INFLUENCES ON GENDER DISPARITY IN TVET ENROLMENT: A COMPARISON OF ENGINEERING AND BUSINESS COURSES IN KENYA.

BY

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DECLARATION

I hereby certify that the content of this thesis relates to my own work taking into account normal candidate-supervisor relations. The thesis contains no material which has been accepted for the award of any other degree or diploma in any university or other tertiary institution and, to the best of my knowledge and belief, contains no material previously published or written by another person, except where due reference has been made in the text. I give consent to the final version of my thesis being made available worldwide when deposited in the University's Digital Repository, subject to the provisions of the Copyright Act 1968.

Meshack Chuma Opwora

December, 2013

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DEDICATION

This thesis is dedicated to our Lord and Saviour Jesus Christ who though not physically seen was always close to me and provided for all my spiritual and physical needs including peace, good health, knowledge, wisdom and understanding. Thank you Lord my God! Amen!

ABSTRACT

Technical, Vocational Education and Training (TVET) has become one of the key policy priorities in education and training in Africa due to the recognition of its effects on social and economic empowerment of the society. In Kenya, TVET has been identified to provide requisite skills and build human capacities especially in key priority areas including science, technology and engineering that support the achievement of its *Vision* of becoming a prosperous and industrial nation by the year 2030. However, there is serious gender imbalance in technology and engineering programmes offered in TVET institutions where the proportion of female students enrolled is much lower than males posing female economic empowerment and equity challenges. Studies on gender enrolment in Kenya focus on other education levels, with very little undertaken at TVET level and provision of up-to-date information at this level, can further inform and may ideally, enhance policy formulation and review.

This study focused on the factors that influence student choice of courses at TVET level generally and by gender, the barriers to female enrolments in technology and engineering courses, their relative importance as well as the effectiveness of the government interventions to bridge the gender gap and other perceived measures that could achieve a more effective solution. Quantitative and systematic analysis of government enrolment data were used to analyse enrolment data from seven technical training institutions as well as opinions of 999 (91%) students and 64 (100%) Heads of Departments of technology and engineering and business departments in 16 technical training institutes in Kenya collected using a separate questionnaire for each sample. Inclusion of business department respondents made it possible to compare engineering and non-engineering students' and their departmental heads' opinions on influences on student enrolment in engineering and business courses, thus, enabling an applicability of the findings to TVET programmes more generally. Enrolment trends in the two courses, students' interests, and opinions on influences on their enrolments in the courses and causes of gender disparities in technology and engineering courses were analysed. The Heads of Department opinions on causes of these disparities as well as measures to address them were also analysed.

The study found a range of factors affecting student enrolment in TVET courses including their interests and attitudes towards courses, related employment and the respective prerequisite secondary school subjects, the subject teachers, parents, career advisors, relatives and friends, TVET policies and system, media, student

objectives to do the course, and culture. Among these factors, student interests in the courses, influences from the respective subject teachers (science and business teachers), employment interests and interests in secondary school subjects (science or business) were the most important in prediction of the differences of student choice of courses at this level.

Unlike in developed countries where getting a better salary is important in choice of courses, this was not so in the case of enrolment in TVET courses in Kenya where students were more driven by their desire to gain employment. The same was the case of use of media in relaying careers information where respondents indicated that they were more influenced by newspapers as opposed to TV and internet which are predominant in conveying this information in developed countries. Compared with males, females in general including those who were enrolled in engineering and technology courses in TVET were less interested in engineering courses, the related employment and prerequisite secondary school subjects which was a major barrier to their enrolment and retention in the engineering courses. Other barriers to female enrolment in engineering were competing interests in other courses, employment and unrelated secondary school subjects, negative cultural stereotyping about female performance in technology and engineering employments, lack of role models, and low quality of training.

The government intervention through bursary awards to encourage female enrolments in technology and engineering courses significantly reduced their dropout rates but had low impact on achieving gender parity in these courses since it did not address the other barriers. Thus, the study concluded that a holistic approach involving all key stakeholders in formulation and implementation of relevant laws, policies and programmes to address the short term, medium term and long term enrolment needs could be a more effective solution.

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LIST OF ABBREVIATIONS AND ACRONYMES

1.	ANOVA	Analyses of Variance
2.	AU	African Union
3.	CTE	Career and Technical Education
4.	DEEWR	Department of Education, Employment and Work Place Relations
5.	EFA	Education For All
6.	ETB	Engineering and Technology Board
7.	FAWE	Forum For African Women Educationists
8.	FET	Further Education and Training
9.	IFAD	International Fund for Agricultural Development
10.	ILO	International Labour Organisation
11.	ISAE	Institute Superieur de Agriculture et Eleverage
12.	IT	Information Technology
13.	FAO	Food and Agriculture Organisation
14.	GDP	Gross Domestic Product
15.	GER	Gross Enrolment Ratio
16.	GPI	Gender Parity Index
17.	HOD	Head of Department
18.	KBS	Kenya Bureau of Statistics
19.	KESSP	Kenya Education Sector Support Programme
20.	MDGs	Millennium Development Goals
21.	MOE	Ministry of Education
22.	MOEST	Ministry of Education, Science and Technology
23.	MOHEST	Ministry of Higher Education, Science and Technology

24.	NCVER	National Centre for Vocational Education Research
25.	NGOs	Non-Governmental Organisations
26.	OAU	Organisation of African Union
27.	OECD	Organisation for Economic Co-operation
28.	SMT	Science, Mathematics and Technology
29.	STEM	Science, Technology , Engineering and Mathematics
30.	STI	Science, Technology and Innovation
31.	SSA	Sub-Sahara Africa
32.	TAFE	Technical and Further Education
33.	TTI	Technical Training Institute
34.	TV	Television
35.	TVET	Technical and Vocational Education and Training
36.	TIVET	Technical, Industrial, Vocational Education and Training
37.	UNDP	United Nations Development Programme
38.	UNESCO	United Nation Educational, Scientific and Cultural Organisation
39.	UNECA	United Nations Economic Commission for Africa
40.	UK	United Kingdom
41.	UPE	Universal Primary Education
42.	USA	United States of America
43.	VET	Vocational Education and Training
44.	VTE	Vocational and Technical Education
45.	YP	Youth Polytechnic

For the purpose of this study, **VET, TVET, TIVET, TE, VTE** and **TAFE** were used interchangeably to mean technical and vocational education.

DEFINITION OF OPERATIONAL TERMS

Artisan level: The certificate training designed for producing basic trade skills out puts.

Craft level: The advanced certificate training for producing multi-skilled outputs.

Education: The long-term development of human resources through transmission of accumulated knowledge, skills and positive values and attitudes.

Enrolment: Refers to the number of trainees who get admitted to the engineering courses in the technical training institutes.

Female Preferred courses: These are courses that are offered in training institutions that were hoped to make female trainees to perform their traditional responsibilities.

Gender: Refers to the cultural and social construction or representation of being a male or female.

Industrial education: Is a general form of education about industry that imparts knowledge and skills and attitudes towards the processes of industry. It is usually provided in Kenya at secondary school level.

Institutes of Technology: These are institutions that were formerly run by the communities before gaining support from government. They offer courses up to Diploma level.

National polytechnics: Are the largest middle level colleges, which cater for a variety of post-secondary career courses, leading to a certificate, ordinary diploma and higher diploma awards.

Participation: Refers to whether learners are enrolled in the TVET sub-sector in technical training institutes engineering departments or not; whether they enrol. In this study, participation is indicated by existing data on enrolment and dropout.

Technical Training: Refers to those programmes that impart skills, knowledge, values and attitudes to individuals preparing to take middle level professional position in the world of work, particularly in engineering and scientific disciplines.

Technical Training Institute: These are institutions, which were formerly technical secondary schools before their conversion to colleges. They offer TVET courses up to High Diploma level.

Training: The art of imparting skills and knowhow for creation of the labour force needed for various production activities.

Vocational Training: Refers to those programmes that impart scientific occupational skills and knowledge required in the world of work.

Youth polytechnics: These are community based training institutions offering courses for imparting to trainees basic skills at Artisan level.

CHAPTER ONE

INTRODUCTION TO THE STUDY

1.1. Introduction

This chapter sets the stage for the study by providing an introduction and overview of the thesis. It places the Kenyan equity challenge in technical and vocational education and training in a global context, outlines the study problem, purpose, objectives, significant and the scheme of the study.

1.1.2. Kenya: National context

Kenya is located in East Africa and is bordered by Tanzania in the south west, the Indian Ocean in the south east, Somalia to the east, Uganda to the west and Ethiopia and Sudan to the north. The total area of Kenya is 582,650 sq km (224,962 sq. miles) including 11,230 sq. km (4,336 sq. miles) occupied by water (Worldmark Encyclopedia of Nations, 2007). It is a democratic state with a devolved system of governance. The 2010 Constitution of Kenya that was promulgated on 27 August 2010 divided the country into 47 county governments, with 254 districts distributed among the counties to provide administrative services at the grassroots. Statistics provided by the Kenya National Bureau of Statistics (2010) indicate that the population of Kenya in 2009 was 38,610,097 comprising 19,417,639(50.3%) females and 19,192,458(49.7%) males, of the total population. The current growth in Gross Domestic Product (GDP) in 2011 stood at 4.4% with 50% of the population living below the poverty level and most of whom were women (Kenya Nation Bureau of Statistics, 2012).

1.2. Background to the study

1.2.1. Enrolment in TVET programmes internationally

Technical and Vocational Education and Training (TVET) leads participants to the acquisition of the basic skills and knowledge required for employment in a trade or particular occupation (Atchoarena and Delluc, 2002). According to UNESCO (2006), TVET consists of relevant work-oriented learning experiences and may occur in educational institutions and/ or the workplace. TVET has been widely recognized for furnishing skills required to improve productivity and access to employment opportunities (Bennell, 1999). This provides youth and women with economic empowerment. The recommendation by UNESCO/ILO (2002) for education systems to prioritize the development of TVET programmes, at all levels is being implemented. As noted by Bunning (2007), TVET has become a key policy issue throughout the world.

However, Rodgers and Boyer (2006) found that emphasis on access to TVET varies significantly around the world with European countries recording relatively high proportions of vocational courses in secondary schools. In contrast, they noted that most low-income countries had vocational proportions below 4% at secondary school. In addition, the majority of the countries had a lower proportion of female students enrolled in vocational programmes in secondary schools compared with their male counterparts. Female representation in vocational school programmes was highest in Latin American countries. Rodgers and Boyer (2006) also found that most of the female students cluster in business preparatory courses while most male students were enrolled in trade and industrial courses.

Even in developed countries including Australia, United States, United Kingdom and Canada, the proportions of female participation in engineering programmes is lower compared with that of males. Franzway, Sharp, Mills and Gill (2009) found that the enrollment statistics for engineering programmes in Australian universities indicate that engineering, as compared with other programmes of study, had the lowest rate of female participation at 14.1% of total enrolment in 2005. They further noted that in the United Kingdom and the United States of America, women made up 9.5% and 19.3% respectively of the total undergraduate engineering degree completions in 2005/06. In Canada, women made up 18.5% of the total enrollment in engineering courses in 2004. They found that the difference among these four countries was explained by their varied entry requirements. Australia and the UK demand that students require mathematics, physics, and chemistry, while the USA and Canada have more flexible options.

In regard to causes of gender disparities in enrolment, Mau (2003) found that women's participation in engineering is affected by the tougher institutional and cultural barriers they face, unlike their male counterparts. Franzway, at el, (2009, p.91) noted that "research carried out in Australia and overseas identified characteristics of an entrenched masculine culture as a major reason for women's lower representation in engineering*."* Apart from cultural barriers, there are other factors that have been found to influence gender enrolments in TVET. For example, Pimpa (2007) found that low affection to TVET and its inherent inequalities are common phenomena in Thailand. Further, female enrolment in Thailand is influenced by their attitudes towards the programmes, curriculum, potential employment, attractiveness of campus, tuition fees, parents and secondary school teachers, and negative attitudes towards manual work (Pimpa, 2007).

Other researchers have singled out attitudes and interests as having an influence on female enrolment in engineering programmes. Prieto, Bourke, Holbrook, Page, O'Connor and Husher (2009) noted that researchers had agreed that attitudes and interests of females were barriers to their participation in Science, Technology, Engineering and Mathematics (STEM). However, these barriers are being addressed since many countries have gender mainstreaming as part of their education and training policies. Adams (2004) noted that the Australian, British and American Vocational, Education and Training systems for a long time have had a focus on access to programs for various groups such as women, disadvantaged, elderly and ethnic groups as strategies for ensuring equity in training.

From the above, it can be deduced that at a global level, countries with high income embrace TVET more than those of low income. In addition, there are gender disparities in TVET enrolment which is caused by various factors. Some of the factors causing the disparities are common to most countries while others differ between countries.

1.2.3. Enrolment in TVET programmes in Africa

In the last 40 years TVET has been viewed as offering the solution for unemployment problems among the youth in many African countries. However, budgetary pressures in the 1980s led many governments to reduce their allocation for public formal TVET (African Economic Outlook, 2010a). According to Heyneman (2003), the rate of return on education influenced the World Bank's education and TVET policies giving highest investment to primary education and reducing government contribution to both secondary and tertiary education. This policy contributed to the neglect of TVET and post basic education in Africa (Fluitman, 2005). The policy led to an absence of a TVET component in most donor and government poverty reduction strategies that were implemented in developing countries (Bennell, 1999). However, a rebirth of TVET came in the mid-2000s when it was internationally agreed that there was need for an all-inclusive approach to education. As a result of this vision, TVET systems in Africa are being reformed (African Economic Outlook, 2010a).

As the TVET reforms take shape in Africa, there are access and equity challenges to these programmes. Palmer (2007) found that in Africa, the enrolment in TVET at secondary school level was below 50% of the total students' enrolment and this varied in different countries. South and sub Saharan Africa had the lowest proportion of TVET at tertiary level. In a study involving 30 countries comprising seven (Botswana, Egypt, Ghana, Senegal, Seychelles, Tunisia and Zimbabwe) from Africa and 21 from America and Asia, UNESCO (2006) found that TVET was viewed as inferior to general education by the public and was meant to solve youth unemployment rather than have an educational focus. In addition, females face more difficulties accessing both secondary education and TVET programmes compared with males. The low enrolment of females in TVET may be attributed to their small percentage enrolment at secondary school level in many developing countries (Atchoarena and Delluc, 2002). This assertion is similar to that of the African Economic Outlook (2010b) which found that countries where women accounted for fewer than 15% of the enrolment in TVET colleges, such as Eritrea, Nigeria, Ethiopia, Namibia, Malawi and Uganda had TVET enrolment of less than 5% of the overall secondary school enrolment. They also had a lower proportion of females enrolled in both tertiary TVET programmes and the entire education system. Other factors influencing young women and girls enrolment in TVET in some countries include ineffective guidance services that direct them towards stereotyped training and occupations (Bennell, 1999, Mayoux, 2005) and their interest in skills development that meets their immediate needs as opposed to longer term needs (Moser, 1989). Similar to what was found at international level, females were found to concentrate in handicrafts, basic food processing and had also shown a propensity to pursue micro-enterprises and homestead farming activities (The World Bank, FAO, IFAD, 2008; Oketch, 2007).

From the foregoing, it is evident that Africa lags behind in promotion of technical and vocational education, and also experiences gender disparities. However, African countries are not all at the same level in regard to promotion of technical and vocational education. According to Atchoarena and Delluc (2002) the differences in political, historical, cultural, educational and economic contexts largely account for such variations in systems, structures, operating conditions and outcomes. For instance, for a long time South Africa had a system of education that was based on racial segregation policies. The Government of South Africa has implemented policy measures to reform its TVET system but has a challenge in building capacities including leadership, infrastructure and lecturer training for effective delivery. Botswana started reforms in Technical, Vocational and Training in 1994, the year South Africa became independent. Botswana is ahead of both South Africa and Namibia in development of its TVET system while Kenya lags behind these countries (Atchoarena and Delluc, 2002, UNESCO, 2011). Therefore, given the respective level of development of TVET systems, individual countries are likely to have their unique causes for disparities in enrolment in general and by gender.

1.2.4. Enrolment in TVET programmes in Kenya

Education in Kenya is considered to be a tool for building the requisite human resource capacity for both individual fulfillment and national economic and social development. Therefore, the Constitution of Kenya that was revised in 2010 provides that education is a basic human right and that every Kenyan must undertake basic education (Republic of Kenya, 2010). TVET is a major component of education that provides employable skills to a majority of Kenyan school leavers. Thus, TVET programmes have been on the Government's agenda from 1964 (Eshiwani, 1993) when the Kenya Education Commission recommended the then Government trade schools be converted to technical secondary schools as a preparation ground for entry into skills training programmes (Republic of Kenya, 1964; Ngerechi, 2003). During this period TVET was considered to be of lower status compared with general education. However, due to economic and social challenges including unemployment, the importance of TVET was later recognised. The growth of this sub sector was further enhanced when the Republic of Kenya (1981) recommended its expansion and inclusion at all levels of education.

The current education and training structure is a dual system providing for both academic and TVET paths. The academic path begins with three years of early childhood education, two years of pre-primary, eight years of primary, four years of secondary cycle, four years of undergraduate degree, two year Masters and three year Doctoral degree (Republic of Kenya, 2005b, pp.10-29).

Public technical vocational education and training institutions are divided into four categories, namely Youth polytechnics, National polytechnics, technical training institutes and institutes of science and technology. Youth polytechnic are small community-based training centres, which offer a two-year Artisan certificate to primary school leavers. The Artisan certificate provides basic skills in a trade area essential for employment. National polytechnics are the largest middle-level colleges that cater for a variety of post-secondary career courses leading to a certificate, ordinary diploma and higher diploma awards. Technical Training Institutes are middle level institutions, which cater for both post-secondary and post-Artisan courses up to Ordinary Diploma level. Institutes of science and technology are formerly community-based middle-level colleges, which were established to offer scientific and technological programmes up to Diploma level. Basically, technical training institutions and institutes of technology are offering similar programmes, however, they differ in origin. Whereas technical training institutions were formerly national technical secondary schools, Institutes of science and technology were established by communities to address the youth unemployment challenge. There are 650 youth polytechnics, 20 technical training institutes, 15 institutes of technology and 3 national polytechnics. In addition to public provision, there are over 1000 private training colleges offering TVET programmes (Ministry of Science and Technology, 2008). However, most of the private colleges do not offer technological and engineering programmes due to their higher costs.

There are a number of channels for advancement offered in the TVET path. Figure 1.1 below presents the structure and organisation of education and training in Kenya, detailing all paths from Early Childhood Education Development (ECED) to higher education.

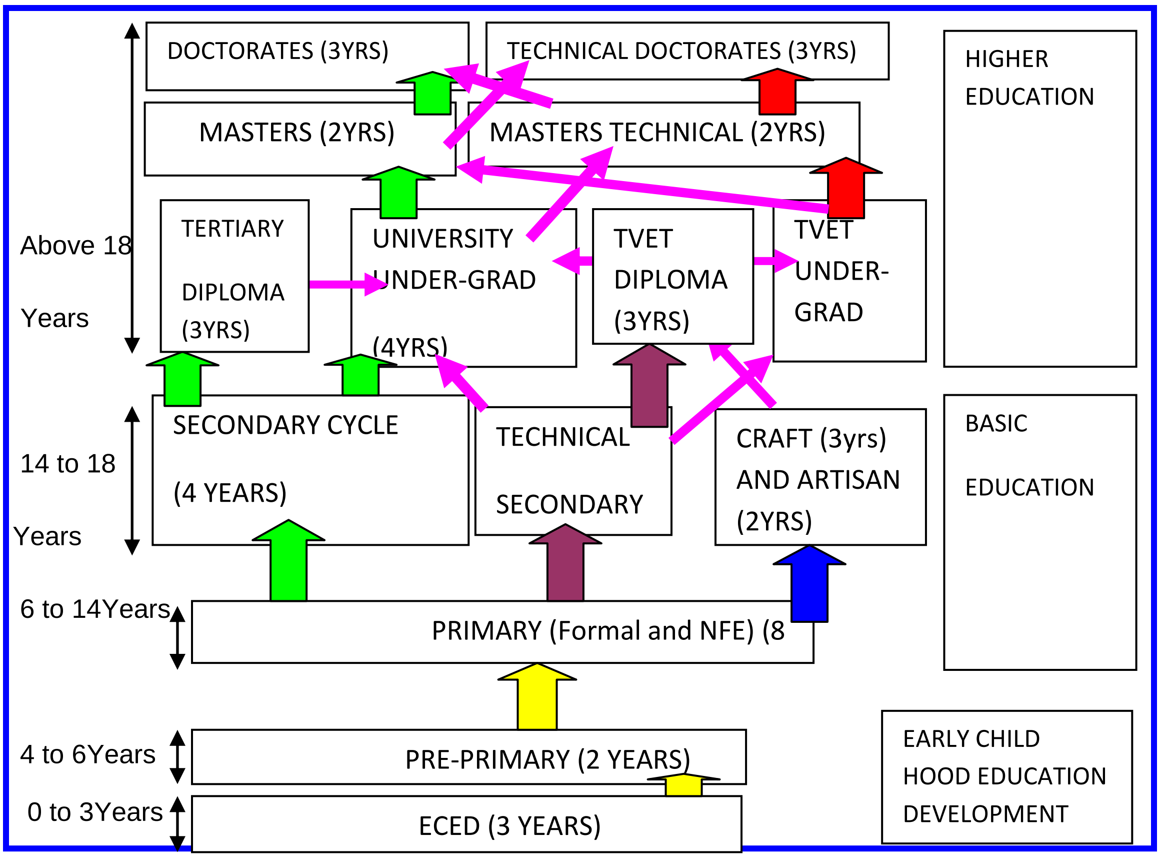

Figure 1.1: Structure and Organization of Education and Training in Kenya (***Source:*** *Republic of Kenya (2005b, p.29)*)

Starting from primary school, one can enrol in Youth Polytechnics, which offer various short vocational training courses including two-year Artisan courses. After acquiring an Artisan certificate, one can enrol into Craft certificate course which takes three years and is offered in both technical training institutes and institutes of science and technology. This qualification will allow one to enrol for TVET Diploma courses offered not only in these institutions but also in National polytechnics and technical training institutions. While national polytechnics offer courses up to Higher Diploma level, the technical training institutes and institutes of science and technology offer courses up to Diploma level. The Diploma qualification leads to entry to undergraduate courses, which may be in TVET or academic fields.

From the foregoing, it can be noted that the education and training system has expanded and provides various paths for achieving qualifications at higher levels.

Despite the expansion, gender disparities remain one of the major challenges facing TVET. Therefore, the need to promote gender parity in education and training has been underscored in recent government key policy documents[1]. The Sessional Paper number 1 of 2005, a policy framework on education and training, underscores the need to address equity challenges at all levels of education. The key policy measures recommended by this paper are being implemented through the Kenya Education Sector Support Programme. The Kenya Education Sector Support Programme (KESSP) consists of 23 programmes financed by the Government and development partners (Republic of Kenya, 2005a, p. viii); some of the programmes being financed through KESSP include free primary education, tuition free secondary education and a TVET development programme. Among the six components of the TVET programme are a bursary award scheme targeting female students enrolled in male-dominated engineering courses, students from poor households, HIV/AIDS orphans, and students with special needs (Republic of Kenya, 2005a, pp. 234 -239). The bursary scheme aims at promotion of equity in accessing TVET programmes.

[1] These include the Poverty Reduction Strategy Plan of 2002, the Economic Recovery Strategy Programme in 2003, the Kenya Vision 2030 of 2007, the Sessional Paper number 1 of 2005 a Policy Framework on Education, Training and Research of 2005, the Kenya Education Sector Support Programme (KESSP) of 2005 and Gender Policy on Education and Training of 2007 (Nyerere, 2009, Republic of Kenya, 2007a).

The interventions have led to near parity in gender enrolment at both primary and secondary levels of education (Republic of Kenya, 2005c). However, the same near-parity is not reflected at tertiary level (Republic of Kenya, 2005c; Daily Nation Newspaper, May 17th; 2006, Page, 20; Republic of Kenya, 2007; Republic of Kenya, 2012). The status and trends in tertiary education level indicate that Kenya's main problem in enrolment is at post-secondary tertiary educational institutions.

The enrolment ratio of females to male students in technological and engineering programmes at tertiary institutions continues to be low. The Gender policy in Education and Training observed that female enrolment in TVET and other mid-level tertiary colleges increased significantly from 22.5% in 1998/1999 to 44.2% in 2001/2002. However, this increase in female students' enrolment was in secretarial, home economics and business-oriented courses with the majority enrolled in youth polytechnics that offer lower-level courses and the lowest proportion in national polytechnics, which offer courses up to Diploma and Higher Diploma levels. The Republic of Kenya (2007a) further observes that between 2006 and 2007, the enrolment in TVET institutions increased by 7.5% with female students trailing in all institutions apart from youth polytechnics. The highest proportion of female enrolment in technical training institutes and institutes of science and technology was 45.7% in 2004 with less than 5% enrolled in technological and engineering disciplines. There is extremely low female enrolment in science, engineering and technological related courses in TVET institutions. The highest record was 1.4%, 4.4% and 5.0% of total enrolment in Mechanical Engineering, Electrical and Electronic Engineering and Building and Civil Engineering respectively in 1998 (Republic of Kenya, 2007a). While analysing enrolment trends in TVET, *the Task Force on the Re-Alignment of the Education Sector to the Constitution of Kenya 2010* raised concern over the extreme low enrolments of female students in technological and engineering related fields is an issue that required being addressed (Republic of Kenya, 2012).

The low female proportions in technology and engineering courses is a challenge to Kenya where science, technology, engineering and innovation have been identified as major platforms for driving its economic development plan underpinned in *Vision 2030.* This *Vision* aspires to transform the country into a middle-income status that would provide high quality life to all its citizens by the year 2030 (Republic of Kenya, 2007b). The achievement of the three pillars of the *Vision*, entailing social, economic and political pillars will depend heavily on the success of science, technology, engineering and innovation, which have been accorded first priority in investment. This has led to a large range of employment opportunities in the sector. Moreover, the requirement of the current Kenyan Constitution that at least 30% of both genders must be represented in employment is a challenge not only in this sector but also for education generally since it is mandated to provide a balance of adequate skills for all sectors. While addressing this challenge will require informed decision, the Ministry of Science and Technology, (2008) reported that very little research had been undertaken at TVET level. Studies carried out in Kenya on gender equity in enrolments focus at basic education and university education levels. I have not located a national study on this subject at TVET level. Therefore, given the importance of TVET in national economic development, and the need to enhance female inclusion in this development, this study investigates into TVET enrolment with a view to inform policy decisions in addition to contributing to the field of knowledge in this area.

1.3. Statement of the Problem

Despite efforts made through education systems to accommodate the changing educational needs of females, gender imbalance in technological and engineering courses has not improved as observed in the available literature. The literature review shows the existence of gender disparities in enrolment in TVET at global, regional and national levels.

Although Kenya has made efforts to alleviate gender disparity in TVET as evidenced in policy documents, there are still serious disparities in enrolment especially in engineering and technological courses. Kenya has identified science, technology and engineering as its major platform for achievement of its vision of becoming a prosperous and industrial nation (Republic of Kenya, 2007b). It is envisaged that the country will move from an agrarian economy to an industrial and knowledge-based economy by year 2030. This means that there would be a wide range of job opportunities in technological and engineering sector in a country where youth unemployment has become a major challenge.

It follows that low participation of females who comprise 50% of the national population is a major concern since it will not only deny them job opportunities but also make the achievement of the *Vision 2030* difficult. The 30% rule for each gender represented in employment by the current Constitution means that education must improve the access of females in these courses.

The availability of up-to-date information on national causes of gender disparities in enrolments in TVET programmes can further inform and, ideally, enhance policy formulation and review. The paucity of information on barriers leading to disparities and their relative strength in Kenya impedes progress towards effective policy formulation. Also, the significance of some of the policy interventions, especially the bursary scheme for females enrolled in engineering and technological courses, has not been tested, and here feedback is important for policy improvement. Thus, there is a clear need to contribute new knowledge about the factors influencing gender enrolment in TVET courses in the Kenyan context, their relative importance, and the emerging impact of the government's intervention through the bursary scheme while identifying possible additional measures.

1.4. Purpose of the Study

The purposes of this study therefore were to determine factors influencing student enrolment in TVET courses generally; and gender enrolment in technological and engineering programmes in technical training institutes in Kenya; determine their relative strength; evaluate the government's policy intervention to alleviate gender disparities in these programmes.

1.5. Objectives of the Study

Specifically this study sought to;

1. Determine the factors attracting student enrolments in TVET (Technology and engineering and business) courses generally and by gender,

2. Find out whether there was any differences in attraction between these courses generally and by gender,

3. Determine the possible barriers to female enrolments in technology and engineering courses.

4. Determine the relative strength of the factors that influence female enrolment in technology and engineering courses.

5. Evaluate the significance of the government's bursary scheme targeting gender balance on female enrolment in engineering courses and recommend further possible interventions.

