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University Students Speak Out: A Comparative Study on Performance by Gender in Selected Science and Technology Programmes in Kenyan Universities

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Abstract: 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 aims to ensure gender equity in power and resource distribution and increase participation of women in all economic, social and political decision making process. Further more education may also contribute to raising the quality of the labour force and hence increased productivity within a lifespan. The purpose of the study was to carry out an in-depth analysis on performance of women with that of men in relation to equity to University learning resources. Second to examine alternative strategic plans for enhance university student performance in science, mathematics and technology programmes. 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 research design used in this study is ex post facto. The study was carried out in 3 Kenyan public and 3 private universities. Chi-square statistical test was used to establish relationships and variable traits while themes were derived from narrative data. The findings of this study revealed 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.

Keywords: University, Comparative Gender, Science & Technology

INTRODUCTION

There is a strong consensus among economists that formal education is an important determinant of individual earnings as well as National economic growth. Economists have been interested in economic growth since Adam Smith made his inquiry into the wealth of a Nations [1]. 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 [2-5].

The contribution of education to economic growth is presumed to occur through its ability to increase the productivity of an existing labour force 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 labour force (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:

$$dA = \frac{1}{A}\frac{dQ}{EQA}\frac{}{Q} \frac{EQk}{EQA}\frac{dK}{K} \frac{EQL}{EQA}\frac{dL}{L}$$

Where $_{E}$ = elasticity.

According to Mokyr [6], 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 [20] 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 [7], people gain value in the job market by increasing their skills and abilities or human capital.

Denison, [5] 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 [8], 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 [9]. Nevertheless, a myriad of factors can make attendance more difficult for girls and, particularly in the poorest countries, their education is still largely ignored [10]. 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) [11]**.**

Table-1: Returns to Education by Gender (percentage)

Educational Level	Men	Women
Primary	20.1	12.8
Secondary	13.9	18.4
Higher	11.0	10.8
Overall	8.7	9.8

Source: Psacharopoulos and Patrinos, [11]

Psacharopoulos [12] 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.

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. Kenyan education policy provides a framework for planning and implementation of gender responsive education as well as research and training at all levels. Similarly despite the many efforts by various institutions to mainstream gender equity to resources remains a pipe-dream. Yet few studies have been conducted in the area of gender and educational facilities [13]. 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 challenge as women's morphology poses myriad of problems making them not to compete at par with their male counterparts

OBJECTIVE OF THE STUDY

- To investigate performance of women with that of men in relation to equity to University learning resources.
- To examine alternative strategic plans to enhance university student performance in science, mathematics and technology programmes.

HYPOTHESIS OF THE STUDY

Ho1: There is no significant relationship between performance of men and women in science and technology programmes in Kenyan universities.

RESEARCH METHODOLOGY AND METHODS

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 [14] 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 [15], 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.

FINDINGS AND DISCUSSION

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 and age. Responses were summarized and subjected to descriptive and statistical analysis. Results were collated and presented in Figures 1, 2 and 3.

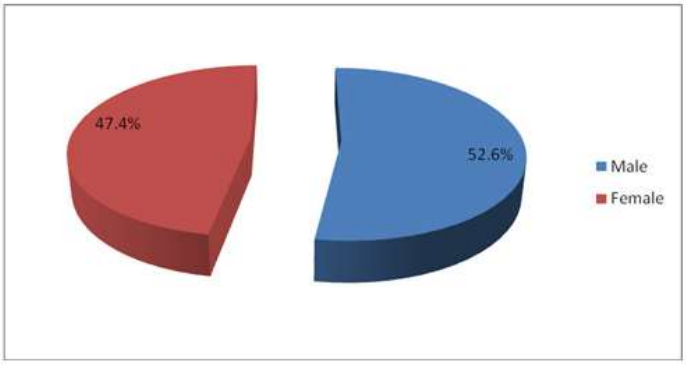

Fig-1: Percentage of either gender of students selected

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. 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 137,848 in 2014/2015 academic year. This is attributed to social demand for university education and limited places in public universities.

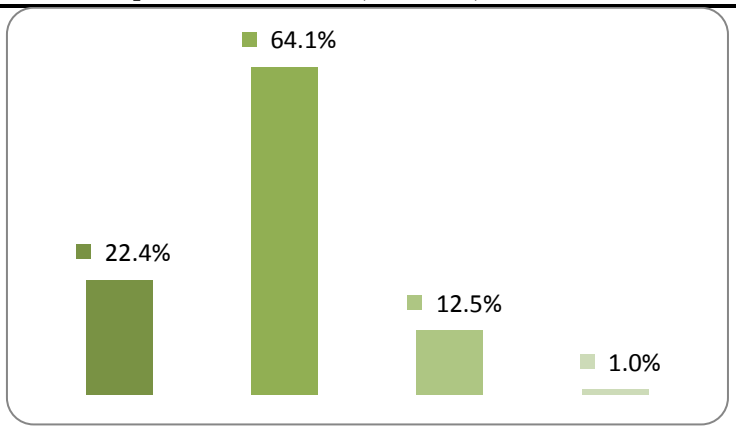

Fig-2: Percentage of students sampled taking selected courses

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.

