims to ensure gender equity in power and resource distribution and increase participation of women in all economic, social and political decision making process (RoK, 2006b). Towards this goal, Kenya’s gross total allocation to the Ministry of Education increased by 12.13 percent from Ksh 122 billion in 2008/09 to Ksh 136.8 billion in 2009/2010 financial year (RoK, 2009). Ministry of Education is determined to improve access, equity, quality, and relevance of education through better management of service delivery to all learners. Achievement in this sector will, therefore, enhance economic growth, create more employment, and guarantee sustainable development for the Kenyan people (RoK, 2005a).

The Vision 2030 also recognizes the critical role played by research and development in accelerating economic development in all newly industrializing countries of the world. More resources are to be devoted to scientific research, technical capabilities of the workforce, in raising the quality of teaching mathematics, science and technology in schools, polytechnics and universities (RoK, 2006b). The country therefore, has no choice but must make massive investment in science, mathematics and technology education, particularly in women; if at all the set targets will be achieved. According to Wambugu, (2007), to achieve the goals well-articulated in Vision 2030, science and technology must be given due recognition and integrated in the structure of the economy.

In a 2007, global forum on science, technology and innovation, organized by the World
Bank, it was observed that an abundant supply of low wage- unskilled labour is no longer a route to rapid economic growth and prosperity. In today’s world, characterized by intense global competition and rapid technological change, the key to prosperity is a well-educated technically skilled workforce producing high value added, knowledge intensive goods and services, employed in private enterprises that have managed capacity to find, adapt and adopt modern up-to-date technology and sell sophisticated goods and services in global markets (World Bank, 2007a).

Technological developments also play a key role in economic growth, but this, too, depend closely on educational progress—and not just because tomorrow’s knowledge workers and innovators require high levels of education. A highly educated workforce is a prerequisite for adopting new technologies and increasing productivity.

As a country, Kenya has always lagged behind in science and technological innovativeness. It is important to examine the genesis of this scenario. One major factor is on KCSE science performance especially in case of girls. The low performance of girls in mathematics, science and technical subjects in KCSE hinders them from joining the world of science at the university level. This limits their opportunity to join lucrative professional fields. In addition, low participation of women in lecturing, research, governance, management and administrative responsibilities at the universities is another setback (RoK, 2007c).

Earlier studies on women’s education in Kenya, for example Kinyanjui (1975), Maleche (1976), Eshiwani (1985) and Mwiria et al (2007), all seem to agree that the number of
female students thins out as one ascends the educational ladder, that girls perform poorer
than boys in science subjects, that girls have low educational aspirations, and that girls
are underrepresented in higher education, particularly in the university. Available
statistics show that even fewer women have access to the graduate level.

Performance of girls in KCSE is a key factor to their access to university education and
admission to the most coveted professional programmes (Kinyanjui, 2006). According to
Kenya National Examinations Council in the year 2012, there were 436,349 candidates
who were registered for KCSE examination. The information on total candidature by
gender from 2006-2012 is tabulated in table 1.1.

**Table 1.1: Number of candidates by gender, KCSE examinations, from 2006-2012**

<table>
<thead>
<tr>
<th>YEAR</th>
<th>Total</th>
<th>Male Total</th>
<th>Female Total</th>
<th>% of Female</th>
</tr>
</thead>
<tbody>
<tr>
<td>2006</td>
<td>243,453</td>
<td>129,071</td>
<td>114,482</td>
<td>47.02</td>
</tr>
<tr>
<td>2007</td>
<td>276,239</td>
<td>150,127</td>
<td>126,112</td>
<td>45.65</td>
</tr>
<tr>
<td>2008</td>
<td>305,015</td>
<td>165,591</td>
<td>139,424</td>
<td>45.71</td>
</tr>
<tr>
<td>2009</td>
<td>337,404</td>
<td>184,563</td>
<td>152,841</td>
<td>45.30</td>
</tr>
<tr>
<td>2010</td>
<td>357,488</td>
<td>198,100</td>
<td>159,388</td>
<td>44.59</td>
</tr>
<tr>
<td>2011</td>
<td>411,783</td>
<td>229,171</td>
<td>182,612</td>
<td>44.35</td>
</tr>
<tr>
<td>2012</td>
<td>436,349</td>
<td>241,139</td>
<td>195,210</td>
<td>44.74</td>
</tr>
</tbody>
</table>

**Source: Kenya National Examinations Council**

There has not been significant difference in percentage of girls and boys registered for
KCSE but as shown in Table 1.2 below, the number of girls taking sciences particularly
physics and all vocational subjects except home science has been comparatively lower
than that of boys. Indeed, there was not even a single girl registered for Aviation
Technology. The subject has traditionally been offered in Mang’u Boys School and lately
Pioneer School in Maragwa. No programmes have ever been put in place to start one in
any girls school. These are the subjects, which ultimately determine whether a student will pursue science and technology course at the university.

Table 1.2: Performance in science by gender, in KCSE, in 2011 and 2012

<table>
<thead>
<tr>
<th>Subject</th>
<th>2012</th>
<th>2011</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>FEMALE Mean%</td>
<td>MALE Mean%</td>
</tr>
<tr>
<td>Maths</td>
<td>195,093 25.03</td>
<td>241,233 31.38</td>
</tr>
<tr>
<td>Biology</td>
<td>183,595 24.36</td>
<td>205,926 27.86</td>
</tr>
<tr>
<td>Physics</td>
<td>32,295 36.22</td>
<td>87,329 38.48</td>
</tr>
<tr>
<td>Chemistry</td>
<td>193,426 25.95</td>
<td>237,293 29.54</td>
</tr>
<tr>
<td>H.Science</td>
<td>12,228 57.49</td>
<td>1,304 43.41</td>
</tr>
<tr>
<td>Agriculture</td>
<td>77,903 32.03</td>
<td>101,217 37.24</td>
</tr>
<tr>
<td>Woodwork</td>
<td>5 34.50</td>
<td>390 46.13</td>
</tr>
<tr>
<td>Metalwork</td>
<td>2 57.00</td>
<td>193 53.40</td>
</tr>
<tr>
<td>B. Const</td>
<td>20 31.25</td>
<td>359 42.74</td>
</tr>
<tr>
<td>P. Mech</td>
<td>2 55.00</td>
<td>147 65.39</td>
</tr>
<tr>
<td>Electricity</td>
<td>4 48.00</td>
<td>211 60.90</td>
</tr>
<tr>
<td>Draw &amp;Des</td>
<td>6 26.17</td>
<td>420 43.28</td>
</tr>
<tr>
<td>Aviation Te</td>
<td>7 52.86</td>
<td>112 60.34</td>
</tr>
</tbody>
</table>

Source: Kenya National Examinations Council

The performance of girls in KCSE in 2011 and 2012 indicates that the quality of their performance (see Table 1.3) was far below that of boys. In 2011, a total of 1,930 candidates scored an average of grade ‘A’ in KCSE, of whom 31.86 per cent were girls while the proportion of girls achieving the grade was 35.34 per cent in 2012. This means that less number of girls were able to compete for degree programmes that require high level of performance in KCSE such as medicine, law, commerce and engineering. Hence, they will not only be under represented in institutions of higher learning but more so in the professional programmes. Physics is critical- for pursuance of any technological course, at the university. Yet the number of girls taking it is dismally low. The percentage of girls during the years 2011 and 2012 were 35.55 and 35.48 respectively.
Table 1.3: KCSE Candidates Eligible for University Admission

<table>
<thead>
<tr>
<th>Year</th>
<th>Candidature</th>
<th>A</th>
<th>A-</th>
<th>B+</th>
<th>B</th>
<th>B-</th>
<th>C+</th>
</tr>
</thead>
<tbody>
<tr>
<td>2011</td>
<td>Total Candidates scoring grade</td>
<td>1,930</td>
<td>9,063</td>
<td>16,390</td>
<td>22,944</td>
<td>30,115</td>
<td>39,216</td>
</tr>
<tr>
<td></td>
<td>% of female</td>
<td>31.86</td>
<td>30.24</td>
<td>31.97</td>
<td>35.52</td>
<td>39.09</td>
<td>42.09</td>
</tr>
<tr>
<td>2012</td>
<td>Total Candidates scoring grade</td>
<td>1,975</td>
<td>9,235</td>
<td>17,730</td>
<td>25,183</td>
<td>31,110</td>
<td>38,471</td>
</tr>
<tr>
<td></td>
<td>% of female</td>
<td>35.34</td>
<td>35.60</td>
<td>33.71</td>
<td>36.61</td>
<td>31.13</td>
<td>42.34</td>
</tr>
</tbody>
</table>

Source: Kenya National Examinations council.

According to Joint Admissions Board of the 16,629 qualifiers from 2007 KCSE examination, only thirty one percent were women. Males were double those of female entrants-notwithstanding the affirmative action of slightly lower entry grades for women. In the 2008 KCSE, girls comprised forty six percent of the 305,000 candidates. This means that though the number reaching form four is high, a majority ends up not achieving grades that can enable them to join universities (Siringi, 2009).

Attempts to increase opportunities for women and girls in science, mathematics and technology (SMT) subjects at secondary and university level have taken high priority in policy discussions in Kenya. However, the commitment to translate this priority into action has remained problematic for many schools due to lack of the required human resources. In addition, even where such resources are available for the girls, career information and counseling has remained wanting, thus continuing to mystify the SMTs, excluding and condemning most girls to a future that lacks adequate scientific and technological knowledge and skills, which are crucial in the development, not only of girls, but also of the nation (Chege & Sifuna, 2006).
But why the gender gap in performance in Kenya? According to Jovanovic, (2007) until recently, it has been believed that the female-male’ differences in mathematics and sciences were caused by biology. In other words, girls and boys’ brains are different, so they were suited for different things. The notion is that boys have superior special abilities making them better for certain mathematical manipulations. Girls on the other hand are supposed to be better at language and writing.

According to Bunyi (2003), the immediate constraint to increased enrollments for females in tertiary institutions is that owing to the poor quality of girls’ secondary school education in most countries, female candidates perform poorly in the matriculation examinations whether these are the end of secondary level exams or special entrance exams for tertiary institutions. Consequently, few females attain high enough marks to compete on an equal footing with their male counterparts for the limited places in these colleges and universities. In response to this problem, many countries have instituted different forms of affirmative action policies.

Quantitative increase in women and the girl child in education may not necessarily translate into gender equality or the end of gender discrimination in education. For within Kenyan educational institutions barriers of access, inadequate facilities, the institutional culture of schooling, the pervasiveness of sexual harassment and the reproductive roles on the girl child and women continue to constrain their full access and success within education (Muteshi, 2006).
Researchers have focused on the influence of the social environment on children's mathematics and science achievement. Boys are given a chance to play with toys or objects that involve many principles inherent in mathematics and science. Girls normally lack these experiences. There is a personality trait attributed to mathematicians and scientists that is associated with males. Mathematicians and scientists are said to be competitive, achievement-oriented and not very social. Parents and teachers who believe in these stereotypes are less likely to encourage or support a young girl's decision to take the subjects.

A study of gender disparities among academic staff in Kenyan universities revealed that gender inequality in educational achievements at higher education level was a historical problem, which translated into fewer women occupying leadership positions at the institutions of higher learning (Kanake, 1997). Few women are to be found in programmes that have traditionally been known to be male domain. Such programmes include engineering, veterinary science and agriculture, among others. Differential treatment of sexes in secondary schools or even earlier, and consequently different choices at the university, may have contributed to poor female representation in science-oriented disciplines and their clustering in arts-based ones.

1.12 Statement of the Problem
Despite the numerous courses of action the gender disparity in science and technology has posed a major challenge not just in Kenya but as well as global order. The ratification of a number of international instruments and declarations is a tacit acknowledgement of failure of government to mainstream gender in their programmes and activities. Such
instruments include, but not limited to Convection on the Elimination of All forms of
Discrimination Against Women (CADAW), (1980), Beijing Declaration and Platform for
Action (1995). In 2007, Kenyan Ministry of Education developed a National Gender
Policy in Education to address critical issues relating to education. The policy provides a
framework for planning and implementation of gender responsive education as well as
research and training at all levels. Kenyan universities that are predominantly science
based have females underrepresented in various faculties. For example in 2008/2009
academic year Kenyatta University which was then predominantly art had 44.99% of its
student population being female while Jomo Kenyatta University of Agriculture and
technology had only 31.19% (RoK, 2013). Researchers have not ventured into finding
out how the few women who qualify to pursue the traditionally stereotyped ‘masculine’
subjects fair from point of entry to exit. Attention has only been focused on summative
assessment and post-university training performance. Similarly despite the many efforts
by various institutions to mainstream gender equal access to resources remains a pipe-
dream. Yet few studies have been conducted in the area of gender and educational facilities
(UNICEF, 2009). Mainstreaming means that power in social relations is redistributed, so
that women have equal access to the same resources as men. Female students have not
have had equal access to laboratory, computer and library resources, due to fear of sexual
harassment during night time hours. The progression in successive years has also been a
challange as women’s morphology poses myriad of problems making them not to
compete at par with their male counterparts.
1.13 Purpose of the Study
The purpose of the study was to carry out an in depth analysis of how performance of women in science, mathematics and technology programmes in class and flow from one academic year to another compared to that of their male counterparts in Kenyan public and private universities. The study attempted to establish if access to resources hampers performance of women in SMT programmes.

1.14 Objectives
In this study, the specific objectives were to:

(i) Compare the performance of women with that of men in selected science, mathematics and technology programmes in Kenyan universities.
(ii) Establish whether men and women have equal access to learning resources in selected science, mathematics and technology programmes in Kenyan universities.
(iii) Determine whether rate of flow of men and women in selected science, mathematics and technology programmes in Kenyan universities is the same.

1.15 Hypotheses
Ho1: There is no significant difference between performance of men and women in science and technology programmes in Kenyan universities.
Ho2: There is no significant difference between men and women in access to resources in science and technology programmes in Kenyan universities.
Ho3: There is no significant difference between men and women in rate flow in science and technology programmes in Kenyan universities.
1.16 Significance of the Study

King and Hill, (1995) devised and applied a method for assessing the impact of different genders on economic progress, with the conclusion that: ‘After accounting for inter countries differences in GDP (or GDP per capital), countries with higher levels of women education, experience more rapid economic growth, longer life expectancy, lower population growth and improved quality of life.’

Issues related to gender have been over researched and there seems to be a consensus that there is low enrolment of women in many levels of education system particularly, in science and technology programmes in Kenyan universities. Women are virtually absent in the better paying sectors of the economy-construction, communications, transport, power production, manufacturing, and related fields particularly in science and technology.

Despite the numerous studies, nothing has been done to know how this small number of women fair in class, access resources and flow in successive years. This study will help in future sustainability of the female students in SMT programmes and results could be used to encourage those in lower levels of education sector. The universities could also improve on access to facilities. This will definitely fast track the achievement of Millennium Development Goals and Kenya’s Vision 2030.

1.17 Delimitations of the Study

By the time of carrying out this study there were a total of seven public and two private universities that offered science based programmes. Although this was a nationwide
study the universities had to be purposefully sampled because they had most of the SMT programmes which were targeted. Private universities were 11 in total but only one offered selected SMT programmes.

1.18 Limitations of the Study
The main limiting factor was that students in different years may not have similar characteristics. Due to limitation of time allocated for this study it may not be possible to follow a student within same cohort for the entire period of the course. Indeed all courses take more than three years.

1.19 Assumptions
(i) The researcher assumed that the existing measures to increase participation of women in SMT programmes are not very effective in Kenyan universities.
(ii) The researcher assumed that the universities chosen represented the whole population under study.
(iii) The researcher assumed that the time allocated was appropriate for the chosen sample of universities.

1.20 Theoretical Framework
The theory used in this study was Liberal feminism. It is rooted in the tradition of 16th- and 17th-century liberal philosophy, which focused on the ideals of equality and liberty. The liberal conception of equality was based on the belief that all men had the potential to be rational and that any inequality had to be justified in rational terms. The liberal conception of liberty meant that people were governed only with their consent within certain limits, generally defined in terms of the public and private spheres (the former the
government can regulate; the latter it cannot) (Connelly et al, 2000). Liberals continue to
debate just where the line should be drawn between the two spheres, but they agree that it
must be drawn to preserve liberty. These ideas are important underpinnings of liberal-
feminist thought.

The first Western feminist theorist, Mary Wollstonecraft, in *A Vindication of the Rights
of Woman with Strictures on Political and Moral Subjects*, argue that women’s capacity
to reason was equal to that of men and that biological sex differences were irrelevant to
the granting of political rights (Wollstonecraft, 1792). She argued that the reason women
appeared to be intellectually inferior is due to their inferior education and, therefore, is a
result of inequality, rather than a justification for it. Twentieth-century liberal feminists
have also used this distinction between biological facts and social norms when they draw
the distinction between sex (biological) and gender (historical, social, and cultural)
differences between women and men. Liberal feminists see women’s subordination as
resulting from gendered norms, rather than from biological sex, and aim to change these
norms. Liberal feminists argue that the inequality of women and men cannot be justified
on rational terms and trust that rational men can be convinced of the folly of perpetuating
that inequality.

The theory was preferred over modernization theory which ignores traditional cultural
factors and socialists’ feminism theory which undermines feminism’s political goals.
Liberal feminists focus on equal opportunities for women and men. Their concern that
women should receive equal opportunities in education and before the law has motivated
worldwide campaigns for women's voting and property rights. These feminists are also concerned that job opportunities be equally open to women so that they can achieve positions of power in government and business. Liberal-feminist activists are concerned with ensuring that laws and policies do not discriminate against women and that women have equal opportunities in all aspects of life. As applied in this study, the theory holds that the equal access to facilities and smooth flow would lead to improved performance of women students in SMTs.

Contemporary liberal feminists, like other liberals, draw a distinction between the public and private spheres of life. They argue that women should have the right to choose on issues such as abortion, pornography, and prostitution. This commitment to the existence of public and private spheres distinguishes liberal-feminist theory from other feminist theories. However, it should be noted that liberal-feminist theorists draw the line between public and private differently than other liberal theorists. Because they concentrate on such issues as domestic violence and the economic vulnerability of homemakers, they argue that some regulation of domestic life is needed to protect women's safety and well-being.

First implications of this theory for policy and action are several. Liberal-feminist theory has been the dominant guide for setting up special women's departments and machinery in government. These departments promote the interests of women within the existing socio-economic system. Second, policies are proposed to remove discriminatory practices in institutions, or actions are taken to create alternative institutions that support women.
For example, if women have unequal access to credit, then bank policy can be changed or special programme can be set up for women’s credit.

Third, liberal feminists are interested in increasing the proportion of women in elected and appointed government positions. Forth liberal feminists are interested in reforms that will improve the condition of women and are less concerned with issues of empowerment and changing the position of women.

This framework has been criticized for blatant lack of analytical value through which to investigate and expose the basis for gender inequality, which lies in power relations with a complex interaction of class, gender and race; both within and outside the school, family, and employment sector. However, liberal feminism has gained tolerance in many parts of the world (Weiner, 1994, cited in Chege & Sifuna, 2006).