1.6. Methodology

The study employed both quantitative and documentary analysis methods to maximise the value of information available and its validity. It drew its samples from Heads of Departments and their students enrolled in technology and engineering courses as well as business courses at technical training institutions in Kenya. Questionnaires were the main instruments used for data collection and were analysed by use of the SPSS analysis programme.

1.7. Basic Assumptions of the Study

In this study, it was assumed that:

a) Both male and female trainees had equal enrolment opportunities in technical training institutes in Kenya

b) The respondents would respond honestly.

c) Documents available were accurate and could therefore be used as secondary data.

d) The measures used to assess interests and attitudes were reliable (Reliability was also tested as part of the study).

1.8. Significance of the Study

It is intended that the findings will be important to the stakeholders and government of Kenya, who will focus the limited resources available to major issues which have a great impact on gender enrolment in TVET. The policy makers are expected to use the information to review policies in TVET and make informed decisions that will guide the growth of the sub-sector. In addition, it is hoped that the curriculum implementers will use the finding to develop strategies that would encourage both genders to equally participate in the TVET courses.

It is also expected that the implementation of the study findings will result in an improvement of gender parity in technological and engineering courses at TVET level. This is important since it is globally accepted that education and training play a significant role in national development. According to UNESCO and ILO (2002) the engines of economic growth and social development are Knowledge and skills and therefore, it is imperative for opening up TIVET systems to all people irrespective of their gender. Women in particular, being underprivileged, should be given the equal opportunity in the communities to be equipped with skills not only for their prosperity but also the well-being of the community. Increased enrolment of women in the technological and engineering programmes will enhance the goal of equitable furnishing the future manpower with requisite knowledge and skills (Republic of Kenya, 2005c).

1.9. Outline of the Chapters

The thesis comprises ten chapters outlined below.

Chapter One was designed to focus on the whole study with specific attention to the background to the study, statement of the problem, purpose of the study, objectives, significance, and scheme of study. It drew from international reports and policy documents in conjunction with scholarly literature on gender disparities in engineering enrolments to analyse the extend of the problem at international, African and Kenyan levels.

Chapter Two provides a review of the literature related to the global and regional context of Technical and Vocational Education and Training (TVET) systems and policies in Kenya. It drew from government policy documents, reports and scholarly studies on TVET systems and policies in five countries comprising Australia, the United Kingdom (UK), South Africa, Botswana and Kenya. It compared their similarities and differences in promotion of TVET in schools, management of TVET at tertiary level, competence based curriculum, qualification frameworks and challenges and achievements made in the respective TVET systems.

Chapter Three details a review of gender equity in education and training at global, regional and Kenyan context. By drawing from international, regional and national policy documents, reports and studies, the chapter explored the trends of gender parity gap in education and training, the international protocols and commitments made to address the gap and commitments and strategies put in place in Africa and Kenya. It highlighted key factors found to influence gender disparities in engineering enrolments and drew the implications to the study.

Chapter Four presents the research questions, the research design, the target population, sampling procedures; sample size and research instruments. In addition, reliability and validity of research instruments as well as data collection procedures and analysis are described.

In Chapter Five, the detailed analyses of the data collected from the student questionnaires on items regarding their attitudes and interests are presented. The results include student interests in secondary school subjects, employment, and courses.

Chapter Six details results of analyses of student questionnaire items about their opinions on various factors that influenced their enrolments and also those responsible for gender disparities in technological and engineering programmes. It describes student opinions about influences on their decisions to enrol in TVET courses including family and other people, government TVET system and policies, media and internet and their objectives for doing their course of choice. In addition, their opinions on whether they are satisfied with their current courses as well as what they perceive as causes of gender disparity in technological and engineering programmes are described. Lastly, the chapter presents results of regression analyses of student characteristics, interests and opinions that may predict their enrolment in either technology and engineering or business courses.

Chapter Seven describes the results of the analysis of the data collected from the Heads of Department (HOD) questionnaire. It details their opinions on the possible causes of gender disparity in enrolment in technological and engineering courses. It also compares these opinions and those of students on the same issue. In addition, HODs opinions on other gender issues affecting TVET and possible interventions to enhance gender parity in TVET programmes are described.

Chapter Eight details the analysis of student enrolment data in technological and engineering programmes and business programmes in eight technical training institutes spread across three types of locations in Kenya that is cities, towns and rural areas. Its main objective is to find out if the government's bursary scheme had improved enrolment and the retention of female students in engineering courses. It also provides further information that could be used to validate Head of Departments' opinions on other TVET enrolment issues including student dropouts in engineering and business courses. It therefore described and compared enrolments and dropouts in engineering programmes as well as business programmes.

Chapter Nine presents the findings drawn from chapter five to eight and attempt to answer the research questions. These are based on the opinions of 999 diploma students enrolled in the two courses and 64 Heads of Departments (HODs) in 16 technical training institutions collected using two sets of questionnaires as well as enrolment data in TVET institutions.

In Chapter Ten, which is the final chapter, the key findings of this study are related to the current literature and specific conclusions are drawn. Finally, recommendations are made for action.

In the next chapter, literature related to TVET is reviewed.

CHAPTER TWO

REVIEW OF TVET POSITIONING IN FIVE COUNTRIES

2.1. Introduction

This chapter provides a review of the literature related to the global and regional context of Technical and Vocational Education and Training (TVET) systems and policies in Kenya. In this part, TVET systems of four countries comprising Australia, United Kingdom (UK), South Africa and Botswana are reviewed to place the TVET system in Kenya in both global and regional contexts. The Australian and UK systems have been chosen since they are among the world leading TVET systems and most of the developing countries in Africa are reforming their systems using approaches and policies from these countries as benchmarks. Kenya, having been a British colony, inherited most of her education policies from the latter. The South African and Botswana TVET systems have been reviewed because the two countries began reforming their systems before Kenya and the lessons learned can be instructive in the development of the Kenya TVET system.

The literature reviewed focussed on brief overviews of education systems, the extent to which technical and vocational education is integrated in the respective schools curriculum, TVET system management structures, the extend of promotion of competence based training, qualification frameworks, and achievements and challenges of TVET systems in the five countries. The review was based on government policy documents, reports and empirical studies undertaken at TVET level in the five countries.

2.2. The role of TVET in economic and social development

As noted in Chapter One, Technical, Vocational Education and Training has been recognised worldwide as essential in the promotion of economic and social development. According to a UNESCO definition, TVET is concerned with the transmission and acquisition of relevant knowledge, skills values and attitudes necessary for the world of work (UNESCO, 2002). It furnishes people with requisite skills for improvement of productivity, rising of income levels and improved access to employment opportunities. High productivity and access to employment enhance national economic development and individuals' social status and empowerment. Freeland (2000) underscores the role played by TVET in reduction of social inequalities through provision of skills that enhances both personal and social development.

Thus, TVET has been viewed by many countries as an important channel for providing the requisite skills needed to meet the challenges brought by technological change, globalization and increased competition caused by trade liberalization. This view is emphasised in the development policies and strategies of many governments across the globe. As noted by Adams (2004, p.2) 'governments such as Britain, United States and Australia view VET as an investment in the economy and society that assists in national development under the pressures of global competition and unemployment'.

This investment is imperative for the countries to remain competitive and economically stable in the global arena. Bunning (2007) notes that world economies are being shaped by the need for skilful and productive personnel. However, skills shortage is a worldwide concern as noted by Kearns and Papadopolous (2000), causing a demand on skilled personnel. The demand has persisted for over a decade as implied by a talent shortage survey involving interviews of more than 38,000 employers in 41 countries and territories including 10,232 in the Americas, 8,786 in Asia Pacific and 19,059 in Europe, the Middle East and Africa which found an acute shortage of skills especially in technical and vocational fields posing a worldwide concern (Manpower Group, 2012). The demand is not limited to trained human resources for particular occupational skills but with the general and multi-skilled capabilities for coping with continuous change in technological and working environments (Manpower Group, 2012; Hodkinson and Issitt, 1995). These necessitate policy makers to respond strategically to the pressures exerted by international economic forces for highly skilled personnel to compete successfully in the global market. The increase in investment in TVET by most governments and employers in both developing and developed countries is indicative of the interest in building a multi-skilled workforce (Niven, and Young, 2005). This is because many developed and developing countries depend on their TVET systems to enable them respond to the changes in the global economy.

Nyerere (2009) observed that many developed and developing countries such as Brazil, Sweden, Italy, Japan and China have adequately funded TVET thus according it more recognition. Countries with heavy investment record the highest enrolments. However, the proportions of enrolment of senior secondary students pursuing some form of vocational or technical education varies across the globe with Europe leading with at least 50 percent. In South East Asia, China and India the enrolment ranges between 35-40 percent, whereas Africa trails with less than 20 percent (Nyerere, 2009). Perhaps the differences in development of TVET policies and systems in these regions could explain the variations of access to TVET programmes.

Kenya is reforming its TVET system to respond to the demands of the new constitution promulgated in 2010 and its *Vision 2030* that are aimed at addressing the social, economic and political developmental challenges facing the country. Key issues under TVET reforms include governance, access, equity, quality and relevance of the TVET system. As Kenya undertakes these reforms, it is important that she keeps an eye on her predecessors in these reforms. Since most reforms in Africa in general and Kenya in particular have been influenced by the World Bank and development partners to include a set of new policy technologies that had been developed mainly in Australia, England, New Zealand and Scotland (McGrath, 2011), a review of systems in some of these countries can provide important lessons to Kenya. Additionally, and as noted earlier, a review of some of the African countries including South Africa and Botswana that started these reforms before Kenya also provides important lessons learnt at regional level. The key policy issues to be reviewed from each of these countries include promotion of vocational education in schools (since this has a positive influence on enrolment in the same courses at tertiary level (UNESCO, 2010), governance structures, competency-based curriculum, national qualifications frameworks, achievements and challenges. Each review will commence with a brief overview of the education system in the respective country.

2.3. Vocational Education and Training in Australia

2.3.1. Overview of the Education system in Australia

The Australia education system is outcome based (Georgescu, Stabback, Jahn, Elmehdi, and Castro, 2008)[2] and encompasses preschool, school, and vocational and higher education levels. School structures and age requirements for student enrolment in Australia differ between the States and Territories. While compulsory school starting age is 6 years except in Tasmania which is 5years all students must remain in school or training till age of 17 (Australian Curriculum Assessment and Reporting Authority (ACARA), 2011). Apart from Queensland, South Australia and Western Australia, whose primary education consists of a preliminary year followed by Years 1 to 7 and secondary education consists of Years 8 to 12 the rest of the states have a preliminary year and years 1 to 6 for primary and years 7 to 12 for secondary (ACARA, 2011). Further, primary is divided into three stages including infants or stage 1 which involves kindergarten 1 and 2, primary stage 2 covering grade 3 and 4, and primary stage 3 that consist of grade 5 and 6. Secondary schooling encompasses stage four (grade 7 and 8), stage five (grade 9 and 10) and stage six (grade 11 and 12) (ACARA, 2011). At stage six students may exit with a Higher School Certificate (HSC) and enrol at university or TAFE depending on their performance and interests (Australia Curriculum Assessment and Reporting Authority, 2010).

2.3.2. Vocational education in school in Australia

Vocational education is a major feature in Australian basic education. Georgescu et al (2008) found that in most of the schools they studied in Australia, it was generally agreed that VET plays an essential role in making the curriculum inclusive of a broader range of needs. VET was also viewed as a

[2] The study by Georgescu et al (2008) on behalf of UNESCO, International Bureau of Education, Federal Ministry for Economic Cooperation and Development sought to provide the extent to which current basic education curricula in African countries address the development of competencies and skills for life and work using Australia and UK as benchmarks.

useful means of improving learning and giving many students a chance of success at school. Australia Curriculum Assessment and Reporting Authority (ACARA, 2010, p.14) noted that the senior school curriculum offers more opportunities for specialisation in learning, including within the regular school programme and through accredited vocational education and training. With regard to access to VET, Bateman, Keating and Vickers (2009)[3] noted that in Australia, about 36 per cent of students undertake VET in schools mainly in the form of one subject at Year 11.

2.3.3. Current VET system and management in Australia

In Australia, significant reforms in the system aimed at improving governance structures, access, quality and flexibility, efficiency and raising the level of private sector investment in training, came about as a result of the economic crisis and market failure in VET experienced in mid-1980s (Bateman et al., 2009). Due to the depth of the perception of market failure, the particular Australian arrangements for the governance have become relatively government centric (Bateman et al., 2009). The VET system is based on an array of institutional arrangements where both the federal and state/territory governments are involved in policy development and delivery, with providers regulated through the Australian Quality Training Framework[4] (NCVER, 2013). Each state manages its own VET/TAFE system that prepares people for work in a career that does not need a university degree. The skill standards, qualifications, provider registration and quality assurances are all conducted through state or state sponsored agencies. Even industry participation in the Australian VET system is government agency supported and brokered (Bateman et al., 2009). The mainstream VET sector in Australia remains among

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[3] This study was commissioned and published by Australian Government, Department of Education, Employment and Workplace Relations. It explores quality assurance processes used for vocational education and training (VET) in five countries including Australia, Canada (Ontario), Germany, New Zealand, Singapore and the United Kingdom identified as key competitors in the international VET market.

[4] The AQTF is the national set of standards which assures nationally consistent training and assessment services for the clients of Australia's VET system, both in Australia and overseas (Bateman et al, 2009, ASQA, 2010). The current version of AQTF was updated in 2010 and offers standards for registration of training organisation (RTOs); regulating and accreditation bodies in the states and territories; delivery and assessment of programs taught and administration systems (The Australian Skills Quality Authority, 2010).

the most nationally integrated and sector autonomous of all OECD VET systems, and one in which national and nationally coordinated state agencies have a central role (Bateman et al., 2009).

It is argued that Australia has an industry-driven system of TVET. In the *Australia's National Strategy for Vocational Education and Training 2004-2010,* ANTA (2003, p.3), noted that industry, through employer and worker representatives and businesses, leads key aspects of vocational education and training. Industry defines the skills that people need for work, and advises about the products and services it requires. Industry also promotes how businesses and employees can undertake vocational education and training at work and outside work, and the benefits of doing so. By establishing Industry Skills Councils with the participation of employer organisations, unions, individual employers, and training specialists, this system facilitates industry input to the development and review of training packages, including curriculum and qualifications. It facilitates the collection of information about the marketplace; the publications of an industry environmental scan and thus promote workforce development (UNEVOC, 2012).

2.3.4. Competence Based Training and National qualifications framework in Australia

Australia was among the first nations in the world to establish National Qualification Frameworks (Bateman et al., 2009). The Australian Qualifications Framework (AQF) is a regulatory framework as it designates nationally recognised qualifications. The current framework was endorsed in 1993 and implemented with effect from 1st January 1995 to underpin the national system of qualifications at all levels of education entailing higher education, vocational education and training and schools (Australian Qualification Framework Council, 2011, p.9). This framework builds on the work of its predecessors including the Australian Council on Awards in Advanced Education *Nomenclature and Guidelines for Awards in Advanced Education (*1972-1985); the Australian Council on Tertiary Awards *Guidelines for the National Registration of Awards* (1986-1990); and the Australian Education Council *Register of Australian Tertiary Education* (1991-1994) (Australian Qualifications

Framework Council, 2013). The current Australian Qualification Framework (AQF) was designed to be comprehensive and flexible for all qualifications in the post compulsory education and training (Goozee, 2001).

With regard to VET curriculum, Competence Based Training (CBT) was introduced in the late 1980s. This introduction was part of a wider economic policy strategy and agenda, which was known as the National Training Reform Agenda (Smith and Keating, 2003). The main goals of CBT include enhancing skills levels of Australian workforce as well as enabling its industry to be more competitive in the global market (National Council for Vocational Education and Research (NCVER), 1999). CBT provides certification through evidence of competence rather than attending training. In CBT, assessment is carried out against agreed standards of particular industries, rather than achievement related to formal training. In Australia, it is the individual training providers (TAFE and RTOs) that conduct examinations and award certification to successful candidates (Bateman et al., 2009).

The Australian training packages have been widely seen as an example of a successful competency-based training system. Despite this, the packages have been criticised for being too detailed and unwieldy (Guthrie, 2009[5]; Wheelahan, 2010). Besides, although Australia is the country where competency-based training has been most extensively implemented, its vocational education system still has weak workplace linkages (Cooney and Long, 2010). Yet the justifications for outcomes or competency-based qualifications are to create closer linkages with workplaces.

2.3.6. Achievements and challenges of VET in Australia

The success indicator of access to VET in Australia is implied in the current high participation rate and flexibilities in the programmes offered. Hoeckel, Field, Justesen and Kim (2008) and Volkoff, Clarke and Walstab (2008) are in

[5] Guthrie (2009), provided the literature review on a historical account of the development of competency-based training in Australia and summarised the issues arising from the range of reviews conducted on elements of the national training system. The review was commissioned and published by the National Quality Council.

agreement that there is relatively high participation rate by students in a wide age range of TAFE programmes. The programmes range from a single unit of competency to graduate diplomas, while training ranges from formal classroom learning to workplace-based learning and may even include flexible, self- paced learning or online training (Hoeckel et al, 2008). Training is provided by both private and public registered training organisations (RTOs) of which there are more than 4,500 schools, universities or other education providers, adult or community education and various cultural, religious or other bodies providing specific training in language and religion (Hoeckel et al., 2008; Willmott, Karmel and Loke, 2011).

Despite the achievements noted in accessing VET, *the National Strategy for Vocational Education and Training* 2004 to 2010 (ANTA, 2003) notes some challenges demonstrating that Australia still needs more reforms in VET. One of the challenges is the need for increasing labour market participation. This is mainly in some skilled occupations, particularly the traditional trades where labour shortages are persistent (Karmel, 2004). The second challenge is assuring equity for all including marginalised communities to ensure that they all benefit from VET. The strategy noted that women were still over-represented in art-based fields and get less-well-paid work after training than do men, especially in technology and engineering fields. Another challenge was the complexity of the TVET system, with students having difficulties navigating their way through it. There exist barriers to students moving between VET/TAFE and universities. Other challenges include the need to further develop the training packages and communicate to clients and providers and the untapped potential for use of flexible and technology assisted learning (Karmel, 2004, ANTA, 2003). Overlapping Australian State and Commonwealth jurisdictions complicates vocational education and training funding and quality assurance (Willmott et al., 2011). Thus, Australia still needs further reforms in the VET system.

2.4. Vocational Education and Training in the United Kingdom (The case of England)

2.4.1. Overview of Education in the UK

The education system in the UK comprises school, further education and higher education. The starting age for compulsory schooling differs within regions with Scottish children beginning earlier at age four (Education, Audiovisual and Culture Executive Agency (EACEA), 2010). In England and Wales, school is compulsory from the age 5, while, the leaving age for all countries was raised from 16 to 18 years by the Education and Skills Act of 2008 (Department for Education (UK), 2012a).

Schooling is divided into four key stages. Primary schooling comprises key stage one (years 1 and 2), and key stage two (years 3 to 7). Secondary schooling is divided into two stages including lower secondary that comprises key stage 3 (year 7 to 9) and upper secondary, which is key stage 4(years 10 and 11) (EACEA, 2010). At the end of key stage 4, students may sit for the General Certificate of Secondary Education (GCSE). After this stage, students have options to continue in school by moving to sixth-form colleges to do A-levels or enrol in colleges of further education, or seek employment with or without apprenticeship. The two-year curriculum offered at the sixth form college provides students with options to choose between general (academics) and vocational subjects or take a mixture of both. At the end of the first year they are awarded the general certificate of education (GCE) and advanced subsidiary (AS) qualification while on successful completion of the second year they are awarded a full GCE A- Level. Depending on their performance in GCE A- Level, students may be admitted to an undergraduate degree programme (EACEA, 2010).

2.4.2. Vocational education in school in the UK

In England, it is compulsory for every school student to pursue vocational education. The statutory requirement for schools passed in 2004 provides for work related learning that requires that all students at lower secondary must learn through work, take work and career education and must develop enterprise and employable skills (Cuddy and Leney, 2005). Thus, life-related competencies are emphasised throughout the compulsory education curriculum and specific work-relevant carrier subjects are being introduced in Key Stage 4 (Georgescu, et al., 2008). The VET policy is aimed at ensuring that all young people have employable skills and get higher education as well as increasing the number of adults with employable skills and those who progress to higher level training (Cuddy and Leney, 2005).

2.4.3. Current TVET system and management in the UK

The UK has had a tradition of limited state intervention in the economy, and a strong tradition of voluntarism in TVET, especially in England (Bateman et al., 2009). The state has formally devolved important elements of its TVET systems to regional governments (Leitch, 2006). However, over the past three decades there has been a greater centralisation of policy making and administrative authority, including the reduction of the role of local government in education and training. Thus, there is a degree of consistency in TVET qualifications across each of the regions.

Further, the industry lead bodies that are responsible for establishing the standards for TVET qualifications are common across the country. Bateman et al (2009) describes the UK TVET system as a governance approach built around enterprise networks. An important feature of the system is its diversity as demonstrated in the formulation and awarding of multiple TVET qualifications across the non-state based and multiple awarding bodies.

2.4.4. Competence Based Training and National qualifications framework in the UK

The concept of Competency Based Training (CBT) system, national standards, industry frameworks supported by a national qualifications framework and by structures to support national coordination, funding and quality assurance was introduced in the UK at the beginning of 1980s (Willmott et al., 2011; Smith and Keating, 2003). In 1986, the National Vocational Qualifications system was introduced in the UK (Willmott et al., 2011). Moreover, similar to Australia, the UK was among the first nations to establish National Qualification Frameworks (Bateman et al., 2009). This framework is designed to relate to all three education sectors including schools, vocational training and higher education (Willmott et al., 2011). This framework was introduced in 2000 for England, Wales and Northern Ireland with the main focus on the entry-level qualifications, schools qualifications, vocational and occupational qualifications and Qualification Framework for higher education (Cuddy and Leney, 2005; National Qualification Authority of Ireland (NQAI), 2006).

Cuddy and Leney (2005) further notes that the NQF and vocational qualifications have been reviewed since 2004 to comply with the Government's skills agenda to create an employer-led qualification system for adults that responds to changing needs. The previous approaches to delivering skills were supply driven based on the government planning supply to meet ineffectively articulated employer demand (Leitch, 2006, p.12). The approaches were weak in that both individuals' and employers' needs were not met (Leitch, 2006).

2.4.5. Achievements and challenges of VET in the UK

The UK's skills base has improved significantly over the last decade with rising school standards and growth in graduate numbers (Leitch, 2006). Willmott, et al (2011) observes that there is expansion in training capacity in the UK as evidenced by new Technical and Further Education Institutes, Further Education Colleges and Polytechnics, and the influx of large numbers of private providers (over 10,000). West and Steedman (2003) added that in England there is high level of access to VET where about 30 percent of 16 year olds opt for full-time vocational programmes in school or college and the presence of a large vocational in higher education that includes professions. Further education colleges play a significant role in school age provision across a range of courses and types of qualifications in England (Bateman et al., 2009). The system is user-led, mainly through patterns of student enrolments and the subsequent course offerings (Bateman et al., 2009). The Association of

Colleges[6] (2012, p.3) points out other achievements of VET sector in the UK as having very high quality of provision, wide range of delivery organisations spanning the public, private and not-for-profit sectors; flexibility of the curriculum, and robust quality assurance measures giving effective government guarantees of high standards of occupational relevance, the integrity of awards, and consistently good governance, management and teaching in providers.

Despite these achievements, the UK VET system still has persistent weaknesses and challenges. West and Steedman (2003) and Wolf (2011) pointed out some key weaknesses in the VET system that needed to be addressed. These weaknesses included the existence of a confusing plethora of qualifications with no image in the minds of young people, parents and employers about what vocational education involves; high degree of dropouts with students switching between the many different courses offered; gender disparities in some of the courses and poor linkage between various types of vocational courses with both higher education and labour markets. Further, Leitch (2006) asserted that, even if current targets to improve skills were met, the UK's skills base would still lag behind that of many competitor countries in 2020. Bateman et al (2009) added that changing policy frameworks and institutional arrangements had destabilised the VET system in the UK in the past decade. The Association of Colleges (2012) asserted that UK further education underperforms internationally in comparison of its higher education and VET systems to that of some competitor countries including Australia, Canada and Germany. Thus, similar to Australia, the UK VET system still requires further reforms for improvement.

2.5. Technical and vocational education and training in Africa

The school systems in most African countries as in most countries in the world, lead to two pathways, which include general education and vocational

[6] UK VET: Towards a comprehensive strategy for international development: Prepared for the Department for Business, Innovation and Skills by the Association of Colleges: Beyond Standards Ltd, Consultants. May 2012.

education (Oketch, 2007). Both pathways are seen to be important for economic growth and social inclusion (UNESCO, 2006). However, for a long period of time technical and vocational education was perceived by many African countries to be inferior to general academic education. The negative attitudes held towards vocational education began when the colonial administrators introduced it as the suitable education for Africans, an idea that was resisted by many Pan African movements which were fighting for independence and missionaries who believed that academic education was the main form of knowledge. Thus, at the time of independence in most countries, vocational schooling had lost ground as the dominant discourse of educational policy became expansion of academic schooling (McGrath, 2011). Africans associated TVET with colonial administration and thus considered it as undesirable in post-independent Africa (Oketch, 2007). Moreover, during this period there was a desire for white-collar jobs, which were previously held by colonial officers as many Africans wanted to have the same status, which they saw in them. At the same time, aspirations for blue-collar jobs dwindled as those who had pursued vocational training were not only less well paid but often stayed longer without employment as compared with their counterparts who went through general education. According to King and Martin (2002), the main reason for this was the then new occupational opportunities generated by the end of colonialism, and the role played by schools as one of the ways for moving young people from subsistence activities to jobs in the modern sector of the economy.

However, by the late 1960s, there were concerns about the alarming rise in youth unemployment across the continent, as educational growth outstripped economic growth, prompting a series of interventions geared towards solving youth unemployment (McGrath, 2011). These interventions resulted in the re-introduction and enhancement of technical and vocational education in many countries. Since then TVET has been on policy agenda of governments and viewed as offering the solution for unemployment problems among the youth in many African countries. However, as noted in Chapter One, budgetary pressures in the 1980s led many governments to reduce their allocation for public formal TVET (African Economic Outlook, 2010a). These pressures were as a result of the influence from the World Bank's education and TVET policies that advocated high investment in primary education while reducing government contribution to both secondary and tertiary education (Heyneman, 2003). These policies were based on studies that found that the rate of return on primary education was higher than that of secondary and tertiary education. As seen in Chapter One, the policy led to neglect of TVET and post basic education (Fluitman, 2005).

As noted in Chapter One, a re-birth of TVET came in the mid-2000s when an international consensus agreed on the need for an all-inclusive approach to education. As a result of this vision TVET systems in Africa are being reformed (African Economic Outlook, 2010a). A policy analysis study on the direction of vocational education and training in Africa, noted that, these reforms, as proposed by the World Bank and development partners include a set of new policy technologies that had been developed in the 'Old Commonwealth' (mainly Australia, England, New Zealand and Scotland) (McGrath, 2011, p.38). These policies include the establishment of new governance structures that would give institutions more autonomy and businesses more say at the local and national levels; competency-based curriculum; and national qualifications frameworks.

As the African countries undertake TVET reforms, they face a number of challenges. While analyzing vocational education policies in Africa, McGrath (2011, p.39) asserted that in general, 'African attitudes towards skills and vocational education are less positive than those in Eastern Asia.' Additionally, he noted that the African vocational education systems are inefficient and ineffective in provision at all levels of education and that institutions are characterized with having poor quality staff and students; working with outdated curricula and outdated equipment; lacking real engagement with the world-of-work and incapable of supporting their graduates' employability. Another weakness of TVET system is lack of linkages between courses offered at this level and university programmes leading to a dead end as opposed to general education where advancement to higher education is much easier (Atchoarena and Delluc, 2001). UNESCO (2006) observed that the African vocational education does not have the flexibility and portability that general education has. Thus, much needs to be done to African TVET systems to place them on the same footing as the rest of the world. However, as demonstrated in the next section, African countries are at different levels of reforming their VET systems and that each has its own unique challenges.

2.6. Technical and Vocational Education and Training in South Africa

2.6.1. Overview of the Education in South Africa

The South African education system is comprised three main categories referred to as General Education and Training (essentially the first nine years of school education); Further Education and Training (comprising vocational and occupational education and training offered at colleges as well as the last three years of general school education); and Higher Education and Training (Universities and Universities of Technology) (South African Government Information, 2012). Adult basic education (or Adult Education and Training – AET) is another category of education and training that is offered mainly on part-time basis at both General and Further Education levels but it is not usually occupational or vocational by nature (South African Government Information, 2012). General Education and Training is compulsory from the age of 7 to 15years. It comprises of both pre-primary, primary (grade 1 to 6) and junior secondary (year 7 to 9) schooling. Further Education and Training (FET) covers Grades 10 to 12 in schools and equivalent levels in FET colleges (previously called technical colleges)(British Council, 2011).