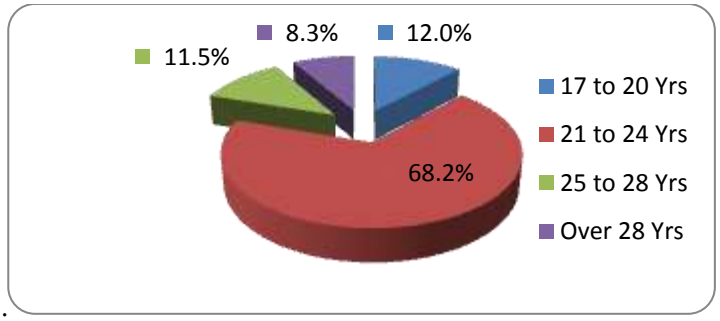

Fig-3: Ages of selected students

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 17-20years; 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.

Performance by Gender in Selected Science and Technology Programmes in Kenyan Universities

The first objective sought to investigate Performance of women with that of men in relation to equity to University learning resources. The second objective sought to examine alternative strategic plans to enhance university student performance in science, mathematics and technology programmes. The third objective was sought to test a hypothesis on relationship between performance of men and women in science and technology programmes in Kenyan universities. The findings are presented in figure 4, Table, 2, 3, 4, 5 and 6

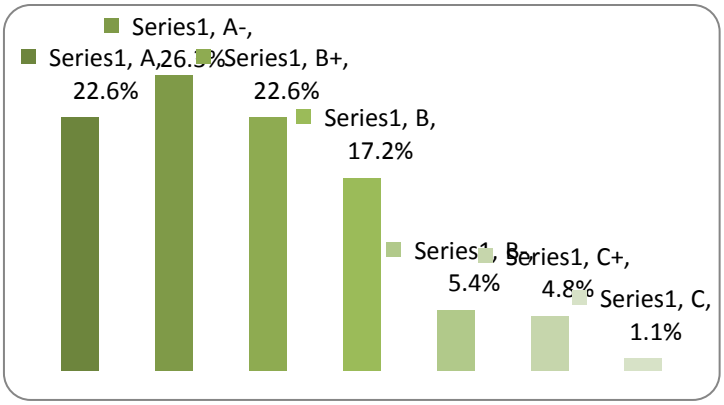

Fig-4: Grades obtained in KCSE

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. The results are further categorized in terms of gender and results displayed in the Table 2.

Table-2: Grade obtained in KCSE by Gender

	Gender	N	Mean Rank	Sum of Ranks
Grade in KCSE	Male	97	95.08	9222.50
	Female	89	91.78	8168.50
	Total	186		

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 α=0.05 then α>p and thus we do not reject the hypothesis that the performance of the two groups is the same. *(if p≤α, then the difference is significant) where α is the level of significance and p is the p-value.* This concurs with Eshiwani [16], 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 [9].

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 results are shown in Table 3.

Table-3: Degree programme by Gender

			Degree			Total
			Medicine	Science	Education	
Gender	Male	Count	17	68	16	101
		% within Gender	16.8%	67.3%	15.8%	100.0%
	Female	Count	26	55	8	89
		% within Gender	29.2%	61.8%	9.0%	100.0%
Total		Count	43	123	24	190
		% within Gender	22.6%	64.7%	12.6%	100.0%

The results in Table 3 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 (χ=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. The findings agree with that of Chege and sifuna [17], 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: Grades obtained by the Student in the Previous Year of Study

Grade	**Gender**	**N**	**Mean Rank**	**Sum Rank**	**Z**	**P**
A	Male	65	53.1	3453.5	-0.758	0.449
	Female	44	57.8	2541.5		
B	Male	66	59.7	3942.5	-0.604	0.546
	Female	56	63.6	3560.5		
C	Male	56	49.2	2754.0	-0.524	0.601
	Female	44	52.2	2296.0		
D	Male	21	20.5	431.0	-0.324	0.746
	Female	18	19.4	349.0		
E	Male	5	8.1	40.5	-0.874	0.382
	Female	8	6.3	50.5		

The results obtained and analyzed in Table 4 indicate that there was no significant relationship between the grades and genders (χ=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 [10]. It's interesting to note that no such correlation exist at university level.

Table-5: Percentages by gender of perceptions towards SMTs

	Gender		Whether women are equally endowed to pursue science, mathematics and technology programmes		Total
			Yes	No	
	Male	Count	81	7	88
		% within Gender	92.0%	8.0%	100.0%
	Female	Count	81	4	85
		% within Gender	95.3%	4.7%	100.0%
Total		Count	162	11	173
		% within Gender	93.6%	6.4%	100.0%

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 labeling of science as men's subjects are transmitted to their students in day- to- day classroom interaction [18].

Table-5: Perceptions of Performance in SMTs by Gender

	Gender		Do you think female students perform equally well when compared with male counterparts in SMTs at university level		Total
			Yes	No	
	Male	Count	68	24	92
		% within Gender	73.9%	26.1%	100.0%
	Female	Count	77	14	91
		% within Gender	84.6%	15.4%	100.0%
Total		Count	145	38	183
		% within Gender	79.2%	20.8%	100.0%

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 (χ=3.19, p=0.074). UNESCO [19] 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 [19] 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.

CONCLUSION

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. Consequently, they must be treated equally with the same opportunities as men, if a country wants to grow and prosper faster. 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. The study recommends that 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 are still in their formative stages of establishing any meaningful SMT programme particularly at degree level.

Policy Implication

The Universities management and policy makers would find this study useful in meeting higher educational 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. The government should set aside lots of capital to equip the SMTs facilities at all the universities, since 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.

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