1.21 Conceptual Framework
The issue of women access to higher education has been a subject of concern worldwide particularly in developing countries where the affirmative action to favour women has received a stiff opposition from male counterparts. The situation is worse in Science, Mathematics and Technology programmes particularly in universities. The number of women completing and graduating from the SMTs programmes will depend on access to facilities in and outside the university premises, the performance in previous exams particularly secondary school level and the background of the student in relation presence role models to inspire them. Even when all these factors are present it is important to
ensure that learning atmosphere is conducive. Negative behavior like sexual harassment grossly interferes with smooth transition of female students.

Equitable access to facilities of female students with their male counterparts, smooth flow in successive years of study without having to repeat and good performance in science, mathematics and technology will ultimately lead to improved labourforce participation by women and their productivity and earnings (World Bank, 2007). This is illustrated in figure 2 overleaf.
Access to facilities
- Library
- Workshops
- Laboratory

PERFORMANCE OF WOMEN STUDENTS IN SMTs
- KCSE
- University exams
- Quality of grades
- Grasping of concepts
- Transition

Background of students
- Role modeling
- Fees chargeable
- Societal stereotypes

Other Factors
- Affirmative action
- Scholarships
- Job Market

LEARNING ATMOSPHERE
- Sexual harassment
- Street lights
- Attitude of lecturers

Completion & Graduation of Women students

Figure 2: Interacting Factors to Improve Women’s Performance
1.22 Operational Definitions of Terms

Access - The right or opportunity of a woman to have or use university facilities that will bring you benefits.

Affirmative Action - Process, which involves putting in place temporally, measures to groups which are disadvantaged in society to correct a particular imbalance and to guarantee them opportunities for participating in community leadership and policy-making.

Economic Growth - An increase in the real gross domestic product of a nation.

Flow of students – movement of a particular cohort of students from one academic year to the next.

Gender Equity - Process of sharing opportunities and resources fairly between the female and male genders.

Gender Equality - Exists when sex based discrimination does no longer exist in society in fields like education, employment and inheritance.

Gender - Socially constructed concept that defines roles of men and women in society.

Human Capital - Any monetary investment by way of education and training for the sake of future financial or non-financial returns.

Performance – refers to how men and women fair in SMT programmes in terms of academic grades and general perceptions of those they interact with.

Science - Is the systematic study of anything that can be examined, tested and verified.
Science and Technology- A thinking process where both are concerned with causal relationships in the material world, and both employ an experimental methodology that results in empirical demonstrations that can be verified by repetition.

Schumpeterian growth - Growth attributable to increases in human capital.

Technology- The application of engineering and science to develop machines and procedures that improve human efficiency.
CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

This chapter involves systematic identification, location, and analysis of documents containing information that are related to research problem. An attempt has been made to develop a thorough understanding and insight into previous works and trends that have been recorded regarding performance and participation of women in science, mathematics and technology in universities at national, regional and international levels. The chapter has been broken down into the several sub-topics. These are; education and economic growth second, access and equity to higher education, third women, education and development forth, science, technology and innovation and finally academic performance.

2.2 Education of Women and Economic Growth

According to Hall (2000), there is a strong consensus among economists that formal education is an important determinant of individual earnings as well as economic growth. Economists have been interested in economic growth since Adam Smith made his inquiry into the wealth of nations (Smith, 1976). But it was not until the introduction of the concept of human capital in the 1960s that economists attempted to study the relationship between education and economic growth. The pioneering work of Becker, Schultz, Mincer, and Edward F. Denison provided new information on the link between education and economic growth (Becker, 1964; Schultz, 1971; Mincer, 1993; and Denison, E F, 1985).
The contribution of education to economic growth is presumed to occur through its ability to increase the productivity of an existing labourforce in various ways, including both technical training and general education. In growth accounting, Output (Q) is assumed to be a function of the stock of capital (K), the labourforce (L), and the level of technical progress (A), which is also a measure of total factor productivity. Hence,

\[ Q = f(K, L, A_t) \]

where A is assumed to be a function of time, t. Recasting in terms of growth rates and transposing results in a production function of the type:

\[
\frac{dA}{A} = \frac{1}{E} \frac{dQ}{Q} \frac{E}{Q} \frac{k}{K} \frac{dK}{K} \frac{E}{Q} \frac{dL}{L} \frac{E}{Q} \frac{A}{A}
\]

where \( E \) = elasticity.

According to Mokyr (1990), the contribution of education to economic growth occurs through two mechanisms. The first, and most highly publicized, is through the creation of new knowledge, known as Schumpeterian growth, named after Joseph Schumpeter (1883-1950) who was the originator of the theory that economic growth was strongly influenced by cycles of innovation. Schumpeterian growth is attributable to increases in human capital. More highly educated individuals translate into more scientists, analysts, technicians, and inventors working to increase the stock of human knowledge through the development of new processes and technologies.

This leads us to the second way that education affects economic growth. It affects economic growth through the diffusion and transmission of knowledge. Schools provide
the education level necessary to understand and digest new information, and a way to transmit new information. Increases in educational levels helped the invention and innovation in the computer industry over the past 30 years, yet without schools to teach how to use computers and new applications, the effect of such innovation would be reduced.

Early attempts to analyze the increase in output of goods and services (i.e., economic growth) were incomplete. Estimation of the growth of output often left researchers with a large "residual": a change in output (i.e., the dependent variable) not explained by the change in the explanatory, or independent variables. The application of human capital to this "growth accounting" allowed researchers to explain economic growth better. Researchers soon found that increases in human capital had a significant effect on economic growth. According to Corbert (2004), people gain value in the job market by increasing their skills and abilities or human capital.

Denison, (1985) undertook one of the most comprehensive studies on the effect of education on economic growth. He estimated that education per worker was the source of 16 per cent of output growth in non-residential business.

According to Psacharopoulos and Patrinos (2004), education should be a profitable investment for the individual. Moreover, the social benefits associated with schooling, particularly women schooling, suggest that primary schooling investment is a priority. However, low economic returns to primary schooling for females in developing countries, especially those not yet having achieved universal primary schooling, may be a
serious policy concern. To the extent that private rates of return to primary schooling inform family decisions about educating daughters, then action may be needed to ensure that girls’ schooling draws adequate investments.

Results from international studies show that higher rates of female enrolments in education equate with higher levels of economic productivity, lower infant mortality, lower fertility and longer life expectancies (World Bank, 2009). Nevertheless, a myriad of factors can make attendance more difficult for girls and, particularly in the poorest countries, their education is still largely ignored (UNESCO, 2003).

Overall, women receive higher returns to their schooling investments (Table 2.1). But the returns to primary education are much higher for men (20%) than for women (13%). Women, however, experience higher returns to secondary education (18 versus 14 percent) (Psacharopoulos & Patrinos, 2002).

### Table 2.1 Returns to Education by Gender (percentage)

<table>
<thead>
<tr>
<th>Educational Level</th>
<th>Men</th>
<th>Women</th>
</tr>
</thead>
<tbody>
<tr>
<td>Primary</td>
<td>20.1</td>
<td>12.8</td>
</tr>
<tr>
<td>Secondary</td>
<td>13.9</td>
<td>18.4</td>
</tr>
<tr>
<td>Higher</td>
<td>11.0</td>
<td>10.8</td>
</tr>
<tr>
<td>Overall</td>
<td>8.7</td>
<td>9.8</td>
</tr>
</tbody>
</table>


Psacharopoulos, (1994) provides an international survey of rates of return to education. The figures cover seventy-eight countries. They show returns to primary education ranging from 42% p.a. in Botswana to only 3.3% p.a. in the former Yugoslavia and 2% p.a. in Yemen. The largest return for secondary education was 47.6% p.a. in Zimbabwe,
falling to only 2.3% in the former Yugoslavia. The range for tertiary education was somewhat narrower, between -4.3% p.a. in Zimbabwe and 24% p.a. in Yemen. It is not clear that much can be learned from these individual data, but aggregates, either by region or by income level can average out some of the variability in the individual returns.

2.3 Access and Equity to Higher Education

2.3.1 Access relating to Educational Facilities

The built environment can be seen as a cultural artifact that is embedded in the process through which individuals build and form their identities. Facilities embody cultural values and imply standards of behaviour (Rendell et al., 2000). These standards are transmitted to designers through decision-making authorities such as planners, architects and surveyors. However, there are three significant challenges to implementing a gender-neutral approach in educational facilities.

The first challenge is that the decision-making professions are traditionally male dominated, and few women have a voice at the design or policy levels. A second challenge relates to the greatest dilemma in feminist theory, i.e. the struggle to articulate the multiple voices of women simultaneously deconstruct the concept of gender. The implication for planning and design is that spaces must be designed in such a way that the different needs of men and women are articulated, but at the same time present inequalities and power relations are not reestablished (Eduards, 2002; Scott, 1996).
A third challenge is that few studies have been conducted on the issue of gender equity and educational facilities. This is despite a growing interest in the subject over recent years among researchers and policy makers, especially in the areas of sustainable development, health, safety and access. Another related field of research is architectural theory (Larsson, 2006);

2.3.2 Access to Higher Education

Issues of access became topical internationally in the 1960s through the work of UNESCO. Interest stemmed from The Universal Declaration of Human Rights (1948), particularly Article 26 which states that everyone has the right to education and calls for free and compulsory education in the elementally and fundamental stages; and for access to technical, professional and higher education. The 1981 UN Convection on Elimination of All Forms of Discrimination Against Women (CEDAW) extends this debate further, particularly through article 10 which details areas where discrimination should be eliminated.

The World Bank's Country Social Analysis notes that girls face a risk of sexual abuse on their way to and from school, as well as great burden of domestic tasks compared to boys when they arrive back home. Women’s lower education levels result in their lower labour force participation as well as higher fertility and lower levels of skills for women entrepreneurs. A growing body of microeconomic evidence shows that gender inequalities in access to schooling constrain productivity and output (World Bank, 2006a)
(UNESCO) estimates that of the 137 million illiterate youths in the world, 63 per cent are female. The female to male ratio literacy ratio is lowest in Sub-Saharan Africa, Middle East and North Africa, and South Asia-regions that also have female disadvantages in primary and secondary enrolment. More than 54 per cent of girls in sub-Saharan Africa do not complete primary school and that the transition rate to secondary school for those who complete is low. This has led to only about 79 females out of every 100 males in secondary schools and universities (World Bank, 2007b).

However there have been dramatic increases in the educational attainment of females that underlie the fundamental changes that have taken place in the global talent pool. Indeed, in most industrial countries, women now are attaining university degrees at a higher rate than men. This trend reverses the pattern of two generations ago, when educational attainment was considerably higher among males (Tembon & Fort, 2008).

In Kenya, as in other African countries the proportion of females, declines as females move up the education ladder. As a result, slightly less than one third of the secondary school students who secure admission to public universities are female (Mwiria et al, 2007). Persistent gender imbalances at the tertiary level to education are a reflection of gender bias and structural differences in access of education. Public universities can make substantive contribution to alleviating gender imbalance by encouraging women and girls to venture into the traditionally male-dominated fields of science and
technology. The first step is to find out the underlying causes of the problem, with view to devising appropriate strategies for tackling it.

While gender disparities in students' enrollment exist at all levels of higher education, they are particularly wide at higher degree levels and in science, mathematics and technology-oriented subjects. Collecting information on the nature and magnitude of gender enrolment inequities in the institution and their causes including the needs of different categories of women to gain a good understanding of the problems so as to be able to devise appropriate solutions would help increase enrolment (Bunyi, 2007).

According to Nawe, (2005) there are several factors militating against women's participation in higher learning. First since the colonial period women have been expected to balance housekeeping and productive roles in line with the colonial policy of minimizing operational costs in subsistence economy. Second at the continental level, women are rarely seen in seminars, workshops and the like involving senior officials, where issues pertaining to higher education are discussed. Third laws and regulations may appear fair but there are salient features that need deeper consideration when dealing with questions of equity. For instance, the law may provide for equal access to education but this alone is not enough.

In addition, Chege and Sifuna, (2006) observe that a number of issues have been advanced to explain the low enrolment of women in higher education. First low secondary school enrolments greatly reduce the scope and progress in higher education.
Second, there is also high rigidity of admission requirements for particular degree courses which also narrow the potential pool of applicants. Third, failure rates in certain fields like medicine and engineering.

Forth, higher level of sexual harassment of women students. The majority of the women decry the advantage male professors take of them. They argued that it is not likely that a woman would complete a thesis process without some bruises. If supervisors make sexual advances and you turn them down, they could dismiss you as a weak candidate (Kamau, 2004). Fifth, low level of manufacturing and service activities tends to discourage parents from sending their girls for university education as they do not see prospects for absorption in the formal labour market. Finally, there are still the social-cultural factors within communities that confine women to lower levels of education system. This perception coupled with economic factors, leads some families to terminate girls education at lower levels.

(Kwesiga, 2002), observed that, access in the educational context soon leads to questions of equality of opportunity. Analysts of education of women in developing countries have grouped access factors under various headings, including socio-economic and demographic conditions; national policies; institutional factors; or household and individual background. Others have classified them as geographical, socio-cultural, health, economic, religious, legal, political/administrative and educational. However, the study further states that one of the most useful and clearest methods of categorizing access factors is through family, societal and institutional.
The cost of education is the most common cause for girls dropping out of school (RoK, 2002). In general, when the cost of education increases at the household level, families tend to prefer schooling for boys. Factors such as teenage pregnancy and early marriages also lead to lower transition rates in secondary and tertiary education for girls (Kimalu, 2002). Although gender inequalities in education enrolment at the primary tier have narrowed to almost parity following the introduction of free primary education in Kenya in 2003, disparities in secondary and university education persist and negatively affect both women's labourforce participation and the ability to acquire skills needed to start and grow a business (RoK, 2005).

According to Nawe (2005), the following recommendations will help increase female access to higher education. Short-term strategies include, gender sensitization, particularly regarding senior officials, counselling for confidence building, remedial course to raise the current female enrolment, an outreach programmes where girls in Form V and VI are supported to perform well through motivational programmes, confidence building and role modeling and Form II girls should be encouraged to take science in Form three and passing in Form IV.

Long-term strategies include interventions at lower levels by monetary support to promote girls' performance particularly in science subjects; role modeling was considered as a very effective way of confidence building. Gender education at all levels is considered as the best way of inculcating appropriate values. Appraisal system that is
gender sensitive should be established and finally to create a friendly and secure environment.

The need to increase enrolment in medicine, pharmacy, engineering and technical based programmes cannot be overemphasized, since there remains shortage of these professionals in the country (Mwiria et al, 2007). Despite both female and male under enrolment in these programmes, the case for enhancing the enrolment is more compelling. According to Mbilinyi (2000), access to resources should also be mainstreamed. Mainstreaming means that power in social relations is redistributed, so that women have equal access to the same resources as men. Of more significance is the second aspect, direct challenges to male privileges, so that women can benefit equally from the same resources. Many actors (administrators and managers, academics, workers, students) agree, for example, with the need to increase female enrolment at undergraduate and postgraduate level, and to increase female recruitment among academic and administration staff. Women staff and students should have equal access to office, laboratory, computer and library resources, which necessitates enhanced safety from sexual harassment during night time hours.

2.3.3 Equity in Higher Education

Equity or inequity can be defined in terms of two basic principles (Wainana, 2006). The first is unequal opportunities; that a person's life achievements should be determined primarily by his or her talents and efforts rather than by pre-determined circumstances such as race, gender, social or family background. The second principle is avoidance of
deprivation in outcomes, particularly in education, health and consumption levels. Equality between men and women relates to their dignity and worth, equality in their worth, equality in their rights, opportunities to participate in political, economic, social and cultural development, and to benefit from results (Mwagiru, 2004).

Gender equity means giving men and women, girls and boys, the same opportunities to participate fully in the development of their societies and to achieve self-fulfillment. The term gender equity is used to imply social justice and fairness in the distribution of resources and opportunities among men and women (staff and students) in universities in Kenya (Onsongo, 2007).

According to Filmer, (2008), measured by the percentage of children who reach the last year of primary school, known as the primary completion rate, the world has made substantial progress toward reaching the Millennium Development Goal of enabling all children to “complete a full course of primary schooling. The primary completion rate in low-income countries increased from 57 per cent to 73 per cent between 1991 and 2006, with growth in all of the poorer regions: Latin America and the Caribbean (82 to 99 percent), Middle East and North Africa (77 to 91 %), South Asia (62 to 80percent), and Sub-Saharan Africa (51 to 60 percent). There are, however, large inequalities in education across and, importantly, within countries. Documenting inequalities across countries is straightforward. So, while some countries are reaching 100 per cent of children completing primary school, the rate is below 50 per cent in many countries: a sizable group of children still fails to complete school. This failure is especially large in
countries where progress has been slow, but also exists in countries where overall progress is being made.

The situation is worse in universities. Despite expansion in the numbers of students attending universities, disadvantaged communities and groups continue to be seriously under-represented in higher education throughout the world. Little is being done by government to promote greater access and equity in higher education, a significant contribution to social justice.

Kwesiga (2002), mentions gender inequity as one of challenges facing higher education in Sub-Saharan Africa, in the new millennium. It exists at all levels; within the student body, within academic staff, and within the decision-making cadre. Moreover, a broad sharing of economic and political opportunities enhances economic growth and development because greater equity implies more efficient utilization of resources. Few, if any, of today's developed nations have developed by excluding the majority of their people from economic and political opportunities.

Data available from Ministry of Education indicate that between 1999 and 2004, North Eastern and Coast provinces had gender disparities of more than 10 per cent while in Central Province, it was only 2 per cent. The widest gender gaps have been at the higher education levels, where, in 2004, female students made up only 36 per cent of those enrolled in the universities. Achievement of gender equity and equality in education is, therefore, a core development issue and a goal in its own right. Towards the achievement of the above goal, the government has developed a Gender and Education Policy, which
provides a comprehensive framework of principles and policies that will be pursued in order to achieve gender equity and equality (MoE, 2007).

The policy acknowledges ongoing initiative in bridging the gender gaps in educational provision. It also identifies the special measures that the government, stakeholders and education providers will use to address the inequalities in education. The policy will also provide a framework for planning and implementation of gender responsive education, research and training at all levels. The policy highlights the key gender concerns in education, including disparities in enrolment, retention and transition rates and persistent negative social cultural practices and attitudes, which inhibit balanced achievement learning environment that are not conducive to the needs of girls. Other areas include stereotyping in learning materials and classroom teaching and lack of appropriate gender role models, among many other issues.

The gender policy caters for all education tiers. It addresses issues of access, equity, retention, progression, transition, relevance and quality. It will also apply to financing, governance and management of education. The implementation of the policy will involve collaboration among various ministries- Education, culture and social services and office of the president. It will also involve the private sector providers, civil society organizations, faith-based organizations, Kenya National Union of Teachers (KNUT), communities. However, the primary responsibility is with Ministry of Education.