2.6.2. Vocational education in school in South Africa

In South Africa, vocational subjects are in both the primary and secondary school curriculum (Development Bank of South Africa, 2010). The Department of Education of South Africa (2008) outlines eight learning areas in the National Curriculum including Languages; Mathematics, Natural Sciences, Technology, Social Sciences, Arts and Culture, Life Orientation, Economic and Management

Sciences for both primary and secondary schooling. However, at senior secondary school level, where provision of skills is more advanced than in basic education, technical and vocational subjects are optional (South African Government Information, 2012).

2.6.3. Current VET system and management in South Africa

For a long period of time, South Africa had a racially segregated system of vocational education which encouraged the production of workers who could be employed in a narrow field but denying them adaptable skills for other occupations. Thus, the post-independence policies have had a focus on the reorganisation and restructuring of the education and training system from a system which was deeply rooted in racially segregated policies of the apartheid era that provided unequal access to education and training opportunities, towards an integrated education and training system that promotes equity and development (Bisschoff and Nkoe, 2005; Walters and Issacs, 2009).

However, the implementation of these policies has met major management and system challenges where the government's two institutions including the Department of Labour and the Department of Education that are responsible for technical and vocational education and training did not integrate (Chisholm, 2009). This resulted in conflicting policy directions and poor performance of the VET system. While the Department of Education focused on supply of skills through reforms in the technical college sector, now known as Further Education and Training (FET) colleges, the Department of Labour has worked on reforming the industry-based training system that emphasises industrial skills demands. Hence the Department of Education can be seen to be working on supply-side while the Department of Labour on demand-side strategies (Chisholm, 2009).

To address this challenge, the Department of Higher Education and Training (DHET) was formed in 2009 as a new department, to bring together all post-school education and training institutions including all higher education institutions, colleges and adult education institutions, formerly with the Department of Education; and the Sector Education and Training Authorities, formerly under the Department of Labour (Department of Higher Education and Training, 2012). The integration of the education and training system and its institutional manifestation through the creation of this department provides an opportunity to enhance and strengthen the role of the education and training system in contributing to the development of the knowledge and skills that are essential elements in giving effect on and overcoming the reconstruction and development challenges that face South African society (Council on Higher Education, 2012). This arrangement has also brought under the same department state agencies responsible for quality assurance, standards setting, assessment and certification (Centre for Higher Education Transformation-South Africa, 2012).

2.6.4. Competence Based Training and National qualifications framework in South Africa

In 1995, the Government promulgated the South African Qualifications Authority Act, which provided for establishment of the South African Qualification Authority (SAQA) and the development and implementation of a National Qualifications Framework (NQF). The mandate of the South African Qualification Authority was to cultivate a culture of lifelong learning while ensuring the development of the National Qualification Framework that is based on systemic coordination, coherence and resource alignment aimed at supporting South Africa's Human Resource Development Strategy and the National Skills Development Strategy (Walters and Isaacs, 2009). The objectives of the NQF as stipulated in *the South African Qualification Authority Act no. 58* of 1995 sub section 2 are to;

1. *Create an integrated national framework for learning achievements,*
2. *Facilitate access to and mobility and progression within education, training and career paths,*
3. *Enhance the quality of education and training,*
4. *Accelerate the redress of past unfair discrimination in education, training and employment opportunities; and*
5. *Contribute to the full personal development of each learner and the social and economic development of the nation at large.*

However, the implementation of NQF was hampered by challenges that included inadequate supporting systems resulting in conflict between qualifications established by educational institutions and those by SAQA structures; limited incentives, lack of resources and trained personnel (South African Qualification Authority, 2012). Additionally, the outcome-based qualifications and unit standards that had been developed by standards-generating bodies created by SAQA, and registered on the NQF, were not implemented and were seen to be too detailed and irrelevant to education needs (Centre for Higher Education Transformation, 2012). Further, the formal education and training system, under the Ministry of Education, did not comply with the official model of the NQF developed by the South African Quality Authority (SAQA). Instead, it 'implemented its own version of an Outcomes-Based Education (OBE) in the primary and junior secondary system with disastrous effects leading to its abandonment' (Centre for Higher Education Transformation, 2012, p.18). The OBE was highly decentralised yet decentralisation of institution-based assessment can only work when education institutions are strong and there is an internalised and shared sense of standards amongst teachers and trainers (Centre for Higher Education Transformation, 2012). 'The lack of these factors in the school system led to the collapse of OBE' (Centre for Higher Education Transformation, 2012, p.22), and also 'poor reliability of continuous assessment in schools' (Van den Berg and Shepard, 2009, p.2).

Moreover, although the initial NQF was meant to integrate all the three levels of education and put them under the coordination of one agency- SAQA, it was subsequently split into three linked frameworks, and three quality councils[7] were created, one for each framework. The three quality councils currently oversee their respective qualifications frameworks thus substantially reducing the coordinating role of SAQA (Heitmann and Mummenthey, 2009). These separations of vocational education (largely under Umalusi), and occupational education under the Quality Assurance in Trades and Occupations (QCTO)

[7] Umalusi- Council for Quality Assurance in General and Further Education and Training; Council for Quality Assurance in Higher Education and Council for Quality Assurance in Trades and Occupations

present a conflict that needs to be addressed. In addition, there is concern that if very different qualifications and quality assurance models are developed for the three frameworks, the gulf between occupational and other qualifications may increase, and the dream of an integrated system will be more elusive than ever (Centre for Higher Education Transformation, 2012). Although the moving of the trades and occupational framework to the Department of Higher Education can bring two of these councils closer together, the qualifications and quality assurance models need to be rethought (Centre for Higher Education Transformation, 2012).

2.6.5. Achievements and challenges of VET in South Africa

The creation of the Department of Higher Education with a view of bringing together all institutions responsible for further education and training is seen as a step forward towards integration of the VET system. In addition, there are key achievements towards provision of skills made separately by the Department of Education and the Department of Labour. With regard to the Department of Education led college system, Chisholm (2009, p.5) noted that:

> *multiple institutions had been merged into large, multi-site campuses with enhanced financial support, radical expansion of enrolments, especially by African, part-time, mature students, in public and private colleges; diversification of provision to meet demand; improvements in formal, intended curriculum; student support in the form of bursaries; support for training of lecturers; and specific initiatives to enhance responsiveness of colleges*.

With respect to skills training through SETA-funded learnerships (courses) led by the Department of Labour, there ‘are expanded possibilities for training among the youthful, unemployed population; and success in finding employment related to the sector’ (Chisholm, 2009, p.4).

Despite these achievements, the South African FET system is still hampered by a number of challenges and weaknesses that need to be addressed. The British Council (2012) notes that some of the main challenges that face FET in South Africa are low Vocational Gross Enrolment Rates (VGER), low graduation and throughput rates arising out of high failure rates and low retention rates, a lack of relevance and responsiveness to the needs of industry and the economy, and a shortage of suitably qualified lecturers to drive vocational training. The FET colleges presently have extremely low success rates – on average around 20 percent of all students who enter ever qualify. In some institutions, the throughput rate is as low as 4 per cent (Centre for Higher Education Transformation, 2012).

Moreover, the Development Bank of South Africa (2010) raises concern over the large numbers of school-leavers that exit the education system and do not enrol in any form of post-school education and training as a significant challenge for the state as it has the potential to further entrench long-term unemployment for youth. The large numbers of post-school youth who are not in employment or education creates a significant pressure point for expansion in FET (Development Bank of South Africa, 2010). It is estimated that three million South Africans aged between 18 and 24 are neither in education or training nor participating in the labour market (Department of Higher Education and Training, 2011). Further, over two-thirds of South Africans aged between 16 and 34 has never worked (Department of Public Works- South Africa, 2009).

2.7. Technical and Vocational Education Training in Botswana

2.7.1. Overview of the education system in Botswana

The Botswana education system comprises school, technical and vocational education and training and tertiary education. The school system includes early childhood, primary, junior secondary and senior secondary. Schooling is compulsory from primary to junior secondary school level. The Government introduced a Ten Year Basic Education Programme that allows 100% transition from primary to junior secondary (Ministry of Education (Botswana), 2004). Akoojee, Gewer and McGrath (2005) noted that free access to ten-year compulsory schooling was assured when school fees were abolished for primary schools in 1978 and for junior secondary education in 1989. However, due to the existing shortage of space in senior secondary schools, transition from junior secondary to this level is still on merit, and limited for those who do well in junior secondary certificate examination. The two-year senior secondary schooling is expected to cater for only 50 percent of those who have a Junior

Secondary Certificate (Akoojee et al., 2005). The government recognises this challenge and promises to overcome it through the ongoing expansion of senior secondary education (Ministry of Education (Botswana), 2004).

At the end of senior secondary education, candidates sit for the Botswana General Certificate of Secondary Education (BGCSE), a qualification that gives them the option of pursuing TVET programmes offered at technical colleges and brigades[8] or follow an academic pathway by going to tertiary institutions such as the University of Botswana and other registered private institutions. Those who drop out of schooling at this level have the option of continuing with their studies through the Department of Non- Formal Education and the Botswana College of Distance and Open Learning (BCODOL) (Ministry of Education (Botswana), 2001) or enrolling in artisan courses offered by the Department of Technical and Vocational Education and Training in technical colleges and brigades training centres (Leburu-Sianga and Molobe, 2000).

2.7.2. Vocational education in school in Botswana

Vocational education is a key feature in the Botswana school curriculum. The National Policy on Vocational Education and Training (NPVET), a guide to the development and reform of TVET of 1997, lays emphasis on vocationalisation of school curriculum (Republic of Botswana, 1997). Thus, its implementation ensured a diverse and balanced curriculum that focused at developing skills and qualities needed for the world of work at the same time vocationalising the school curriculum in order to strengthen post–school technical and secondary education and training (Ministry of Education (Botswana), 2001). Further, the policy framework lays more emphasis on science and technology as well as taking control of the quality assurance systems to achieve all curriculum objectives. Industry-specific subjects such as Agriculture were introduced in upper primary to reflect local economic circumstances while professional subjects are available as practical options in junior secondary (Georgescu et al., 2008).

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[8] The brigades were started as an integrated community initiative in 1963 designed by the socialist government to respond to the unemployment of school leavers without any opportunities for education, training or work (Akoojee et al 2005).

2.7.3. Current VET system and management in Botswana

Currently, the Botswana VET system is managed by two national government departments - the Department of Vocational Education and Training (DVET) in the Ministry of Education and the Ministry of Labour and Home Affairs (Akoojee et al., 2005). While the Ministry of Education is responsible for the Botswana Technical Education programmes, the Ministry of Labour and Home Affairs is responsible for the apprentices training model. The management of VET by two separate departments posed a coordination challenge where policies were not harmonised. Thus, the Revised National Policy on Education (RNPE) of 1994 proposed the development of an integrated national training system whose goals, content and organisation are uniform and of the highest standard to transform the economy and meet the challenges of the 21st century (Republic of Botswana 1994: 9). In line with this, quality assurance and accreditation of all technical and vocational education programmes and providers are done by a national agency - Botswana Training Authority. This Authority was established by *The Vocational Training Act, No. 22* of 1998 as the statutory body responsible for coordination and promotion of vocational training in Botswana (Republic of Botswana, 1998). The mandate of the Authority include accreditation, registration and monitoring of both public and private training institutions to ensure compliance to the required standard and quality of training while minimising variability between training institutions (Republic of Botswana, 1998). In Botswana, the Quality Assurance Unit in the Ministry of Education carries out TVET examinations and certification.

2.7.4. Competence Based Training and National qualifications framework in Botswana

In Botswana, the current national policy agenda is underpinned by *Vision 2016 “Towards Prosperity for All”* (Presidential Task Group, 1997, p.5). With respect to education, it underscores the need to improve its relevance, quality and accessibility while laying emphasis on the need to ‘empower citizens to become the best producers of goods and services’ and to ‘produce entrepreneurs who will create employment through establishment of new enterprises’ (Presidential

Task Group, 1997, p.5). The *Vision* further directed that TVET should be made available to all Botswanans as an alternative academic study. It advocates not only for excellent standards for TVET but also a flexible mode of its provision which will allow people to access it at any time of their life regardless of age or gender (Ministry of Education (Botswana), 2008).

Thus, the enactment of the *Vocational Training Act* of 1998 led to the establishment of the Botswana National Vocational Qualifications Framework (BNVQF) which was meant to set vocational qualification standards as well as addressing the mismatch between acquired skills and needs dictated by the economy (Tau and Modesto, 2010). However, the BNVQF is limited in scope as it does not cover qualifications in general and higher education making it difficult to integrate it with the rest of the education system (Tau and Modesto, 2010).

Further, the Botswana Technical Education Program (BTEP) that is essentially a structured Work-Based Learning (SWBL) vocational training system was developed in 1997 and its implementation began the same year (DTVET, 2005). The Ministry of Education (Botswana) (2004), view BTEP as a Competency-Based Training programme based on the British general vocational qualifications. The aim is to provide lifelong training opportunities and to prepare students for self-employment. The BTEP further aims at providing access to and increase equity to vocational education, provide skilled workers for local business and industry and equip school leavers, the unemployed and adult learners with employable skills (DTVET, 2005).

TVET is mainly provided by the Government through the Botswana Technical Education Programme (BTEP) and the National Craft Certificate (NCC) (Senwelo, 2010). With regard to private participation, a small number of registered private providers offer TVET programmes that are accredited by the Botswana Training Authority (BOTA) and other accrediting bodies such as City and Guilds of London.

2.7.5. Achievements and challenges of TVET in Botswana

TVET system in Botswana is viewed as young and evolving yet moving in the right direction. (Akoojee et al., 2005, p.29) asserts that the system is not only evolving but also important breakthroughs have been made to refine it. These breakthroughs include developments within the system that are responsive to different demands. Notable ones include the establishment of the Gaborone Technical College (GTC) and the establishment of the BTEP as a curricular alternative in the full-time post-school system, and the establishment of the BOTA to co-ordinate the TVET system and provide quality assurance as a means to achieve some degree of articulation within the work-based training system.

However, the problem remains that greater co-ordination is needed in the system as a whole. As noted earlier, the current qualification framework is sectorial, as it does not include basic and higher education. Hence, TVET awards have no currency at the University of Botswana. Besides, even though in the TVET sector the Ministry of Education has made an effort to upgrade the quality of provision through the twin thrust of the new state-of-the-art facilities at the GTC and the new curriculum of the BTEP, Akoojee et al (2005, p.29) warned of 'the existence of real concerns about how grounded these initiatives are in Botswanan reality and the feasibility of extending them beyond Gaborone.' Moreover, although Botswana has made attempts to expand the TVET sector, relevance, access and equity issues remain problematic within TVET institutions. The most challenging is how the access of rural and female learners is to be radically improved (Akoojee et al (2005).

2.8. Technical and Vocational Education and Training in Kenya

2.8.1. Overview of Education system in Kenya

Since independence in 1963, the Government has recognized education as a basic human right and a powerful tool for human and national development (Ministry of Education -Kenya, 2008). As observed by *the Task Force on the*

Re-Alignment of the Education Sector to the Constitution of Kenya 2010, provision of quality education and training to its citizens at all educational levels is a major commitment of the Government (Republic of Kenya, 2012). This commitment is demonstrated in both the constitution and the major government policies. For instance, *Vision 2030* singles out education and training as the vehicle that will drive Kenya into becoming a middle-income economy while the Constitution which was revised in 2010 provides for free and compulsory basic education as a human right to every Kenyan child (Republic of Kenya, 2012). Both the Sessional paper number 1 of 2005- a policy framework work on education, training and research; and the Economic Recovery Strategy Programme lay emphasis on access, equity, quality and relevance of education and training at all levels.

The levels of education in Kenya are structured in what is known as 8-4-4 system of education. The system comprises eight years primary, four years secondary and a minimum of four years of university education.

At primary school level, pupils are exposed to five compulsory subjects that are examined by the Kenya National Examination Council for the award of the Kenya Certificate of Primary Education at the end of their eight years of study. These subjects are Mathematics, English, Kiswahili, Science and Social Studies/ Christian Religious Education. The majority of graduates at this level of education join secondary education as the others who do not find chance in secondary schools, may opt to join TIVET courses at Youth Polytechnics or apprentices training in the informal sector. In Kenya, youth polytechnics (YP) now known as vocational training centres (Republic of Kenya, 2013, p. 838) are the major institutions currently targeting the primary school leavers who do not pursue secondary education (Kerre, 1997, Woltjer, 2006).

During the first two years of secondary schooling, students are exposed to at least 10 subjects and are expected to choose seven subjects at the third year. The criteria used in subject choice include:

1. Compulsory subjects (Mathematics, English and Kiswahili)
2. At least two sciences from (Chemistry, Biology and Physics),

3. At least one humanity (Geography, History, Christian Religious Education, Social Ethics)
4. Any other subject from the above three categories or vocational subjects.

The subjects' choice criteria demonstrate that vocational subjects are not compulsory at this level of education.

At the end of their fourth year, candidates sit for the Kenya Certificate of Secondary Education (KCSE) examination. Depending on their KCSE performance, students interested in further education and training have the options of joining university education or middle level colleges, which include TIVET. When analysing the demand for TIVET courses, the Ministry of Science and Technology (2008) noted that out of about 250,000 students who graduate from secondary school annually, only 30,000 transits to university education leaving the rest to find places at TIVET level. Thus, TIVET institutions are responsible for developing a significant population in Kenyan that is critically important for economic development.

2.8.2. Vocational education in school in Kenya

In Kenya, vocational subjects are optional at secondary school level and not taught at primary school level. Technical, industrial and vocational subjects were removed from the regular primary school curriculum while technical and industrial subjects were removed from secondary schools following the review of curricula between 2002 and 2005 (Ministry of Education Kenya, 2004). Thus, in Kenya, the school curriculum structure reflects traditional subjects while subject syllabuses consist largely of knowledge statements (Georgensu et al., 2008).

Policies on promotion of technical, industrial and vocational education at school level have not been consistent. After independence, technical, industrial and vocational subjects were removed from the primary school curriculum after the Ominde Commission of 1964 found them not relevant at this level (Ministry of Science and Technology, 2008). However, the Ominde Commission recommended the conversion of the then two-year industrial and vocational courses which were being offered at primary school into four-year technical secondary school courses (Ministry of Science and Technology, 2008). Later, in 1986, these subjects were introduced at all levels of education following the recommendation of the Mackey Commission of 1981. The objective was to address the rising youth unemployment by providing them with skills for both self and formal employment. The system was aimed at producing all-round individuals that were self-reliant, and could fit easily into any working environment (Ferej, Kitange and Ooko, 2012). However, the introduction of these subjects in schools was not sustained due to implementation challenges including limited training equipment, facilities and teaching staff leading to the current situation where the subjects have been removed from the primary school curriculum and some[9] made optional in the secondary school curriculum.

However, owing to the current economic challenges resulting to rising youth unemployment, there is critical need for technical and vocational skills in the country (*The Human Development Report* (UNDP), 2010). Thus, the Task Force for Realignment of the Education Sector to the Constitution of Kenya 2010 emphasised the need for the Government to actively revive TIVET programmes in secondary schools through the provision of facilities for industrial arts to offer technical education to promote and attract early interest in TIVET courses (Republic of Kenya, 2012, p.81). This was further reinforced by the manifesto of the current Jubilee Coalition government that promised to expand technical education and introduce e learning and teaching in primary school (Jubilee-Coalition-Manifesto, 2013).

2.8.3. Current VET system and management in Kenya

In Kenya, TIVET programmes are managed by several government ministries and departments which have their own legal frameworks and offer their own

[9] At secondary school level, technical and industrial subjects such as electricity, building construction, technical drawing, woodwork, metal work, automotive, and plumbing were removed from the school curriculum due to the training cost. However, vocational subjects seen to have lower costs of training such as business, accounting, home economics, home science, and computing, are still offered but are optional.

curricula and examinations separate from that of the Ministry of Education, Science and Technology despite its mandate of overall responsibility for national TIVET policy (The Ministry of Science and Technology, 2008). This has led to disparities in training standards, and uncoordinated policies (The Ministry of Science and Technology, 2008). Other broad challenges in the TVET system include low quality, relevance, access and equity to the TVET programmes (The Ministry of Science and Technology, 2008; Ministry of Education, Science and Technology, 2003).

To address these challenges, the government enacted the *TVET Act, number 29 of 2013* to provide for:

1. *the establishment of a technical and vocational education and training system;*
2. *the governance and management of institutions offering technical and vocational education and training;*
3. *coordination, assessment, examination and certification of TVET programmes;*
4. *a mechanism for promoting access and equity in TVET; and*
5. *TVET standards, quality and relevance (Republic of Kenya, 2013, p.837)*.

The Act establishes an agency known as TVET Authority whose functions include:

1. coordination of the TVET system,
2. undertaking the quality assurance and accreditation function and
3. promoting the access, relevance and equity to TVET programmes.

The authority takes over all the functions of the Directorate of Technical Accreditation and Quality Assurance (Ministry of Education, Science and Technology). It is also responsible for advising the Cabinet Secretary for the Ministry of Education, Science and Technology on all matters relating to TVET. However, the Act provides that individual ministries and government departments will retain management of TVET institutions. The Act also creates new management structures for all TVET institutions to allow for autonomy and decentralisation.

2.8.4. Competence Based Training and National qualifications framework in Kenya

A weakness in the Kenyan TVET system is lack of a qualification framework leading to disparities in standards of TIVET programmes (Ministry of Education, Science and Technology, 2003, Republic of Kenya, 2012). With regard to curriculum, the *TVET Act no 29* of 2013 established a second agency known as TVET Assessment and Certification Council. The functions of the Council include development of syllabuses for training institutions' examinations, assessment and competence certification (Republic of Kenya, 2013, pp.859-860). Others include making rules for the examinations, conducting examinations and competence assessments and awarding certification to successful candidates. While this agency will focus on competency-based curriculum development and examination, the Kenya Institute of Education and the Kenya National Examination Council will continue developing the previously existing academic syllabuses as well as providing for its examination and certification at primary, secondary, teacher training college and TVET programmes.

Currently, Kenya is in the process of developing competence-based training at TVET level. However, there is concern raised on how relevant the curriculum is given the limited participation in its development by both the industry and private sector who are consumers of TIVET graduates (Republic of Kenya, 2012).

2.8.5. Achievements and challenges of the TVET system in Kenya

Kenya has made many attempts to reform its TVET system since 2003 including formulation of the education, training and research policy framework contained in sessional paper number one of 2005, the enactment of TVET Act number 29 of 2013, establishment of the directorate of technical accreditation and quality assurance, development of a national TVET strategy 2008 to 2013 to guide the system, establishment of centres of excellence in technological trades, and upgrading of training facilities and equipment for TVET institutions.

Other initiatives include establishing access and equity programmes including bursary schemes, and construction of additional training institutions.

These initiatives are directed towards addressing the challenges and weaknesses identified by stakeholders at the beginning of TVET reforms in 2003. These include inadequate and obsolete teaching and learning facilities/equipment, curriculum that is not rationalized, lack of linkages between TIVET institutions and other educational institutions, and the needs of industry (Ministry of Education, Science and Technology, 2003). In addition, the stakeholder workshop was concerned about TIVET teachers, a majority who were inadequately trained, and also the existence of a weak quality assurance, inspection and supervision system. The Ministry of Science and Technology (2008) recognised that major challenges in TIVET entail a lack of unifying policies and legal frameworks. In addition, many private institutions were offering TIVET programmes with varying degrees of time duration and content yet awarding the same levels of qualifications. Besides, the sector was challenged by ineffective application of information communication technologies, lack of effective research and development and inadequate funding (Ministry of Science and Technology, 2008). The system also faces acute access and equity challenge as there are increased primary and secondary school outputs as both levels of education have been made free (Ministry of Science and Technology, 2008) and recognised by the constitution as being basic rights for all Kenyans (Republic of Kenya, 2010), yet the available spaces at TVET are limited.

The access challenge in TVET programmes has led to criticism of the upgrading of national polytechnics and technical and vocational colleges (Technical training institutions and institutes of technology) to university of technology status. The upgrading is seen to be denying access to training to those who do not qualify for university education as well as encouraging a reversed pyramid of skills where the numbers of graduates with management and supervision skills will be higher than those with technical skills required for the middle and low level cadres (Michira, 2013). It is therefore not surprising that, despite the high proportion of unemployment in Kenya, the foreign companies, which have taken over most infrastructural projects in the country, have to import some of the skills (Michira, 2013). Moreover, whether these new universities of technology will maintain their mandate is a subject of debate. Universities which were earlier established with the core mandate to offer engineering and technological skills, such as Moi University, have significantly lower enrolments in these programmes compared with non-technology and engineering programmes. Thus, while the upgrading of training facilities and equipment for TVET institutions is important, their further upgrading to university status should be discouraged since their original mandate of provision of skills to middle cadres will not be achieved (Republic of Kenya, 2012).

The current political and legal environments in Kenya provide opportunity for expansion of TVET institutions and programmes. The manifestos of both major contenders for the presidency in the Kenya’s 4th March 2013 elections, proposed restructuring higher education and making it free, building more technical training institutes, providing new student bursaries and higher salaries for lecturers (UNESCO, 2013). They both suggested higher education-related changes, ranging from the expansion of current capacity to increased funding and bursaries as well as considering expanding technical education and training in the country where the pool of technical skills has failed to match growing demand (UNESCO, 2013).

With regard to the legal environment, the *TVET Act no 29 of 2013* provides for expansion of training opportunities to Kenyans through construction of at least one vocational training centre in each constituency and one technical vocational college in each county. However, for the implementation of this provision to be more effective, the construction of new institutions needs to be located in places where the demand is high. Thus, while the environment seems to be conducive, further actions would only be effective if they are based on adequate and reliable information. This could best be provided by undertaking relevant studies.

Moreover, the previous efforts made to improve the TVET system since the beginning of reforms in 2003 have not been evaluated, but feedback is essential for system improvement. Evaluation will also reveal the extent to which the reforms have addressed the existing weaknesses and challenges in the system and also to uncover further issues that need to be addressed. In their discussion of the issues facing TIVET, the Ministry of Science and Technology (2008) expressed concern that very little research has been carried out on TIVET institutions in Kenya, and that where research has been undertaken the results have not been disseminated, leading to negligible impact on both policy and industrial growth. Thus, one of the objectives of this study is to undertake an evaluation of equity programmes put in place by the government as part of the wider reform agenda in the TVET system.

2.9. Discussions and conclusions

Based on the foregoing review, Kenya does not have a significant presence of vocational training in secondary and primary schools that is seen in the other four countries. Yet student enrolment in vocational secondary school programmes has a positive influence on their progression in similar programmes at tertiary level (UNESCO, 2010). Thus, Kenya needs to reconsider its former policies which encouraged promotion of VET in the school curriculum.

A review of the countries' TVET systems and management structures reveal that, there have been conflicts where TVET policy is the responsibility of different government institutions or different levels of governance. In Australia, there has been overlap of jurisdiction between the Commonwealth government and individual states in matters of policy. Similar conflict is seen in South Africa and Botswana, which had two government departments responsible for TVET policy. Thus, although Kenya's enactment of *TVET Act no. 29* of 2013 established an agency, TVET Authority to coordinate the system as well as undertake quality assurance and standards setting, not putting the management of all TVET institutions and programmes under the same ministry may pose future potential conflicts such as what happened in the South Africa where two departments did not agree despite having a common agency (South Africa Qualification Authority).

The summary of the review on the positioning of TVET in the five countries is presented in Table 2.1.

Table 2.1.Summary of position of TVET systems in Australia, the UK, South Africa, Botswana and Kenya

	TVET in schools	TVET System and management	Competency based training and qualification framework	Challenges and achievements
Australia	Vocational education is major feature in schools.	The federal and state/territory governments involved in policy development and delivery. Individual states manage their TAFE system. State agencies responsible for quality assurance and standards. High industry participation supported by government agency.	Qualification framework relates to three levels of education and has had a continuous review. Training packages developed by industry skills councils brokered by government agency. Individual institutions conduct examination and certification.	Has high participation rate and flexibility of programmes offered. Challenges are need to increase labour market participation; overlapping States and Commonwealth jurisdiction in TVET funding and quality assurance, ensuring equity for marginalised communities and women in STEM courses, and progression from TAFE to universities.
United Kingdom	Compulsory for every school student to undertake work related courses.	Devolved management of TVET to regional governments but centralised policy making. Qualifications and standards are industry led.	Qualification framework relates to all levels of education and has been reviewed to make them demand driven. Industry involved in development of CBT. Has multiple qualifications and awarding bodies	Achievements are high access; flexibility of the curriculum, and high quality assurance measures. Challenges include ensuring relevance of programmes to labour markets; too many and confusing qualifications, high dropouts, gender disparities in some programmes; progression from TVET to university education.
South Africa	Compulsory at lower school but optional at senior secondary school	Integrated education and training system under one government department. Centralised system of policy and management of FET. Quality assurance, standards setting, assessment and certification done by state agencies.	NQF relates to the whole education system but split into three sectorial frameworks. Has undergone several amendments. CBT developed by sector education training authorities. Examination and certification undertaken by providers.	Achievements include merging of colleges into larger institutions and provision of relevant occupation skills for employment. Challenges are low access, equity and completion rates, relevance of training programmes. Low quality and training capacities.
Botswana	VET introduced in primary school and optional at junior secondary school.	Centralised system of policy and administration through two government departments. Government agency created to coordinate policy and assure quality and standards of training.	Qualification framework relates to only TVET level of education. CBT is based on British general vocational qualifications model. Government department undertake examination and certification.	Achievements include establishment of Government agency to coordinate and assure quality of TVET and Gaborone Technical College (GTC) with state of the art facilities. Challenges include progression from TVET to universities, relevance, and access and equity problem especially for rural students and females.
Kenya	Industrial subjects not in school curriculum. Optional VET in secondary	Central government but under several ministries and departments. Government agency to coordinate policy and quality assurance. Low industry participation.	No QF, but in process of developing CBT. Established an agency for development of examination curriculum for CBT, assessment and award of certificates	Achievements include, enactment of TVET Act that establishes government agencies for policy coordination, and quality assurance and CBT; Establishment of centres of excellent. Challenges are low access, equity quality and relevance of TVET; Limited application of research in TVET. Conflict in TVET policies by government departments.

The review further demonstrates that Kenya has not developed a national qualification framework, but it is in the process of developing an outcomes-based curriculum. Lessons from the other four countries demonstrate that an outcomes-based curriculum should be based on a qualification framework. In addition, the framework that relates to all education levels is more effective for integration of the system.

Developing an engineer is a lifelong process starting from formal education, and ‘post formal educational activities of educational nature’ (Trafford, 1982, p.79), Thus, having ‘relationships between universities and employers could, and do, provide opportunities for both to engage in mutually beneficial undertakings’ (Trafford, 1982, pp.79-80).This means that involving both training institutions and employers in curriculum development and implementation would make training of engineers more relevant and beneficial. The review indicates that industry is involved in curriculum development and implementation of TVET courses in developed countries including Australia and the UK where training programmes are relatively more relevant to industry needs. Thus, Kenya should enhance industry involvement in the curriculum development and implementation to enhance the relevance of its TVET programmes to the needs of industry.

The review further indicates that all the five countries have challenges despite varying efforts and achievements in promotion of TVET.

In conclusion, the review implies that despite efforts made in reforming TVET systems as witnessed in both developed and developing countries, challenges and weaknesses still exist within them. This means that addressing TVET challenges is not an event but a continuous process. Thus, notwithstanding the efforts made in the recent reforms in TVET system including establishment of centres of excellence, access and equity programmes and enactment of TVET Act of 2013, Kenya still has a long way to go to place its TVET system at the same footing as that of developed countries. The country must be prepared to carry out further reforms. This can only be effective if Kenya invests more in research into the TVET system. From the lessons learnt, other countries continuously undertake research to improve their TVET system since there is a continuous change. Research at the TVET level of education will not only disclose the potential weaknesses, barriers and challenges that could hinder the development of the TVET system at every stage of the reforms but also recommend possible solutions. Thus, there is a need to undertake studies on existing challenges and the effectiveness of measures undertaken to address them. In this regard, this study investigates gender equity challenge in enrolment in TVET programmes as well as evaluation of the effectiveness of the measures put in place by the government to address the challenge. Lastly, it is important to note that lessons from this review chapter indicate that what is found for Kenya can also have an international relevance.

In the next chapter, a detailed review on access and gender equity for general education and TVET programmes at the global, African and Kenyan levels is presented.

CHAPTER THREE

REVIEW OF GENDER EQUITY IN EDUCATION AND TRAINING

3.1. Introduction

This chapter provides a review of the literature on gender equity in education and training in schooling, tertiary and technical and vocational education with particular focus on Africa and Kenya. The first section explores the international context. The second section presents factors that have been found to influence gender differences in enrolment in technical and vocational programmes. The review is based on 24 reports, 11 policy documents and 56 studies undertaken at international, African regional level and Kenya. Most of the literature focused on engineering enrolment.

3.2. International Perspective of Gender Equity in Education and Training

The term gender refers to the social characteristics of, and relations between the two sexes, female and male as opposed to their biological differences (UNESCO, 2008). It concerns the social development of both men and women, and therefore should not be seen as the province of women as is often the case, where 'gender' is assumed to be interchangeable with 'women' (Colclough, 2007, p.11). However, women and girls are often more disadvantaged by the unequal gender relations that exist between the two sexes.

Education and training empowers people to develop the knowledge, understanding and skills they need in order to achieve what they value for their lives. Several decades of research have demonstrated that the education of women produces significant personal, family, community and social benefits including reducing gender inequalities, poverty, and improving national development (Bunyi, 2008). Hausmann, Tyson and Zaidi (2012, p. v) noted that, 'since women make up one half of the world's human capital, empowering and educating them and leveraging their talent and leadership fully in the global economy, politics and society are fundamental elements of succeeding and prospering in an ever more competitive' world. Besides, with the projection that talent shortages will become more severe in much of the developed and developing world, maximizing access to female talent is a strategic imperative for business (Hausmann et al., 2012). In this regard, most countries across the globe have declared a commitment to gender equity in education and training through a number of policies and declarations made in the last two decades.

The commitments fall into two main categories. The first category consists of international human rights treaties adopted and ratified by countries that required them to make education universally available while pursuing educational policies that ensure gender parity (Colclough, 2007). One of the earliest treaties, the Universal Declaration of Human Rights, was made three years after the Second World War, where countries across the globe declared education to be the right of every human being and thus called for free and compulsory education across the elementary and fundamental stages of provision and access to technical, vocational education and training; and for professional and higher education (United Nations, 1948; Onsongo, 2011). This treaty was not practically realised leading to the ratification of the 1962 treaty of the United Nations Educational Scientific and Cultural Organisation (UNESCO) Convention against Discrimination in Education. The latter emphasized the need for the formulation of policies to promote equality of opportunity, including free and compulsory primary education, accessible secondary, TVET and higher education (Colclough, 2007).

Equal treatment of men and women in all aspects of life was further emphasised by The Convention of Elimination of All forms of Discrimination against Women (CEDAW) in 1981 (Onsongo, 2011). This treaty required governments to

> *embody the principle of gender equality in national constitutions while abolishing existing laws, regulations, customs and practices that discriminated against women; take all appropriate measures, including legislation, to ensure the full development and advancement of women, for the purpose of guaranteeing them the exercise and enjoyment of human rights and fundamental freedoms on a basis of equality with men; and provision of the same conditions for career and vocational guidance at all levels, same curricula and quality of institutions, removal of stereotypes from roles of men and women, same scholarship opportunities and reduction of female dropout rates (Onsongo, 2011, p.17*).

The second category of world commitments includes international declarations issued under the auspices of the United Nations (Onsongo, 2011; Colclough, 2007). There are five major declarations under this category outlined by Onsongo (2011, p.17) as follows:

1. The World Conference on Education for All held in Jomtien, Thailand in1990 which required the achievement of the Universal Primary Education (UPE) by the year 2000.
2. The International Conference on Population and Development, held in Cairo, Egypt in1994, which set the target for achievement of primary gender parity, and Universal Primary Education (UPE) before 2015.
3. The Fourth World Conference on Women held in Beijing, China in 1995, which set the target for achievement of primary, and secondary schools gender parity by 2005, and emphasised the need to achieve UPE by 2015. It further recommended the removal of deep-seated barriers to equality of opportunity for both gender including discriminatory laws, customs, practices and institutional processes as well as developing the freedoms of all individuals, irrespective of gender, to choose and achieve their reasonable valuable outcomes.
4. The Education Forum, held in Dakar, Senegal in 2000 set the target for achieving gender parity in primary and secondary education by 2005 and gender equity in education by 2015.
5. The United Nations Summit on Millennium Development Goals (2000) not only reinforced all the previous declarations but also set 2015 as the target for the achievement of gender parity at all levels.

Other worldwide campaign initiatives particularly for gender parity in education and training include the United Nations Girls Education Initiative (UNGEI) launched in 2000 whose objective is to ensure implementation of the World Education Forum in Dakar’s 2000 target set for gender equality in education; and The Global Campaign for Education (GCE) launched in 2005 to monitor the progress made by countries towards the achievement of the Millennium Development Goals (MDGs) target for 2000 (Onsongo, 2009; Onsongo, 2011).

The spirit of the global declarations and campaign initiatives is to have education systems that facilitate capacity developments for all and freedoms irrespective of gender. This means freedom to attend school, to learn and participate meaningfully (Aikman and Unterhalter, 2007).

Both Colclough (2007), (while examining the processes by which the achievement of gender parity and women empowerment came to be included amongst the MDGs), and the *Education for All Global Monitoring Report of 2011*(UNESCO, 2011)[10] observed that some of the declarations have been found to have had poor design and set unrealistic dates for the achievement of their respective educational goals. For example, UNESCO (2011) identified that the elimination of gender disparity in enrolment at both primary and secondary school levels by 2005 (which was the original goal set by the World Education Forum) was overambitious and was missed by a wide margin. The current goal of gender equality in access to primary education set to be achieved by 2015 is seen to be a more credible ambition (UNESCO, 2011). Further, the MDGs targets do not make mention of equality but only of the need to achieve enrolment parity, implying equal numbers of boys and girls attending schools, TVET colleges and universities. Thus, they are weak in that *'they do not mention of the need for achievement of equality of opportunities in learning processes whilst at school, equality of outcomes such as learning achievements and equality of external results including job opportunities and equal remunerations for men and women with similar qualifications'* (Colclough, 2007, p.10).

3.2.1 Participation at primary and secondary education

In 2010, 2011 and 2012, UNESCO commissioned a team to evaluate the status of implementation of the *Education for All* commitments across the globe. The team found that global gender disparities in primary and secondary school enrolments had narrowed since 1999, but that many governments were moving too slowly to eliminate them (UNESCO, 2011). The team further noted that in

[10] UNESCO (2010, 2011, and 2012) are all EFA Global Monitoring reports by UNESCO.

2008, the averages for the world's gender index (the ratio of girls to boys)[11] were 0.97 and 0.96 at primary and secondary school levels respectively. These results indicate that globally, there is very close to parity at primary and secondary school level.

However, UNESCO (2011) noted that countries across the globe were at different stages of implementation of global declarations and commitments on gender equity in education and training at both primary and secondary school levels. The differences were evidenced by the variations in GPIs for countries. For example, UNESCO (2011) found that the GPI for 52 countries was 0.95 at the primary school level while that for the other 26 countries evaluated had a primary GPI of 0.90. A majority of the 47 countries which were not yet at parity but had enough data for projection to 2015 were found to be moving in the right direction. However, across the globe, 38 countries were predicted to fall short of the target at primary school level (UNESCO, 2011). At secondary school level, UNESCO (2011) observed that about a third of all countries with data had achieved gender parity in secondary school; however in many countries significantly fewer girls than boys were enrolled.

When comparing countries by their income, UNESCO (2011) found wide variations in gender parity between high and low income countries for both primary and secondary schools**.** High income countries had the highest average gender parity index at both primary (0.99) and secondary schools (0.99) while low income countries had the lowest average gender parity index at both levels (0.93 and 0.87 at primary and secondary school respectively) (UNESCO, 2011).

The enrolment statistics from Australia, United States, the UK and France further indicated that although the four countries were at the same level of achievement of gender parity at primary school level, there were differences at secondary school levels. Additionally, the proportion of male students was

[11] UNESCO (2006) defines the GPI – The Gender Parity Index as measure of the ratio of female-to-male value of a given indicator. Values below 1 indicate a gender disparity in favour of boys while those above 1 indicate a disparity in favour of girls. *According to UNESCO (2011), g*ender parity is reached when the gender parity index is between 0.97 and 1.03.

slightly higher than that of female students at both levels. UNESCO (2012) found that in 2010, Australia, United States and France had GPIs of 0.98 in favour of boys at primary school level and that in 2009 the UK had similar GPI at this level of education. Further, apart from Australia, which had a GPI of 0.94, the remaining three countries, had the same GPIs of 0.98 at secondary school level in the same year. In contrast, the GPI at secondary school in 2008 for Australia was 0.92, United States (0.96), the UK (0.96) and France (0.96) (UNESCO, 2011) all that were lower than their respective GPIs in 2010. UNESCO (2012) explains the lower Australian GPI at secondary school level as due to the enrolment data for upper secondary education which included adult education students over age 25, particularly enrolled in pre-vocational/vocational programmes, in which males were in the majority. However, the trends show an improvement of gender parity at secondary level of education in all the four countries.

3.2.2. Participation at tertiary level

There are more females compared with males enrolled in tertiary education across the globe. *The Global Gender Gap Report* by Hausmann et al. (2012) on behalf of the World Economic Forum found that the gender gap at the tertiary level had been reversed and women made up the bulk of the high-skilled workforce. UNESCO (2010) statistics indicated that, at the tertiary level, the GPI increased in favour of females between 1999 and 2007. Thus, females constituted more than half of the students enrolled at tertiary level in 2007 (See Figure 3.1). However, the increase varied with stage of development. Developing countries had the lowest average proportion of female enrolment in 1999 and 2007. Sub-Saharan African region lagged behind the rest. Figure 3.1 presents Gender Parity averages at tertiary level by regions.

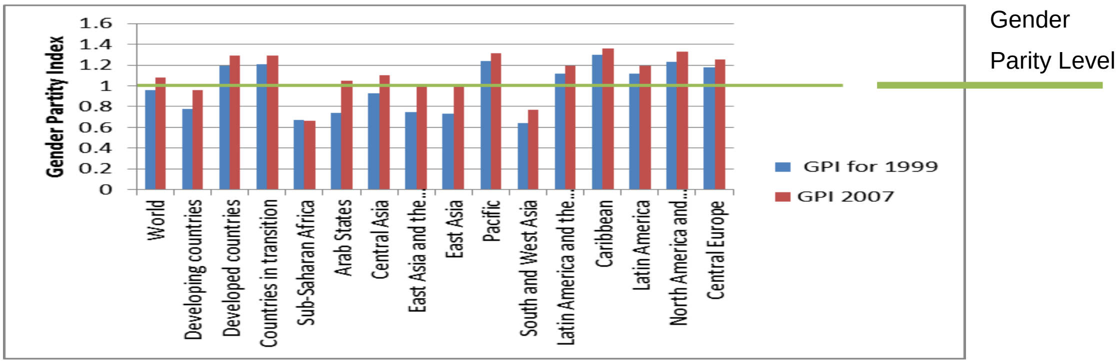


Figure 3.1. The Gender Parity Index at tertiary level by region by year

Extracted from the *EFA Global Monitoring Report* by UNESCO (2010, Table 9B,)

Despite the higher proportion of female students at tertiary level, there are wide gender disparities in science, engineering, and technology based courses globally. *The Education For All Global Monitoring Report* of *2008* found that 'in most countries where data was available, women represent less than one-third of tertiary students in science-related fields (engineering, manufacturing and construction, life sciences, physical sciences, mathematics and computing, agriculture) but over two-thirds in humanities, arts, education, social sciences, business and law, services, and health and welfare' UNESCO (2008, p.91). Further, the 2007 tertiary enrolment statistics presented by UNESCO (2010) indicated that the proportion of female participation in science-based courses varies by regions and country's status of development as shown in Figure 3.2.

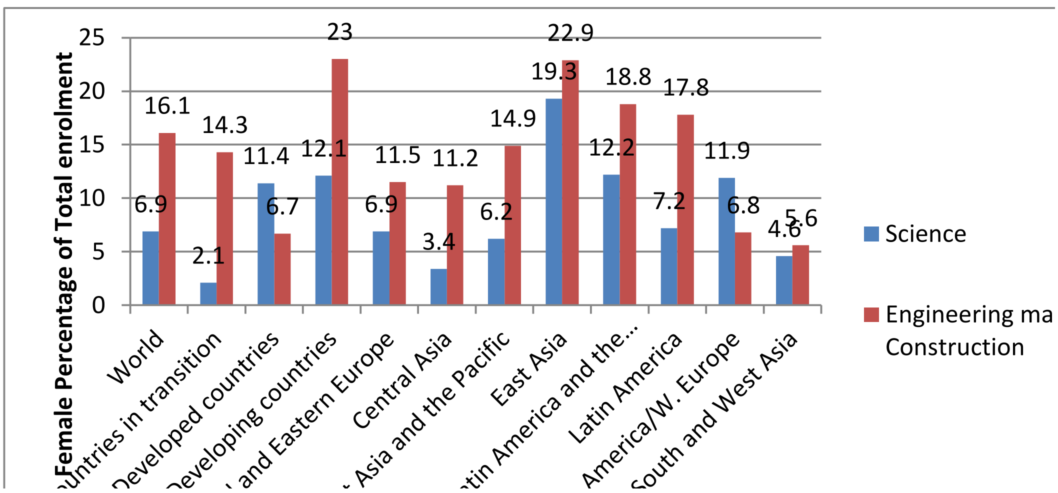


Figure 3.2. Percentage median of tertiary female students enrolled in science based courses by region Extracted from: *EFA Global Monitoring Report* (UNESCO, 2010, Table 9B)

Based on Figure 3.2, developing countries had higher proportions of female enrolments in science based courses. At regional level, South and West Asia had the least proportion of female participation in engineering, manufacturing and construction while Central Asia trailed in female participation in science courses.

3.2.3. Participation at TVET level

A report of the sub-regional seminar for TVET policy-makers and UNEVOC centre coordinators held in Kenya observed that, there is increasing recognition that technical and vocational education and training (TVET) is an effective means of empowering young people to engage in productive and sustainable livelihoods (UNESCO, 2005). Thus, the report noted that governments of many countries where vastly increased numbers of youth will be completing primary and secondary education in the years ahead are faced with the challenge of providing further learning opportunities for them or preparing them for the world of work. According to the report, there is consensus that livelihood skills development must form an integral part of basic education. Thus, enhancing access to skills development and TVET programmes is viewed as a contribution to EFA Goal three which seeks to provide young people and adults with quality life skills programmes.

Despite its importance, participation in TVET programmes has been found to vary between countries across the globe. As noted in Chapter One, in their examination of cross-country data from UNESCO descriptive statistics and the USA Department of Education data, Rodgers and Boyer (2006) found that emphasis on access to TVET varied significantly around the world with European countries recording relatively high proportions of vocational courses in secondary schools. In contrast, they noted that most low-income countries had vocational proportions below 4 percent at secondary school level. Similar trends persisted with slight improvements in 2007. UNESCO (2010) found that, in 2007, 16 percent of secondary school students in developed countries were in technical and vocational education, compared with 9 percent in developing countries.

Developed countries are not all at the same level of promotion of TVET programmes as demonstrated by their wide variations in the share of vocational education in secondary school programmes. The enrolment in technical and vocational education at the secondary level was found to range from less than 20 percent in fourteen countries, including France, Spain and the UK, to over 45 percent in the Netherlands (UNESCO, 2010).

Studies indicate that there is gender disparities in participation in technical and vocational courses across the globe in favour of males despite the higher proportions of female students witnessed at tertiary level as discussed earlier. As noted in Chapter One, Rodgers and Boyer (2006) found that most countries had lower proportions of female students enrolled in vocational programmes in secondary schools compared with their male counterparts. Findings of UNESCO (2012) and UNESCO (2010) confirm that there are gender inequalities in technical and vocational education programmes across the globe in favour of males and varies by country status of development with developing countries recording the highest proportion of females at this level (See Figure 3.3).

The UNESCO statistics further indicate that there was a slight drop in proportion of female enrolments worldwide between 2008 and 2010. At regional level, Latin America and the Caribbean had higher proportions of female enrolment at this level while Africa was among regions that had lowest proportions of female enrolments in both years. Figure 3.3 compares proportions of female enrolment in TVET programmes by country status of development.

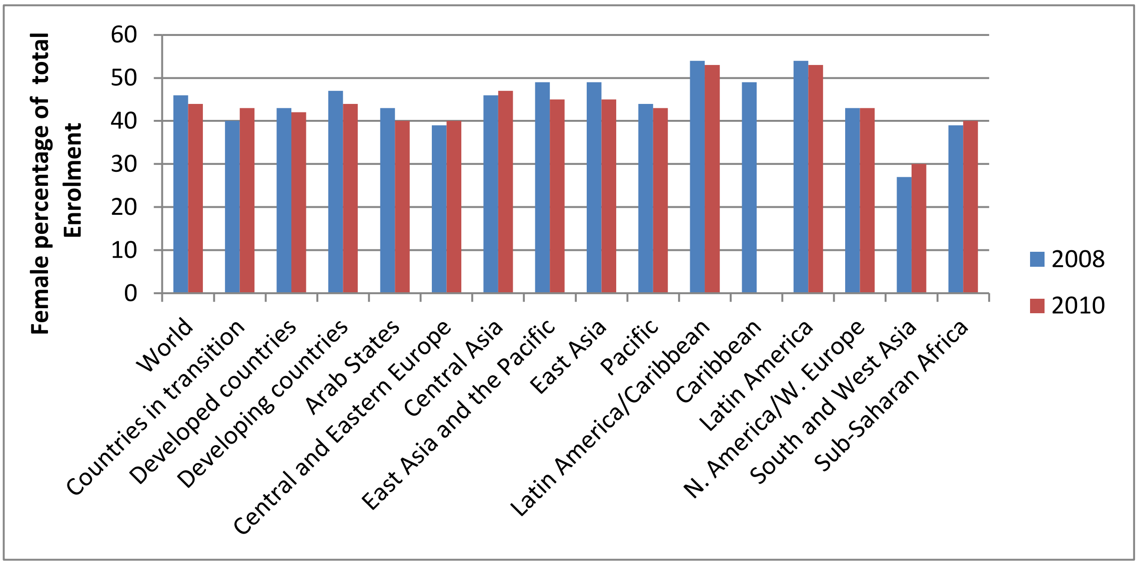


Figure 3.3. Proportions of females in secondary TVET Programmes by country status of development by year (Source: Extracted from *EFA Global Monitoring Report* by UNESCO (2011, p.324, Tble 7; UNESCO, 2012, p. 370, Table 7).

However, there are differences in choice of TVET courses by gender. As discussed in Chapter One, Rodgers and Boyer (2006) found that most of the female students cluster in business preparatory courses while most male students were enrolled in trade and industrial courses.

3.3. Gender Equity in Education and Training in Africa

African countries are signatories to the international protocols that emphasise gender equity in education and training as well as human rights. Lumumba (2006) observed that African states have signed international conventions within sub-regional and continental organizations from the Organization of African Unity (OAU) to the African Union (AU) in addition to worldwide organizations that call for gender equity in specific sectors including education and labour. Further, in a study on gender dimensions in transition from upper secondary to higher education in sub-Saharan Africa, Bunyi (2008) noted that, all sub-Saharan African (SSA) governments have committed themselves to working towards ensuring gender equity and equality at all levels of education by 2015. They have recognized the benefits of women's education and are therefore expected to implement these policies and declarations with view to overcoming gender inequalities not only in education and training but also in all other sectors, which include social, political and economic development.

Despite these commitments, Bunyi (2008) noted that the education of women, especially at the higher education level, continues to pose major challenges to education systems in Africa. Studies on the implementation of the global declarations found most countries in spite of ratifying them; do not allocate enough resources for their implementation (Kwesiga, 2002 and Mama, 2002). Colclough (2007), Aikman and Unterhalter (2007), Chege and Sifuna, (2006) noted that lack of and under-allocation of funds to support implementation occurs in many African countries.

While analysing the gender responsive budgeting in education, Aikman and Unterhalter (2007) observed that increasing flows of resources into education and training have not been matched by an increasing concern to develop gender equality in education and training. This shortfall is one of the factors hindering the implementation of the global declarations in Africa. Only few countries make a commitment to mainstream gender issues in their development plans despite ratification of the declarations, collection of gender disaggregated data and specification of objectives to improve female enrolments to qualify for development aid (Onsongo, 2011). In light of the above, Aikman and Unterhalter (2007) concluded that attempts to promote gender equality in education are not only slow but also the actions within some countries are unsupported and inadequate.

Five years after the conferences, the United Nations Economic Commission for Africa (2001) carried out an assessment on the progress made in the implementation of the Dakar Platform for Action and the Beijing Programme of Action with regard to women's education. The Commission found that progress had been made in education, though in varying degrees. The progress made in access to primary education was higher compared with that of TVET and higher education. The Commission further observed that the whole school attendance had increased and large-scale reform programmes had been initiated before the Beijing Conference. Countries were found to give more priority to enrolment in the primary schools (which employ 80 percent of teachers), which could be attributed to the decisions of the Jomtien Declaration. In addition, the World Bank policies had laid emphasis on investment in primary education arguing that it had produced higher rates of return compared with investment in secondary and tertiary education.

African countries are not all at the same level in regard to promotion of education in general and technical and vocational education and training in particular. The levels attained vary, depending on the conditions that had prevailed earlier on and the efforts made thereafter in respective countries (The United Nations Economic Commission for Africa, 2001). In their book focusing on TVET trends and policies in Africa, Atchoarena and Delluc (2002, p.1) noted that 'the differences in political, historical, cultural, educational and economic contexts largely account for such variations in systems, structures, operating conditions and outcomes'. For instance, for a long time South Africa had a system of education which was based on racial segregation policies. The Government of South Africa has implemented policy measures to reform its education and TVET system but has a challenge in building capacities including leadership, infrastructure and lecturers for effective delivery. Botswana started reforms in TVET Training in 1994; the year South Africa became independent. According to Atchoarena and Delluc (2002), both Botswana and South Africa were a head of Kenya and Namibia in development of their TVET systems. However, the four countries were at different levels of development. Therefore, given the respective level of development of TVET, individual countries have their unique causes for gender disparity in enrolment. The United Nations Economic Commission for Africa (2001) further found that although the implementation of Beijing Conference and the Dakar Platform for Action led to some progress, this varied with countries. These variations were demonstrated in the national plans of action, which were found to vary with countries in giving priority to education in general and for women in particular. The United Nations Economic Commission for Africa (2001, p.16) stated:

> *Out of the 51 countries that took part in the world conference on women 47 countries, about 88.6 percent said that they had formulated and adopted national plans of action to implement the commitments made in Beijing on education. Of these countries, 39 had identified education as a priority.*
>
> *Forty-one African countries were found to have included the education of women and girls in their national priorities for the next four to ten years. However their plans varied from country to country in regard to development of*

pre-school education, the education of girls throughout the school system, the education of young girls, the functional literacy of adult women and the development of science and technology for increased productivity.

Many African countries were implementing a number of strategies to improve women and girls' training and education. Most of the strategies included a raft of rural measures with an emphasis on the community participation in schools. These strategies as outlined by the United Nations Economic Commission for Africa (2001, p.18) are:

1. *Establishment of universal free primary education in some countries and making this compulsory in other countries;*
2. *Recruitment of teachers for rural and urban areas;*
3. *Implementation of flexible programmes in rural areas to encourage the education of girls and keep them in school;*
4. *Establishment of rural schools closer to communities;*
5. *Revision of school programmes and teaching materials to remove gender-based discriminations and to sensitize pupils to positive gender relations;*
6. *Decentralization for schools, with the participation of local councils, as a means of improving efficiency and ensuring that greater account is taken of the interests and needs of communities;*
7. *Establishment of more dynamic partnerships among governments, NGOs, local communities including parents and donors; hence making it easier to include women's issues in education;*
8. *Strengthening the school system as a community establishment;*
9. *Giving dispensation to adolescent mothers and pregnant girls to enable them to continue their education.*

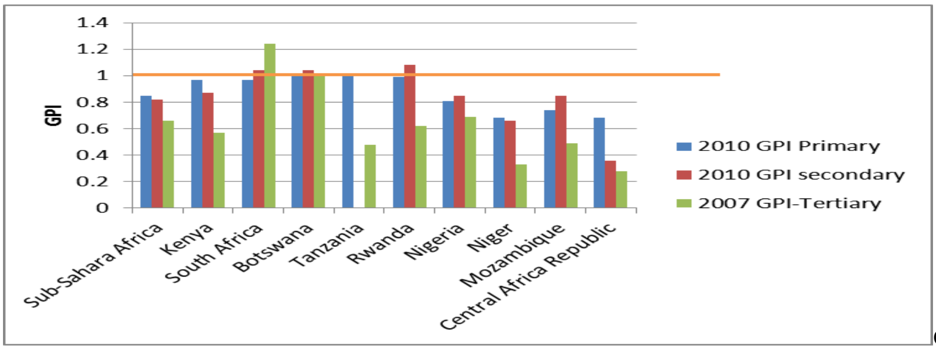
Apart from the aforementioned strategies, several interventions aimed at ameliorating the gender inequities in transition to and effective participation in tertiary education in sub-Sahara Africa were being implemented in the school system. According to Bunyi (2008) affirmative action policies and programmes were being implemented at both secondary and higher education level; while in a number of higher education institutions, interventions such as policies and programmes to combat sexual harassment and gender-based violence, and gender mainstreaming were being implemented. Further, in a case study on interventions that had been put in place to alleviate gender disparities in tertiary education in Africa, Bunyi (2003) observed that lowering the cut-off admission points for females as part of affirmative action policy measure increased enrolments of females at the university level in sub-Saharan African countries. For example, a total of 462 females entered the six public universities in Kenya during the 2002/2003 academic year while in Ghana, female enrolments increased from 21 percent to 27 percent between 1990 and 1999. Similarly, in Uganda, female participation in Makerere University increased from 27 percent to 34 percent between 1990 and 1999 and in the University of Dar es Salaam in Tanzania, the increase was from 19.5 percent to 27 percent between 1997/98 and 2000/2001 academic years (Bunyi, 2003). However, the programme was criticised for compromising academic standards as well as endorsing the notion of women as the intellectually weaker gender. Besides, Onsongo's (2009) examination of the outcomes of affirmative action policies aimed at improving access for women students to university education in Kenya, Uganda and Tanzania, found that affirmative action that focuses only on lowering admission points for females was not effective in enhancing gender parity at university level as it did not address their poor performance at secondary school level as well as financial constraints for those from poor families.