One civil society provider known as, *Society for Economic Development*, conducted a study on education, and established that, Kenya is characterized by large inequalities with
respect to income distribution and this has constrained economic growth. As such, investment in education is an important strategy to address such inequalities, and thus facilitate economic growth.

The study concluded by giving the following recommendations among others. First, to achieve EFA in the primary education sub-sector and also address the challenges within the sub-sector, there is need to increase the enrolment of girls at all tiers of the education system by improving retention, completion rates, and examination performance of girls, especially in mathematics and sciences. Second within the management of education and training in Kenya, there are fewer women managers as compared to men. To address this imbalance, there is need to enhance gender parity and balance at the management level. Third in a number of instances, girls who get pregnant are forced into early marriages, drop out of school and are not provided with opportunity for re-entry. To address this issue, there is need to develop and adopt mechanisms that will allow the re-entry of girls who drop out of school due to pregnancy and early or forced marriage. Forth, TIVET and university education play a key role in the development of any country. To address the concerns of workforce skill development and enhancement, there is need to develop TIVET institutions, especially in undeserved areas of the country, and provide loans to TIVET trainees. At the same time, there is need to improve the existing university loans system to ensure availability of financial support to poor students. Fifth at present, males dominate management of higher education in particular public universities. To address this inequality, there is need to set affirmative action that will
guarantee equitable access to and management of university education and ensure that more women are admitted to science-based programmes than is the case currently. Sixth, to enhance learning and training opportunities to all adults, out of school youth, other venerable groups and expand the post-graduate programme to cover all districts, there is need to promote open and distant learning opportunities.

According to World Bank’s *Kenya Gender and Economic Growth Assessment Paper*, gender inequalities in education and access to agricultural inputs could result in one-off increase in output by as much as 4.3 percentage points of GDP, followed by sustained year-on-year increase of 2.0 to 3.5 percentage points in GDP growth. To achieve its target of 7 per cent real GDP growth, the government of Kenya therefore, must address gender-based barriers (World Bank, 2006).

### 2.4 Women, Education and Development

In Kenya, most of the working poor are in the informal economy, and are overwhelmingly women. Therefore, although women worldwide are growing presence in labour markets, many women are in precarious work of the informal sector and unless efforts are made to address women’s economic security poverty will not be eliminated nor gender equality achieved (Muteshi, 2006).

Kasente (2001), in a paper presented in 10th General Conference of African Association of African Universities pointed out that, emphasis on promoting women’s education to the highest level must be put in place because it is one of the most cost-effective investments towards improving standards of living and improving indicators of social
development. It is, therefore, a policy issue of national interest and not just an interest of the women’s movement.

Women in Kenya are poorer than men although they comprise 51% of the total population. Kenya’s national poverty rate, estimated at 52.3 per cent in 1997, had increased to 56.8 per cent by year 2000 but had fallen to 53 per cent in 2002 (Kimalu, 2002). The World Bank’s *Country Assistance Strategy* recognizes that “women are more likely than men to be poor and vulnerable to adverse shocks than men”. In Kenya, 54 per cent of rural and 63 percent of urban women and girls live below poverty line (Republic of Kenya, 2005b).

There is growing recognition internationally that gender equality is good for economic growth and essential for poverty reduction (Ellis, 2004). Where gender inequalities constitute barriers to women entering or participating fully in markets, economic growth and private sector development will be constrained with less investment, less competition and lower productivity (Blackden & Bhanu, 1999). While Kenya Government *Economic Recovery Strategy for Wealth and Employment Creation* recognizes that women have unequal access to opportunities and assets, it does not examine implications of this inequality.

Although there have been many attempts to measure the effect of investment in human capital on the productivity or earnings of workers in general, in the case of women, relatively little has been done. One tends to find general statements, for instance citing education as a means of increasing women’s access to vocational or technical training,
thereby providing more income for women's personal or family developments. There is evidence from industrialized countries that women's education positively correlates with the inclination and ability to work, thus stimulating them to take a wider range of jobs, including agriculture and industry. Other studies, such as those by Schultz (1989), Jabre (1988) or Smock (1981) point out that access to education increases parents' urge to improve their economic and social standing and that better educated women are more capable of finding ways of succeeding in wage employment or trade and coping with housework at the same time.

Unfortunately, minimal information is available on women and this makes the assessment of rates of return difficult. The few available studies suggest that absolute monetary returns to female education are lower than for men, if we use conventional measurements. In 1987, average women's earnings comprised 74% of male earnings in Egypt, and 66% in the United Kingdom. Woodhall (1973), considered the problem, using evidence from nine countries. She found that the average rate of return to secondary and higher education was about two percentage points lower for women than for men. The study pointed out that 'the higher a women level of education, the closer her income approaches to that of similarly educated men. There were variations among the countries and in some cases, the rate of return was higher for women than for men.

It is easier to measure men's work experience without much error by the number of years that have passed since a man left school, but this method cannot be accurately applied to women, as they have an interrupted work cycle. Whereas the earnings of men typically
rise throughout most of their working life, women’s earnings usually show a decline during child-bearing and child-rearing years. After that period, the earnings of the more educated women continue to rise with age whereas women with only minimum education never again reach the level of earnings they achieved at age 20-25. It is important to note that even when women take minimal maternal leave breaks, motherhood slows their smooth upward career progress.

The underlying cause of the lower rate of return is women’s reproductive role. Reproduction is taken as an alternative occupation to paid employment. A woman who has never married is likely to spend 90% of the years after she left school in the labour market, while married women with children spend less than 50% of their time there. This has two effects on the benefits women derived from education. In the first place, women’s lifetime earnings are reduced if they interrupt their working life to have children. Second, employers may decide to pay less to women than to men because women are likely to have children.

Oxaxaca,(1987) observed that ‘Sex Differentials’, earnings differentials are attributed to four factors; first is taste (and prejudice): An employer may discriminate on various grounds and can forgo many economic returns, in order to avoid employing a certain group. It is only when there is high competition that employers who discriminate open their doors wider. When there is dire need, gender can be ignored. When there is unemployment, women are regarded as intrudes.
Second is Labour market structure: Women are paid less, particularly where there is competition. Some regulations bar women from entering certain occupations (such as mining). This has been described as 'industrial apartheid' creating 'dual-labour-market', divided into higher and lower paying jobs, with restricted upward mobility. Higher paying jobs are tied to promotional or career ladders and are more stable. Women are concentrated in part-time or informal jobs and the less stable sector of the dual market system and this lowers their earnings.

Third is imperfect information: Employers sometimes believe that women are less productive in certain jobs (many times from a biased perspective). As a result, individual women are judged on the basis of perceived group characteristics, and not on individual merit. Those who are employed are paid less than men because they are regarded as a risk (this is no longer universal).

Forth is sex differences in labour market skills: Material and family responsibilities are believed to account for male/female differences in human capital investment. In general, the female working cycle is intermittted. Since women take off time to nurse babies, it is argued that they cannot effectively invest in job skills at the same level as men. Women (in industrial countries) work for shorter periods and lose accumulated skills and it takes time to recoup the skills.

The use of earning differentials to measure the effect of education on women's productivity does not capture the full contribution women make to economic activity because it neglects the benefits of unpaid work. It is difficult to measure this in monetary
terms but when it is attempted, most estimates show lower value for men than women. As with general spill-over benefits, there are many other economic benefits from educating women, which are indirect and are not measured by conventional rate of return techniques. For women in Sub-Saharan African, the ultimate benefits of investment in their education are blurred by their social-economic and political conditions.

2.5 Science, Technology and Innovation
According to Burnie, (2004) science is the systematic study of anything that can be examined, tested and verified. From early beginnings, science has developed into one of the greatest and most influential fields of human endeavor. Scientists utilize existing knowledge in new scientific investigations to predict how things will behave. For example, a scientist who knows the exact dimensions of a lens can predict how the lens will focus a beam of light. In the same way, by knowing the exact makeup and properties of two chemicals, a researcher can predict what will happen when they combine. Sometimes scientific predictions go much further by describing objects or events that are not yet known. In science, important advances can also be made when current ideas are shown to be wrong. Through advances like these, scientific knowledge is constantly added to and refined. As a result, science gives us an ever more detailed insight into the way the world around us works.

Technology on the other hand is the general term for the processes by which human beings fashion tools and machines to increase their control and understanding of the material environment. Both science and technology imply a thinking process, and are
concerned with causal relationship in the material world. They employ an experimental methodology that results in empirical demonstrations that can be verified by repetition (Merrit, 2004).

Science, at least in theory, is less concerned with the practicality of its results and more concerned with the development of general laws, but in practice, science and technology are inextricably involved with each other. The varying interplay of the two can be observed in the historical development of such practitioners as chemists, engineers, physicists, astronomers, carpenters, potters, and many other specialists. Differing educational requirements, social status, vocabulary, methodology, and types of rewards, as well as institutional objectives and professional goals, contribute to such distinctions as can be made between the activities of scientists and technologists; but throughout history the practitioners of “pure” science have made many practical as well as theoretical contributions.

Indeed, the concept that science provides the ideas for technological innovations and that pure research is therefore essential for any significant advancement in industrial civilization is essentially a myth. Most of the greatest changes in industrial civilization cannot be traced to the laboratory. Fundamental tools and processes in the fields of mechanics, chemistry, astronomy, metallurgy, and hydraulics were developed before the laws governing their functions were discovered. The steam engine, for example, was commonplace before the science of thermodynamics elucidated the physical principles underlying its operations.
The varying interplay of the two can be observed in the historical development of the practitioners as chemists, engineers, physicists, astronomers, carpenters, potters and many other specialists. According to Lips (1999), around the world, young women are disproportionately absent from science and engineering disciplines in higher education. There are some signs that the gender gap is narrowing somewhat in some of the sciences and mathematics, it appears that it may be widening in technology and computer science education.

Watson et al., (2003), examined ways in which science and technology support poverty alleviation and economic development and how these themes have given emphasis on short shrift in various areas of World Bank work. The authors' main findings are first, science and technology has always been important for development, but the unprecedented pace of advancement of scientific knowledge is rapidly creating new opportunities for and threats to development. Second, most developing countries are largely unprepared to deal with the changes that science and technology advancement will bring. Third, the World Bank’s numerous actions on various domains of science and technology could be more effective in producing the needed capacity improvement in client countries and finally the World Bank could have a greater impact if it paid increased attention to science and technology in education, health, rural development, private sector development and the environment.

Central to the papers thesis, is the now well-established argument that development will increasingly depend on the country’s ability to understand, interpret, select adapt, use,
transmit, diffuse, produce and commercialize scientific and technological knowledge in ways appropriate to its cultural aspirations and level of development.

According to Wainaina (2006), for Kenya to achieve high economic growth targets and social development, a high priority needs to be placed on development of human capital through education and training by promoting technical and vocational training, as well as teaching of sciences and information technology. Kwesiga (2002) observes that girls tend to take the arts and humanities subjects. Explanations for girls' poor performance in science and mathematics are gradually being found, including society's assumption about men and women and parental expectations. Through this socialization, subject stereotypes are created and accepted. The result is sex-linked differences in participation and performance in school. The influence of such attitudes is confirmed by a reported prevalent belief among girls that you cannot do sciences and be beautiful at the same time. Other factors are absence of suitable role models, differential treatment by teachers, girls are ignored or not encouraged, masculine image of girls, home and peer environments and finally, selection procedures/regulations to higher education institutions and professions.

Kenya Government in conjunction with that of Japan (JICA) started in 1997 the SMASSE project. This is acronym for strengthening mathematics and science education. This would be done through institutionalization and regulation of in-service training of teachers. The main problem areas that the project addresses are the poor attitude of the teacher, learner and key stakeholders, inappropriate teaching methods and approaches
poor content mastery by the teacher, Poor utilization and distribution of school resources and inadequate supervision/guidance from the Ministry of Education.

The United Nations University and the UNESCO in the year, 2007, appointed Nairobi a regional centre of expertise on education and sustainable development. Nairobi becomes the first city in Africa to get such an award, joining 35 other global cities. It is already a home to international organizations such as UNEP, the International Centre for Research in Agro forestry (Icraf), the International Centre for Insect Physiology and Ecology (Icipe), the International Potato Centre, and the Nepad Bioscience Facility for Eastern and Central Africa. Consequently, countries in the region are looking to Kenya to provide strong regional position on research and development (Wambugu, 2007). Kenya has already published a bill on Biosafety Bill.

Science and technology advances are transforming the world at astonishing rate. Developments in computing and communications, in particular, are helping to accelerate these changes. Organizations in even the most advanced economies struggle to keep up, while developing countries like Kenya face serious threats, as well as some new opportunities.

According to the World Bank (2007), technological innovation, often fuelled by government-led research and development (R&D), has been the driving force for industrial growth around the world. The best opportunities to improve living standards, including new ways of reducing poverty, will come from science and technology. Such impacts can translate directly into economic growth. A well-developed higher education
sector is fundamental here: it allows countries to generate new scientific knowledge, to wisely select and implement existing technologies, and to effectively adapt them to local circumstances. To achieve these tasks, higher education in science and technology badly needs more investment from the national budget and more efficient allocation of existing resources. This will require a formidable effort. The development of new technologies consists of three types of interconnected activities; namely, research technology development and adaptation, and production and marketing.

The WB publication on research in science and technology unfolds a very interesting scenario as shown in table 2.2 below. Kenya isfairing very badly in its investment in research and development, which is key in its Vision 2030. This is illustrated in figure 2.4 below.

### Table 2.2: Research and development data in science and technology, for selected countries

<table>
<thead>
<tr>
<th>Country</th>
<th>Researchers in R&amp;D people</th>
<th>Technicians in R&amp;D people per million</th>
<th>Scientific &amp; tech Journal Articles</th>
<th>Expenditure For R&amp;D %GDP</th>
<th>High Tech Exports (% Of Manufactured exports)</th>
<th>Total Patent Application Filed</th>
<th>Trade Mark Application Filed</th>
</tr>
</thead>
<tbody>
<tr>
<td>U.S.A</td>
<td>4,605</td>
<td>211233</td>
<td>2.68</td>
<td>32</td>
<td>356,943</td>
<td>240,483</td>
<td>240,483</td>
</tr>
<tr>
<td>Thailand</td>
<td>287</td>
<td>208</td>
<td>1072</td>
<td>0.26</td>
<td>27</td>
<td>5010</td>
<td>31,853</td>
</tr>
<tr>
<td>South Africa</td>
<td>307</td>
<td>73</td>
<td>2364</td>
<td>0.76</td>
<td>7</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>Singapore</td>
<td>4999</td>
<td>381</td>
<td>3122</td>
<td>2.25</td>
<td>57</td>
<td>9191</td>
<td>23348</td>
</tr>
<tr>
<td>Egypt</td>
<td>1720</td>
<td>0.19</td>
<td>1</td>
<td>1</td>
<td>694</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>Malaysia</td>
<td>520</td>
<td>0.69</td>
<td>55</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>Kenya</td>
<td>258</td>
<td>3</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>Uganda</td>
<td>90</td>
<td>.81</td>
<td>14</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
</tbody>
</table>

Source: 2007 World development Indicators.

Data on researchers and technicians are calculated in terms of full-time equivalent. The information does not reflect the quality of training and education, which varies widely.
Similarly, R&D expenditures are no guarantee of progress: governments need to pay close attention to the practices that make R&D expenditures effective.

On per capital basis, developed countries have nearly ten times as many research and development scientists and technicians as developing countries. They have a much share of their populations studying science at the tertiary level, principally due to substantially greater enrolment rates. Further, they are spending some 2 per cent of GDP on R&D, compared to an average rate of 0.5 per cent or less in most developing countries. Western Europe, North America, and the newly industrialized countries, Kenya used as a yardstick in its vision, accounting for 84 percent of scientific articles published. These regions also provide more than 97 per cent of all new patents registered in Europe and the United States.

This calls for government-driven research initiatives and support. Kenya has great potential for strengthening science and technology links between higher education institutions and industries. Of all manufactured goods exported Kenya only managed 3 per cent as opposed to Uganda’s 14 percent high technology exports. That time the so-called Asian tigers managed a whooping over 50 per cent. Many very useful discoveries end up being sidelined because of lack of support from business or government. In the case of the Bayllis wind up radio that requires neither outside sources of electricity nor batteries-a very popular product that has brought news and information to many poor families- the inventor spent long, frustrating years trying to raise the interest of manufacturers.
The government unveiled 98 million shilling ambitious programme that seeks to improve the training in the country to boost Kenya’s competitiveness (Daily Nation 24th August, 2007). The programme aims to establish more linkages between industry and the education institutions to address production demands. It also aims at refurbishing the science technology innovation (STI) policy, research development, authorization and coordination as well as technical education (TE) for economic, social prosperity and global development.

2.6 Academic Performance
Students attending university in Kenya receive one of four grades, the highest or first class degree, followed by upper second, lower second and pass at the undergraduate level. Until recently, the opportunity for postgraduate education was awarded to students receiving either a First Class or an Upper Second. According to Chege and Sifuna (2006), studies undertaken in the seventies and eighties showed that academically, female university students tend to be under-represented among those students who graduate with honours.

Data obtained in early 1990s reflected marked improvement in women’s performance. Although they were relatively few in the first class degree, they became sizeable number in the first class and upper second class combined. But a lot need to be done in SMT programmes. For example, in 2005 at the University of Nairobi, 86.75 per cent of males obtained a first class or upper second-class degree in engineering, while 13.25 per cent of females did. In the same year, 95.16 per cent of males obtained lower second class and
pass degrees as against 4.84 per cent of females. In 2006 males were 89.89 per cent in first and upper second class while females were 10.11 per cent. Males constituted 93.88 per cent in the lower class and pass degrees while females were 6.12 per cent. The situation does not appear different at Jomo Kenyatta University.

In 2005, males were 96.47 per cent in the first class and upper second class while females were 3.53 per cent. In the lower class and pass degrees, males were 93.9 per cent as females 6.10 per cent. In 2006, males were 84.85 per cent in the first class and upper second, while females were 15.15 per cent. In the lower class and pass degrees, males were 88.39 per cent and females were 11.61 per cent. At most public universities, therefore, females though showing slight improvement in academic performance, they have a lot to do to catch up with their male peers in SMT programmes.

Table 2.3: Academic performance at University of Nairobi and Jomo Kenyatta University Engineering course in 2005 and 2006

<table>
<thead>
<tr>
<th>Year</th>
<th>Sex</th>
<th>First Class/upper Second (%)</th>
<th>Lower Second/Pass(%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2005</td>
<td>Male</td>
<td>86.75</td>
<td>95.16</td>
</tr>
<tr>
<td></td>
<td>Female</td>
<td>13.25</td>
<td>4.84</td>
</tr>
<tr>
<td>2006</td>
<td>Male</td>
<td>89.89</td>
<td>93.88</td>
</tr>
<tr>
<td></td>
<td>Female</td>
<td>10.11</td>
<td>6.12</td>
</tr>
</tbody>
</table>

Jomo Kenyatta University

<table>
<thead>
<tr>
<th>Year</th>
<th>Sex</th>
<th>First Class/upper Second (%)</th>
<th>Lower Second/Pass(%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2005</td>
<td>Male</td>
<td>96.47</td>
<td>93.9</td>
</tr>
<tr>
<td></td>
<td>Female</td>
<td>3.53</td>
<td>6.10</td>
</tr>
<tr>
<td>2006</td>
<td>Male</td>
<td>84.85</td>
<td>88.39</td>
</tr>
<tr>
<td></td>
<td>Female</td>
<td>15.15</td>
<td>11.61</td>
</tr>
</tbody>
</table>

Source: University of Nairobi and Jomo Kenyatta University graduation booklets
Although female students are on the whole performing as well as their male counterparts, some studies show that early marriages before completion of their courses, especially in the undergraduate programmes, and subsequent pregnancies and child-care responsibilities put extra demands on female students' study time. In addition, there are household chores that also burden them and affect their performance (Ominde, 1999 cited in Chege and Sifuna, 2006). The study further reports cases of sexual harassment by male lecturers, some of which have appeared in the dailies and which are said to contribute to women's poor performance. These have included victimization against female students who do not submit to sexual advances. There are also negative attitudes of male students regarding women academic performance. Some of the male students hold perceptions that female students are not expected to perform well academically because they spend a lot of time on leisure and beauty instead of academic assignments.

According to Mbilinyi (2000), performance of female students and that of males in University of Dar el Salaam, on average was about equal. A higher percentage of women pass courses than men; but fewer excel in most courses. In the majority of courses, men performed slightly better than women; but in some, women outperformed men. Women outperformed men in some engineering classes, for example, and based on disaggregated data for 15 years, women outperformed men in Mathematics.

2.7 Summary
The literature reviewed shows that attempts have been made to study issues of access to higher education particularly in science and technology. There is acceptance that higher education for women should be given more attention than has been the case. Mindful of
the historical shortcomings of the system, unless the providers of the university education (both private and public) take special and very deliberate steps to become more inclusive, other factors will continue to ensure that women lag behind men within the whole system. This is particularly true of imbalance in student enrolment between science and technology-based programmes.

The following gaps were evident in the literature reviewed:

First there are many gender studies most of which are general. None is focused on access to facilities in science and technology programmes in Kenyan universities. Second, there are no data showing the flow of men and women in successive years of their studies in science and technology programmes in Kenyan universities. Third, no study has analyzed how the few girls who make it to universities in science and technology programmes fair in their academic work. Forth, despite all the studies, the problem of poor access of women to science and technology programmes in Kenyan universities continues to persist. Forth, the few studies analyzing performance at Kenyan universities seem to be summative and none is formative.

In an attempt to seal these gaps, the study will look at how access to facilities, performance and flow of men and women in science, mathematics and technology programmes in Kenyan private and public universities in successful years compare. The researcher will analyze the data before making recommendations on the way forward.
CHAPTER THREE
RESEARCH METHODOLOGY

3.1 Introduction
This chapter discusses the procedure and strategies to be used in the study. It is organized under the following sections: research design, research sites, population, sampling techniques, research instruments, data collection procedures and data analysis.

3.2 Research Design
The research design used in this study is retrospective ex post facto as I traced the history of subjects. The term ex post facto according to Landman (1988) is used to refer to an experiment in which the researcher, rather than creating the treatment, examines the effect of a naturally occurring treatment after it has occurred. In other words, it is a study that attempts to discover the pre-existing causal conditions between groups. According to Kothari (2004), the researcher has no control over variables; he can only report what has happened or what is happening. It also includes attempts by researchers to discover causes even when they cannot control variables.

The study aimed at collecting information from respondents on whether the few women students who make it to science, mathematics and technology fair well when compared with their male counterparts. This was done in three dimensions; academic performance, flow in successive years and access to facilities. The decision to use this design came about due to the fact that this study aimed at analyzing what has already occurred regarding performance. After collection of data, the researcher proceeded to measure, classify, analyze, compare and interpret them.
3.3 Variables

The researcher hypothesizes that men and women in Science, Mathematics and Technology in Kenyan universities have differences are in the following areas academic performance, access to facilities and Internal efficiency in regard to flow of women when compared to men.

This is illustrated in figure 3 below.

**Figure 3: Variables**

Independent Variables

- Access to Facilities
  - Laboratory
  - Library
  - workshops

- Flow of Students
  - Transition rates
  - Repeater rates

- Academic performance
  - KCSE
  - University exams

Dependent Variable

- Graduation
  - Graduation rates
3.4 Location of the Study
The study was carried out in 3 Kenyan public and 3 private universities: namely University of Nairobi, Kenyatta University, Jomo Kenyatta University of Agriculture and Technology, Aga Khan University, Mt Kenya and Catholic university of Eastern Africa. Purposeful sampling was used to select the six. Nairobi is the pioneer University in Kenya and its traditions may have over the years greatly influenced the choice of courses by gender. Kenyatta University on the other hand, has been associated with education in all its years of existence. It means the many teachers in this country have played a major role in choice and availability of information over choice of careers (RoK, 2008).

Jomo Kenyatta University of Agriculture and Technology was the first University to be established specially for science and technological courses. It’s also the one with lowest concentration of female students. Aga Khan, Mt Kenya and Catholic universities are the only private universities offering science degree programmes. Others are on formative stages of starting the programmes (RoK, 2008).

3.5 Target Population
By the year 2008 Kenya had seven public universities with a toatal population of 1,143,130 (RoK, 2008). The public universities are the University of Nairobi (founded in 1956); Kenyatta University (1972), in Nairobi; the Jomo Kenyatta University of Agriculture and Technology (1981), near Nairobi; Egerton University (1939), near Nakuru; and Moi University (1984), outside Eldoret, Maseno University in Kisumu and Masinde Muliro University in Kakamega. The private universities are Daystar, Baraton,
Catholic, USIU, Aga Khan, Strathmore, Kabarak, Nazarene, Methodist and Kiriri all with a population of 37,848. It means the total population of all universities was 180,978 out of whom 49,821 pursue SMTs programmes according to *2011 Kenya Economic Survey*. All public universities and three private universities offer science and technology courses. The private ones are Catholic, Mt Kenya and Aga khan universities.

**3.6 Sampling Techniques and Sample Size**

Sampling is the procedure a researcher uses to gather people, places or things to study. A sample is a finite part of a statistical population whose properties are studied to gain information about the whole (Webster, 1985).

**3.6.1 Sampling Techniques**

Slavin, (1984) observed that due to limitations in time, funds and energy study can be carried out from a carefully selected sample to represent the entire population. Gay (1992), postulates that a sample size of at least 20% of the population is a good representation in quantitative social studies.

As the sample size approaches the population size, the more representative it is.

Therefore to get a representative sample for universities’ populations a 42.85% of the 7 public universities were selected. This gave a sample size of 3 universities. Again, to ensure private universities that offer science are represented, 3 were selected. The science mathematics and technology courses were first stratified into 4 categories out of the 6 universities. The four categories are engineering, medicine, education-science and computer science. Stratified random sampling was employed to get a good representation in terms of science and technology by selecting 42.85% of the courses.
3.6.2 Sample Size
Each type of programme was represented by 25% of its women and men student population. To get to specific science and technology programmes in respective universities for the study, a list of undergraduate science and technology programmes was obtained from Joint Admissions Board, out of which random sampling was employed. The study involved male and female students spread over all years of study, as well deans of respective selected science, mathematics and technology faculties in universities. This was done through purposeful sampling.

Table 3.1. Summary of the sample.

<table>
<thead>
<tr>
<th>UNIVERSITY</th>
<th>DEPARTMENT</th>
<th>ENGINEERING</th>
<th>MEDICINE</th>
<th>EDUCATION</th>
<th>COMPUTER SCIENCE</th>
<th>SAMPLE</th>
<th>ACTUAL SAMPLE</th>
</tr>
</thead>
<tbody>
<tr>
<td>NAIROBI</td>
<td>5</td>
<td>5</td>
<td>2</td>
<td>1</td>
<td>13</td>
<td>30</td>
<td></td>
</tr>
<tr>
<td>KENYATTA</td>
<td>2</td>
<td>2</td>
<td>4</td>
<td>1</td>
<td>9</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>JKTUAT</td>
<td>7</td>
<td>-</td>
<td>-</td>
<td>2</td>
<td>9</td>
<td>21</td>
<td></td>
</tr>
<tr>
<td>AGA KHAN</td>
<td>-</td>
<td>3</td>
<td>3</td>
<td>-</td>
<td>3</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>CATHOLIC</td>
<td>-</td>
<td>-</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>MT KENYA</td>
<td>2</td>
<td>3</td>
<td>-</td>
<td>2</td>
<td>7</td>
<td>13</td>
<td></td>
</tr>
<tr>
<td>TOTAL</td>
<td>14</td>
<td>10</td>
<td>7</td>
<td>5</td>
<td>36</td>
<td>76</td>
<td></td>
</tr>
</tbody>
</table>

Students in all faculties were be represented

3.7 Research Instruments
Questionnaires used in this study were administered to the deans of various SMT faculties and students of the 6 universities from the sample. According to Kombo and
Tromp (2006), to ensure the effectiveness of the questionnaires a pretest should be carried out. This was done with a sample of students from Moi University. The questionnaires, consisted of two sections. Section A consisted of items, which were to gather demographic data such as age, sex, academic qualifications and category of university. The section also consisted of both structured and unstructured questions, which restricts the respondents by saying “Yes” or “NO” for the researcher to know clearly about a situation.

In section B, the questionnaire sought information from lecturers and students opinions about women access to science and technology in universities. The statements used consisted of negative and positive statements. The Likert scale was used to score negatively and positively stated items as follows: -

<table>
<thead>
<tr>
<th>Statement</th>
<th>Code</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strongly Agree</td>
<td>SA</td>
<td>5</td>
</tr>
<tr>
<td>Agree</td>
<td>A</td>
<td>4</td>
</tr>
<tr>
<td>Undecided</td>
<td>U</td>
<td>3</td>
</tr>
<tr>
<td>Disagree</td>
<td>D</td>
<td>2</td>
</tr>
<tr>
<td>Strongly Disagree</td>
<td>SD</td>
<td>1</td>
</tr>
</tbody>
</table>

Tuckman (1994) observes that the Likert scale is an equal appearing interval which is used to register the extent of agreement or disagreement with a particular statement of an attitude, belief or judgment. The unstructured questionnaire enables the respondents to give their opinions. The admission nominal rolls and graduation booklets were also analyzed.
3.8 Pilot Study
The questionnaires were piloted with a small representative sample from Moi University.
After piloting and making the necessary amendments the researcher carried out an
evaluation of the revised questions.

3.9 Validity
The validity of a test is a measure of how well a test measures what it is supposed to
measure (Kombo & Tromp, 2006). Before the actual research, a pretest was carried out in
Moi University. The pretest assisted in determining the accuracy and clarified the
suitability of the instruments. The study applied content validity. This type of validity
shows whether the test items represent the content it is designed to measure (Borg &
Gall, 1989). By applying content validity, the researcher ensured that the test covered all
areas which were to be examined by pre-test being evaluated by the supervisors.
Supervisors’ feedback helped affirm and improve the instrument.

3.10 Reliability
Reliability enhances the dependability, accuracy and adequacy of the instruments through
piloting. Mugenda and Mugenda, (1999) observe that the reliability is a measure of
degree to which a research instrument yields consistent results or data, often a repeated
trial. Borg and Gall (1989) define reliability as the level of internal consistency on
stability over time of the measuring research instruments. To ensure reliability of the
study, the test-pretest was applied. This involved administering the same questionnaire at
an interval of one week to the same group and then comparing the responses.
Respondents conducted during the pre-test phase were deliberately excluded during the
final administration of the instrument. This helped control extraneous influences on the research findings due to prior knowledge of the information required by the instruments.

3.11 Data Collection Techniques
After getting permission from MoE to conduct research, the researcher personally visited sampled universities to administer the questionnaire of which he hired 2 research assistants. During the data collection, the researcher and his assistants visited universities to collect the completed questionnaires. Cases of non-response or refusal to answer the questionnaire were treated appropriately.

The researcher sampled 6 of the 17 universities. Slavin (1984) observed that due to limitations of the fund and energy, a study could be carried out from a carefully selected sample to represent the entire population. In each university, 40% of science and technology courses were selected and in turn 20% of female student were the sample size. Where the females were too few, efforts were made to ensure all were involved. The questionnaires were piloted with a small representative sample.

3.12 Data Analysis
After coding and organizing observations systematically, the researcher proceeded to process data with the aid of computer statistical package for social sciences (SPSS). To establish whether there was any significant difference between men and women in performance and access to learning resources Chi square statistical test was done. According to Lucey (2002), chi-square test is an important extension of hypothesis testing and is used when an actual, observed distribution with a hypothesized or expected distribution.
The researcher also used the Wilcoxon – Mann – Whitney Test. This test is a non-parametric analog to the independent t-test and is used when one does not assume that the dependent variable is a normally distributed interval variable (one only assume that the variable has at least ordinal).

Actual promotion rate is the total number of students in subsequent grade in a subsequent year, divided by total enrolment in previous year (Wako, 2003). Grade repeater rate is the number that repeats the same grade in previous year. Graduation rate is the number who graduates from a terminal grade in a particular year divided by total number enrolled in that terminal grade. Average number of years is the estimated average number of years for students to graduate from a given cohort in a given cycle.

3.13 Logistical and Ethical Considerations
According to Kombo and Tromp (2006), researchers whose subjects are people or animals must consider the conduct of their research, and give attention to the ethical issues associated with carrying out their research. In this study, the researcher maintained utmost confidentiality. All subjects participated voluntarily.

The researcher was open and honest in dealing with other researchers and research subjects. All reasonable measures were taken to protect the subjects physically and psychologically. Research was explained fully to the participants in advance and “de-briefs” subjects afterwards.
CHAPTER FOUR
DATA ANALYSIS, RESULTS AND DISCUSSION

4.1 Introduction
This chapter is devoted to analysis of the information collected and discussions. The analysis begins with demographic information on students and finally the other part of questionnaires. Each of questionnaires had 2 sections i.e part A and B.

4.2 Demographic Characteristics
The purpose of this section is to describe the demographic characteristics of the respondents. Respondents were requested to give information in regard to university, gender, age and teaching experience. Responses were summarized and subjected to descriptive and statistical analysis. Results were collated and presented in Figures 4, 5, 6, 7, 8, 9, 10 and 11.

University of Nairobi had the highest number of respondents and Agha Khan University the least as shown in figure 4. According to Abagi et al., (2005), there is high demand for science and technology programmes at tertiary level in Kenya. This ranges from medicine to pharmacy, computer science, engineering and architecture. This is the reason why universities that offer such programmes continue to attract high number of students.
SMTs programmes are capital-intensive courses demanding heavy investment. As they are time-demanding, expensive to set up and require qualified personnel who are often in short supply and who can demand high salaries. Private universities have stayed away from mounting those programmes, albeit for Mt Kenya university.

Out of the sampled members of teaching staff, women formed the twenty percent. The problem of gender inequality is not peculiar to Kenya but a world-wide problem.
In both United States and Britain for example, women form a small majority of university teachers (Blackstone & Fultons, 1975. A survey conducted on women’s participation in university management (Onsongo, 2002) revealed that women were a minority in university management.

Female Lecturers are very few when compared with male counterparts. 21.1 percent of the sampled students do not even have a single female lecturer. 62.7 percent have lecturer below 62.7 percent while only 16.2 percent have those teaching them above 50 per cent.
Figure 6: Percentages of Female Lecturers

Kanake, (1997), observed that social cultural constraints, economic value of education, societal attitudes towards higher education for women, and historical factors are some of the man factors contributing to women underrepresentation in university teaching and administration. In Kenya Lodiaga and Mbevi (1995) conducted a study to investigate, women's employment level, opportunities and career advancement in selected public institutions. The specific objectives of the study were to establish the status of women in selected public institutions, identify factors that may enhance, promote or inhibit status and advancement of women.

Majority of university lecturers have five or fewer number of years of teaching experience. It means either there is very high rate of turnover or because of latest influx of students since establishment of module II more have been recruited.
Women particularly are disadvantaged when it comes to experience and therefore stagnate in one position for a very long time. For example, women are given less opportunity for attending professional seminars, workshops and conferences, less chance to present their own papers and less opportunity to display and receive recognition for their professional skills (The Kenya Case Study 2011, IIEP).

Science category of the sample included Bachelor of Science general, Engineering and Computer Science and had the highest number of students followed by Medicine. Medicine lately is attracting many self sponsored students majority of whom are females though engineering remains a preserve of Males.
Figure 8: Percentage of students sampled taking selected courses

Majority of students sampled (68.2%) are in category of 21-24 years. Students spend 8 years in primary plus four in secondary and until the academic year 2011/2012, the Joint Admissions Board students had to wait for 2 years before joining university. 12.0 per cent of students fell in the category of 17-20 years.

Figure 9: Ages of selected students
The well-to-do parents ensure that, their children join the parallel degree programmes as there is no waiting period. The 8.3 % over 28 years are likely to be students who go through middle level colleges. Out of the number of students sampled, 47.4 % were females and 52.6 % were males. According to 2011 Economic Survey, though male numbers are still higher than of females, the total male enrolment in public universities dropped by 0.4 per cent from 89,611 in 2009 to 89,257 in 2010/2011 academic years. During the same period, the total female enrolment increased by 1.8 per cent from 52,945 to 53,873 students.

Figure 10: Percentage of either gender of students selected

The changes to enrolment could be attributed to the affirmative action adopted by the Joint Admissions Board (JAB) of admitting female students with a point lower than their male counterparts. Enrolment in private universities grew by 7.6 per cent from 35,179
students in 2009/10 to 37,848 in 2010/2011 academic year. This is attributed to social demand for university education and limited places in public universities.

Dramatic increases in the educational attainment of females underlie the fundamental changes that have taken place in the global talent pool. A review of latest trends towards change in women’s access to HE reported by UNESCO (2012) in its first *World Atlas of Gender Equality in Education* demonstrates the expansion at an unprecedented rate for women in HE from 1970 to 2009. Only two regions continued to have men advantage (Sub-Saharan Africa and South and West Asia), and one region showed parity (Arab States). From the regions showing disparity, it is noted that North America and Western Europe had the largest GRE favouring women, while Sub-Saharan Africa had the largest favouring men.
4.3 Comparison of Performance between Men and Women in SMTs in Kenyan universities.

This section deals with findings of first objective which was to compare the performance of women with that of men in selected science and technology programmes in Kenyan universities. Respondents were required to supply information relating to performance in university entrance and subsequent examinations. Graduation booklets were analysed to
establish quality of degrees by both sexes. Responses were summarized and subjected to analysis.