Moreover, Bunyi (2008) observed that majority of the interventions are in the form of small pilot projects executed by NGOs with little impact thus the attainment of the EFA and MDG goals of gender equity and equality in higher education in sub-Sahara Africa remains a distant dream for most countries. The United Nations Economic Commission for Africa (2001) noted that despite the implementation of the aforementioned strategies and measures, most African countries acknowledged that women's access to and participation in science, technology and engineering remained marginal.

3.3.1. Participation at primary and secondary school levels in Africa

Available data on participation at various levels of education and training in sub-Sahara African countries indicate that, on average, gender disparities in these programmes begin at an early stage of schooling and widen at secondary and tertiary education. UNESCO enrolment statistics for 2010 and 2007 indicated that, in sub-Sahara Africa, the average proportion of boys participating in education and training was higher compared with that of girls and this gap widens with the level of education (UNESCO, 2010; UNESCO, 2012) (See Figure. 3.4).

Further, the statistics showed that there were variations in achievement of gender parity at both primary and secondary school levels among individual countries in sub-Sahara Africa. As shown on Figure 3.4, in 2010, South Africa had achieved gender parity at both levels while Botswana had achieved parity at primary school level. Niger and Central Africa Republic, however, were far from achieving gender parity at both levels. Meanwhile, in Kenya, gender parity was almost achieved at primary school level but still far from achieved at secondary school level; yet nearer to achievement compared with that of Central Africa Republic and Niger.



G. ***Parity LEVEL***

Figure 3.4. Gender Parity Index by African country and level of education

(Extracted from –*The EFA Global Monitoring Reports* (UNESCO, 2012, Table 5 and7; UNESCO, 2010, Table 9A)

At regional level, sub-Saharan Africa trailed in achieving gender parity at the two levels. UNESCO (2010) found that the two regions with the largest gender disparities at both primary and secondary school level in 2007 were South and West Asia, and sub-Saharan Africa. Further to this, UNESCO (2010) noted that secondary-level GPI for sub-Saharan Africa had slipped from 0.82 in 1999 to 0.79 in 2007(UNESCO, 2010) despite the many interventions that had occurred.

3.3.2. Participation at tertiary level in Africa

A review of evidence about impact of tertiary education to economic growth in sub- Sahara Africa revealed that enrolment rates at tertiary level of education in this region were by far the lowest in the world (Bloom, Canning, and Chan, 2005). This meant that the region would continue to lag in both social and economic development. UNESCO (2010) found that tertiary enrolment was 6 percent in sub-Saharan Africa, compared with 22 percent in the Arab States and 35 percent in Latin America. Moreover, the region had the highest gender disparities at this level compared with other regions as evidenced by the lower proportion of female enrolment (40 percent) at this level in 2007 compared with the other regions which ranged from 42 percent in East Asia to 58 percent in Caribbean (UNESCO, 2010).

Similar to the trends at the regional level, enrolments at tertiary level vary across countries in sub-Saharan Africa although in most cases the proportions of males are higher than that of females. According to Griffin (2007), women constituted an average of 32.9 percent of total enrolment in the seven case study universities in the Pathways research project in East Africa. At country level, the United Nations Economic Commission for Africa (2001) found that female graduates with higher education diplomas and degrees accounted for 38.5 percent of the total enrolments in Algerian universities. In Rwanda, the proportion of females constituted only 26.8 percent of students enrolled in public universities in the five years 2001- 2005 (Huggins and Randel, 2007). In Nigeria, the average proportion of women comprised 31.2 percent of the students enrolled in 23 federal universities (Pereira, 2007) which was higher compared with their counterparts in Rwanda but lower compared with Algeria. In Botswana, the proportion of females at tertiary level in 2005 was 50 percent while in South Africa females constituted 55 percent of total enrolment at this level in 2007 (UNESCO, 2010).

Moreover, UNESCO (2010) found higher proportions of female students at tertiary level pursuing art based programmes and very few enrolled in technology and engineering programmes in most countries in sub-Sahara Africa. For example, in 2005, the proportions of females enrolled in technology and engineering courses in Rwanda and Tanzania was 20 percent and 24 percent respectively. In Nigeria, female students constituted only 27 percent of those in science and technology programmes in the universities in 1999 /2000 academic year (UNESCO, 2010). A much more interesting scenario is the case of Sokoine University of Agriculture in Tanzania, where for a period of 15 years between 1977 and 1992, women made up only 2.8 percent of the total forestry graduates (Abeli, Muzanila, Lyimo-Macha, and Pereka, 2005).

3.3.3. Participation at TVET level in Africa

The level of enrolment in TVET programmes in secondary school is relatively lower than that of academic programmes in sub-Sahara Africa. Palmer (2007) found that in Africa, the enrolment in TVET at secondary school level was below 50 percent of the total students' enrolment and this varied with different countries. UNESCO (2010) also found that the differences between countries' averages were very large and sub- Sahara Africa had the lowest proportion of enrolment in TVET programmes at secondary school level. For instance, UNESCO (2010) noted that in 13 of the 25 countries in sub-Saharan Africa with data, the share of technical and vocational education in secondary enrolment was less than 5 percent.

Similar to university enrolment trends, the proportions of females enrolled in TVET programmes are generally lower compared with those of their male counterparts and vary in respect to regions and countries. In sub-Saharan Africa, females accounted for 40 percent of the total enrolment in TVET programmes in 2008 which was higher compared with that in South and West Asia (31 percent) but lower compared with the rest of the regions (UNESCO, 2010; UNESCO, 2011). At country level, Algeria had achieved gender parity with females comprising slightly more than half (51 percent) of total enrolment at this level in 1997(the United Nations Economic Commission for Africa, 2001) while females in other countries such as Botswana and Nigeria comprised 38 percent, and 35 percent of total enrolment at this level in 2005 and 2006 respectively (UNESCO, 2010).

However, in most countries in sub-Sahara Africa, the majority of females were enrolled in traditional female occupations, often in areas characterized by low pay (UNESCO, 2010). In Algeria, most females were enrolled in business and hospitality oriented courses with a small proportion in engineering related courses (the United Nations Economic Commission for Africa, 2001). In Rwanda, the proportion of female students in technical education /engineering and Agro-veterinary courses in 1999 was lower (14.6 percent and 37.6 percent respectively) compared with business courses (59.7 percent) (the United

Nations Economic Commission for Africa, 2001). Interestingly, there were no females enrolled in technical courses such as mechanical engineering, plumbing, and fabrication and welding in the 1999/2000 session in Nigeria (Federal Ministry of Education, Nigeria, 2010).

The foregoing review confirms Gakusi's, (2010) assertion that, there is still a long way to go before achieving universal primary education in Africa, and that the access problem is acute at all levels of education. This is reflected in the lower gross enrolment ratios at secondary and tertiary levels which are the lowest level compared with any other region in the world. The female enrolment ratio is much lower than that of males at all levels of education. Although over years the differences have reduced, they still remain very high. In addition, there is variation within African countries in their attempt to achieve gender parity at all levels of education.

3.4. Gender Equity in Education and Training in Kenya

The Government of Kenya recognises that the provision of education and training is fundamental to its overall development strategy. Therefore, human resource development has been recognised as central to the country's achievement of its goal of industrial development and technological advancement (Ministry of Education, Science and Technology-Kenya (Ministry of Education, Science and Technology, 2004). The country is committed to ensure that universal access to education and training ensures equity to all children in schools including the disadvantaged and venerable groups (Ministry of Education, Science and Technology, 2004). This has further been emphasised by the current major policy document, the Kenya *Vision 2030* (Republic of Kenya, 2007b, p.12) that states:

> *The 2030 Vision for gender, youth and vulnerable groups is gender equity, improved livelihoods for vulnerable groups, and a responsible, globally competitive and prosperous youth…. Specific strategies involve increasing the participation of women in all economic, social and political decision-making processes and …improving access of all disadvantaged groups in education.*

Kenya is a signatory to international protocols that emphasise gender equity in education and training as well as human rights and therefore its policies are cognisant of international commitments. The National Council for Science and Technology (2010) noted that, the government has continued to pursue policies and practices aimed at expanding and strengthening educational programmes with particular reference to basic education and the Education for All goals. Additionally, education policies in Kenya are based on the constitution which stipulates that education is a human right. The Kenyan constitution forbids discrimination on the basis of religion, race, ethnicity and sex. It calls for political equality, social justice, human dignity and equal opportunities for all (Republic of Kenya, 2010, section 27 and 59). The Constitution further stipulates that at least one third of each gender must be represented in all elective and appointment positions (Republic of Kenya, 2010, section 27). This requirement indicates the deliberate efforts of the Government to ensure gender parity in employment and therefore implies that education and training must ensure acquisition of adequate skills, knowledge, values and attitudes by both genders in order to comply with the constitution's requirement.

Therefore, education policies from the time of independence have had a focus on gender equity. The policies have been formulated following recommendations of various government commissions of inquiry and working parties, which focus on the requirements of the constitution and international commitments. For example at independence the Education Commission of Kenya, referred to as the Ominde Commission of 1964, recommended the need to have universal free primary education for all Kenyans (Republic of Kenya, 1964). Another commission that made key recommendations towards enhancement of parity in education was the Presidential Working Party on Education and Man-power development for the next decade and beyond chaired by Professor Kamunge in 1988. This Commission noted that many children of school age were not in school. In particular a higher proportion of girls were not in school compared with males and therefore, the Commission recommended need to require all parents with children of school age especially girls to send them to school (Republic of Kenya, 1988). In addition to ensuring retention, the report also recommended that parents retain their children in school for the entire period of primary education. Equity in access to education and training was further highlighted by the 1998 Commission of Inquiry into

Education System headed by Dr. Devis Koech (Republic of Kenya, 1998). The Commission emphasised the need to have flexibility of entry and re-entry to education and training; enhancement of quality, relevance and equity in education and training; a total overhaul of the education system and review of the legal framework, which was out-dated, among other recommendations. The report observed that there were wide gender disparities at primary, secondary school, TVET and university, which required to be addressed urgently. Girls were underenrolled at all these levels but worse in SMT based courses at university and TVET levels.

A weakness of these commissions is that they focussed on the symptoms (i.e gender disparities at all levels) rather than the disease (factors influencing gender disparities in education and training) that caused these symptoms and were therefore not effective in addressing the disparities. Other studies on factors influencing gender equity in access of university education have been done but none at the national level for technical and vocational education and training.

In addition to the Commissions of inquiry into education, other policy documents have been formulated to ensure equity in education and training. These are:

1. The National Gender Development Policy (2000).
2. Sessional Paper no. 1 of 2005, A policy Framework on Education Training and Research
3. The Gender Policy on education and training of 2007.

At a broad level, the National Gender Policy focuses on issues concerning social, economic, legal and political environment. According to the Republic of Kenya (2000), the *National Gender Development Policy* recognises that it is the right of men, women, boys and girls to participate in and benefit from development and other initiatives. It further advocates for the need to employ new strategies that are aimed at ensuring greater participation of men and women and equal access to development resources and distribution of the benefits. It therefore lays emphasis on the development of a coherent framework to guide gender mainstreaming. This is imperative for the planning and programming process to be efficient and productive. It will ensure better targeting of marginalized groups and their integration into mainstream of development (Bunyi, 2008). However, gender equity policy frameworks can only be effective when their development and formulation are based on informed knowledge and understanding of the problem.

In this regard, the National Gender Policy recognises the need to focus on empowerment strategies that not only demonstrate understanding of the essential linkages between the reproductive and productive roles of women, but also recognizes the need to adopt equality as a good and its achievement through the removal of any existing disparities between men and women. It proposes strategies that will ensure that resources and structures are out in place to address specific needs and skills of men and women (Republic of Kenya, 2000).

Alongside the *National Gender Development Policy*, other policies, structures and legal frameworks have been put in place. Examples of these measures are;

1. the establishment of family courts in 2001 to deal with family related cases;
2. the *National Commission of Gender and Development* Act of 2003 that monitors gender parity in all sectors of development;
3. the *Children's Act Cap. 586 of 2001* that emphasises the right for all children to education and stipulate punishment for noncompliance (Ministry of Education, Science and Technology- Kenya, 2004);
4. *Sexual Offences Act no. 3 of 2006* which stipulates measures for protection of all persons from unlawful sexual acts.

The above measures are broad and focus on all sectors at national level. The specific Government policies for the education and training sector are contained in Sessional paper no. 1 of 2005 which is a policy framework for education training and research. This policy document underscores its commitment to achieve gender parity at all levels of education and training. This is in recognition that despite the rapid expansion of higher education and TVET over the past two decades, challenges to access and equity still exist (Republic of Kenya, 2005b). In addition, the need to promote gender parity in education and training has been underscored in major national government policy documents and therefore the Sessional paper aligned education policies with the current national policies. The Government's major policy objective on education at tertiary and TVET levels is to enhance and sustain measures to eliminate gender disparities in access, retention, transition and performance in education for both boys and girls (Republic of Kenya, 2005b, 51). The Sessional paper identified the following key general measures for implementation at higher education and TVET levels:

1. Promotion of scholarship based on the needs of the economy; targeted bursaries and loans to the needy, taking into account gender parity in higher education and TVET.
2. Promotion of private sector investment in the development of higher education.
3. Promotion of the expansion of skills training and university education in tandem with population growth and the demand of industry (Republic of Kenya, 2005b, p.51).

As noted in Chapter One, the measures outlined by the Sessional paper are being implemented through the Kenya Education Sector Support Programme (KESSP). This programme is financed by the Kenyan government and development partners (Republic of Kenya, 2005a). The KESSP consists of 23 programmes targeting all levels of education and training. Examples of some of the programmes being financed through KESSP include free primary education, tuition free secondary education, higher education programme, and TVET development programme.

TIVET development programmes have six components. They are:

1. Revitalisation of youth polytechnics that is aimed at improving the quality of training in youth polytechnics;
2. Establishment of centres of excellence in TIVET programmes,
3. Upgrading of National polytechnics to degree awarding status,

4. Establishment of industrial and business incubators,
5. Capacity building for TIVET management, and
6. TVET bursary award scheme. (Republic of Kenya, 2005a, pp. 233-234).

The Bursary award scheme is the primary policy measure to ensure there is gender parity in science, technology and engineering programmes at TVET level.

The overall goal for the TVET bursary award scheme is promotion of equity in accessing TVET programmes. The scheme targets female students enrolled in male-dominated engineering and technology courses to enhance their access and retention. All female students enrolled in technological and engineering programmes receive bursaries to cover all tuition fees. The scheme has been in place since 2007, but no evaluation has been undertaken to find out if it has increased the recruitment and the retention of female students enrolled in these programmes-a gap that this study endeavours to fill. Other groups targeted by the scheme are students from poor households, HIV/AIDS orphans, and students with special needs (Republic of Kenya, 2005a).

While the Sessional paper no 1 of 2005 outlines the broad policy direction for education, training and research, the Government of Kenya formulated a specific gender policy framework in education. This policy document, launched in 2007, drew material from the past government policies and legal frameworks, and consolidated all current and previous policy recommendations.

An assessment of the commitment of the Government to ensuring participation of women in education was carried out by Non-Governmental Organisations (NGOs) in 2004 which noted that the Kenyan Government, was making efforts in the right direction to ensure women's participation in education and training, however, these gender policies remained unclear and not well understood, by the public (NGOs[12], 2009).

[12] The NGOs include African Women's Development and Communication Network (FEMNET); Association of Media Women in Kenya (AMWIK); Centre for Rights Education and Awareness (CREAW); Federation of Women Lawyers –Kenya (FIDA-K); Girl Child Network (GCN); GROOTS Kenya and Maendeleo ya Wanawake Organization (MYWO)

Critics of the policies state that they are mere political declarations, and not based on informed research and difficult to monitor and evaluate. Chege and Sifuna (2006) argued that political declarations tend to serve political ends and not easy to assess. They maintain therefore that a crucial strategy is policy decisions based on information; clear targets and dates by which to measure success of implementation. This study seeks to bridge the gap in policy making by revealing the causes of student choices of various TVET programmes and their gender differences.

Another weakness that contradicts the equity policies is the fact that some of the national laws especially on property rights disadvantage women. In spite of the constitution extending equal rights and freedom to men and women in society, women experience a wide range of discriminatory practices that limit political and economic freedom (Bunyi, 2008).

3.4.1. Participation at primary and secondary education levels in Kenya

One of the achievements of the government in education and training is that transition rates from primary to secondary school have increased over the years. The Ministry of Science and Technology (2008), in analysing access challenges, observed that there had been remarkable increase in student transition from primary to secondary school level between 2003 and 2008. Ministry of Science and Technology (2008) statistics, indicate the transition of students from primary to secondary increased from 46 percent in 2003 to 70 percent in 2008. Figuere 3.5 presents yearly transition from primary to secondary school in Kenya over this period.

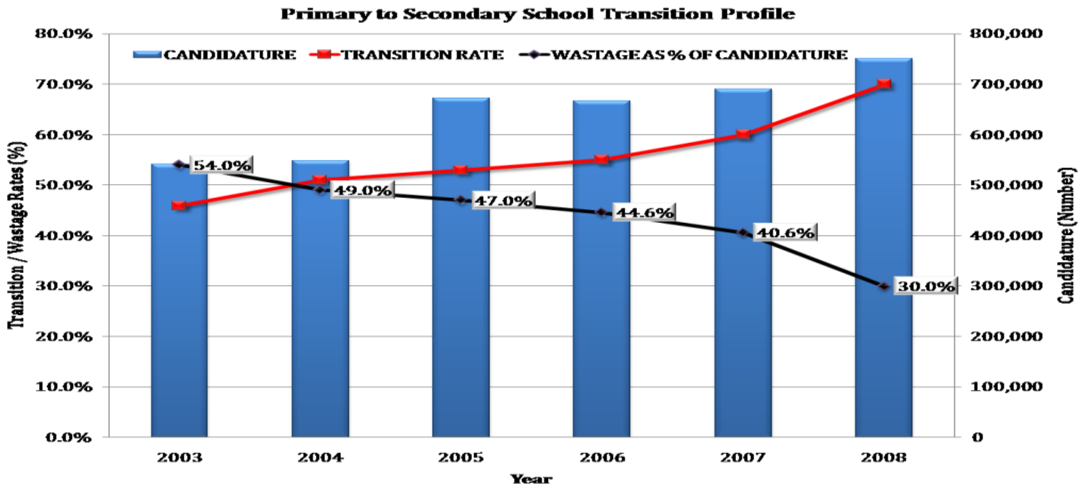


Figure 3.5. Primary to Secondary School Transition Profile in Kenya over this period (Source: *Technical, Industrial, Vocational And Entrepreneurship Training Strategy* (Ministry of Science and Technology, 2008, p.7))

However, the same proportions of transition between primary and secondary school level are not reflected at the tertiary level. The Ministry of Education, Science and Technology (2004) noted that transition from secondary to university education was only 12 percent in 2003. Moreover, the government enrolments statistics indicated that only 23.8 percent of candidates registered for the Kenya Certificate of Secondary Education in 2008 qualified for university admission. However, only 6.6 percent of the qualified candidates were admitted in public universities (Republic of Kenya, 2012, p.159).

There are gender disparities at both primary school and secondary school levels. Statistics released by the *Education for All Global Monitoring Reports of 2010, 2011 and 2012* indicated that female students constituted 49 percent of the total enrolment at primary school level in 2005, 2008 and 2010(UNESCO, 2012, p.352; UNESCO, 2011, p. 308 and UNESCO, 2010, p.346.). Thus, the GPI at this level was 0.95 indicating near parity. The report of the Task Force on the Re-Alignment of the Education Sector to the Constitution of Kenya revised in 2010, also noted that gender parity in enrolments at primary school had been improving steadily and that the disparity was relatively small with an index of 0.98 in 2009, 0.95 in 2010 (Republic of Kenya (2012, p.15).

At secondary school level, available statistics indicate that female students comprised 46 percent of the total enrolment in 2010 and that the GPI at this level was 0.85 (Republic of Kenya, 2012, p.60; UNESCO, 2010). The statistics suggest that that the gap between student genders widens as the level of education increases.

3.4.2. Participation at tertiary level in Kenya

The Republic of Kenya (2005c), in its needs assessment and costing report on the achieving Millennium Development Goals noted that the previous interventions had achieved near gender parity at both primary school and secondary school levels. However, the same near-parity was not reflected at tertiary level. Female students constituted 36 percent of the total enrolments at tertiary level (UNESCO, 2010). At university level, the Republic of Kenya (2012, p.64) statistics indicated that the proportion of female students between 2006 and 2010 was below 40 percent. This proportion is lower compared with both averages for regional (40 percent) and global (51 percent) proportions of females at tertiary levels as discussed in the previous sections. Thus, the status and trends in tertiary education level indicate that Kenya's main problem in enrolment is at post-secondary tertiary educational institutions. Figure 3.6 presents trends of proportion of female enrolment at university level in Kenya.

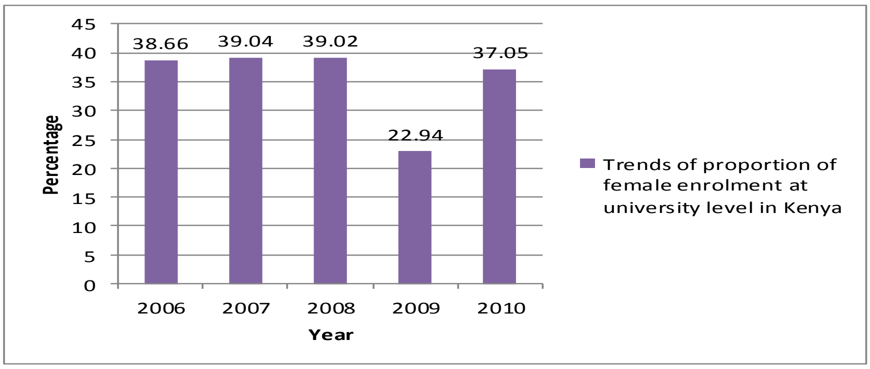


Figure. 3.6. Proportion of female enrolment in university programmes in Kenya from 2006 to 2010 *(Extracted from Table 4.3 (Republic of Kenya, 2012, p. 64))*.

Most female students were found to be enrolled in arts based degree programmes with low proportions in science, technology and engineering based programmes. Onsongo (2006) noted that females comprised 16.1 percent and 26.3 percent of those enrolled in the Bachelor of Architecture and Bachelor of Computer Science degree programmes respectively during 2002/2003 to 2004/2005 academic years at the University of Nairobi. The Republic of Kenya (2012) noted that the gender disparity at university level is still even wider in STEM courses and that females are under-represented an issue that require to be addressed.

Moreover, the proportion of males in teacher training colleges was found to be higher compared with that of females. The enrolment data of diploma teacher training colleges in Kenya presented by the Republic of Kenya (2012, p.117) indicated that between 2003 and 2007 female enrolment was less than 46 percent of the total enrolment. In 2004/2005, the proportion of women enrolled in bachelor of education degrees with specialization in science, mathematics and technology subjects was 25.9 percent (Onsongo, 2006). This indicates that there were fewer female teachers preparing to teach science subjects at secondary schools compared with males. This means that the number of female role models in STEM subjects at secondary school level is limited.

3.4.3. Participation at TVET level in Kenya

The main challenges of TIVET programmes in Kenya are quality, relevance, access and equity. The Ministry of Science and Technology (2008), acknowledged that TIVET institutions are not able to accommodate the large number of school leavers from both primary and secondary school levels who desire to pursue the TIVET programmes. In addition, the programmes suffer both geographical and gender inequities. According to the Ministry of Science and Technology (2008), the distribution of TIVET institutions was not equitable and the programmes were characterized by wide gender disparities.

As noted in Chapter One, the *Gender Policy of Education and Training* observed that, female enrolment in TIVET and other mid-level tertiary colleges increased significantly from 22.5 percent in 1998/1999 to 44.2 percent in

2001/2002. However, the proportion of female enrolment in TIVET programmes remained lower compared with their overall proportion of enrolment in all mid-level programmes.

Similar to the international and regional trends, the enrolment ratio of females to male students in technological and engineering programmes at TIVET institutions in Kenya continues to be low. As noted in Chapter One, in 1998, the proportion of female enrolment at TVET level was 1.4 percent, 4.4 percent and 5.0 percent of total enrolment in Mechanical Engineering, Electrical and Electronic Engineering and Building and Civil Engineering respectively (Republic of Kenya, 2007a). There was no much change in later years as the highest female enrolment in technical training institutes and institutes of technology was 45.7 percent in 2004 with less than 5 percent of total students enrolled in technological and engineering disciplines, 52 percent in business courses and the remainder in other courses such as secretarial, home economics, food and beverage, textiles, hair dressing and cosmetics (Republic of Kenya, 2007a). A fact book focusing on the tracking of different youth indicators captured in different documents for purposes of providing a global overview of youth issues in Kenya and published by the Institute of Economic Affairs indicated that the proportion of female enrolments in TVET institutions was below 38 percent between 2005 and 2009 (Njonjo, 2010)[13]. (See Figure 3.7).

[13] The enrolment statistics provided at TVET and university levels were the latest available.

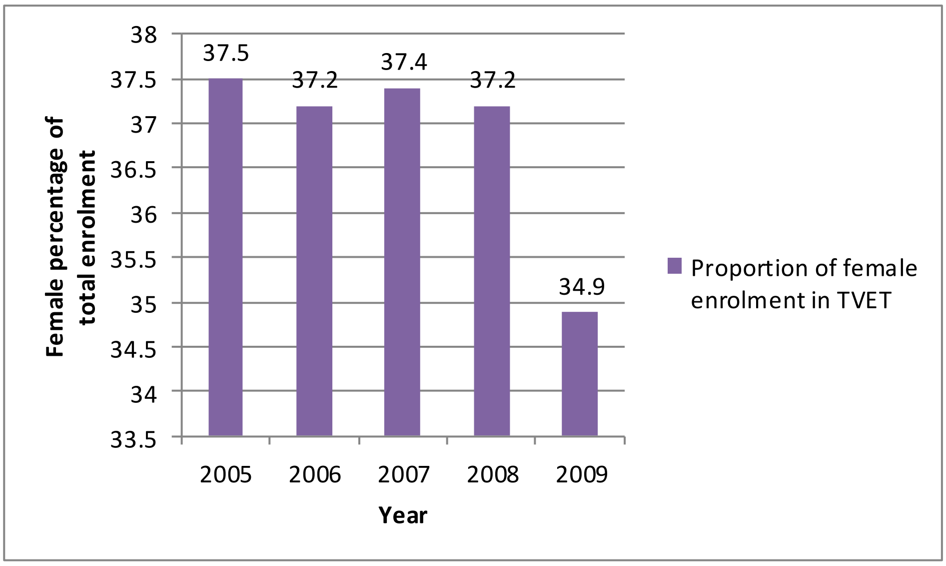


Figure 3.7. Proportions of female enrolments in TVET between 2005 and 2009, (Extracted from Njonjo, 2010, p.70)

The Republic of Kenya (2007a) further observed that between 2006 and 2007, the enrolment in TVET institutions increased by 7.5 percent with female students trailing in number of enrolled in all institutions apart from youth polytechnics. Even though there was an increase in the proportion of female students in TVET and mid-level tertiary colleges, the Republic of Kenya (2007a) acknowledged that this increase was in secretarial, home economics, food and beverage, hair dressing, textiles and business-oriented courses with the majority enrolled in youth polytechnics, which offer lower-level courses.

The Task Force on the Re-Alignment of the Education Sector to the Constitution of Kenya 2010 raised concern over the extremely lower proportions of female participation in industrial, technological and engineering courses at TIVET level over the years (The Republic of Kenya, 2012). The Task Force found that, at this level, female students were largely concentrated in business and management courses which were perceived to be female-oriented. The Report of the Task Force stated that:

> *A noticeable feature of enrolment patterns in most TIVET institutions in Kenya is the relatively low female participation in technical training. Most TIVET institutions offer engineering courses alongside courses in science and business studies. However, data on student enrolment by department/course and gender shows female concentration in non-engineering courses. Business*

> *studies and management courses are perceived as female-oriented and record high female enrolment (Republic of Kenya 2012, p.155).*

This review indicates that the proportions of female students enrolled in science, technology and engineering related courses has been low over time with little change.