To establish whether there was any significant difference between men and women in performance Chi square statistical test was done. According to Lucey (2002), chi-square test is an important extension of hypothesis testing and is used when an actual, observed distribution with a hypothesized or expected distribution. The researcher also used the Wilcoxon – Mann – Whitney Test. This test is a non-parametric analog to the independent t-test and is used when one does not assume that the dependent variable is a normally distributed interval variable (one only assume that the variable has at least ordinal). Findings and results were presented in Tables 4.10, 4.11, 4.12, 4.13, 4.14, 4.15, 4.16, 4.17, 4.18, 4.19 and 4.20. Presentations were also done in Figures 12, 13, 14, 15, 16, 17 and 18.

The highest number of students sampled had grade A- in university entrance examination known as Kenya certificate of secondary examination (KCSE) as shown in figure 12. A few had grade C and these are possibly students who have risen through the education system via the middle level colleges as the minimum qualification for university education is C+. The lowest grade for those selected by Joint Admissions Board is B. Some of the students admitted in public universities are likely to have been self-sponsored in programmes popularly known as Module II.
Figure 12: Grades obtained in KCSE

The results are further categorized in terms of gender and results displayed in the table 4.10 below.

Table 4.10: Grade obtained in KCSE by Gender

<table>
<thead>
<tr>
<th>Gender in KCSE</th>
<th>N</th>
<th>Mean Rank</th>
<th>Sum of Ranks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grade in KCSE</td>
<td>Male</td>
<td>97</td>
<td>95.08</td>
</tr>
<tr>
<td></td>
<td>Female</td>
<td>89</td>
<td>91.78</td>
</tr>
<tr>
<td>Total</td>
<td>186</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The above results suggest that there is no statistically significant difference between the underlying distribution of the grades obtained in KCSE of males and the grade obtained in KCSE of female ($Z=-0.427$, $p=0.0669$). Since $p=0.0669$ and $\alpha=0.05$ then $\alpha>p$ and thus we do not reject the hypothesis that the performance of the two groups is the same. *(if $p\leq \alpha$, then the difference is significant)* where $\alpha$ is the level of significance and $p$ is the p-
value. This concurs with Eshiwani, (1983) who observed that generally given conducive learning environment, girls can perform as well as, if not better than boys. Gender differences are now widest at the level of secondary education, where the acquisition of cognitive skills is crucial for national economic growth. Many children attending secondary schools are failing to master the skills and competencies needed to succeed in today’s labour market (Tembon, 2008).

Constraints to educational attainment also operate differentially across genders and new patterns have begun to emerge. On average, school repetition and, to a lesser extent, dropout rates are higher among boys than among girls. In many countries, girls outperform boys in school. In the United States, girls get better school grades in all major subjects, including math and science (Perkins and others (2004)). At the tertiary education level, women are equally or more likely to graduate from university than men in all regions, except SSA and South Asia. But there is also considerable sorting across fields of study. Men tend to be concentrated in the engineering, manufacturing and construction fields, while women tend to predominate in areas such as education, health and welfare, humanities and arts.

To establish if there was a significant difference between the degree programmes that the two genders were pursuing, the researcher used the chi-square analysis. A chi square test is used when one wants to test a relationship between two categorical variables.
Table 4.11: Degree programme by Gender

<table>
<thead>
<tr>
<th>Gender</th>
<th>Mal Count</th>
<th>Medicine</th>
<th>Science</th>
<th>Education</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>% within Gender</td>
<td>16.8%</td>
<td>67.3%</td>
<td>15.8%</td>
<td>100.0%</td>
</tr>
<tr>
<td>Fem</td>
<td>Count</td>
<td>26</td>
<td>55</td>
<td>8</td>
<td>89</td>
</tr>
<tr>
<td></td>
<td>% within Gender</td>
<td>29.2%</td>
<td>61.8%</td>
<td>9.0%</td>
<td>100.0%</td>
</tr>
<tr>
<td>Total</td>
<td>Count</td>
<td>43</td>
<td>123</td>
<td>24</td>
<td>190</td>
</tr>
<tr>
<td></td>
<td>% within Gender</td>
<td>22.6%</td>
<td>64.7%</td>
<td>12.6%</td>
<td>100.0%</td>
</tr>
</tbody>
</table>

The results above show the relationship between gender and the degree programmes being pursued by the two. However, the results showed that there was no significant relationship between gender and the degree programme ($\chi^2=5.2$, $p=0.70$). If the significance level is 10%, then the results of the study show that there is a significant relationship between the courses which male pursue in the university with the courses that their female counterparts pursue in the university. According to Chege and Sifuna (2006), in the Faculty of Engineering women have in the past been generally under represented. Percentage of women pursuing engineering has been steadily rising over the years. Contrary to a popular belief, female students are not the majority in Bachelor of Education Degree although they are fairly well-represented. It was established that there was no significant relationship in any of the grades in relation to gender. Grades obtained at university level have no relationship with gender.
Table 4.12: Grades obtained by the Student in the Previous Year of Study

<table>
<thead>
<tr>
<th>Grade</th>
<th>Male</th>
<th>Female</th>
<th>Male</th>
<th>Female</th>
<th>Male</th>
<th>Female</th>
<th>Male</th>
<th>Female</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>65</td>
<td>44</td>
<td>53.1</td>
<td>57.8</td>
<td>3453.5</td>
<td>2541.5</td>
<td>-0.758</td>
<td>0.449</td>
</tr>
<tr>
<td>B</td>
<td>66</td>
<td>56</td>
<td>59.7</td>
<td>63.6</td>
<td>3942.5</td>
<td>3560.5</td>
<td>-0.604</td>
<td>0.546</td>
</tr>
<tr>
<td>C</td>
<td>56</td>
<td>44</td>
<td>49.2</td>
<td>52.2</td>
<td>2754.0</td>
<td>2296.0</td>
<td>-0.524</td>
<td>0.601</td>
</tr>
<tr>
<td>D</td>
<td>21</td>
<td>18</td>
<td>20.5</td>
<td>19.4</td>
<td>431.0</td>
<td>349.0</td>
<td>-0.324</td>
<td>0.746</td>
</tr>
<tr>
<td>E</td>
<td>5</td>
<td>8</td>
<td>8.1</td>
<td>6.3</td>
<td>40.5</td>
<td>50.5</td>
<td>-0.874</td>
<td>0.382</td>
</tr>
</tbody>
</table>

The results obtained and analysed in Table 4.12 indicate that there was no significant relationship between the grades and genders ($\chi^2=0.766$, $p=0.381$). That means there are no courses designed or meant for particular gender. Results of several examination years reveal that girls are outperformed by boys in Mathematics, Science and Technical subjects in Kenya Certificate of Secondary Education (KCSE). This renders them unable to attain equal parity with their male counterparts in joining world of science at the university level. As a result they have relatively limited opportunity to acquire professional skills in sciences (UNESCO, 2010). It’s interesting to note that no such correlation exist at university level.
Table 4.13: Percentages by gender of perceptions towards SMTs

<table>
<thead>
<tr>
<th>Gender</th>
<th>Whether women are equally endowed to pursue science, mathematics and technology programmes</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Male</td>
<td>Count</td>
<td></td>
</tr>
<tr>
<td></td>
<td>81</td>
<td>7</td>
</tr>
<tr>
<td></td>
<td>% within Gender</td>
<td></td>
</tr>
<tr>
<td></td>
<td>92.0%</td>
<td>8.0%</td>
</tr>
<tr>
<td>Female</td>
<td>Count</td>
<td></td>
</tr>
<tr>
<td></td>
<td>81</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>% within Gender</td>
<td></td>
</tr>
<tr>
<td></td>
<td>95.3%</td>
<td>4.7%</td>
</tr>
<tr>
<td>Total</td>
<td>Count</td>
<td></td>
</tr>
<tr>
<td></td>
<td>162</td>
<td>11</td>
</tr>
<tr>
<td></td>
<td>% within Gender</td>
<td></td>
</tr>
<tr>
<td></td>
<td>93.6%</td>
<td>6.4%</td>
</tr>
</tbody>
</table>

The absence of or low numbers in female teachers in science tends to reinforce sex stereotyping in curriculum choice. Although there is little difference in the background knowledge, the girls and boys bring to secondary school science, the differences in their attitudes and interests result to the tendency for girls' preference for biological as opposed to physical sciences. Female teacher's negative attitudes to science or labelling of science as men's subjects are transmitted to their students in day- to- day classroom interaction (Shelley & Whaley, 1994).
Table 4.14: Perceptions of Performance in SMTs by Gender

<table>
<thead>
<tr>
<th>Gender</th>
<th>Do you think female students perform equally well when compared with male counterparts in SMTs at university level</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Male</td>
<td>Count</td>
<td></td>
</tr>
<tr>
<td></td>
<td>68</td>
<td>24</td>
</tr>
<tr>
<td>% within Gender</td>
<td>73.9%</td>
<td>26.1%</td>
</tr>
<tr>
<td>Female</td>
<td>Count</td>
<td></td>
</tr>
<tr>
<td></td>
<td>77</td>
<td>14</td>
</tr>
<tr>
<td>% within Gender</td>
<td>84.6%</td>
<td>15.4%</td>
</tr>
<tr>
<td>Total</td>
<td>Count</td>
<td></td>
</tr>
<tr>
<td></td>
<td>145</td>
<td>38</td>
</tr>
<tr>
<td>% within Gender</td>
<td>79.2%</td>
<td>20.8%</td>
</tr>
</tbody>
</table>

At 10% level of significance then, there was a relationship between the gender in the way they think of the female performance in SMTs where male thought that females do not perform equally with them ($\chi^2 = 3.19$, $p = 0.074$). The first *World Atlas of Gender Equality in Education* by UNESCO (2012) gives proof that trends towards change are on the race. As the report states, in the last four decades an, almost entirely reversion of the historical process of exclusion of women in HE has occurred and they have gained some more or much access to this level of education. Notwithstanding this, at barely three years of compliance with the deadline set for the HE sector in the goal 5 of the Dakar Framework for Action 2000 of the Education for All (EFA) movement, and in the target 4 of the United Nations Millennium Development Goals (MDGs), the same UNESCO (2012) report has identified two regions in which the HE system persists to be unfair to women, showing still great disparity in disadvantage for them. These are: South and West Asia and in Sub-Saharan Africa.
It was imperative that lecturers give their opinions in regard to status of men and women in public and private universities due to their daily interactions with them. The researcher wanted to establish the perceptions of lecturers in rating performance of women as compared to men.

Figure 13: Ratings of women's performance

Over 90 per cent of respondents believe that women perform equally well when compared to their male counterparts as indicated in Figure 13. It means grasping of concepts is independent of gender. Constraints to educational attainment operate differentially across genders and new patterns have begun to emerge. On average, school repetition and, to a lesser extent, dropout rates are higher among boys than among girls. In many countries, girls outperform boys in school. In the United States, girls get better school grades in all major subjects, including math and science (Perkins *et al.*, 2004). At the tertiary education level, women are equally or more likely to graduate from university than men in all regions, except SSA and South Asia. But there is also considerable
sorting across fields of study. Men tend to be concentrated in the engineering, manufacturing and construction fields, while women tend to predominate in areas such as education, health and welfare, humanities and arts.

Despite being considered as the weaker sex 90 per cent of Lecturers sampled believe men and women are treated equally may in access to facilities or when being taught as indicated in Figure 14.

![Pie chart showing perceptions on gender favouritism]

**Figure 14: Perceptions on gender favouritism**

Traditionally, women have been socialized to conform to a feminine stereotype, to be warm, kind, selfless, quiet, unassuming, compliant and obedient; and they are reputed to be emotional, irrational, concerned with trivia and detail. The common perception of a leader is a male who is forceful, rational, competitive, decisive, strong, self-confident, independent and sometimes aggressive, a person with vision, report Yukongdi and
Benson (2005), on China, Hong Kong, Japan, India, Singapore, South Korea and Taiwan. Failure to favour women will ultimately make them independent, confident and above all overcome this stereotype.

Most institutions of higher learning have alumni associations and are therefore, able to get a glimpse of how their graduates are faring in the job market.

![Performance in job market](image)

**Figure 15: Performance in job market**

All respondents feel that females just like males do equally well in the job market as shown in Figure 15. Growing economic opportunities have drawn large numbers of new female workers into the market. Between 1980 and 2008, increases in female labour force participation (FLFP) were observed in all regions and across all age groups, with growth generally being faster in developed world and among young adults. In Argentina, FLFP jumped from 39 to 51 percent during this period, while in Beni, the share of female workers grew from 58 to 68 percent. On average, growth in anticipation rates has been
higher among women than men and, consequently, the female-male participation gap has diminished across the world. But important differences still exist in terms of the distribution of men and women across industries and occupations. Women tend to be concentrated in particular areas of the economic space and, within these areas, women are more likely to engage in lower-productivity activities than men. Women are more likely to be self-employed and work in the informal salaried sector than men. Female workers are also more likely to transition between the informal sector and being out of the labour force, and are less mobile between the formal and informal sectors (Bosch and Maloney (2009), Gong & Van Soest (2004).

Half of women pursuing SMTs break for maternity leaves in due course of study as shown in Figure 16. Because of age factor women in universities at times get married and subsequently bear children in due course of their study. Surprisingly this does not affect the females' academic performance.

Figure 16: Maternity leaves
Most of women go through many hardships as they move up the academic ladder and this directly affects their rate of transition. The result is presence of overage women who double up roles of learning and child bearing. This is likely to adversely affect the academic performance of women.

Lecturers perceive women and men to be equal good in conceptualization of what is taught. Ninety percent agree with the statement as shown in Figure 4.15. Again performance in examinations has nothing to do with gender. Innovativeness, inquisitiveness, repetition in academic years and performance do not depend on whether one is man or a woman.

Table 4.15: Perceptions of Lecturers on Women’s Performance

<table>
<thead>
<tr>
<th>Statement</th>
<th>S1</th>
<th>D</th>
<th>T</th>
<th>B</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grasping of concepts of both men and women is the same</td>
<td>10%</td>
<td>50%</td>
<td>40%</td>
<td></td>
</tr>
<tr>
<td>Performance is SMTs exams does not depend on gender</td>
<td>10%</td>
<td>30%</td>
<td>60%</td>
<td></td>
</tr>
<tr>
<td>Men are more innovative in experiments than women</td>
<td>40%</td>
<td>30%</td>
<td>10%</td>
<td>20%</td>
</tr>
<tr>
<td>When teaching higher percentage of men than women ask questions</td>
<td>20%</td>
<td>30%</td>
<td>10%</td>
<td>30%</td>
</tr>
<tr>
<td>A higher percentage of women than men repeat academic years</td>
<td>30%</td>
<td>60%</td>
<td>10%</td>
<td></td>
</tr>
<tr>
<td>On average women perform better than men</td>
<td>20%</td>
<td>30%</td>
<td>30%</td>
<td>10%</td>
</tr>
</tbody>
</table>
Section B of questionnaire was meant to establish the general perceptions of students in regard to their own performance and results are recorded in table 4.16 below.

**Table 4.16: Perceptions of students towards Performance**

<table>
<thead>
<tr>
<th>Gender</th>
<th>N</th>
<th>Mean</th>
<th>Sum of Rank</th>
<th>Z</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Men are better achievers in science, mathematics and technology than women</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>99</td>
<td>115.01</td>
<td>11386.00</td>
<td>-5.45**</td>
<td>0.000</td>
</tr>
<tr>
<td>Female</td>
<td>90</td>
<td>72.99</td>
<td>6569.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Society has a general belief that sciences are male subjects</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>99</td>
<td>99.11</td>
<td>9811.50</td>
<td>-1.172</td>
<td>0.241</td>
</tr>
<tr>
<td>Female</td>
<td>90</td>
<td>90.48</td>
<td>8143.50</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Special scholarship programmes for girls should be established</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>94</td>
<td>68.73</td>
<td>6461.00</td>
<td>-6.192**</td>
<td>0.000</td>
</tr>
<tr>
<td>Female</td>
<td>87</td>
<td>115.06</td>
<td>10010.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>In secondary school girls are not properly inducted on performance of sciences</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>98</td>
<td>86.67</td>
<td>8690.00</td>
<td>-1.576</td>
<td>0.115</td>
</tr>
<tr>
<td>Female</td>
<td>90</td>
<td>100.84</td>
<td>9076.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Female lecturers are better in terms of content delivery than their male counterparts</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>98</td>
<td>85.75</td>
<td>8403.50</td>
<td>-2.491**</td>
<td>0.013</td>
</tr>
<tr>
<td>Female</td>
<td>91</td>
<td>104.96</td>
<td>9551.50</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male lecturers are biased towards female students when teaching</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>95</td>
<td>106.05</td>
<td>10074.50</td>
<td>-3.358**</td>
<td>0.001</td>
</tr>
<tr>
<td>Female</td>
<td>91</td>
<td>80.40</td>
<td>7316.50</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**significant at 0.05 level of significance**

The p value is significant meaning that gender is correlated with performance in science, mathematics and technology. Male students are on whole performing better than their female counterparts, an earlier study shows that early marriages before completion of their courses, especially in undergraduate programmes, and subsequent pregnancies and childcare responsibilities put extra demands on female students' study time. In addition,
there are household chores that also burden them and affect their performance (Ominde, 1999).

Majority of respondents feel that women need preferential treatment when it comes to scholarship awards ($Z=-6.102$, $p=0.000$). According to Obura et al., (2011), Scholarships compensate families for the direct and indirect costs of education, and are effective for families that view cost as an impediment to girls schooling. Girl scholarship programmes have attracted girls into schools and kept them there in Bangladesh and Kenya. Though some NGOs such as FAWE give scholarships to women students, the process has not been very transparent. According to Oyuke (2013), the government is stepping up efforts to address gender imbalance in engineering. The National Industrial Training Board through the National Industrial training Authority (NITA) is offering female students full sponsorship to study engineering. The Board was seeking 25 qualified and needy females from 20 marginal areas of the country to be sponsored in engineering disciplines at craft and diploma levels in various public training institutions from May, 2013.

On perceptions by students of female lecturers and their male counterpart $P$ value is .013 and this is significant. There is correlation between gender and teaching and both men and women can handle different concepts in SMTs programmes equally well. Again on biasness towards Female Students, the $p$ value is .001 and this is significant meaning the perception of male lecturers towards female students is equally the same with the female students. Though male lecturers have been accused of sexually harassing the young.
female students, in academic matters they have not been biased and any poor performance is possible because of other factors.

On grasping of concepts of both men and women, over 90 per cent responded on the affirmative disagreeing with misconception that women are not able to conceptualize academic ideas in equal measure as men. The differences between men and women are merely biological but not intellectual. It’s only in SSA that boys continue to dominate in academics dominance. In Germany, studies have shown that girls achieve higher academic excellence than boys. However, research has revealed that boys of all ages are in receipt of more praise and more censure from both male and female teachers. Girls are quiet losers in schools all the way to the universities while the boys are boisterous winners (Otunga & Ojwang, 2005). As countries move up the income ladder, gender disparities against females tend to first shift across educational levels, from primary, to secondary, to tertiary education, and ultimately, they reverse. The largest female gender gaps tend to occur in nations with low income and low overall participation in schooling; the gender gap tends to turn in favour of women in nations with higher income and high overall participation in schooling. By 2008, boys in 51 out of 156 countries lagged significantly behind girls in primary/secondary school enrolment (World Bank, 2012).

Innovation is the act or process of inventing or introducing something new. Forty per cent of respondents strongly disagree with this statement. Over the years women have been placed in subordinate status to men in terms of establishing themselves both as individuals in their own right and as a group whose participation is central to developing
and implementing initiatives for national building. According to the international food policy research institute report cited by Blackden and Bhanu (1999), African women perform about 90 per cent of the work of processing food crops and providing household water and fuel wood. They also contribute 80 per cent of the work of food storage and transport from farm to village, 90 per cent of work of hoeing and weeding and 60 per cent of the work of harvesting and marketing.

From percentages on the table 4.16, it is hard to distinguish which of the two genders is more inquisitive. It therefore means gender is not an impediment to the person who is curious to learn through asking questions. At lower levels of education, there is misconception that presence of boys will make girls shy away from asking questions. Questions from students are important as they make anyone to fully comprehend what is being discussed.

The percentages seem not to give a clear consensus. While females generally do not perform much below males in mathematics, they consistently report much lower interest in and enjoyment of mathematics, lower self-related beliefs, and much higher levels of helplessness and stress in mathematics classes. This reveals inequalities between the genders in the effectiveness with which schools and societies promote motivation and interest and, to an even greater extent, help students overcome anxiety about different subject areas. The performance of males and females at school, and their motivation and attitudes in different subject areas, can have a significant influence on their further educational and occupational pathways. These factors, in turn, may have an impact not
only on individual career and salary prospects, but also on the broader effectiveness with which human capital is developed and used in economies and societies. (Tembon & Fort, 2009).

The table 4.17 overleaf gives the trend of the students who graduated from 2005 to 2009 at the University of Nairobi with a degree in Engineering.

![Bar chart showing the trend of students' degrees by gender from 2005 to 2009.](image)

**Figure 17: A comparison of quality of degrees by gender, UoN**
Table 4.17: Degree class by gender in UoN, 2005-2009.

<table>
<thead>
<tr>
<th></th>
<th>1&lt;sup&gt;st&lt;/sup&gt; CLASS</th>
<th>2&lt;sup&gt;nd&lt;/sup&gt; UPPER</th>
<th>2&lt;sup&gt;nd&lt;/sup&gt; LOWER</th>
<th>PASS</th>
</tr>
</thead>
<tbody>
<tr>
<td>2005</td>
<td>Men 4.6%</td>
<td>50.4%</td>
<td>37.4%</td>
<td>7.6%</td>
</tr>
<tr>
<td></td>
<td>Women 21.4%</td>
<td>57.1%</td>
<td>14.3%</td>
<td>7.1%</td>
</tr>
<tr>
<td>2006</td>
<td>Men 3.5%</td>
<td>43.0%</td>
<td>40.1%</td>
<td>13.4%</td>
</tr>
<tr>
<td></td>
<td>Women 6.7%</td>
<td>53.3%</td>
<td>40.0%</td>
<td>0.0%</td>
</tr>
<tr>
<td>2007</td>
<td>Men 7.0%</td>
<td>47.6%</td>
<td>36.2%</td>
<td>9.2%</td>
</tr>
<tr>
<td></td>
<td>Women 0.0%</td>
<td>62.5%</td>
<td>37.5%</td>
<td>0.0%</td>
</tr>
<tr>
<td>2008</td>
<td>Men 6.1%</td>
<td>43.3%</td>
<td>43.3%</td>
<td>7.3%</td>
</tr>
<tr>
<td></td>
<td>Women 9.1%</td>
<td>86.4%</td>
<td>4.5%</td>
<td>0.0%</td>
</tr>
<tr>
<td>2009</td>
<td>Men 4.2%</td>
<td>41.7%</td>
<td>45.2%</td>
<td>8.9%</td>
</tr>
<tr>
<td></td>
<td>Women 10.5%</td>
<td>73.7%</td>
<td>10.5%</td>
<td>5.3%</td>
</tr>
</tbody>
</table>

According to the results, the proportion of women who graduated with 1st class honors was higher than for men in all years besides 2007 when there was no female candidate who graduated with a 1<sup>st</sup> class honors. Further, the proportion of females graduating with a 2nd class honors upper was also high for females in all years than for their male counterparts. Nevertheless, the results show that the proportion of males graduating with 2nd class upper and pass was higher than for females. This implies that females were likely to get higher grades than their males counterparts. To test the overall performance of males and females, the chi-square test of significance was conducted and the following results were obtained.

Table 4.18: Performance in Engineering at UoN

<table>
<thead>
<tr>
<th></th>
<th>High (1&lt;sup&gt;st&lt;/sup&gt; Class and 2&lt;sup&gt;nd&lt;/sup&gt; Upper)</th>
<th>Low (2&lt;sup&gt;nd&lt;/sup&gt; Lower and Pass)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>25.1%</td>
<td>24.9%</td>
</tr>
<tr>
<td>Female</td>
<td>38.1%</td>
<td>11.9%</td>
</tr>
</tbody>
</table>
According to the above results, the overall performance of females was found to be higher than that of their males counterparts with the difference being significant at 5% level of significance ($\chi^2=29.21, p=0.000$). This means that females were found to perform better than their males counterparts pursuing an engineering course at the University of Nairobi.

The results in Figure 4.24 and table 4.22 are for the students who graduated with various degrees from the JKUAT.

![Graph](image)

**Figure 18:** Overall performance of all faculties in JKUAT by gender.
Table 4.19: Degree's class by gender in JKUAT

<table>
<thead>
<tr>
<th></th>
<th>1st Class</th>
<th>2nd Upper</th>
<th>2nd Lower</th>
<th>Pass</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>BSC Computer Science</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Men</td>
<td>41.2%</td>
<td>52.9%</td>
<td>5.9%</td>
<td>0.0%</td>
</tr>
<tr>
<td>Women</td>
<td>0.0%</td>
<td>100.0%</td>
<td>0.0%</td>
<td>0.0%</td>
</tr>
<tr>
<td><strong>BSC General</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Men</td>
<td>0.0%</td>
<td>6.5%</td>
<td>29.0%</td>
<td>64.5%</td>
</tr>
<tr>
<td>Women</td>
<td>0.0%</td>
<td>40.0%</td>
<td>55.0%</td>
<td>5.0%</td>
</tr>
<tr>
<td><strong>Engineering</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Men</td>
<td>1.5%</td>
<td>57.6%</td>
<td>28.8%</td>
<td>12.1%</td>
</tr>
<tr>
<td>Women</td>
<td>0.0%</td>
<td>66.7%</td>
<td>16.7%</td>
<td>16.7%</td>
</tr>
</tbody>
</table>

According to the results, the proportion of men who had first class honours in the two degree programme was higher than that of females, though the proportion of female with a second class upper was higher than for the males in all the three areas. Further, the results showed that proportion of males who had 2nd lower and pass was higher than that of their female counterparts. A test of difference between the two genders and their performance which was grouped in two as high (1st Class and 2nd Upper) and low (2nd Lower and Pass) was done in the following results obtained.

Table 4.20: Performance in Engineering at JKUAT

<table>
<thead>
<tr>
<th></th>
<th>High (1st Class and 2nd Upper)</th>
<th>Low (2nd Lower and Pass)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Male</strong></td>
<td>26.6%</td>
<td>23.4%</td>
</tr>
<tr>
<td><strong>Female</strong></td>
<td>34.4%</td>
<td>15.6%</td>
</tr>
</tbody>
</table>

As shown in the above table, the proportion of males with a higher degree was lower than that of the females. Also, the proportion of males with a low degree was higher than that of female. Further, the difference between the performance of males and females was found to be significant at 5% level of significance ($\chi^2=18.32$, $p=0.001$) meaning females performed better than their male counterparts.
4.4 Establishment of Whether Men and Women have Equal Access to SMT facilities in Kenyan Universities

This section aimed at establishing whether men and women have equal access to learning resources in selected science, mathematics and technology programmes in Kenyan universities which was second objective. Respondents were asked to give information relating to frequency of visits to learning facilities which include workshops, resource centre, library and laboratories. They were also required to state the obstacles they encounter as they access these facilities.

Responses were summarized and subjected to analysis using Chi square statistical test. The researcher also used the Wilcoxon – Mann – Whitney Test since the three variables were not normally distributed. This test is a non-parametric analog to the independent t-test and is used when one does not assume that the dependent variable is a normally distributed interval variable (one only assume that the variable has at least ordinal).

Findings were presented in Tables 4.21, 4.22, 4.23, 4.24, 4.25.

First it was important to establish the frequencies of access to university facilities per week and results are summarized in Table 4.21 below:

<table>
<thead>
<tr>
<th>Facility</th>
<th>Gender</th>
<th>N</th>
<th>Mean Rank</th>
<th>Sum Rank</th>
<th>Z</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Laboratory</td>
<td>Male</td>
<td>88</td>
<td>86.8</td>
<td>7638.5</td>
<td>-0.961</td>
<td>0.337</td>
</tr>
<tr>
<td></td>
<td>Female</td>
<td>78</td>
<td>79.8</td>
<td>6222.5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Resource</td>
<td>Male</td>
<td>39</td>
<td>37.71</td>
<td>1470.5</td>
<td>-0.328</td>
<td>0.743</td>
</tr>
<tr>
<td></td>
<td>Female</td>
<td>37</td>
<td>39.34</td>
<td>1455.5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Centre</td>
<td>Male</td>
<td>84</td>
<td>82.91</td>
<td>6964.5</td>
<td>-1.171</td>
<td>0.242</td>
</tr>
<tr>
<td></td>
<td>Female</td>
<td>73</td>
<td>74.50</td>
<td>5438.5</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
The above results show that both genders accessed the above facilities equally per week since in all cases, the p value was less than the level of significance (5%). In addition, the students were asked whether both girls and boys had equal access to university facilities and the results which were analyzed using a chi-square analysis showed that there was no significant difference ($\chi^2=0.305$, $p=0.581$).

According to Kasakye (2010), there are different constraints or challenges which are gender-based that affected students from accessing and using the laboratory. These include; the male students dominating the computer laboratory, some female students being uncomfortable with the male ‘laboratory attendant’ as most of them refer to him, among others. There are also general challenges such as the limited time allocated to the users, the limited number of computers which do not correspond to the students’ number, the limited space which makes the opposite sex students uncomfortable, the laboratory being closed most of the time, the laboratory attendant asking for some money to offer technical support to the users, to mention but a few.

Traditionally women are more careful in handling items. Majority of respondents feel that women are more cautious in handling of facilities as compared to male counterparts. This is an important factor for universities and subsequent employers and this save them substantial revenue in terms of maintenance.

The results above show that 27% of the sampled female students said that they leave the university resource centre earlier than they would have preferred for fear of sexual harassment while only 9.1% of the boys who do so. In addition, the results of the chi-
square analysis showed that there was a significant relationship between the gender and leaving the university resource centre for fear of sexual harassment ($\chi^2=11.2, p=0.001$). Although access to facilities is the same, the males have longer periods to make use of facilities than their female counterparts.

Eighty per cent of respondents feel that access to facilities by women is fair as shown in Table 4.23. In an earlier research, it was interpreted that public universities did not have satisfactory number and quality of computers for effective teaching and learning and that lack of enough physical facilities such as lecture rooms, computers, laboratories and laboratory and workshop equipment negatively affected the quality of teaching and learning in public universities (Gudo et al., 2011)

Table 4.22: Perceptions of Lecturers on Women’s Access to Facilities

<table>
<thead>
<tr>
<th>Statement</th>
<th>10%</th>
<th>10%</th>
<th>80%</th>
<th>10%</th>
<th>20%</th>
<th>20%</th>
<th>10%</th>
<th>40%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Access to facilities by women students is fair</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Women are more careful than men in handling university facilities</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Science and technology programmes are practical subjects and the longer the exposure, the greater is grasping of various concepts. Most female students claimed that the hostels were far way from library and study centres and the paths were dimly lit exposing the girls to risk of physical and sexual abuse. This makes them keep off such areas when darkness falls leaving their male counterparts with a big competitive advantage.
Table 4.23: Sexual harassment by gender

<table>
<thead>
<tr>
<th>Gender</th>
<th>Do you leave any university resource earlier than you would have otherwise preferred for fear of sexual or any other form of harassment</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Male</td>
<td>Count 9</td>
<td>90</td>
</tr>
<tr>
<td></td>
<td>% within 9.1%</td>
<td>90.9%</td>
</tr>
<tr>
<td>Female</td>
<td>Count 25</td>
<td>65</td>
</tr>
<tr>
<td></td>
<td>% within 27.8%</td>
<td>72.2%</td>
</tr>
<tr>
<td>Total</td>
<td>Count 34</td>
<td>155</td>
</tr>
<tr>
<td></td>
<td>% within 18.0%</td>
<td>82.0%</td>
</tr>
</tbody>
</table>

Table 4.24 above is a good illustration indicating how women are disadvantaged when it comes to access to facilities. 9.1 percent of males leave the facilities earlier than anticipated as compared to 27.8 percent of females. This amounts to higher level of sexual harassment of women students. The majority of the women decry the advantage male professors take of them. They argued that it is not likely that a woman would complete a thesis process without some bruises. If supervisors make sexual advances and you turn them down, they could dismiss you as a weak candidate (Kamau, 2004)

It was important to collect students’ perceptions towards access to facilities results of which are summarized in Table 4.24 overleaf.
Table 4.24: Perceptions towards access to facilities

<table>
<thead>
<tr>
<th></th>
<th>Gender</th>
<th>N</th>
<th>Mean</th>
<th>Sum of Z</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Rank</td>
<td>Ranks</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Access to university facilities for men and women is at the same rate</td>
<td>Male</td>
<td>99</td>
<td>102.78</td>
<td>10175.50</td>
<td>-2.08**</td>
</tr>
<tr>
<td></td>
<td>Female</td>
<td>91</td>
<td>87.58</td>
<td>7969.50</td>
<td></td>
</tr>
<tr>
<td>Sexual harassment by male counterparts is rampant at university</td>
<td>Male</td>
<td>98</td>
<td>88.06</td>
<td>8629.50</td>
<td>-1.630</td>
</tr>
<tr>
<td></td>
<td>Female</td>
<td>89</td>
<td>100.54</td>
<td>8948.50</td>
<td></td>
</tr>
<tr>
<td>Women should be isolated from men when pursuing SMTs programmes</td>
<td>Male</td>
<td>98</td>
<td>92.87</td>
<td>9101.50</td>
<td>-0.524</td>
</tr>
<tr>
<td></td>
<td>Female</td>
<td>90</td>
<td>96.27</td>
<td>8664.50</td>
<td></td>
</tr>
<tr>
<td>SMTs facilities especially in university laboratories are too few and we always share</td>
<td>Male</td>
<td>97</td>
<td>93.21</td>
<td>9041.00</td>
<td>-0.082</td>
</tr>
<tr>
<td></td>
<td>Female</td>
<td>89</td>
<td>93.82</td>
<td>8350.00</td>
<td></td>
</tr>
</tbody>
</table>

**significant at 0.05 level of significance

The results showed that there was a significant relationship between gender and access to university facilities \((Z=-2.08, \ p=0.037)\) with men having better access than female. Once enrolled in universities, female students encounter more difficulties than males in other ways such as inadequate accommodation, poor sanitary facilities, inadequate security and sexual harassment. Moreover, inadequate funding to pay for tuition fees and subsistence has meant that women devise survival tactics which may not be acceptable to society. Some students have turned to prostitution or to relationships with men who are working, to meet their day-to-day needs. These relationships make them vulnerable to HIV and AIDS infections. Society is quick to condemn their behaviour without understanding the root cause of their problems. All these features indicate that universities do not have a conducive atmosphere for women students (Onsongo, 2007). Again, majority of
respondents are in consensus that access to facilities is not the same for both genders. Society has a general belief that sciences are male subjects.

For a long time, particularly in Africa, Sciences have been perceived as male subjects. Analysis of satisfaction level with laboratory equipment was made. It was found that public universities did not have up-to-date laboratory and workshop equipment as the satisfaction level was 79.167% and 34.70% for private and public universities respectively. The interpretation was that public universities did not have satisfactory laboratory and workshop equipment for effective teaching and learning. (Gudo et al., 2011).

When it comes to sexual harassment by Male counterparts at universities P value of .103 is not significant which does affirming the general belief that females are sexually harassed by their colleagues and lecturers. Lecturers analysis showed that 26.846% and 27.692% of students in public and private universities respectively used sex to obtain undeserved grades and that sex was a more popular tool in the hands of students than money to influence the grades obtained (Gudo et al., 2011).

On isolation of men and women pursuing SMT programmes P Value of 0.6 was not significant and this means majority of respondents suggest that for women to improve in performance and enrolments, then they need not be separated from male counterparts. There is only one Women University known as Kiriri which is private. No public university is single sexed. Though women reside in separate hostels, they use same
facilities for learning. This may be impractical given that the women are being prepared for outside world where it would be impossible to live in isolation.

On scarcity of facilities in university laboratories, P value (0.935) is not significant which imply that there was a general agreement that there is scarcity for SMTs facilities in University Laboratories. Because of the popularity of self-sponsored programmes, the growth of student numbers is not commensurate with provision of facilities. Again science facilities are expensive and any purchase would probably reduce the income to the universities. Consequently, the science students have continued to suffer as they share meagre resources. Women continue to be disadvantaged as they can only spend limited time in the laboratories

On biasness the p value is .001 and this is significant meaning the perception of male lecturers towards female students is equally the same with the female students. Though male lecturers have been accused of sexually harassing the young female students, in academic matters they have not been biased and any poor performance is possible because of other factors.

On learning atmosphere the P value is .792 and this is statically insignificant. This means learning atmosphere for female students is equally the same with their male counterparts. According to Nawe, (2005) laws and regulations in universities appear fair but there are salient features that need deeper consideration when dealing with questions of equity. Women because of their reproductive role may be unable to take advantage of opportunities that only come their way once in a while. Again, now that students are
housed in places at times many kilometers away it makes women more disadvantaged as they leave the resource facilities early for fear of attacks.

4.5 Comparison of Rate of Flow of Men and Women in Selected SMTs Programmes in Kenyan Universities

The purpose of this section was to establish whether rate of flow of men and women in selected science, mathematics and technology programmes in Kenyan universities is the same which was third objective. Respondents were asked to give information relating transition from one academic to the other. Total numbers of students in first year nominal rolls for particular cohorts were compared with respective terminal data as reflected in graduation booklets.