Moreover, there is gender disparity at all levels of education but this is wider at the tertiary and TVET level especially in STEM programmes. Females concentrate in business oriented fields rather than engineering fields. Thus, a comparison of influences on enrolment in business courses with engineering courses may help to explain the gender differences in the two courses an issue that this study endeavoured to uncover.

The next section presents a review of factors that have been found to influence gender disparities in education and training.

3.5. Factors Affecting Gender Disparities in Education and Training

Research on gender in education across the globe demonstrates that the transition to, and participation in, different levels of education and training by females is influenced by a complex combination of factors (Namuddu, 1995; Kwesiga, 2002; Mama 2002; Onsongo, 2004; Griffin, 2007; Pereira, 2007, UNESCO, 2010; UNESCO, 2011). They include those that emanate from the education system and policies, the influences of other people including families, friends, school teachers and career advisors, culture, employment, media and internet, student objectives, and individual interests in, and attitudes towards, TVET programmes.

3.5.1. Education system and policies

Gender disparities originate at different points in the education system. According to UNESCO (2011), gender gaps start to open on the first day of a school career in many countries and intake into grade one is often skewed in favour of boys. UNESCO (2011) further found that three-quarters of the countries that had not achieved the gender parity goal at the primary level enrol more boys than girls at the start of the primary cycle. For example, in Mali, the male gross intake rate is 102 percent while that for females is 89 percent (UNESCO, 2011). This means that unless the imbalance is corrected later through higher survival rates for girls, the inevitable result of an unequal intake is a permanent gender bias in primary school.

This bias is transferred to secondary school level. According to UNESCO (2011), gender disparities in secondary education are a reflection of the disparities in primary school. While there are exceptions, in most countries girls who have completed primary education have the same chance as boys of making the transition to secondary education (UNESCO, 2011). However, once in secondary school, girls are often more likely to drop out compared with boys (UNESCO, 2011). This means that the gender gap in enrolments is likely to widen at this level. This is true even for Bangladesh, where government stipends have helped turn a large gender gap in favour of boys in the transition to secondary school into a gap in favour of girls (Bangladesh Bureau of Educational Information and Statistics, 2008). However, the disparity in favour of girls shrinks rapidly with progression through school so that the completion rate is 23 percent for boys and 15 percent for girls. Moreover, boys outperform girls in the lower secondary school exam (Bangladesh Bureau of Educational Information and Statistics, 2008).

Causes of gender disparities at secondary school level are more complex compared with those at primary school level and therefore pose many challenges. UNESCO (2011) found that some of the barriers to gender parity at the primary level are more difficult to surmount at the secondary level. For example, in sub-Saharan Africa, several countries have instituted free primary education policies, while other school-related costs such as school uniforms, secondary school fees and other costs, and the costs of higher education remain too high for poor parents (Bunyi, 2008). The high cost of secondary schooling often forces poor households to ration resources among children. Where girls' education is less valued, or perceived as generating lower returns, parents may favour sons over daughters (Gakusi, 2010; UNESCO, 2011). A background paper for *Education For All Monitoring Report*, exploring the extent of educational marginalization in arid districts in Kenya reported that “a proverb of the Gabra community in northern Kenya states: ‘God first, then man, then camel, and lastly girl.’ explains a reluctance to sell camels to finance girls’ secondary education, unlike for boys” (Ruto, Ongwenyi and Mugo, 2009, p.11). The social attitudes behind such sentiments are deeply damaging for girls’ education. An examination of country data in different sub-Sahara African countries by Bunyi (2008) found that gender disparities in access to secondary education are wider among women from socio-economically disadvantaged communities than among women from the better off communities.

The costs in technical and vocational education are much higher than that of secondary education thus posing a more serious challenge to parents. While analysing TVET provision, patterns and policy issues in sub-Sahara Africa, Atchoarena and Delluc (2001) observed that part of the reason for the higher costs of TVET is that the class sizes are much smaller than in general education and the cost of equipment is higher, hence vocational education faces far higher per capita costs – about twelve times the average for primary school and four times that for secondary school.

Another barrier to enrolment at secondary school level is the limited number of secondary schools. Bunyi (2008) found that in sub-Saharan African countries, the demand for secondary and higher education far surpasses the supply. UNESCO found the same trends in 2007 (2010). For example, the statistics indicate that in 2006, the mean transition rate from primary to secondary school level was 58 percent in Uganda, 65 percent in United Republic of Tanzania, 94 percent in South Africa, 58 percent in Mozambique, 77 percent for Eritrea and 97 percent in Botswana (UNESCO, 2010). The challenge of limited number of secondary schools is more for girls compared with boys. Bunyi (2008) found that many sub-Saharan African countries have fewer secondary schools for girls than for boys. This finding is confirmed by the lower transition rate of girls from primary to secondary school compared with that of boys. UNESCO (2010) found that the transition rate from primary to secondary school was higher for boys compared with girls in most sub–Sahara African countries. For example, in

2006, the mean transition rate from primary to secondary school level in Uganda was 57 percent for girls and 59 percent for boys (UNESCO, 2011). Statistics provided by UNESCO (2011) further indicate that in the United Republic of Tanzania, transition from primary school to secondary was 59 percent for girls and 71 for boys while in Eritrea 76 percent of girls transited to secondary compared with 78 percent of boys. South Africa and Botswana are among a few examples of sub-Sahara African countries, which had higher percentage of girls' transition from primary to secondary school compared with boys (UNESCO, 2011).

In a report on examination of current trends and issues in TVET in Africa, Oketch (2007) found that gender disparities witnessed in secondary school have had an influence on both higher education and TVET programmes. There is a relationship between student enrolment in vocational secondary school programmes and their progression in similar programmes at tertiary level (UNESCO, 2010). The proportion of secondary school students who are enrolled in such programmes could be used to assess participation in technical and vocational education (UNESCO, 2010). The assumption is that students who are enrolled in vocational secondary school programmes are likely to enrol in the same programmes at college level.

At regional level, Atchoarena and Delluc (2002) found that the low enrolment of females in TVET may be attributed to their small percentage enrolment at secondary school level in many developing countries. The same findings are echoed by Bunyi (2008) who asserted that the extremely low transition of girls from upper secondary to higher education and the subsequent low participation of girls and women in higher education are to a good extent a reflection of the gender inequities at the primary and lower secondary school levels. While comparing countries, the African Economic Outlook (2010b) found that those countries where women accounted for fewer than 15 percent of the enrolment in TVET colleges, such as Eritrea, Nigeria, Ethiopia, Namibia, Malawi and Uganda had proportion of TVET enrolment of less than 5 percent of the overall secondary school enrolment. They also had a lower proportion of females enrolled in both tertiary and TVET programmes and the entire education system. It is therefore of interest to note that although Kenya has near gender parity at primary and secondary school level, the same is not reflected at TVET level.

Gender disparities at tertiary and TVET level could also be as a result of low quality of basic education. Globally, failures in basic education have important consequences for technical and vocational education (UNESCO, 2010). At regional level, UNESCO (2010) found that technical and vocational education reaches one percent to two percent of the total secondary school age group level in sub-Saharan Africa, and South and West Asia respectively. One of the causes of this is that, in many countries in both regions, only a small share of the secondary school age population reaches the middle grades of secondary school (UNESCO, 2010).

Female students in sub-Saharan Africa are more likely to perform more poorly in national end of year secondary examinations compared with males. For example, in Tanzania, about 45 percent of the boys who sat for the national end of Form four examination obtained Division one to three but only 31 percent of the girls got similar results in 2004 (Abeli, Muzanila, Lyimo-Macha, and Pereka, 2005). In Zambia, the educational statistical bulletin of 2005 indicated that in the Grade 12 examination, girls attained a pass rate of only 50.8 percent compared with 61.4 percent pass rate for boys (Republic of Zambia, Ministry of Education, 2006). In Rwanda, a paper on analysis of national gender equality in education revealed that girls underperformed boys in the upper secondary leaving examination in the three years 2000/01 to 2004/05 (Huggins and Randell, 2007). Failures in basic education can be attributed to poor quality of schools attended. The type of secondary school attended, the environmental conditions offered and its quality is a significant determinant of how well one will learn and perform in various learning achievement assessments. However, in sub-Sahara Africa, most girls were found to be enrolled in rural and urban secondary day schools. These schools were characterized by poor infrastructure which was deficient in basic requirements such as science laboratories and equipment, appropriate toilets and menstruation management equipment (Bunyi, 2008). These deficiencies were cited to be some of the causes of poorer performance of girls in science and mathematics subjects in secondary school compared with boys. Bunyi (2008) noted that lack of science laboratories and equipment in schools for girls, inadequate female science teachers, and gender-insensitive pedagogy caused poor performance of girls in secondary schools.

The learning environment presented in schools and TVET institutions may also influence participation of both genders in the programmes. The wider learning environment determines the prospects of successful provision of vocational education. The lessons from successful countries in East Asia are that high levels of literacy, numeracy and broad-based general education are the real foundation for acquiring flexible and transferrable vocational skills; however, many countries lack the foundation (UNESCO, 2010). In sub-Saharan Africa, many girls schools have been found to present unfriendly gender environment that consists of sexual harassment and gender-based violence which predisposes girls to pregnancy and early marriages; there are inadequate number of female teachers to serve as role models for the girls, and girls unfriendly, male dominated school governance and management that is often resistant to gender responsive policies such as the re-entry policy for girls who become pregnant while still in school (Griffin, 2007; Forum for African Women Educationalists (FAWE) -Zambia, 2004). Thus, as noted by FAWE-Zambia (2004), in their report on re-entry policy for adolescent school girl mothers in Zambia, girls are not attracted to such schools, and a good proportion of those who enrol drop out midstream or show poor performance in matriculation examinations which are the end of secondary level exams or special entrance exams for higher education institutions. This means that most females do not attain high enough grades to compete on an equal footing with their male counterparts for the limited places especially in SMT programs at TVET and university levels.

Lower participation of females in management and teaching staff in tertiary institutions has also been found to have negative effect on girls' enrolment in the institutions. *The Education for All Global Monitoring Report* noted that, the masculinized nature of educational institutions and especially universities is evident from the absence of women in senior management and academic ranks that have been reported across Africa. In 2004 the report noted that only 17 percent of tertiary teachers in Africa were female (UNESCO, 2006). The implication is that a male perspective predominates in the culture and processes of these institutions with the specific needs and interests of female students and staff being relegated to the periphery. In particular, the absence of women academics generally and of senior female academics in the ranks of Professor especially in the SMT departments and faculties, means that female students and junior academics have no role models to emulate.

Another significant influence on gender disparities in enrolment at tertiary and TVET levels of education is the school curriculum. In particular, student interests in courses and career choices have been found to be influenced by the teaching of the prerequisite sciences and engineering and how they are portrayed at school level. The interests of female students towards these subjects are negatively influenced where these subjects are portrayed as male preserve. Research done in the UK found that curriculum and assessment issues could undermine effective teaching in science and engineering. In a study involving 1,011 year 9 students drawn from 42 schools in the UK, the Engineering and Technology Board (2005) blamed the assessment requirements and demands for having blocked effective STEM teaching as teachers felt pressured to deliver National Curriculum results and grades with little time left for developing and supporting non-syllabus topics associated with engineering.

In Israel, a quantitative study involving a sample size of 635 drawn from 9th grade students in 25 secondary schools, found that the students had a ‘neutral’ interest in physics, but a negative view of science classes (Trumper, 2006). This difference was blamed on the student’s school science experience. It was concluded that curriculum and organisational changes could be used to address the student science experience. In the USA, school curriculum was pointed out as one of the factors influencing a decrease in the number of female students undertaking tertiary studies in engineering. In a survey which analysed attitudes of 522 K-12 teachers in USA towards engineering, Douglas, Iverson, and

Kalyandurg (2004), found that students were unable to make informed choices about further education and work options due to their having had little chance to learn in school on how science and math skills could translate into professionally useful knowledge. In addition, longitudinal interviews and surveys involving 33 high school Californian students who were once interested in STEM courses found that, only about half of the high achievers with an interest in science-based studies were found to persist with STEM-enabling courses throughout high school science (Aschbacher, Li and Roth, 2010). In Australia, studies indicate that high school curriculum has a significant influence on a student's intention to undertake careers in science and engineering (DEST, 2003; Prieto, et al., 2011).

3.5.2. Career information

Research has shown that student choices of courses at the tertiary and TVET level are also related to the curriculum knowledge available. In their analysis of declining interest in engineering studies in the USA, Johnson and Jones (2006) noted that before high school students make decisions for choice of courses of study they often compare engineering to alternate paths such as computer science where the curriculum is less formidable. In a study of major factors which may have influence on participation and completion rates in VET courses for six ethnic communities using a sample of 200 participants, Miralles (2004) found that in Australia, enrolment in technical and vocational education was strongly linked to an understanding of the diversity of training outcomes and range of programmes available. A study in the USA found that the common reason that young people become attracted to a career field is that the career appeals to their intellect and emotions: they are intellectually aware of the benefits of the work and emotionally committed to the work because of its personal relevance to their lives (Brown, 2001). Therefore, sources of information about careers and available curriculum, their accuracy and competence play a great role in influencing students' decisions to enrol in TVET programmes. The information about careers and curriculum available to students has been found to emanate from multiple sources, which include parents, teachers, career advisors, media, internet, and industry. This was identified in a review by Prieto et al. (2011, p.5) who list: ‘a*vailability of sources of information about engineering for secondary students, the accuracy and competence with which these sources were produced and disseminated, and the influence from parents, teachers, career advisors, media and industry’ as ‘impacting on intention to enrol….’*

3.5.2. The Influence of family and other people

3.5.2.1. Parents’ influence

Research on the influence of parents and the family on children’s career choice and development indicate that there are links between career development and such factors as socioeconomic status, parents’ educational and occupational attainment, and cultural background (Kerka, 2000). Parental support and guidance can include specific career or educational suggestions as well as experiences that indirectly support career development, such as family vacations, provision of resources such as books, and modelling of paid and nonpaid work roles (Altman, 1997; Kerka, 2000). The absence of parental support, guidance, and encouragement can lead to the inability to develop and pursue a specific career focus. In addition it can lead to withdrawal of financial and emotional support for a career path not of the parent’s choice (Kerka, 2000).

In Australia, Miralles (2004) found that parental background was an important factor in determining student participation in vocational education and training. Parents’ level of education and occupation were related to students’ enrolments in vocational education and training. A quarter of the students whose parents had only completed secondary school participated in vocational programmes, compared with 14 percent of those with tertiary educated parents (Miralles, 2004). Similarly, a lower proportion (15 percent) of those students whose parents were in professional occupations participated in vocational education, compared with 27 percent of those whose parents were employed in manual occupations. Participation rates were lower among those students whose family background was from a non-English speaking country (18 percent as compared with 24 percent from Australian-born parents) (Miralles, 2004).

While a higher proportion of students whose parents have low education and occupation status enrol in non-STEM vocational education and training courses; those whose parents have higher educational levels and occupations are more likely to enrol in STEM programmes. The evidence is seen in their choice of mathematics and enabling sciences at secondary school level. In a longitudinal survey of patterns of participations of Australian youth in year 12, Fullarton, Walker, Ainley, and Hillman (2003) found that students whose parents did not complete secondary school were significantly less likely to be enrolled in intermediate level mathematics compared with other students. In contrast, those whose parents had high occupational status were more likely to be enrolled in advanced mathematics, physics and chemistry.

In the UK, parents were also found to have had a greater influence on student enrolment in vocational education and training than other factors. In their study of the perceptions and attitudes of secondary school students towards careers in engineering in the UK, West Midlands Education and Training Department (2004) found that almost one half of the students (48 percent) pointed out that their most influential information came from their parents, followed by other family relations (11 percent), and the school careers advisor (10 percent). In a mixed method study involving interviews of 40 college women in Virginia, USA, Creamer and Laughlin (2005) found that women were more likely to turn to their parents for advice and direction about career choice and that their trust on parents seemed to override others. The influence of parents is also evident in the kind of careers the students eventually follow. A longitudinal study on parents' expectations and their children's gender-type occupations by Jacobs, Chhin and Bleeker (2006) found that in USA, parents' early gender-typed occupational expectations for their children were highly related to the actual occupational decisions made by their adult children.

3.5.2.2. Careers advisors' influence

Career advisors, their knowledge, and competency have also been identified as influencing student choices of careers. Prieto et al. (2011) observed that the adequacy of knowledge of career advisors has been targeted in many reports concerning influences of student choices of careers, and this is part of general theme linked to the adequacy of information generally. Inadequate knowledge of available careers and curriculum may result to ineffective guidance and counselling which has been underlined as one of the factors influencing young women and girls' enrolment in TVET programmes. As noted in Chapter One, studies have found that in some countries, gender disparities in TVET programmes could be as a result of ineffective guidance services that direct female students towards stereotyped training and occupations (Bennell, 1999; Mayoux, 2005). Also noted in Chapter One is that, in third world countries, Moser (1989) found that ineffective career guidance directed female interests in skills development that meets their immediate needs as opposed to longer-term needs. In the USA, Wonacott (2002) asserted that gender stereotyping in guidance and counselling practices and materials, bias in teacher practices, and harassment by other students discouraged non-traditional enrolment by females and in practice restricted Career and Technical Education (CTE) opportunities for females to lower-wage, traditionally female, health and cosmetology occupations. As noted in Chapter One, in sub-Saharan Africa, females were found to concentrate in handicrafts, basic food processing and had also shown a propensity to pursue micro-enterprises and homestead farming activities (The World Bank, FAO, IFAD, 2008; Oketch, 2007). In addition, the region suffers from poor linkage between secondary and tertiary institutions those results from ineffective career guidance, which in turn has been blamed for having caused gender disparities in TVET and higher education. Bunyi (2008) found that in sub-Saharan Africa, rural and urban poor secondary school students (especially girls) and their parents had limited knowledge about the process of proceeding to higher education and the options available. Thus, they were challenged in making right choices of subjects in upper secondary school for broader scope of course selection at higher education. This was because of inadequate and gender insensitive career guidance and counselling services in secondary schools and the fact that universities rarely made the effort to provide the missing knowledge (Court and Sutherland, 2004).

3.5.2.3. School teachers' influence

Teachers' knowledge about available careers and their capacity to deliver enabling sciences have been found to influence student career choices. According to Miralles (2004) teachers were the most often cited means of finding out about vocational education and training. In addition, they were also cited as the most trusted sources of information. This is because students of all ages spend much more of their time with the classroom teacher compared with the guidance counsellor (Stitt-Gohdes, 1997; Miralles, 2004).

In addition to teachers' awareness of available careers, their capacity to deliver curriculum instruction including their qualifications, initial training and further professional development play a role in influencing student choice of careers. Many studies in the field of science and mathematics agree that teacher qualifications are inadequate (Prieto et al., 2011). It has also been pointed out that, on average, college graduates who become teachers have somewhat lower academic skills compared with those who do not go into teaching (National Science Board, 2006). In addition, studies have shown that many teachers are not qualified to teach enabling sciences because they majored in other subjects at university. While reviewing STEM education issues and legislative options, Kuenzi, Matthews and Mangan (2006) found that among middle school teachers in the USA, about half (52.6 percent) of those who taught math and two-fifths (40 percent) of those who taught science had neither a minor nor major qualification in those subjects. The low qualifications of teachers indicate low quality of teaching and this may affect students' performance in secondary examination in these subjects, hence contributing to low transition to SMT courses at TVET and tertiary levels. Huggins and Randel (2007) cited the low number of qualified mathematics and science teachers and the poor facilities in schools as causes of the poor performance in mathematics and science at the secondary level in Rwanda.

3.5. 3. Media and internet influences

Other information channels that have been found to influence student choice of courses include media, internet and community organizations. In the USA, the media, and in particular the internet and television have been reported to play a predominant role in developing opinion about science and technology. In their review of the science and engineering indicators in the USA and at the global level, the National Science Board (2006) found that in many countries including the USA, most adults find information about careers including science and technology mainly from watching television, including educational and non-fictional programmes, newsmagazines, newscasts, and even entertainment programmes. In addition, the impact of internet on career information transition to the public has been found to be increasing. The National Science Board (2006) found that in 2004, the internet was the second most popular source of news about careers including science and technology, up from fourth place in 2001.

Another popular form of media in relaying information about careers and curriculum programmes is the radio. Miralles (2004) found that the use of radio was preferred over written media in relaying information about available careers in vocational education and training. Other information channels were face-to-face information sessions for example women's groups; written brochures; and community events such as festivals which were seen to be a valuable way of connecting with the community and raising awareness (Miralles, 2004).

The use of information channels has been found to depend on the community receiving the information. In communities, which basically constituted groups of people speaking same ethnic languages in Australia, Miralles (2004) found that different communities used different information channels to access information about vocational education and training careers. For example, communities, which were more established than others within Australia, such as the Vietnamese and Cantonese, were found to have set up media and community organisations to serve groups such as youth, women, or religious sectors.

Others such as the Bosnians, who were further divided along religious lines, had limited media and community organisations to represent the diversity of the community (Miralles, 2004).

A major concern for those interested in various careers in TVET programmes, particularly those related to engineering and technology is the existence of incorrect or inaccurate information delivered through information channels. The channels fail to distinguish between fantasy and reality by failing to cite scientific evidence when it is needed (National Science Board, 2006). Johnson and Jones (2006) noted that potential engineering students and their families are often deterred from engineering study and employment owing to an aura of instability promoted in media about the engineering profession - including the spectre of unemployment. In sum, these sources cannot be ignored but have obvious limitations.

3.5.4. Individual objectives to do the courses

The Individual's own employment needs also influence enrolment in vocational education and training courses. Miralles (2004, p. 27) noted:

> *As the main purpose for enrolling was to get a job—not to achieve promotion or, for small business owners, to improve business skills and profitability—once in a job, few people saw a further need to take up other training programs. Other research has identified the pressing need to work and the lack of time faced by workers as significantly impacting on the low enrolment.*

Miralles' findings suggest that individuals decisions to enrol in TVET course were more influenced by their desire to get employed compared with getting skills for improvement while on their jobs.

In addition to employment desire, having better payment was found to be an important factor in deciding on career choices. An evaluation of attitudes of pre-teens, teenagers and parents towards engineering and insights for attracting young people to engineering careers by the National Grid (2009) found that, in the USA, job security and pay are crucial in deciding on a career for both young people and their parents. However, 'young people place a greater emphasis on pay than their parents (the parents consider work-life balance and flexible working just as important) and are also more influenced by ethical and environmental concerns and more inclined to want to contribute to the wider society' (National Grid, 2009, p.18). When analysing career choices and influences on youth aged between 11 and 16 years, Engineering and Technology Board (ETB) (2009) found that in the UK, being valued was ranked as the most important factor followed by enjoyment then better pay. Creamer and Laughlin (2005, p.24) concluded that an exhibition of students self-authorship was important for making "informed choices about careers that are not within their own personal experience or the experience of trusted others in their immediate environment".

3.5.5. Employment inequalities

Gender imbalances in education and training are transmitted directly to the labour markets (UNESCO, 2011). The inequality in education and training implies that males have higher chances of employment skills compared with females. UNESCO (2011) noted that girls leaving school and seeking jobs carry the disadvantages that come with fewer years in education. This means that they not only have difficulty in gaining employment but also have the disadvantage of lower wages when employed. Both Kabubo-Mariara (2003) and Kapsos (2008) analyses of wage determination and the gender gap in Kenya and Bangladesh respectively, concur that in most developing countries, education is a key determinant of not only wages but also wage inequality. Therefore, gender imbalances in choice of courses at tertiary and TVET levels contribute to wage differences between males and females. The same imbalance is witnessed in developed countries. Adams (2007), in a World Bank background paper exploring the role played by skills development in the transition from school to work, observed that gender stereotyped courses often channel females into areas characterized by low skills and low pay, fuelling a cycle of restricted expectation and limited opportunity. This was also the case of Australia as indicated by the Australian National Training Authority (2003) finding that women were overrepresented in certain fields and underrepresented in others, and were employed in less-well-paid jobs after training than men.

Furthermore, the labour markets have been often found to reinforce gender disparities and not least the working environment, wages inequality, and recruitment practices which are tied to education level. The work environment in male-dominated engineering and technology fields has been found to be hostile to females. A mixed method study, analysing data collected from interviews of 51 engineers and 96 professionals working in large engineering firms, and online survey responses from 367 engineers in Australia, found engineering workplaces to be uncomfortable environments for professional women, thus posing a challenge for enhancing gender equity in engineering education (Gill, Sharp, Mills and Franzway, 2008). Another study by Male, Bush and Murray (2009), which investigated 300 engineers who had completed degree programmes in Australia, and 250 senior engineers working in managerial positions, a majority of whom were males, also found that there was gender stereotyping within the Australian engineering profession. In a qualitative study involving interviews of 25 women working in information technology across the USA, Wentling and Thomas (2009, p.25) found that the IT culture was mainly *"white, male dominated, anti-social, individualistic, and competitive."* However, they found that, *"it was the collaborative and teamwork oriented aspect of their workplace environment and working together on projects and building close relationships with colleagues that benefited"* women in IT *"the most in their career development"* (Wentling and Thomas, 2009, p.25).

In addition to uneasy work environments, UNESCO (2011) found that women face barriers to obtaining the types of jobs for which they have the skills and qualifications. This finding concurs with that of a quantitative study in the USA that explored the causes of low participation of females in engineering using national data on undergraduate engineering programmes, which found that, the comparatively low number of female engineers is almost entirely a recruitment issue, there being no differential attrition by gender (Cohen and Deterding, 2009).

3.5.6. Cultural and social practices

Women's pay and their employment conditions are influenced not just by the supply of labour and demand for skills, but also by social barriers, cultural practices and discrimination (UNESCO, 2011). For example, studies carried out in East Africa found that self-employed women in the United Republic of Tanzania earned 26 percent less than their male counterparts (Chen, Vanek, and Carr, 2004). Similarly, in Kenya, annual earnings for men who were self-employed or working in the private formal sector were more than double the earnings of women in the same sectors (Kabubo-Mariara, 2003). Bloom and Cohen (2005) mentioned lower market wages for women which can make investing in schooling for boys before schooling for girls a rational economic decision for a family as one of the barriers of gender equity in education in Africa. The discrimination in labour markets not only diminishes returns of schooling, but also weakens incentives for parents to keep girls in schools, hence reinforcing a vicious circle of gender inequality. In addressing these barriers, the Kenyan constitution and other laws and policies formulated in mid 2000s discourage wage discrimination in employment with a view to ensuring gender equity in labour markets.

The imbalance found in the labour markets could also be linked to social norms governing gender roles in economic life and culture. The traditional roles and responsibilities assigned to men and women create a gendered division of labour (UNESCO, 2011). In a report on child labour which analysed choices between schooling work, the World Bank (2005) observed that in some countries, social and cultural practices were blamed for keeping young women from spending time outside the home. Such practices, which are linked to factors ranging from perceptions of family honour to concerns over female safety, heavily influence labour force participation patterns in many countries (World Bank, 2005). Household labour arrangements diminish females' opportunities for participating in education and well paid employment. While analysing educational challenges and policy measures undertaken, Gakusi (2010) observed that in Africa, girls still provide most of the household labour at expense of other employment opportunities. Adolescent girls and young women are often expected to spend more time compared with boys and men in activities such as collecting water and firewood, cooking, and caring for children or sick relatives, which restricts their opportunities to earn income beyond the home (UNESCO, 2011). The domestic gender roles frequently lead to greater demand for women in jobs that pay less and require fewer skills. For example, Chen et al (2004) noted that in the informal sector men are often more likely to be employers and own-account workers with better pay than women, who are more likely to be informal wage workers and home workers.

As noted in Chapter One, research undertaken in Australia and elsewhere, found that an entrenched masculine culture has also been cited as a major reason for women's lower representation in engineering (Franzway, at el., 2009). This finding is supported by a review of factors that influence persistence in science and engineering career aspirations by Mau (2003) who noted that, women’s participation in engineering is affected by the tougher institutional and cultural barriers they face, unlike their male counterparts. Miralles (2004) noted that cultural issues, transport and child care influenced Vietnamese, Turkish and Arabic women enrolment in TVET programmes. In a mixed method study on women in industrial engineering, Brawner, Camacho, Lord, Long, and Ohland (2012, p.288) found that in the USA, women ‘were drawn to industrial education due to favourable social factors including warmth, flexibility, a sense that it was more feminine, career opportunities’, and that ‘it emphasized collegiality and leadership opportunities’.

The socio-cultural beliefs, norms, values, attitudes and practices that are hostile to the education and training of women have also been found in nearly all societies in sub-Saharan Africa (Bunyi, 2008). These comprise low appreciation of the education of women; low anticipations regarding women’s performance generally but particularly in science, mathematics, technology and engineering; gender specific roles and domestic responsibilities that cause girls and women to be overloaded; and the high value placed on marriage for girls and motherhood which leads to pregnancy and early marriages (Bunyi, 2008).