Responses were summarized and subjected to analysis using calculation of percentages of either gender from which bar graphs were produced. The researcher also used the Wilcoxon – Mann – Whitney Test since the three variables were not normally distributed. This test is a non-parametric analog to the independent t-test and is used when one does not assume that the dependent variable is a normally distributed interval variable (one only assume that the variable has at least ordinal). Findings were presented in Tables 4.26, 4.27, 4.28, 4.29 and figures 19, 20 and 21.

On Transition, the results showed that both gender were equally likely to repeat ($\chi^2=2.9$, $p=0.09$). Women are naturally disadvantaged a lot because of their morphology which significantly affects their transition rate. Unlike in lower levels of education, women do equally well as men. This is an important observation as it dispels the societal
misconception that women cannot do well in SMTs. Therefore, more work needs to be done at primary and secondary schools to increase the number of students joining the universities.

Transition rate from one academic year to the other is very similar according to lecturers as shown table 4.25 below.

Table 4.25: Perceptions of Lecturers on Women’s Transition

<table>
<thead>
<tr>
<th>Perception</th>
<th>Lecturer</th>
<th>Donor</th>
<th>UN</th>
<th>Abstract A</th>
</tr>
</thead>
<tbody>
<tr>
<td>A higher percentage of women than men repeat academic years</td>
<td>30%</td>
<td>60%</td>
<td>10%</td>
<td></td>
</tr>
<tr>
<td>Transition of women from one year to another is smoother than that of men</td>
<td>20%</td>
<td>40%</td>
<td>30%</td>
<td>10%</td>
</tr>
<tr>
<td>Graduation rate of men is higher than that of women</td>
<td>30%</td>
<td>20%</td>
<td>30%</td>
<td>20%</td>
</tr>
</tbody>
</table>

90 per cent of respondents disagree with the statement that a higher percentage of women than men repeat academic years. 60 per cent of lecturers believe that transition of women from one academic year to the other is independent of gender. Finally all respondents believe that graduation rate of either gender is the same. Table 4.27 indicates that 95.6 per cent of females as compared to 89 per cent of males have never repeated any year of study.
Table 4.26: Repetition rates of male and female

<table>
<thead>
<tr>
<th>Gender</th>
<th>Have you ever repeated any year of study</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Male</td>
<td>Count</td>
<td>11</td>
</tr>
<tr>
<td></td>
<td>% within Gender</td>
<td>11.0%</td>
</tr>
<tr>
<td>Female</td>
<td>Count</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>% within Gender</td>
<td>4.4%</td>
</tr>
<tr>
<td>Total</td>
<td>Count</td>
<td>15</td>
</tr>
<tr>
<td></td>
<td>% within Gender</td>
<td>7.9%</td>
</tr>
</tbody>
</table>

4.5.2 Students with Examinations Re-sits

Students who do not score minimum marks in particular examinations are required to have re-sits for them to be considered to have passed. This can therefore be another good indicator of performance of men and women in SMTs. 89 per cent of males have never repeated academic years as compared to 95.6 per cent of females as shown in Table 4.27.

Table 4.27: Percentages of Students by Gender Sitting for Re-sits Examinations

<table>
<thead>
<tr>
<th>Gender</th>
<th>Have you ever sat for supplementary exam</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Male</td>
<td>Count</td>
<td>17</td>
</tr>
<tr>
<td></td>
<td>% within Gender</td>
<td>17.2%</td>
</tr>
<tr>
<td>Female</td>
<td>Count</td>
<td>24</td>
</tr>
<tr>
<td></td>
<td>% within Gender</td>
<td>27.0%</td>
</tr>
<tr>
<td>Total</td>
<td>Count</td>
<td>41</td>
</tr>
<tr>
<td></td>
<td>% within Gender</td>
<td>21.8%</td>
</tr>
</tbody>
</table>
On sitting for the supplementary exam, the results showed that both boys and girls were equally likely to sit for the supplementary exams ($\chi^2=2.6, p=0.103$). Though females in lower levels are more exposed to risk of failing examinations because of household chores and failure to access sanitary pads, this is not a problem at university level. On the problem experienced in the learning from students colleagues, the results showed that there was no significant relationship with gender ($\chi^2=1.9, p=0.166$). This means the problems that students might experience have no relationship with gender.

**Table 4.28: Interference from Either Gender**

<table>
<thead>
<tr>
<th>Gender</th>
<th>What form of problem do you experience in your learning from students colleagues of other gender</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Dominance in use of Contempt facilities</td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>Count</td>
<td>27</td>
</tr>
<tr>
<td></td>
<td>% within</td>
<td>51.9%</td>
</tr>
<tr>
<td></td>
<td>Gender</td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>Count</td>
<td>29</td>
</tr>
<tr>
<td></td>
<td>% within</td>
<td>65.9%</td>
</tr>
<tr>
<td></td>
<td>Gender</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>Count</td>
<td>56</td>
</tr>
<tr>
<td></td>
<td>% within</td>
<td>58.3%</td>
</tr>
</tbody>
</table>

At primary that there is no significance difference between performance of men and women at university level and secondary school levels, mixing males and females affects either gender but at university level, this has no correlation perhaps because of level of
maturity. Women because of their reproductive role may be unable to take advantage of opportunities that only come their way once in a while. While reproduction is a human essential, a woman’s inability to take up opportunities at particular times is often seen as her own fault. The percentages do not give a clear consensus on who among men and women has a higher rate of graduation. This is a confirmation of an earlier assertion.

The following are the analysis trends for the admission and graduation data for the science oriented courses in some selected universities in Kenya as shown in figures 19, 20 and 21. According to Republic of Kenya (2012) Engineers Registration Board statistics, there were 277 registered consulting engineering, only five (1.8 %) are women. Of 1,341 registered engineers, only 43 are women. Of 5,387 registered graduate engineers, only 413 (7.7 %) are females, while of 1,145 graduate technicians only 17 are women.

![Figure 19: Engineering in University of Nairobi](image)

Based on the above figure 4.25, the results show that in 2005, 2006 and 2009, there were more male graduates than the females admitted to pursue an engineering course at the
University of Nairobi. However, in 2007 and 2008, there were more males who graduated than those who were admitted to pursue the same. Nevertheless, the results of the study showed that in any year, there were more males admitted to pursue the Engineering course than females. In addition, in the results showed that there was no statistical difference between the average number of males admitted to pursue an engineering course with the average number of males who graduated with the same ($t=1.709, 0.16$). However, the results showed that there was a statistical difference between the average number of females who were admitted and those who graduated ($t=-3.81, p=0.01$). The negative sign means that the average number of females admitted to pursue an engineering course was more than those who graduated at the University of Nairobi.

The results show below in figure 20 indicate that there were more graduates in any given year than the number of students admitted to pursue a degree in medicine. This is because data on those admitted on self sponsored programme was not availed.

![Figure 20: UoN medicine admission and graduation rates by gender](image-url)
Further, the results show that there was more men pursuing the medicine course when compared with their female counterparts. However, the difference was minimal as demonstrated by the graph above. Nevertheless, the results of the survey showed that there was no significant difference between the average number of men who were admitted and those who were graduating with a degree in medicine at the UoN ($t=2.239$, $p=0.075$). However, according to the results, there was a significant difference in the average number of females admitted and those who graduated where those who were admitted being more than those who graduated ($t=-3.668$, $p=0.02$). This is attributed to the fact that data on privately sponsored programmes were not availed.

According to the above figure 21 below, in both years, there were more male admitted to the Engineering Department than were the female. In addition, there were also a higher number of males who graduated from the same course when compared with their female counterparts.
The results of the survey also showed that there was no significant difference between the average number of males who were admitted to pursue the engineering course and those who graduated from the same course \((t=9.66, p=0.066)\). However, the results showed that there was a significant difference between the average number of girls admitted to pursue the engineering course and those who graduated in the same course where those who graduated were less than the average number of those who were admitted \((t=81, p=0.000)\).

The following table 4.30 shows analysed results of students' perceptions on transition from one academic year to the next.
Table 4.29: Students’ Perceptions on Transition.

<table>
<thead>
<tr>
<th>Gender</th>
<th>N</th>
<th>Mean</th>
<th>Sum of Ranks</th>
<th>Z</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lowering of university admission</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>99</td>
<td>77.48</td>
<td>7671.00</td>
<td>-4.731**</td>
<td>0.000</td>
</tr>
<tr>
<td>Female</td>
<td>90</td>
<td>114.27</td>
<td>10264.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>In secondary school girls are not properly inducted on performance of sciences</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>98</td>
<td>88.67</td>
<td>8690.00</td>
<td>-1.576</td>
<td>0.115</td>
</tr>
<tr>
<td>Female</td>
<td>90</td>
<td>100.84</td>
<td>9076.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Repetition rate for women is higher than that of men</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>94</td>
<td>94.90</td>
<td>8921.00</td>
<td>-1.381</td>
<td>0.167</td>
</tr>
<tr>
<td>Female</td>
<td>85</td>
<td>84.58</td>
<td>7189.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Transition rate for men is smoother than of women</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>82</td>
<td>81.74</td>
<td>6702.50</td>
<td>-0.362</td>
<td>0.718</td>
</tr>
<tr>
<td>Female</td>
<td>78</td>
<td>79.20</td>
<td>6177.50</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**significant at 0.05 level of significance

On whether university admission points for girls should be lowered by one point, P value is significant, meaning majority of respondents feel that by lowering university admission points by one unit is not adequate. Despite the affirmative action by government where women are admitted with point lower than their male counterparts have not helped increase student numbers significantly. According to republic of Kenya 2011, the total enrolment in all universities grew by 1.8 per cent from 177,735 students in 2009/10 academic year to 180,978 students in 2010/2011 academic year. The total enrolment in the public universities dropped by 0.4 percent from 89,611 in 2009/2010 to 89,257 in 2010/11 academic years. During the same period, the total female enrolment increased by 1.8 per cent from 52,945 to 53,873 student.

On comparison of repetition rate for women and men, P value of 0.167 is not significant and it indicates that repletion rate of men is equally the same with that of women.
Failures to obtain minimum mark, indiscipline, sickness or even pregnancy are some of major factors that make students repeat academic years. It means women have higher chances of repeating than their male counterparts.

On comparison of Progression P Value of 0.718 is not significant meaning majority of respondents feel that transition in Kenyan universities for women is equally the same with transition rate for men. Enrolments at secondary and tertiary education levels have converged across genders in many countries, although significant gaps remain in some regions. The exception is Sub-Saharan Africa where more boys gained secondary school access relative to girls between 1999 and 2008, worsening gender disparities in this period. During the last decade, tertiary education enrollments surged in all regions of the world. On average, we now observe a gender gap favouring females. Female tertiary enrollment rates in 2008 lagged behind in 36 countries (out of the 121 with available data), but exceeded males in 79 countries. Across regions, MENA, and to a lesser extent South Asia, experienced the greatest relative growth in female tertiary student enrolments (World Bank, 2012).

Despite the many natural disadvantages associated with women and which are likely to affect their smooth transition, 60 per cent of respondents disagree with the statement affirming an earlier assertion that unlike in lower levels in education, women can do equally well as men if not better at university level. Women are still able to overcome the many challenges that befall them.
CHAPTER FIVE

SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.1 INTRODUCTION
This chapter primarily concerns itself with summarizing major findings from the discussions and conclusions made in chapter four and making recommendations where possible.

5.2 SUMMARY
The study has established women just like their male counterparts, are part of the essential human resource base of each country that contributes to its competitiveness and sustainable development. Keeping them away only by unfair reasons of gender is indeed a waste of this valuable resource, as stressed by De Mcpherson (1999). Consequently, adds the World Economic Forum (2010), they must be treated equally with the same opportunities as men, if a country wants to grow and prosper faster. The latter confirms why UNESCO (1998a) highlights that the entire gender issue has gained worldwide attention as a crucial component in the development process. Education constitutes one important sector that deserves special attention when tackling these obstacles and challenges. It has helped in reducing the gap and is empowering women to take their full place in the world of the 21st century, where multiple internationally agreed development goals should be reached with their help.

There has been unprecedented raise in number of charted universities in Kenya, towards the end of president Kibaki’s tenure. In year 2013 alone, the president has elevated 15 public to full universities bringing the total to 22 in the country. This includes
Multimedia University, University of Kabianga, Karatina University and Meru University of Science and Technology and two private universities, namely; Kenya College of Accountancy and Adventist University of Africa. The universities Act, 2012 revoked the former charters of the older universities of Nairobi, Moi, Kenyatta, Maseno, Maside Murilo, Egerton and Jomo Kenyatta.

Moi, Kenyatta, Jomo Kenyatta and Nairobi seem to be the only universities with fully fledged facilities to comfortably handle SMTs programmes. Other public universities require lots of financial support from government and donors to accommodate the many students who intend to pursue courses such as engineering and medicine. Private universities such as Mt Kenya and Catholic are still in their formative stages of establishing any meaningful SMT programme particularly at degree level.

Adequate qualified personnel remain the number one factor that hinder the full rolling out of SMT programmes besides the expensive equipment in both public and private universities. These are Capital-intensive courses demanding heavy investment. As they are time-demanding, expensive to set up and require qualified personnel who are often in short supply and who can demand high salaries, private universities have avoided mounting those programmes.

Engineering courses remain preserve of the males in all public universities but the number of students pursuing medicine is predominantly women. Medicine is the science and art of diagnosing, treating, and preventing disease and injury. Its goals are to help people live longer, happier, more active lives with less suffering and disability. Self
sponsored programmes have helped many women join their perceived dream careers of medicine. This is a welcome development as for a long time Kenya has suffered deficit of doctors. With opening of the opportunities in the universities, the existing clinical officers have also enrolled for the course to advance their career. Aga Khan University only offers post graduates training to a few selected students.

All public universities were not able to provide data on admission for the self-sponsored programmes and subsequently graduation lists reflect more students than those admitted. Most universities could only provide more signed nominal roles by students admitted through the then Joint Admissions Board. Lately registration for most public universities has gone online and this is likely to improve on management of data.

Detailed information on performance of men and women was impossible with Vice chancellors citing confidentiality. The research ended by conducting only summative as opposed to formative evaluation. It thus becomes difficult to make conclusion on how both genders perform as they go through the university cycle. The bureaucracy of getting a permit from vice chancellors to conduct research in their respective universities is tedious, costly and time-consuming and the artificial walls surrounding these offices must be demolished. This responsibility could also be delegated to a more junior staff that is more accessible.

However the data obtained showed that there is no statistically significant difference between the underlying distribution of the grades obtained in KCSE of males and the grade obtained in KCSE of female (Z=-0.427, p=0.0669). Since p=0.0669 and α=0.05
then $a > p$ and thus we do not reject the hypothesis that the performance of the two groups is the same. In Engineering the overall performance of females was found to be higher than that of their males counterparts with the difference being significant at 5% level of significance ($\chi^2=29.21$, $p=0.000$). Further, the difference between the performance of males and females was found to be significant at 5% level of significance ($\chi^2=18.32$, $p=0.001$) meaning females performed better than their male counterparts. This is attributed to the very small number of female students in Engineering compared to men.

Majority of students at the university are those that have gone through the Kenya’s education system as their ages range from 21 to 24. The overage students are those that might have worked for a few years after going through middle level colleges before coming to universities to sharpen their skills and at least get a degree.

It is also very clear that in lower levels of education tier boys outdo girls in SMTs in terms of performance. However, at university level, women and men perform equally well if not better. This is a proof that there is no correlation between gender and performance at university level. Perhaps the girls are able to overcome this stigma as they mature to adulthood, a clear proof that with proper support girls could even beat boys at primary and tertiary institutions.

On quality of degrees, women were found to perform better than men. Women scored highly in first class honours degree and second upper but men dominated second lower and pass. This is an important discovery as it helps to dispel misconception that women can never perform better than men in SMTs. The greatest challenge now remains of
ensuring that both males and females girls should be encouraged to pursue the SMTs subjects.

There is no correlation between degree selected and gender. But for numbers men or women are equally likely to select any of the SMT programmes. This is important information for those in lower levels particularly those in Form two as the class forms the transition period in choice of subjects to be taken in form three and ultimately determine the career choices to be pursued in the universities.

As male enrolment continues to drop in SMTs female numbers continues to steadily rise. Overall the number of candidates who qualified for university admission has continued to go up since establishment of 8 4 4 system of education in 1985. In 2011 for example, the candidates who scored the threshold grade of C+ for university entry were 119,658 out of which only 41,879 were selected under the government sponsored regular programmes, (KNEC, 2012).

Female lecturers continue to be scarce in SMT programmes. Some departments like engineering don’t even have a single female lecturer. Professionals of this level are the much talked about role models and their scarcity only helps to make matters worse. This subsequently only helps to perpetuate the stereotype that such courses are reserved for men.

The results showed that there was a significant relationship between gender and access to university facilities (Z=-2.08, p=0.037) with men having better access than female. Once
enrolled in universities, female students encounter more difficulties than males in other ways such as inadequate accommodation, poor sanitary facilities, inadequate security and sexual harassment. We therefore reject the hypothesis that access to facilities of male and female students is the same. Sexual harassment by lecturers and fellow students continues to be a major factor affecting women students at the universities. This inhibits adequate access to university facilities by female students by making them leave earlier than they have otherwise done. Coupled with this factor is the insecurity as the facilities are located in far away place from halls of residence and the pavements or streets leading to them are dimly or not lit at all. It means access to facilities is not at the same rate with male counterparts. However, there is no other cited interference. Universities' facilities were also found to be inadequate. P value (0.935) is not significant which imply that there was a general agreement that there is scarcity for SMTs facilities in University Laboratories.

Contrary to general misconception that transition of women is not at same rate as men, the study has shown that the difference is insignificant. There is very little effect by those who may become pregnant in due course of their studies perhaps because they are very few in SMT programmes. Rate of transition is a very effective way of comparing performance of either gender. When it's low, it means all is not well in course of the studies.

Affirmative action of lowering university admission grade by one point has helped to increase female student numbers. Interventions of this nature are the only long term solutions to problem of gender disparity. In SMT programmes, it would be prudent to
lower the admission grade by a further one point given the wide gap between performance of boys and girls.

Besides affirmative action special scholarship programmes for women should be established if as a country we are to ever close the gender gap. But for FAWE that give slimited scholarship to girls who may want to pursue law, women compete equitably for few scholarships available. Starting special scholarships in SMTS targeting women only would play a significant role in closing the gender gap particularly now that all government departments are required to ensure two thirds of employees are of either gender.

The study has established that there is no correlation between gender and preference of SMT programmes at university level. Again, performance of SMTs has no relation with gender. Indeed, the study has shown that women lecturers are as good as men in content delivery. The misconception in society is that SMTs are preserve for men and women who dare plunge into murky waters of masculine subjects are perceived as abnormal. Teachers and administrators need to aggressively be involved in gender sensitization and portray a shift from traditional perceptions about the roles of girls and women in national development.