3.5.7. Past policy failures

Vocational education problems emanate from a legacy of past policy failures that led to lower access, equity, relevance and quality of the programmes compared with general education. UNESCO (2010) asserted that the access and quality of provision of vocational education in Africa suffered enormously with deep cuts in spending under structural adjustment programmes in the 1980s and 1990s. Both Heyneman (2003) and Bloom, Canning, and Chan, (2005) noted that because of a longstanding belief that primary and secondary schooling are more important than tertiary education for economic development, the World Bank encouraged African governments' relative neglect of tertiary education. This policy was flawed (Bennell and Segerstrom, 1998) as it contributed to the neglect of TVET and post basic education (Fluitman, 2005). The neglect adversely affected the access to TVET programmes with females being more affected compared with males due to lack of resources to address the barriers that were already in the system.

Even though there is international consensus to have an all-inclusive approach to education (African Economic Outlook, 2010a), the current policies still exhibit some limitations that lead to gender disparities in technical and vocational education. In a World Bank study, examining recent research on informal sector employment and skills development in sub-Sahara Africa, Adams (2008) observed that wider problems are evident in the current policies where vocational systems are designed to meet the needs of formal sector employers, notably in government. However, in the last three decades formal sector job creation has deteriorated while informal sector employment has matured in importance. Adams (2008) noted that in most countries, informal employment and self-employment leads in both rural and urban areas, accounting for over 80 percent of total employment. Providing training to those employed in the informal sector involves reaching people with lower levels of education that do not give them qualifications required for enrolment in engineering, technology or science based programmes. Studies carried by Liimatainen (2002) and Haan (2006) in Kenya, Senegal, the United Republic of Tanzania, Zambia and

Zimbabwe reported that half the informal sector workers who had any education had reached only primary education level.

Another policy barrier in achieving gender equity in TVET as noted by Garcia and Fares (2008) is that most countries have failed to integrate technical and vocational education into strategies for reaching marginalized groups including youth and women. This finding concurs with that of Bunyi (2008) who noted that despite the apparent gender inequities and inequalities in education and training in sub-Saharan Africa, many countries have not developed comprehensive policies to address the issue. For instance in the United Republic of Tanzania, out of twenty-eight programmes reviewed by Garcia and Fares (2008), only three targeted the poorest youth, one targeted youth with no education and three targeted rural areas where the massive majority of the poor live but none of the programmes targeted the enhancement of gender equity in TVET. In Burkina Faso, only one-third of interventions involving technical and vocational education were focused on disadvantaged groups, primarily through micro-credit programmes. Further, where policies have been developed by most sub-Saharan Africa countries to address gender equity in education and training, they have been found to be ad hoc with little effort to implement and monitor their effectiveness. Bunyi (2008) found that in most countries where ad hoc policies such as the re-entry policy to enable girls who become pregnant while still in school to re-enter the system upon delivery are articulated, they have not been followed by strict implementation and monitoring of their effectiveness. Consequently, such policies do not address effectively the relevant issues.

3.5.8. Student attitudes and interests

Studies have found that the lower proportion of students in TVET programmes was as a result of the negative attitudes towards the programmes. As noted in Chapter One, a UNESCO study involving 30 countries with seven (Botswana, Egypt, Ghana, Senegal, Seychelles, Tunisia and Zimbabwe) from Africa, found that TVET was viewed as inferior to general education and was meant to solve youth unemployment rather than have an educational focus (UNESCO (2006). Also described in Chapter One, Pimpa (2007) found that low regard to TVET and its inherent inequalities are common phenomena in Thailand. Additionally, female enrolment in Thailand is influenced by their attitudes towards the programmes, curriculum, potential employment, attractiveness of campus, tuition fees, parents and secondary school teachers, and negative attitudes towards manual work (Pimpa, 2007).

Attitudes and interests have been singled out by other researchers as having an influence on female enrolment in engineering programmes. As noted in Chapter One, Prieto, et al (2009) noted that researchers had agreed that attitudes and interests of females were barriers to their participation in Science, Technology, Engineering and Mathematics (STEM). In Australia, the Engineering and Technology Board (ETB) (2005) found that a higher proportion of young males demonstrated real interest in learning science, technology and mathematics compared with their female counterparts who would opt to do these subjects only because of their importance in life after school. In a mixed methods study involving nine institutions with engineering undergraduate degree programmes in the USA, Amelink and Creamer (2010) found that satisfaction with the engineering major did not transform directly to pursuing a career in engineering, mostly among women. However, they found that the experiences students had with faculty and peers were more likely to have both short- and long-term impacts on their interest in engineering as a major and as a career. The American Association of University Women found that the number of women graduating in computer sciences and information technology was decreasing despite the increased need for workers in these areas (Friedman, 2000). Emotional and social attitudes about computer capabilities including level of math and science achievement were cited as some of the factors that caused women and minorities to avoid high-tech careers (Brown, 2001).

3.6. Summary and implications

The foregoing review indicates that gender disparities in education in general, and technical and vocational education programmes constitute a global challenge. The gender gap in enrolment widens with the increase of education level although direction differs by country. For example, in developing countries gender disparities are in favour of males at all levels of education and that at schooling levels, the gaps are much lower compared with those witnessed at tertiary level in general and technical and vocational education in particular. In addition, factors influencing the gender differences increase and become more complex with an increase in the level of education hence requiring more complex measures to address them. At tertiary and technical and vocational education levels, gender differences in enrolments are evident. More females than males are enrolled in tertiary programmes while more males than females are enrolled in technical and vocational education programmes globally. A major challenge witnessed at tertiary and TVET levels is bridging the substantial gender disparities in enrolments in science, mathematics, engineering and technology programmes where males dominate at all levels. This challenge is greater in the African region, which has wider gender disparity gaps in favour of males at both levels of higher education compared with other regions. The situation is worse in Kenya where proportions of female enrolments in engineering and technological programmes at both tertiary and TVET levels are lower compared with regional averages.

Therefore, considering the importance of technology and engineering in wealth creation and economic development, females in Kenya lag behind in possibilities for economic empowerment compared with their counterparts elsewhere. Further, given that the Kenyan government has identified science, technology, engineering and innovation as a springboard for achieving its *Vision 2030* in which it aspires to be industrialised by the year 2030, it is imperative to raise the proportions of females in these programmes not only for their empowerment and inclusion but also for the success in achieving the *Vision*. The review reveals that there is goodwill expressed by the Kenyan government to address this challenge as evident in its commitment to international and regional protocols and treaties that require governments to ensure equity in education; and commitments made in its constitution and national policies. Despite the goodwill and policies that have been put in place, the challenge persists. It is therefore imperative to investigate why the challenge persists in order to address the problem.

The available literature indicates that there is a complex interplay of many factors that are responsible for the differences in enrolments generally and by gender in technical and vocational education programmes across the globe. As demonstrated by the review, these factors include, gender disparities in enrolment at schooling levels, cost of education at both secondary school and TVET levels, quality of teaching at schools and training at TVET levels, dropout rates especially of girls enrolled at secondary school levels in developing countries, poor performance of females in STEM subjects, limited number of schools, inadequate teaching facilities for STEM courses, unconducive learning environment, lack of role models for girls in STEM subjects and courses and in employment; school curriculum, student experience in school science and mathematics, limited information about available careers, influences from people (parents, career advisors, and teachers), influence from media, internet, labour market influences, culture and social practises, educational policy failures, student own objectives to do the courses and student interests and attitudes.

However, the relative impacts of factors vary from region to region and country to country. In addition, there are differences and commonalities in barriers to gender equity by education levels. For instance, gender disparities at secondary, tertiary and TVET levels of education are more influenced by costs compared with the primary level of education which is free in most developing countries. In addition, interest in specific areas of study manifest more at secondary, tertiary and TVET education levels compared with primary school level. In contrast, cultural stereotypes about who can enrol in engineering, roles played at home by young children and education policies influences cut across enrolments in enabling sciences at schooling levels to choice of courses at tertiary levels. Therefore, it is difficult to generalise the barriers found from one level of education to all the others or those found from one country to all other countries thus confirming the UNESCO (2011) recommendation that individual countries need to determine their own solutions to address gender disparities at each level of education and training.

It is evident in an examination of the studies that seek to identify what factors influence enrolments in STEM courses (see appendix A), that little or no attention is given to breaking down data to allow comparison between subject areas, and whether or not these factors are different from those influencing enrolments in non-STEM courses. Yet, comparison is a powerful tool and may provide insights that will assist in addressing issues of importance to engineering. Thus, the findings of other studies such as Rodgers and Boyer (2006), UNESCO (2010) and the Republic of Kenya (2012) that higher proportions of female students cluster in business courses while higher proportions of male students in engineering courses, prompted this study to compare influences on enrolment between the two courses in attempting to find a better solution.

In Kenya, national studies have been undertaken that focus on factors that influence gender disparities at school and university levels, but none have been carried out in technical and vocational education programmes at the national level. Perhaps this gap may explain the weakness of gender equity policies at this level which focus mainly on financial incentives (bursary awards scheme) as provided by Sessional Paper number 1 of 2005 and employment equity as required by the current constitution[14]; without considering other possible measures. Information about barriers to technical and vocational programmes and possible measures to address them is important for the country to formulate and review effective gender equity policies at this level of education. The government of Kenya acknowledged that very little research is carried out in TVET institutions (Ministry of Science and Technology (2008) a situation that should be addressed.

Since this review reveals that enrolment decisions are influenced by multiple factors which vary by country and by level of education, it is important to establish with accuracy which of the factors influence student enrolment decisions into technology and engineering courses at TVET level in Kenya and

[14] The Kenya Constitution requires at least a third of each gender in all public employment, thus posing a challenge to technological and engineering sector which have lower proportions of females.

how they relate to each other and by gender. Further, it would be of interest to compare the factors identified with those influencing enrolment in other courses such as business in which most females get enrolled in order to provide a better understanding of the phenomenon. A broad understanding of the problem is necessary if a more effective and applicable solution is to be realised.

3.7. Conceptual Framework of the study

While this study is fundamentally aligned with capacity building in engineering in Kenya, and in effect the aim to increase the number of engineers resonates with a human capital perspective, the literature also points to the complexities connected with bringing about changes in the gender composition of engineering enrolments. There is also documented difficulty in achieving gender equality in education in many countries. As Unterhalter (2012) points out it is possible to consider gender in a numeric sense (i.e proportion of males versus females enrolled) but also in a way that

> *draws out the interconnections of relationships associated with power and meaning in different sites…This is linked with a view of education that is wider than that limited to years of enrolment in school or attainment in particular tests. It explores how schools and processes of learning operate both to reproduce and to transform inequalities. (p.68)*

As the literature above has suggested both perspectives are pertinent when considering efforts to: directly address student inequalities and well-being in a specific discipline such as engineering; determine the relative impact of direct intervention to achieve this, and barriers to positive outcomes.

With regard to the human capital perspective, education is viewed as a vehicle for improved productivity of human resources (Olaniyan and Okemakinde, 2008). It provides relevant skills, knowledge and positive attitudes which are important for national development. As noted by Meltem (2011), education, experience and acquisition of knowledge have become the basic determinants of a nation’s productivity in the twentieth century. Moreover, it has been recognised that the determinant of a country’s living standards is ‘how well it succeeds in improving’ skills and knowledge through educating the majority of its population. The greater the rate of schooling, the 'greater the investment in human capital in the society and the greater the increase in economic growth' (Meltem, 2011, p.287). At the personal level education 'can help one to find a job, to be less vulnerable on the labour market… and to find information on economic opportunities ..' *(*Roybens 2010, *p.71).* In short, skills and knowledge acquired through education constitute an important part of a person's income-generating abilities (Roybens 2010).

Therefore, education plays an instrumental role for both personal and collective economic development and these are in turn the core foci of the human capital approach to education (Roybens, 2010). Within this framework the pursuance of education can be seen to be motivated by students' interests in and desire to obtain various economic outcomes such as getting employment, acquiring desired skills, advancement in their employment and further education, and earning a better salary. It could also imply that students' economic goals may influence their interests in various secondary school subjects and choice of courses at TVET level. Moreover (as noted in Chapter Three Section 3.5.2), there are links between student career development and socioeconomic status of parents.

In the literature reviewed in Chapters Two and Three, it was noted that the major aims of most governments' education policies and systems is to enhance access, equity and quality of education because of the instrumental role education can play in the country's economic development. Policies such as awarding bursaries and scholarships to marginalised groups, offering flexible curriculum, improvements in training quality and environment, and equitable distribution of training institutions were all identified from the literature review as having been implemented to enhance access to and equity in education generally and TVET particularly. It is therefore important to consider such influences when determining what causes enrolments in engineering courses, the barriers to this enrolment and measures to address enrolment shortfalls.

However, as noted earlier, while the economic instrumental role of education is an important consideration when analysing access and equity issues, a broader approach involving both intrinsic and non-economic instrumental roles of education is important for wider understanding of the problem. The ‘Capabilities Approach’ to education is a multi-dimensional and comprehensive model that can account for both the intrinsic and non-economic roles of education (Dreze and Sen, 2002; Unterhalter, 2003). It takes into account all sources of inequities in people’s lives and in the society generally (Robeyns, 2010). It can therefore, account for the range of influences on enrolment in engineering courses whether economic, non-economic or intrinsic. For example, it is argued that people may value knowing something simply for its intrinsic value (Robeyns, 2010). This implies that students may have interests in subjects such as technology, engineering, science, mathematics, or business even when they are unlikely to use them, but the subjects are intrinsically satisfying. Additionally, students may be influenced by their desire to achieve goals which are not economically driven. Robeyns (2010) noted that

> *at a personal level, one could think of having access to information by being able to read the newspaper or a medical instruction leaflet, being knowledgeable about issues of health, reproduction and contraception, ….., being able to work with a computer and communicate with people worldwide through the internet,…..’(p.71)*

Moreover, as noted in the literature reviewed in Chapter Three, cultural stereotypes, media, internet, family and other people can all have significant influences on engineering enrolment. The Capability Approach to education can account for all these influences on engineering enrolment. Robeyns, (2010) notes that an important element of Capability Approach is that consideration is given to all affected capabilities, that is, all changes in the well-being of people when a policy is evaluated. This implies that it is important to consider all sources of inequalities in schools, families and the society as a whole when determining causes of inequalities in engineering enrolment and measures to address them.

The literature review indicates that gender differences in access to engineering courses at TVET level depend on a complex of factors which influence student choice of courses. Thus, it was conceptualised that causes of gender inequalities in engineering courses at TVET level are multidimensional and go beyond school attendance. While gender inequalities in education generally and engineering courses in particular could be perceived as a result of a formal school environment, in which the curriculum is gendered, and teachers and managers make assumptions about what kinds of knowledge and subjects are suitable for females and males, much gender inequality is also associated with informal school spaces, private relations within families, media, and public inequalities in the labour market (Unterhalter, 2012, p.69).

Social, economic and cultural relationships influence course selection by both genders leading to disparities in enrolment in engineering courses. As noted in Chapter Three Sections 3.5.5 and 3.5.6, cultural stereotyping about female domestic roles and employment capabilities were found to have channelled females into non-engineering occupations. Kosteas (2013) found that holding more traditional attitudes towards gender roles is related to a lower probability of women participating in post schooling training. Also, gender role attitudes appear to have significant indirect effects on human capital acquisition, operating through a lower probability of labour market participation (Kosteas, 2013). Moreover, it has been found that women leave engineering at a greater rate than men because they pay a lower penalty; men lose more future earnings by leaving engineering than women do (Rubineau, Cech, Seron and Silbey, 2011).

Drawing from the above findings and literature reviewed in Chapter Three Section 3.5 it is clear that many factors arising at the student level, from their families, friends, through to schools, government policies and culture, social and economic environment together have an effect on female enrolment in engineering courses at TVET level. Thus, consideration of both human capital and a Capability Approach is important in understanding these influences.

The influences on student choice of TVET courses could further be understood by application of equity theory. Equity theory attempts to explain relational satisfaction in terms of perceptions of fair or unfair distributions of resources within interpersonal relationships. Equity theory developed by Adams in 1963 emphasises the need for social justice and fairness as a means of motivation of workers (Guerero, Anderson and Afifi, 2007). Adams asserted that employees seek to maintain equity between the inputs that they bring to a job and the outcomes that they receive from it against the perceived inputs and outcomes of others (Adams, 1965). The belief is that people value fair treatment which causes them to be motivated to keep the fairness maintained within the relationships with their co-workers and the organization. Unfair treatment results in demotivation and reduction of outputs while fair treatment motivates them to increase their outputs.

This may easily be translated into the education arena. Unfair experience in education may result in enrolment in specific areas. Any background that would incorporate any of these inequitable experiences would be seen as a barrier to the related courses. Compared to males, females face more barriers in the choice of technology and engineering courses.

Informed by the above theoretical frameworks, the conceptual framework for this study is presented in Figure 3.8 below.

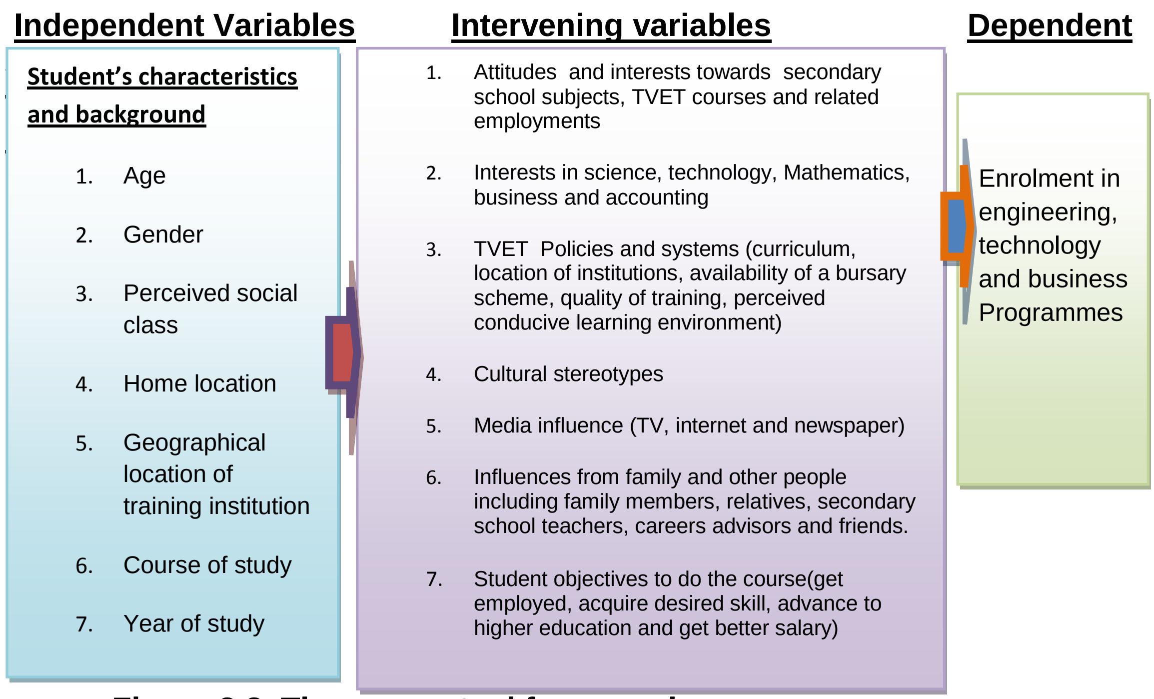


Figure 3.8. The conceptual framework

In the conceptual framework of this study, the various determinants that influence gender enrolment in TVET courses (Business and Engineering) and how they affect development of technically skilled manpower were considered. It was conceptualised that student characteristics and backgrounds were the independent variables. These had the potential of influencing the intervening variables including attitudes and values towards the courses and employment, interests in science, technology and mathematics, objectives of doing courses and influence from family and other people in making choices of TVET courses. Enrolment in engineering and business courses formed the dependent variables of the study.

The conceptual framework guided the analysis of the relationship between student background and characteristics with choice of courses (Business and engineering). This was to determine which of the background variables directly influenced enrolment in either course. Additionally, each of the intervening variables was analysed to determine its relationship with course enrolments overall and by gender. Variables which had negative influences on enrolment in a course were considered to have been barriers and those with positive influences were considered to have been causes of enrolment in the course. Barriers to enrolment were conceptualised to be influences that were as a result of unfair rewards, or unfair experiences and expectations of future outcomes. These were likely to have demotivated students from enrolling in the course and increased dropout. Thus, addressing these barriers as well as boosting those influences that were found to have positive influence on course enrolment could possibly enhance gender parity in engineering at TVET level.

In the next chapter, the study methodology is presented.

CHAPTER FOUR
METHODOLOGY

4.1. Introduction

This chapter presents the research methodology, which includes the research questions, research design, the target population, sampling procedures, and sample size, and research instruments. In addition, the reliability and validity of research instruments are also described. A description of data collection procedures as well as analysis forms the last part of this chapter. For the purpose of this study, technology and engineering as well as technological and engineering are referred to here as “engineering”.

4.2. Research questions

To meet the objectives and purpose of the study (Refer to Chapter 1 section 1.4 and 1.5), the study sought to answer the following questions.

1. Are there differences in the factors attracting students to TVET engineering and business courses in general and by gender?
2. What are the perceived barriers to female enrolment in traditional engineering courses?
3. What is the relative importance of factors that influence female enrolment in engineering courses?
4. What are the appropriate measures that can be implemented to enhance gender parity in engineering courses?
5. Has the government’s bursary scheme improved retention of female students in traditional engineering courses?

4.3. Research Design

The study methodology employed was an empirical approach where both quantitative method and systematic analyses of government records were used to maximise the value of information available and its validity (Aiken, 1996). The two methods complemented each other in providing information for the study.

Quantitative method was chosen given its advantage over other methods in studying large numbers of people as well as evaluating the independent and joint effects of the independent variables on the dependent variables. In addition, the method was the most appropriate given that the study aimed at establishing relationships between sets of variables as well as testing hypotheses constructed before the data were collected.

In carrying out the quantitative research, survey design was employed. Survey designs are procedures in quantitative research in which investigators administer a survey to a sample or to the entire population of people to describe the attitudes, opinions, behaviours, or characteristics of the population (Creswell, 2008). Since I intended to describe the attitudes and opinions of students and Heads of Departments in technical training institutions on factors that had an influence on student enrolments in general and by gender in engineering and business programmes using responses from samples of the population, the survey design was appropriate for the study. Since factors influencing gender enrolment in TVET programmes which were the intervening variables and enrolments (dependent variables) had already occurred, an ex-post facto design was used in discovering the causes of behaviour patterns (Borg and Gall, 1979). I selected the independent variables and made inferences about the relationships among the variables (Creswell, 2008). The data collected and analysed by use of this design focussed on students enrolled in engineering and business disciplines and the corresponding Heads of Departments in technical training institutes in Kenya.

Systematic analysis of government records of TVET institutions' enrolment data at the diploma level in engineering as well as business programmes in public technical training institutes in Kenya was undertaken.The objective was to compare enrolment trends in both engineering and business courses, note the differences and find out whether there were significant changes in these trends when the government bursary scheme targeting female students enrolled in engineering courses was introduced. The major focus was to find out whether there was improved female enrolments and retention in engineering courses.

Thus, it specifically focussed on enrolment increase and drop outs in relation to the course of study, student gender, and geographical location of institution. Therefore, the relevant enrolment data collected included enrolment trends in engineering and business courses for a period of 7 years including three years before and after implementation of the bursary scheme in 2007. The bursary scheme was introduced as a policy intervention in an attempt to ensure equity in enrolment in TVET programmes. It specifically targeted females enrolled in male dominated engineering disciplines, students from poor households, marginalised groups and those with special needs (Republic of Kenya, 2005a).

4.4. Research instruments

This study required two related research instruments to be developed for the survey. Both instruments were questionnaires, one for the students enrolled in engineering and business departments and the other for the corresponding Heads of Departments. The questionnaires included both closed and open questions. Responses to the closed questions provided data that could be recorded by allocating specific numerical codes, and the open questions supplemented these responses by providing additional detail of their opinions.

Since the study was quantitative, and investigated attitudes and opinions, questionnaires were deemed to be the most appropriate method of data collection. They had the advantage of collecting information in a standardised way that could be analysed more objectively than in other methodological approaches, and much of the information collected was not open to observation. In addition, as compared with interviews, questionnaires were relatively cost effective in collecting information from a large number of people which was required in a short time.

The next section presents details of how these instruments were designed and developed.

4.4.1. Design and development of research instruments

During the design of the instruments, I considered four major steps which included the purpose of the instrument, literature review, developing and finally testing of the questions. Considering the purpose of the study as outlined in Chapter One (section 1.5) I selected studies that were relevant to my study and reviewed their instruments. From the review, the research instruments used for two studies including a study of engineering enrolment and career by Prieto et al, (2011) and a study of factors influencing career choices by the Engineering Training Board (ETB), (2005) were selected for consideration in the development of the instruments of this study. The study by Prieto et al undertook the task of identifying directly what could capture and build young people‘s interest in engineering and to unlock what was necessary for an effective communication strategy to stimulate enrolments in university engineering programmes. The survey instruments for the study included questionnaires for primary school pupils, secondary school students, university students, school teachers, counsellors and engineers in Australia. These instruments were developed in 2010 by the authors and their procedures for recording data fitted the research questions of this study. Therefore, they were deemed to be current enough and relevant for use in this study. In addition, the authors had tested the instruments' validity and reliability and used them successfully to collect data for the study whose report was published by the University of Newcastle, Australia.

The study by ETB (2005) was commissioned to determine how year 9 students could be better supported with advice and background information relating to career opportunities in the science, engineering and technology sector in Australia. The study collected data by administering questionnaires to year 9 students. The questionnaire had questions relevant to my study. Since it was administered in 2005, and its questions were tested by the authors and found to be reliable and valid, it was considered to be both current and appropriate for consideration.

Selection of scales and their respective questions from the above studies began a process of adaptation for use in my study with modifications. Modifications included broadening the subject scope to include business programmes and making the items relevant to the Kenyan environment. In addition, the questions were given to experts to scrutinize and assess their content and give constructive criticism that enhanced the content validity before approval by the University Human Ethics Committee. The next section describes how the two sets of questionnaires were structured.

4.4.2. Student questionnaire.

The student questionnaire had questions grouped into three parts (Refer to Appendix E). The first part covered personal characteristics, backgrounds and course details of respondents, including their gender, age, family social status, home location, and courses of study, year of study and geographical location of the technical training institution enrolled in. These variables were used to categorise student responses on the other parts of the questionnaire.

Students were asked to give the locations of their home and institution based on three options: city, town and rural. Kenya has three cities (Nairobi, Kisumu and Mombasa) and gazetted towns across the country, the remaining areas are considered rural. All these locations are common knowledge known to all Kenyans including youth.

Family social class was also presented in three categories: namely low social class, middle social class and high social class. Since students in technical training institutions were adults (18 years and above), their perceptions of their respective social classes could be taken as reliable. This approach to obtaining social class was developed following a trial of the questionnaire which included a more complex method describing lifestyles as defining three social classes. The complex method was abandoned following the findings of the pilot study that a vast majority of the respondents did not attempt the question due to lack of understanding of the options of lifestyles described.

The second part of the student questionnaire sought to collect data on their interests in and attitudes towards secondary school subjects; engineering and business programmes, tasks in various areas and occupations and their opinions on factors hypothesised to have an effluence on their enrolments in TVET programmes in general. In order to collect data on student interests, attitudes and opinions, groupings of statements about student experiences in secondary school subjects including science, mathematics, computing and business subjects were adapted from the Prieto et al (2011) and ETB (2005) studies. Additionally, groupings of statements on student opinions on usefulness of science, engineering, mathematics, engineering and business, interests in various tasks in business, engineering and general areas and opinions on various factors perceived to have had influence on their enrolment in TVET programmes were adapted from the same studies with some modifications to suit my study. Respondents were asked to indicate their opinions about the statements by choosing from a four-point rating scale. The ratings either ranged from strongly agree to strongly disagree or very high influence on no influence as appropriate.

In addition, there were questions that required the respondents to indicate the secondary school subjects they most and least liked, and those they found most and least difficult. In each case respondents were asked to select four subjects from a range of secondary school subjects presented. In addition, presenting them with a list of occupations, and requiring them to indicate their preferences on a four-point scale, collected data on the respondents' preferences for various occupations. The scale ranged from very high preference, high preference, and low preference to least preference.

The last part of the questionnaire sought to collect data on student opinions on causes of gender disparities in enrolment in engineering programmes. Thus, statements selected from the two studies were modified and grouped in accordance to each hypothesised cause of gender disparity in engineering programmes including cultural stereotyping about engineering, interests in mathematics and science, interests in TVET courses, employment interests, and student objectives to do the courses, influences from family and other people, influences from TVET system and policies, and influence from media and internet. The respondents were asked to indicate on a four-point scale the alternatives that best described the extent to which they agreed or disagreed with the statements. In all cases strongly agree was coded four and strongly disagree one. Lastly an open-ended question was used to invite any other information the respondent felt was important for the study.

The next section describes the development of HODs questionnaire.