Majority of respondents felt that for effective gender balance in SMTs, then women and Men need to learn separately at university level. But this would not reflect the reality in society where men and women cannot be separated in tasks of national building. Perhaps there is need to borrow a leaf from Moi High Kabarak where boys and girls still mingle

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in class and the school still emerged to be the best national in KCSE in the year 2012, with a performance index of 78.859 (KNEC, 2013).

In both private and public universities facilities, in SMTs are shared due to scarcity and increase in student numbers. Establishment of self-sponsored programmes popularly known as module II has aggravated the problem. In such circumstances, women are the worst hit as they have less time to spend in the facilities. Universities need to put more facilities, buy more equipment and continuously monitor the ballooning needs of the students.

Lecturers sampled majority of whom are men have less than 5 years experience meaning that the rate of turnover is very high. Universities need to ensure lecturers are well-motivated to capitalize on cumulative work experience on their members of staff. The situation is even worse in private universities where only senior staffs are permanent employees. The temporally ones are fresh post-graduates with minimum or no experience thus compromising the standards of the academics. The university also lacks the policy on professional development. The commission for higher education should ensure its statutes are adhered to.

On sitting for the supplementary exam, the results showed that both boys and girls were equally likely to sit for the supplementary exams ($\chi^2=2.6$, $p=0.103$). On Transition, the results showed that both gender were equally likely to repeat ($\chi^2=2.9$, $p=0.09$). The results of the survey showed that there was no significant difference between the average number of men who were admitted and those who were graduating with a degree in
medicine at the UoN \( t=2.239, \ p=0.075 \). We therefore do not reject the hypothesis that transition of both female and male students is the same.

Finally but by no means least, women are more careful in handling facilities and do equally well as men in the job market. Through alumni associations, universities are able to keep abreast with how their graduates are fairing in utilizing skills learnt in serving mankind. To achieve vision 2030, government needs to capitalize on this factor so that one half of the population is not left out.

UNESCO (2012) report has identified two regions in which the HE system persists to be unfair to women, showing still great disparity in disadvantage for them. These are: South and West Asia and in Sub-Saharan Africa. Higher levels of education are generally associated with better social-economic outcomes at the individual level and, ultimately, with increased economic growth at the aggregate level. However, the benefits of public investments in education do not always accrue equally to different groups of the population, including men and women. For instance, the construction of new schools in underserved areas could have a differential impact on enrolment rates among boys and girls if the two groups face different constraints to schooling (e.g. girls cannot travel unaccompanied, while boys can) or different opportunities in the labour market (e.g. boys have access to profitable employment opportunities more frequently and/or at an earlier age than girls). In this context, measures intended to make it easier and safer for girls to go to school or that provide incentives for boys to remain in school as they approach working age would fall under the first type of policies discussed above—that is, policies
that aim at levelling the playing field so as to enhance the equalizing potential of economic growth. (World Bank, 2012).

If current trend of gender disparities in SMTs at university level is not addressed, then it will be hard to achieve vision 2030. The current constitutional requirement of recruiting at least a third of either gender may not work in technological sectors of the economy because qualified women do not in the first place exist. This is because government is only concentrating on expansion and award of charters to universities, something that is not commensurate with availability of facilities particularly in SMTs.

Sharing of facilities does not only affect women hands-on experience but has an overall effect of affecting quality of graduates. Since ancient times, apprenticeship has been used as a very effective method of inculcating skills in trainees. When facilities are few, it means students will not acquire skills of the world of work.

Since gender gap in faculty of medicine is being closed, the government should capitalize on gains made. Perhaps out of the traditional belief that women ultimately become nursing mothers, there has been misconception that medical world is a preserve of women. All along women have mainly worked as nurses by either taking care of patients in hospital wards or being assistants to doctors in theatre rooms. There has been a turnaround and women want to be in driver's seat.

Dominance of male lecturers in SMTs mystifies the subjects and this helps to kill any future hope of other females joining. The staff of universities particularly the lecturers is
groomed by those already there as soon as they join first year. This is a deliberate effort and has over the years help on staff development. A policy needs to be put in place so that such grooming also captures women students.

If only it was possible to bring all girls to university, they would be sustained. The fact that girls are equally good in terms of performance at the university level means gender gap can be crossed in SMTs related professions. A lot then needs to be done from early childhood education, through primary to secondary school level to significantly improve the number of girls transiting to university. This includes exposure to girls through educational trips, invitation of role models and assigning all students' scientific projects that would nature the intrinsic innovative talents.

5.3 CONCLUSION
In a globalised world there are no opportunities set aside for a particular gender. Dramatic increases in the educational attainment of females underlie the fundamental changes that have taken place in the global talent pool. Indeed, in most industrial countries, women now are attaining university degrees at a higher rate than men. This trend reverses the pattern of two generations ago, when educational attainment was considerably higher among males. In the United States, for instance, 32 per cent of men ages 55–64 years—the cohort that was of school age two generations ago—have university degrees, compared with 27 percent of women. In contrast, today 25 percent of American men ages 25–34 years—people who went to school in recent years—have university degrees, while 33 percent of women in that same age group do. And in Japan, where male educational attainment still outstrips that of women, the gap has narrowed.
Two generations ago, 22 percent of Japanese men and 5 percent of Japanese women had university degrees; today the rates are 35 and 21 percent, respectively (OECD, 2007).

The overall literacy rate for Kenya is 76.8 per cent, with literacy rates among males amounting to 82.5 per cent and those of females reaching only 71.2 per cent (RoK, 2008). The rural literacy rates for both males and females are much lower than urban rates. For rural areas, the overall literacy rate is 72 per cent; for males it is 78.6 per cent and for females it is 65.4 per cent. The overall literacy rate in urban areas is 87.7 per cent, with the rate among males estimated at 91.0 per cent and among females at 84.4 per cent. The lower levels of literacy are reflected in the lower skill level of most women and consequently the lower capacity of women to participate in employment.

It's only Nairobi, Moi, Jomo Kenyatta and lately Kenyatta that can pride themselves as being fully equipped to handle Major SMTs programmes such as medicine and Engineering. Of course Nairobi being the pioneer university can handle all courses but for congestion following the influx of self-sponsored students. All the other universities particularly the ones being awarded charter later need a compressive policy on how they are to fund the purchase of SMTs equipment and facilities.

Performance has no relation with gender because both men and women can do equally well. As stated earlier, there has been a misconstrued perception that women can never do better than men in SMTs subjects. This study has since established to the contrary that if someone fails to score high marks, then that must be attributed to other factors but not gender.
The gender gap in medicine is closing but engineering remains a preserve of men. Moi and Nairobi universities are the only institutions of higher learning that are fully equipped to handle bachelor of medicine. This includes referral hospitals. Data available at university of Nairobi indicate that medicine has become a preferred career for women. This is an important observation as experts must now concentrate on engineering.

Agha Khan University should consider starting undergraduate programmes as they are fully equipped. Africa suffers from deficit of doctors and brain drain. It is not enough to increase the knowledge of already trained and existing doctors. Selecting students straight from secondary schools and giving them specialized training right from undergraduate would surely go a long way in improving quality of graduates in medicine.

More equipment should be bought. Adequate provisions of necessary equipment and facilities would help reduce scrambling of their use which often affects women more than men. Most universities, both private and public, cannot cope with the sudden increased social demand for higher education. More funds need to be set aside to upgrade and update the existing infrastructure.

Today, Kenya Government is pursuing Vision 2030. Kenya Vision 2030 is the country's new development blueprint covering the period 2008 to 2030. It aims to transform Kenya into a newly industrializing, "middle-income country providing a high quality life to all its citizens by the year 2030" (Republic of Kenya, 2006a).
Women just require encouragement from childhood and they can do equally well. Critical work has been undertaken at the ministerial levels, but this is not reflected in the strategies *Vision 2030* proposed for this subsector. While such proposed measures as increasing financial support to poor students, improving quality, and increasing spaces for admission to secondary and university levels will likely benefit disadvantaged students, there is a need to link these initiatives explicitly to the disparities that exist by sex. In the immediate to medium term, the sub-sector should target female students from poor families across all regions so as to increase enrolment, retention and completion (post-primary and post-secondary), and transition. The distribution of financial assistance should be aimed at narrowing the gender gap, and intra- and inter-regional targets should be set for the medium to longer term.

Policy makers also need to work with communities to tackle the issue of girls’ multiple gender roles. The responsibility that girls have (especially those living in the rural areas) relative to their male counterparts leaves them with less time to dedicate to their educational performance. This has contributed to their lower performance and it needs to be addressed as part of overall efforts to improve girls educational achievement (UNICEF, 2007).

5.4 RECOMMENDATIONS
Universities are established to meet specific objectives. In the event that these objectives are not met, then they cannot justify huge public expenditure on them. The researcher gives the following recommendations to improve participation and performance of women in SMTs.
First government should set aside lots of capital to equip the SMTs facilities at all the universities. Second, more private universities-private sector partnerships should be encouraged to facilitate training of students. This can be done by allowing private universities to share the already existing public infrastructure such as hospitals and workshops.

Third, lecturers should be motivated to minimize turnover and brain drain. This will not only ensure quality of staff but reduce wastage of resources. Forth, private universities should employ their own lecturers to avoid over reliance on part-time ones. They increase cost of labour sustainability but create confidence among clients. Fifth performance data for ongoing students should be disclosed as too much secrecy only helps perpetuate suspicion.

Sixth, to qualify for Masters Degree, women can be admitted with less points for masters degree and subsequent Ph.Ds. This is already happening at undergraduate level and extending the affirmative action at higher levels would definitely increase number of women to emulate as role models. Universities can introduce initiatives that create a friendly environment friendly to women employees and students. They can also develop legal mechanisms for dealing with issues such as sexual harassment.

Facilities near women’s halls of residence should be provided so that women can access them at any time of their convenience like the male counterparts. Special scholarship programmes tailored to women should be provided. Lack of funding have hampered many girls from access higher education. Finally increase already existing infrastructure
so that both men and women need not share as one sex is likely to have advantage over the other.

There is need to work towards gender parity in the management of the education system, as this may be one way of transforming perceptions of the rights and abilities of females relative to males. There is also a need to improve female representation in education and training through recruitment practices, mentorship programmes and training schemes. Such efforts will encourage females in the education system to aspire to greater accomplishments; they will prompt communities to challenge existing stereotypes; and they can also result in the effective integration of gender-sensitive approaches into the education system.

Given the fact that there should be equal representation of both sexes at all levels, female applicants have to be given special and fair selection in relation to their male counterparts. This should be done especially in the sciences, mathematics, and technology-oriented subjects where gender disparities have often been observed (Chacha, 2004). Studies indicate that there is a higher number of female students than male students in private universities. This could be due to the existing gender imbalance in public universities in favour of male students, leading to more female students seeking university education at private universities. Female students in public universities comprise about 40% of the total number of students (Munavu et al., 2008).
5.5 FURTHER RESEARCH

There is need to carry out further research as this study was limited to SMTs programmes in the Kenyan universities. Studies need to be done to establish how well Kenyan universities are equipped to handle SMTs programmes. This is because employers are already concerned that graduates are not equipped to handle work challenges of 21st century. Second, it is important to establish workability of partnerships of between public facilities such as hospitals and private universities to speed up learning. There is no need of duplicating already existing facilities when they are available in nearby governments departments. Good examples are hospital morgues and public works garages. Third establish empirically and by use of demographic data how well women fair in the job market when compared with male counterparts. If serving lady CEOs is anything to go by then possibly women professionals make a turnaround in Kenya. Finally it is important to establish how women fair in humanities performance when compared with male counterparts. Dominant gender here are females but it would be interesting to know if they do equally well.
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APPENDICES

APPENDIX 1A: INTRODUCTION LETTER TO THE STUDENTS

JOHN KAMAU NJOROGE
KENYATTA UNIVERSITY
DEPARTMENT OF EDUCATION
MANAGEMENT, POLICY AND
CURRICULUM STUDIES
P.O. BOX 43844
NAIROBI

DATE

Dear Sir/Madam,

We are carrying out a study aimed at establishing how well, the few women who pursue Science Mathematics and Technology (SMT) in the Kenyan universities fair. Having taken cognizance of your endeavors, we request to complete the attached questionnaires, the purpose of which is to help us explore why majority of our women don’t pursue sciences.

Your positive participation will go a long way in improving performance of women in science and technology field.

Thank you.

JOHN KAMAU NJOROGE.
APPENDIX 1B: STUDENTS QUESTIONNAIRE

INSTRUCTIONS

Read the following instructions carefully before answering any question.

(i) This is not an exam.

(ii) The questions to be asked are about your school.

(iii) Do not write your name anywhere on this paper.

(iv) This paper has two sections ‘A’ and ‘B’

(v) Attempt all questions in both questions

(vi) Please be frank, specific and honest in your answers in that the information will be treated confidentially i.e known to researcher only

(vii) Your cooperation will be highly appreciated.

(viii) SMT is abbreviation for Science, Mathematics and Technology.

PART A: CONTEXTUAL AND PERSONAL DATA.

1. (a) Name of your University ..............................................................

   (b) Degree Programme ........................................... Faculty ..............

1. (a) Name of Secondary school attended ...........................................

   (b) Average Grade scored in K.C.S.E? ..............................................

2. Year of Study

3. Age □ □ Years

4. Gender.

   Male □ □
Female

5. Number of years expected to complete your degree programme.

4. Academic year of admission

6. Indicate number of times in a week you access the following facilities?
   - Laboratory
   - Resource centre
   - Library
   - Others (Specify)

7. Do you have equal access to university facilities with male/female colleagues?
   - Yes
   - No
   - I don't know

8. What percentage of your lecturers are female?
   (i) 0%
(ii) Below 50% 

(iii) Above 50% 

9. Do you leave any university resource earlier than you would have otherwise preferred for fear of sexual or any other form of harassment?

Yes [ ] No [ ] tick {✓}

9. Have you ever repeated any year of study?

Yes [ ] No [ ] tick {✓}

10. Have you ever sat for a supplementary exam? If so how many?

Yes [ ] No [ ] tick {✓}

11. What forms of problems do you experience in your learning from students colleagues of other gender?

- Dominance in use of facilities
- Contempt
- If others specify

12. Indicate the total number of respective grades scored in last academic year.

A [ ]
14. Do you think men and women are equally endowed to pursue science, mathematics and technology programmes? If so why?

PART B
In this section read each statement carefully then write at the end of it a letter corresponding to the statement, which indicates how you feel about the statement you need. The choices from which only one is taken for each statement are

SA: Strongly agree
A: Agree
U: Undecided
D: Disagree
SD: Strongly disagree

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<td>SD</td>
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<td>3. Society has a general belief that sciences are male subjects.</td>
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<td>4. Lowering of university admission points for girls by one point is not enough</td>
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<td>5. Special scholarship programmes for girls should be established</td>
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</table>
6. Sexual harassment by male counterparts is rampant at university

7. Women should be isolated from men when pursuing SMTs programmes

8. In secondary school girls are not properly inducted on importance of sciences.

9. SMTs facilities especially in university laboratories are too few and we always share.

10. Repetition rate for women is higher than that of men.

11. Transition rate for men is smoother than that of men.

12. Female lecturers are better in terms of content delivery than their male counterparts.

13. Male lecturers are biased towards female students when teaching.

14. Learning atmosphere for men in SMTs at university is more conducive than that of women.

15. Generally in your opinion do you think female students perform equally well when compared with their male counterparts in science, mathematics and technology programmes at university level?

If no give reasons for your answer.

______________________________________________________________________________
______________________________________________________________________________
______________________________________________________________________________

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Dear Sir/Madam,

We are pleased to acknowledge your efforts towards promoting the education of Kenyans. We are carrying out a study aimed at establishing how well, the few women who pursue Science Mathematics and Technology (SMT) in the Kenyan universities fair. Having taken cognizance of your endeavors, we request you plus a few of your students to complete the attached questionnaires, the purpose of which is to help us explore why majority of our women don’t pursue sciences.

Your positive participation will go a long way in improving performance of women in science and technology field.

Thank you.

JOHN KAMAU NJOROGE.
APPENDIX 2B: LECTURERS’ QUESTIONNAIRE

PART A: CONTEXTUAL AND PERSONAL DATA

Please provide answers to these questions. Be frank and honest in your response. Your response will be treated with utmost confidentiality.

1.(a) Name of your University

(a) Gender: Male □ Female □

(b) University teaching Experience

0-5 □ 6-10 □ 11-20 □ Above 20 years □

(d) FACULTY □

2. Student population (This section is to be filled with assistance of admissions/graduation office) Please indicate the number of students who have been admitted and graduated in a particular cohort.

<table>
<thead>
<tr>
<th>YEAR OF GRADUATION</th>
<th>YEAR OF ADMISSION</th>
<th>GENDER</th>
<th>NUMBER ADMITTED</th>
<th>NUMBER GRADUATED</th>
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</table>
(iv) QUALITY OF DEGREES
This section is to be filled with assistance of graduation office and gives quality and number of degrees of men and women.

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<th>Gender</th>
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4. Please indicate the graduation rates of men and women in last academic year.
(i) Male %

5. What is the total annual fee for the degree programme in your department.

4. Number of years expected to complete degree programme in your faculty

5. How would you rate women as compared to men as your students in your faculty?
   Equally good
   Poor
   Slower in grasping concepts
6. Are women students given any form of special treatment in your faculty?

Yes [ ]

No [ ]

7. How do the female graduates fare in the job market in comparison to men.

- Very well [ ]
- Well [ ]
- Badly [ ]
- Very badly [ ]

8. Do women students break for maternity leaves in due course of their study?

Yes [ ]  No [ ]

PART B

In this section read each statement carefully, and then write at the end of it a letter corresponding to the statement, which indicates how you feel about the statement you read. The choices from which only one is taken for each statement are:

- SA: Strongly agree
- A: Agree
- U: Undecided
- D: Disagree
- SD: Strongly disagree
<table>
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<th>STATEMENTS</th>
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<td>1. Access to facilities to women students is fair</td>
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<td>2. Grasping of concepts of both men and women is the same.</td>
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<td>3. Performance in exams does not depend on gender</td>
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<td>4. Men are more innovative in experiments than women</td>
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<td>5. When teaching higher percentage of men than women ask questions</td>
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<td>6. A higher percentage of women than women repeat academic years</td>
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<td>7. On average women perform better than men</td>
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<td>8. Transition of women from one year to another is smoother than that of men</td>
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<td>9. Women are more careful than men in handling university facilities</td>
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<td>10. Graduation rate of men is higher than that of women.</td>
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11 (a) Generally, in your opinion how does performance of women compare to that of men?

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THIS IS TO CERTIFY THAT:

Prof./Dr./Mr./Mrs./Miss/Institution
John Njoro Kana
of (Address) Kenyatta University
P.O. Box 43844, Nairobi

has been permitted to conduct research in

Location
All

District
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Province

on the topic: An analysis of performance of women in science, mathematics and Technology programme in Kenyan Universities.

for a period ending 30th August 2012

Date of issue 15th August 2010
Fee received KES 1,000

Applicant's Signature

Secretary National Council for Science and Technology