4.4.3. Heads of Department questionnaire

The Head of Department questionnaire had questions grouped into three parts (Refer to Appendix F). The first part sought to collect data on the respondents' personal characteristics, and institutional and department details including their gender, age, department headed and location of training institution.

The second part sought data on respondents' opinions on the possible causes of gender disparity in enrolment in engineering courses. This part comprised the same statements and groupings of questions presented in the students' questionnaire concerning causes of gender disparities in engineering programmes to enable comparison of the opinions of the two categories of respondents.

The third part of the questionnaire had four gender stereotyping statements about engineering and business courses with a four-point rating scale ranging from strongly agree to strongly disagree, on which respondents were asked to indicate their opinions. Also included in this part were eight interventions hypothesised to have possible effects on enhancing gender parity in TVET programmes. Respondents were to select and rank the best four interventions they would recommend for implementation in their respective institutions. The questionnaire had additional open-ended questions to collect further information regarding the respondents' opinions and suggestions.

4.5. Reliability of research instruments

Although the questions in the instruments had been tested for their validity and reliability by the previous studies, it was necessary to re-test them given that they had not been used within a Kenyan population. A test – retest procedure was used to examine the extent to which scores from the two samples were stable over time from one test administration to the other. In test- retest reliability procedure, the researcher administers the test at two different times to the same participants at a sufficient interval of time. Reliable scores of the two tests will relate at a positive and reasonable high interval. Thus, to test the reliability, I administered the instruments twice at interval of two weeks to 40 students enrolled in diploma programmes in engineering and business programmes and five of their respective Heads of Departments in Rift Valley Institute of Science and Technology. Respondents from this institution had similar characteristics to those of the target population in technical training institutes (Borg and Gall, 1979). Also, Rift Valley Institute of Science and Technology ran similar programmes as those in technical training institutes.

The scores from the first and second administration were correlated and the following coefficients of reliability obtained;

- Student questionnaire was 0.92
- Heads of Departments questionnaire was 0.86

The reliability of any instrument may be expressed as a correlation coefficient, which measures the strength of association between variables, and that a coefficient of 0.0 indicates no reliability while that of 1.0 indicates perfect reliability. Hence both questionnaires were considered reliable since the coefficients of reliabilities were high.

4.6. Sample and Sampling procedures

As stated earlier, this study was carried out in Kenya targeting students and Heads of Departments in technical training institutes. At the time of data collection, the country had 20 technical training institutes spread across all provinces (now divided into counties). Sixteen of the 20 technical training institutes had students enrolled in engineering and business courses at diploma level. Since students' enrolment at diploma level was the focus for the study, the 16 institutions were targeted. These institutions were spread geographically covering the three categories of locations: rural, cities and towns with enrolment of students from 42 cultural languages in Kenya. Therefore, there were many perspectives of the students' and Heads of Departments population represented in the sample.

First and third year Diploma students registered in the engineering and business programmes were targeted for study to gather a wide range of opinions from both new entrants and those about to exit the programmes. The specific departments targeted were Building and Civil Engineering, Electrical and Electronics Engineering, Mechanical and Automotive Engineering, Information Technology and Business. The enrolment in courses offered by the four engineering departments was male dominated, a fact that had prompted this study. Respondents from the Business department provided a comparison of views from students who did not choose engineering careers. Additionally, the inclusion of business courses in the study was intended to permit me to make more generalisable findings concerning TVET programmes.

Female students enrolled in engineering courses were all included in the sample owing to their small numbers. In addition, all students in the appropriate departments of small institutions were included. However, owing to their large numbers, male engineering students and all business students in large institutions were sampled by use of a probability sampling procedure.

Based on Table 4.1, which presents the total enrolments of diploma students in the engineering and business departments in 2011, the target population for year 1 and year 3 engineering students was 869 and 774 respectively. For the business department, the target population was 1215 and 1137 for first and third year students respectively.

Table 4.1. Enrolment of Diploma Students in Traditional Engineering Courses and Business Courses in 2011

Name Of Technical Training Institute	Enrolment In Diploma In Traditional Engineering Courses		Enrolment In Diploma In Business Courses	
	Year 1	***Year 3***	***Year 1***	***Year 3***
Kabete T. T. I	101	90	220	235
Kitale T. T. I	80	75	105	107
Nyeri T. T. I	71	60	130	121
PC. Kinyanjui T. T. I	15	12	33	27
Mombasa T.T.I	10	9	115	110
Mathenge T.T.I	13	12	9	6
Thika T.T.I	101	90	61	50
Nairobi T.T.I	84	80	97	91
Masai T.T.I	26	18	20	22
Kaiboi T.T.I	40	43	18	14
Sigalagala T.T.I	15	11	39	30
Riftt Valley T.T.I	110	98	60	50
Bumbe T.T.I	8	6	3	1
O'Lessos T.T.I	50	42	75	68
Machakos T.T.I	72	66	70	60
Meru T.T.I	73	62	160	145
Total	**869**	**774**	**1215**	**1137**

The minimum sample size for the students was determined by use of the following formula for calculating the sample size for finite population (Creative Research System, 2012).

Sample size for finite population (n) = $N Z^2 P (1- P) / ((d^2 (N-1) + Z^2 (1-P))$

Where:

N = Population size,

Z = z statistic for a level of confidence. In this case the level of confidence was 95% and Z score for this level is1.96)

P = Expected proportion or worst-case percent. In this case, 50 percent was chosen.

d = Precision or Margin of error (or) Confidence Interval. A confidence interval of .05, which is commonly used in education studies, was chosen for this study.

The variables were entered into the Sample Size Calculator, which is programmed for calculating sample sizes using the above sample size formula for finite population. Table 4.2 presents the calculated sample sizes for various categories of the target population of the study, as well as the summary of return rate.

Table 4.2. Student population and sample sizes by course and year of study.

YEAR AND DEPARTMENT	POPULATION	SAMPLE SIZE	TOTAL SAMPLE	RETURN RATE	
				NUMBER	PERCENTAGE %
Engineering- Year 1	869	267	559	553	98.9
Engineering- Year 3	774	257			
Business –Year1	1215	292	579	446	77.0
Business- Year 3	1137	287			
TOTAL	**3,995**	**1,103**	**1,103**	**999**	**90.6**

Heads of Departments in engineering and business departments were also included as a second target population due to their experience in managing student affairs including admissions, and the focus of this study being in those areas. There were 64 Heads of Departments in the 16 technical training institutions. Owing to their small numbers, all were included.

The following sections present how data were collected and analysed.

4.7. Data collection procedures

I sought approval of the University Human Research Ethics Committee for authority to conduct the study. Upon approval by the Committee (refer appendix C), I sought further authority to conduct research in Kenya from the National Council for Science and Technology in the Ministry of Higher Education, Science and Technology. It is a requirement in Kenya that all research studies must be authorized by the Council before being carried out. The Council authorized the study within two weeks, which considerably assisted my timetable.

After receiving authorization from the Council (refer Appendix D), I further sought consent from the Director of Technical Education (refer to Appendix H.1) to authorize the conduct of the research in technical training institutions as per the requirements of the Human Research Ethical Committee. The Director of

Technical Education was positive about the study and promptly authorized it on the same day the request was presented.

I further sought consent from the Principal of Rift Valley Institute of Science and Technology to allow him to undertake piloting of the instruments in this institution (Refer to appendix H.2). After piloting of the instruments, additional consent was sought from the principals of the sixteen technical training institutes, which were targeted for the study (refer to Appendix H.2). The principals were also requested to appoint one officer from their respective institutions to distribute the questionnaires. All 16 principals of the institutes approved the study and appointed respective officers to undertake the distribution of packages of questionnaires to their respective institutions. None of the officers appointed had authority over the respondents in carrying out their day-to-day duties at their respective institutions. Therefore, they had no undue influence on the respondents.

I visited all 16 technical training institutions to give instructions to the officers in regard to distribution of research materials as well as ethical requirements for the study. The officers were supportive and were careful to follow the instructions provided. The appointed officers printed name labels of targeted students and Heads of Departments from enrolment and staff lists. This was attached to packages containing pre-paid return post envelopes, participants' information statements and respective questionnaires (refer to Appendix E, F and G.3). The packages were distributed to respondents by dispatch through the internal mail system. The participants who sent back their responses were deemed to have consented.

The most challenging part of this study was accessing student enrolment data in engineering and business courses from the Ministry of Higher Education, Science and Technology. The enrolment records were manually kept and characterized by incompleteness and some missing information. Therefore, the Directorate of Technical Education sought further data from the technical training institutions. However, some data remained incomplete and was therefore not useful for the study. In view of the foregoing, I used the available and complete data from eight institutions for the study.

The institutions were from varied geographical locations. Two were from city, two from towns and three from rural locations. City institutions were all located in Nairobi County and included Kinyanjui Technical Training Institute and Kabete Technical Training Institute. The latter is one of the largest and oldest technical training institutions in Kenya. Town institutions were Kitale Technical Training Institute located in Kitale County and Rift Valley Technical Training Institute located in Uasin Ngishu County. Both of them had been upgraded to the centres of excellence status in technology and engineering programmes. Rural institutions included Masai Technical Training Institute located in Kajiado County, O'llessos Technical Training Institute and Kaboi Technical Training Institute both located in Nandi County and Mathenge Technical Training Institute located in Othaya County. Kaiboi Technical Training Institute had been upgraded to centre of excellence status in technology and engineering fields. To some extent, therefore, the data obtained represented the national enrolment in TVET institutions.

4.8. Data analysis

This stage involved data coding, entry into SPSS, followed by extensive data cleaning which involved counter checking of the data to ensure that it was correctly entered. The data were also submitted to the thesis supervisor who extensively counter checked and approved it for analysis. The effective response rate for students was very high (see Table 4.2) and all heads of departments responded.

Scales were developed for different variables within both student and HOD's data sets. In student data sets, scale scores for the attitudinal, interests, student opinions on possible influences on their enrolments as well as possible factors causing gender disparities in enrolments in engineering programmes were developed. The attitudinal and interests developed were of three categories as follows:

1. Those focusing on student experience with secondary school subjects including:

i. experience in science,
ii. experience with mathematics,
iii. experience with computing,
iv. experience with accounting and
v. Experience with business subjects.

2. Scales on student opinion on usefulness of following subjects;

i. Science,
ii. Mathematics,
iii. technology/computing,
iv. engineering, and
v. Business subjects.

3. Scales on student interests in various tasks and activities in the following areas:

i. Engineering
ii. Business
iii. General

Other scales developed for student opinions on possible influences on their enrolments were:

i. Family and other people influence,
ii. media and internet influence,
iii. their objectives to do the courses and
iv. TVET system and policies influence.

The last of set scales were developed for both student and Heads of Departments' data sets. These included the following variables on students' and Heads of Departments' on possible factors causing gender disparities in enrolments in engineering programmes:

i. students' attitudes and interests in the courses,
ii. employment interests,
iii. science and mathematics interests
iv. influences from culture,
v. Media and internet[15]
vi. Family and other people influences,
vii. TVET system and policies influences
viii. Individual objectives in doing the course.

The reliabilities of these scales were checked by use of Cronbach's alpha as described in Chapter 5 section 5.1. In addition, tests for skewness and kurtosis were undertaken and z scores noted for testing their distribution. Scales with z scores between -1.96 and 1.96 were considered to be within the normal distribution range (Doane and Seward, 2011).

The respondents' demographics and backgrounds were first analyzed and described using percentages and frequencies and their correlations noted. Further, the responses of various categories of respondents on the scales were described by use of percentages, means and standard deviations. The differences between these responses on the scales were tested and described by use of t-tests, ANOVAs and Chi Square as appropriate. In each case 0.05 level of significance was employed. Differences with alpha level less than or equal to 5 percent were considered to be significant and those with alpha level more than 5 percent considered not significant.

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[15] It is important to note that media and internet influence had one item and thus, did not require development of scale. It is included here as one of the variables to be analysed.

Where ANOVAs were employed, Scheffe's statistical test was used. Scheffe's test is used to make unplanned comparisons, rather than pre-planned comparisons, among group means in an analysis of variance (ANOVA) experiment. Due to its flexibility, it can be used to test any comparisons that appear interesting. The results of the analyses were presented and described using percentages, frequencies, means, standard deviations, cross tabulations and bar charts.

As noted in Chapter Three Section 3.7, the conceptual framework guided the analysis of the relationships and differences between student backgrounds and characteristics with course enrolment. Further, the relationship and differences between these backgrounds and characteristics (independent variables) with the hypothesized intervening variables were analyzed and noted. The intervening variables were further analysed to find out their effects on enrolment in both business and engineering courses. Those which had negative influence towards any of the course were construed to have been barriers to enrolment to the course and thus responsible for inequalities in access to the course. Conversely, positive influences were seen to be causes of enrolments in the course. Barriers to enrolments would negatively affect human capital formation in the area as opposed to positive influences which are likely to enhance human capital formation in the area.

The final stage of analysis required the identification of the most important factors for predicting the student enrolment in either engineering or business TVET courses. Thus, variables in the ten categories listed below were entered into a regression equation as independent variables, separately for each of the two outcomes. Binary logistic regression analysis was used to determine the relative strengths of the variables, and their odds ratios were noted and compared. Variables that were not significantly related to the outcome were progressively removed from the equation until only significant variables remained. The 10 variable categories were:

1) Student personal characteristics, backgrounds and course information,

2) Their experience in secondary school subjects - enjoyment

3) their experience in secondary school subjects-liking,

4) experience in secondary school subjects-difficulty,

5) usefulness of subjects, interest in areas,

6) influence from family and other people,

7) interests in employment,

8) influence from other sources (TV, Internet and newspaper),

9) individual objectives for enrolling in the course and

10) influence from TVET system and policies.

Enrolment trends in engineering and business courses, obtained from the systematic analyses of government documents, were described using frequencies and percentages. Changes in enrolments and retentions for various variables including gender, course of study, and location of institutions were noted and described.These results were compared with those from the questionnaire analyses for possible explanations and clarifications.

Finally the results of the analyses were discussed in comparison with existing studies. The major conclusions drawn were noted, described and suggestions made.

Following this description and justification of the methodology, the following chapter presents the results of analysis of student interests and attitudes.

CHAPTER FIVE
STUDENT DEMOGRAPHICS, INTERESTS AND ATTITUDES

5.1. Introduction

The results of the analyses of student questionnaire responses have been divided into two categories and presented in two chapters. This chapter presents the results of the detailed analyses of the data collected from the student questionnaires on items regarding their attitudes and interests. Their responses to items regarding their opinions about possible influences in enrolment in TVET programmes are described in Chapter Six.

The demographic profile of the students who participated in the study is presented first, with information about their institution, their course and their year level in the course. Secondly, student interests in and attitudes towards a range of subjects taught in secondary schools including Science, Mathematics, Computing, Accounting and Business are described. Thirdly student opinions about usefulness of science, technology, engineering and business and their interests in these areas and employment are described. Finally, a summary of findings on student interests and attitudes form the last section of this chapter.

Results in this chapter, Chapter Six and in Chapter Seven are presented using frequencies, percentages, cross-tabulations, means and standard deviations. Where possible differences between groups are of interest, chi-square tests, t-tests and ANOVAs were used as appropriate. In each case, the 0.05 level was used to test significance. Since samples were unequal, Scheffe's test was used in the ANOVAs.

Where scales were developed, their reliabilities were tested using the Cronbach alpha reliability. The rule used for interpretation of Cronbach's alpha values is $\alpha > .9$ – excellent; $\alpha > 0.8$ – good; $\alpha > 0.7$ – acceptable; $\alpha > 0.6$ – questionable; $\alpha > 0.5$ – poor and $\alpha < 0.5$ – unacceptable (George and Mallery, 2003 p. 231). Further, as described in Chapter Four section 4.8, the distributions of all scales developed were tested by use their respective z scores.

5.2. Student demographics and enrolment information

The obtained sample was 999 of the 1103 questionnaires supplied to students enrolled at 16 technical training institutions spread across seven provinces in Kenya. The response rate was thus 91 percent. The questionnaires were carefully completed with only small proportions of missing data among the student demographic and enrolment variables, ranging from less than 1 percent for course of enrolment to less than 5 percent for geographical location of their homes. The results of analysis of student demographics and enrolment information summarised in Table 5.1.

Table 5.1 Student demographic information

CLASIFICATION OF STUDENTS		FREQUENCY	PERCENTAGE	ENGINEERING & TECHNOLOGY %	BUSINESS %	Total MALE %	Total FEMALE %
STUDENT'S HOME LOCATION	**City**	170	17.80	18.20	17.30	17.60	18.30
	Town	108	11.30	10.40	12.60	11.30	11.40
	Rural	675	70.80	71.40	70.10	71.10	70.30
	Total	**953**	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**
STUDENTS' SOCIAL CLASS	**High class**	16	1.60	1.60	1.60	1.50	1.90
	Middle class	624	64.00	58.80	70.90	61.30	68.60
	Low class	335	34.40	39.60	27.50	37.20	29.40
	Total	**685**	**100.00**	**100.00**	**100.00**	**100.0**	**100.00**
GENDER	**Male**	625	62.60	76.90	45.10	100.00	0.00
	Female	374	37.40	23.10	54.90	0.00	100.00
	Total	**999**	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**
AGE BRACKET	**Up to 25years**	899	90.00	87.90	92.60	87.80	93.60
	26 to 30years	75	7.50	8.70	6.10	9.40	4.50
	31 to 40years	21	2.10	2.70	1.40	2.20	1.90
	41yrs & above	4	.40	.70	.00	.60	.00
	Total	**999**	**100.0**	**100.00**	**100.00**	**100.00**	**100.00**
INSTITUTION LOCATION	**City**	291	31.20	32.80	28.60	32.70	28.50
	Town	235	25.20	25.30	25.20	22.30	30.30
	Rural	407	43.60	41.90	46.20	45.00	41.10
	Total	**933**	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**
DEPARTMENT	**Engineering**	553	55.50	100.00	0.00	68.00	34.50
	Business	443	44.50	0.00	100.00	32.00	65.50
	Total	**999**	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**
YEAR OF STUDY	**First year**	463	48.40	50.40	45.60	49.50	46.50
	Third year	494	51.60	49.60	54.40	50.50	53.50
	Total	**957**	**100.00**	**100.00**	**100.0**	**100.00**	**100.00**

The information summarised in Table 5.1 indicate that approaching two-thirds of the students were male (63 percent), and almost all students were aged between 18 and 25 years (90 percent). Almost two-thirds of the students were middle class (64 percent), about one-third was lower class (34 percent), and there were very few from the upper class. There were significant differences found between student social classes and their enrolment by course of study (χ^2 = 16.08, df = 2, sig < 0.05) and by gender (χ^2= 6.23, df = 2, p < 0.05). A higher proportion of students in business courses (71 percent) compared with those in technology and engineering courses (59 percent) were from the middle social class while a higher proportion of technology and engineering students (40 percent) compared with business students (28 percent) were from lower social class. On the other hand, a higher proportion of female students (69 percent) compared with males (61 percent) were from the middle social class while a higher proportion of male students (38 percent) compared with females (29 percent) were from the lower social class.

Most students resided in rural areas (71 percent), but less than a half attended an institution in a rural area (44 percent). Most students were enrolled in institutions located in their respective home locations. However, there was a higher percentage of students from city homes (72 percent) enrolled in institutions in their home locations compared with those from town (52 percent) and rural (53 percent) homes enrolled in their respective home located institutions. This difference was found to be statistically significant (χ^2 = 195.87; df = 4 and p < 0.05). In addition there was a higher proportion of female students (30.3 percent) compared with males (22.3 perecent) enrolled in town institutions while a higher proportion of males (45.0 percent) compared with females (41.1 percent) were enrolled in rural institutions. These differences were found to be statistically significant (χ^2 =7.34, df = 2 and p < 0.05). Further analyses of student gender by course of study and institution location found that these differences were between males and females enrolled in technology and engineering courses. A higher proportion of male students (52 percent) compared with females (42 percent) in technology and engineering courses were enrolled in institutions located in rural areas. There was no significant difference between students by gender enrolled in business courses and the location of institutions. More than half of the students (56 percent) were enrolled in technology and engineering courses and the remaining proportion were enrolled in business courses. Most males (68 percent) were enrolled in technology and engineering courses while approximately two thirds of the females (66 percent)[16] were enrolled in business courses. Finally, approximately half the students were in their first year of study (48 percent), the remainder being in their third year of study.

5.3. Student interests in and attitudes towards secondary school subjects.

Student interests in and attitudes towards a range of secondary school subjects including Science, Mathematics, Computing, Accounting and Business have been determined by first analysing their experiences in the subjects and second their opinions on the extent they liked or found the subjects difficult.

5.3.1. Student experience in secondary school subjects

Students were presented with six statements about their possible experiences in the Science, Mathematics, Computing, Accounting and Business subjects in secondary schools and provided with four categories of responses which ranged from strongly agree (coded 4) to strongly disagree (coded 1). The experiences were: whether the student enjoyed the subject, felt good in doing the assignments of the subject, thought the subject was exciting and found it interesting. Other questions asked if the students liked working on the subject during their spare time or whether they wanted to learn more about the subjects.

Scales for each of the subject experiences were developed by calculating the mean of the six experiences per subject. Additionally, the Cronbach's alpha reliability for each scale was calculated, with all found to be greater than 0.8. The z scores of each scale ranged from -1.62 to 1.30 thus were within the range of the normal distribution ($-1.96 < z < 1.96$). See Table 5.2. The development of

[16] Females were deliberately over-sampled in engineering courses to provide adequate numbers. Hence the 42% of females in engineering is more than would otherwise be expected.

the scales was followed by analyses of variance (ANOVA) of each of the scale to find out whether there were differences in means of student experiences in the subjects between their gender, the courses they were enrolled in, age, year of study, home location, institutional location and the student's social class.

As the mean[17] for each scale was greater than the neutral point of 2.5 (the mid-point between 1 indicating strong disagreement and 4 indicating strong agreement), the students generally agreed that they had favourable school experiences in all the five subjects under study. Their best experiences were with Business and worst with Accounting. There were significant differences in student experiences by gender in Computing ($F = 5.20$, $df = 1$, $p < 0.05$). Female students had a higher mean (2.85) of favourable experience in Computing compared with males (2.68). (See Table 5.2 below and detailed analyses in Appendix K, Table 10.4, Appendix L, Table 11 and Appendix M, Table, 11.5).

Table 5.2. Summary of scale reliability and analysis of means of students' experiences per secondary school subjects by gender

Total experiences per secondary school subject	Gender	Descriptive Statistics		Number of variables	Reliability Cronbach's Alpha (α)	Z score	One Way ANOVA		
		Mean	Std. Deviation				F	df	Sig
Science	Male Female **Total**	2.93 2.71 **2.85**	.61 .68 **.65**	6	**0.92**	-1.40	3.19	1.00	.07
Mathematics	Male Female **Total**	2.81 2.67 **2.76**	.70 .81 **.74**	6	**0.88**	-1.35	.04	1.00	.84
Computing	Male Female **Total**	2.68 2.85 **2.74**	.80 .72 **.78**	6	**0.84**	-1.55	5.20	1.00	.02
Accounting	Male Female **Total**	2.50 2.57 **2.53**	.86 .82 **.85**	6	**0.83**	1.30	1.86	1	.17
Business Education	Male Female **Total**	2.92 3.19 **3.02**	.81 .75 **.80**	6	**0.81**	-1.62	.42	1.00	.52

Although female students had higher mean scores for Accounting and Business subjects than their male counterparts, these differences were not statistically significant. Also there was no significant difference in the higher means of male experiences in Science and Mathematics compared with females.

[17] The mean, being the best indicator of groups, has been used to report results of analyses in this thesis. However, standard deviations which measure the spread of the responses have also been noted.

As summarised in Table 5.3, the two-way ANOVA results show significant differences between business and technology and engineering students in all experiences in the five subjects. (See appendix K, Table 10.4, appendix L, Table 11 and appendix M, Table 11.5).

Table 5.3 Summary of analysis of means of student experiences in secondary school subjects by course of study

Total experiences per secondary school subject	Course of study	Descriptive statistics		Two Ways ANOVA		
		Mean	Std Deviation	F	df	Sig.
Science	Technological & engineering	3.06	.54	120.43	1	.00
	Business	2.57	.67			
	Total	**2.85**	**.65**			
Mathematics	Technological & engineering	2.94	.65	70.13	1	.00
	Business	2.52	.79			
	Total	**2.75**	**.74**			
Computing	Technological & engineering	2.67	.80	3.72	1	.05
	Business	2.84	.74			
	Total	**2.74**	**.78**			
Accounting	Technological & engineering	2.32	.78	60.11	1	.00
	Business	2.78	.85			
	Total	**2.53**	**.85**			
Business Education	Technological & engineering	2.69	.79	190.22	1.	.00
	Business	3.41	.62			
	Total	**3.02**	**.80**			

Technology and Engineering students had higher mean scores for their experiences in Science and Mathematics compared with their Business counter parts. On the other hand Business students had higher means for their experiences in Computing, Accounting and Business compared with their Technology and Engineering counterparts. Therefore, as might be expected the courses in which students were enrolled were related to their interests and attitudes towards the respective prerequisite secondary school subjects including Science, Mathematics, Computing, Accounting and Business. In addition, it was of interest to note that students had wider range of views about their experiences in secondary school subjects not related to the courses they were enrolled in compared with those that were related.

Further analysis between the scales and year of study of the students found significant differences in experience in Science between first and third year diploma students. First year students had higher means for experiences in Science compared with third year students, as shown in Table 5.4. This could be attributed to the results of the implementation of the secondary education strategy funded by the Kenya Education Sector Support Programme that began in 2007. One of the projects under this strategy was the Strengthening of Mathematics and Science in Secondary Education (SMASSE) whose aim was to improve the teaching of Mathematics and Science subjects in secondary schools.

Table 5.4. Students experiences in secondary school subjects by their year of study

Subject	Year of study	Experiences		Independent samples test for equality of means		
		Mean	Std. Deviation	t	df	Sig. (2-tailed)
Science	First year	2.91	.63	2.68	948.19	.01
	Third year	2.80	.65			
Mathematics	First year	2.80	.73	1.05	942.00	.29
	Third year	2.75	.74			
Computing	First year	2.78	.76	1.19	846.95	.23
	Third year	2.72	.78			
Accounting	First year	2.48	.79	-1.87	810.00	.06
	Third year	2.59	.88			
Business Education	First year	2.96	.81	-1.78	881.15	.08
	Third year	3.05	.80			

There were no significant differences between the years the students were enrolled with the other scales. Year of study is not related to students' interests in Mathematics, Computing, Accounting and Business Education.

Differences between experiences of students enrolled in institutions in different locations were found to be significant for Mathematics and Science. Students enrolled in institutions located in towns and cities had more favourable experiences in Science and Mathematics than those enrolled in institutions located in rural areas. Perhaps the differences could be attributed to the higher resources and facilities in city and town-located schools compared with rural schools. Table 5.5 presents a summary of results.

Table 5.5 Students experiences in secondary school subjects by their institutional geographical location

Subject experience scales	Institution location	Descriptive statistics		One way ANNOVA results		
		Mean	Std. Deviation	F	df	Sig.
Science	City Town Rural Area	2.89 2.91 2.83	.68 .61 .62	3.67	2	.03
Mathematics	City Town Rural Area	2.81 2.89 2.73	.77 .73 .69	3.67	2	.03
Computing	City Town Rural Area	2.73 2.79 2.73	.78 .75 .78	.45	2	.64
Accounting	City Town Rural Area	2.46 2.49 2.61	.82 .87 .84	2.61	2	.07
Business Education	City Town Rural Area	2.92 3.04 3.04	.88 .79 .76	2.17	2	.11

There was no difference in experiences of Accounting, Computing and Business Education between students enrolled in institutions in different locations.

Analyses of the scales for students from homes in different geographical locations indicate that there were significant differences in their experiences in Computing as shown in Table 5.6.

Table 5.6 Students experiences in secondary school subjects by their geographical home location

Subject scales	Home location	Descriptive statistics		One Ways ANOVA results		
		Mean	Std. Deviation	F	df	Sig.
Science	City Town Rural Area	2.83 2.85 2.87	.67 .66 .62	.39	2	.67
Mathematics	City Town Rural Area	2.71 2.76 2.81	.78 .81 .71	1.26	2	.28
Computing	City Town Rural Area	2.92 2.90 2.68	.77 .65 .79	7.76	2	.00
Accounting	City Town Rural Area	2.45 2.57 2.55	.85 .76 .85	.94	2	.39
Business Education	City Town Rural Area	2.98 3.03 3.00	.85 .82 .79	2.00	.11	.89

Students from town and city homes had more favourable experiences compared with those from rural homes. The home location of the students would seem to influence their interests in and attitudes towards Computing. This could be attributed to the lower utilisation of computer technology in rural locations compared with town and city locations.

The results of one-way analysis of variance of means also indicate that there were no significant differences in experiences of Science, Mathematics, Accounting and Business Education by students from different home locations. There is no relationship between the location of the home of the students and their experiences in these subjects.

However, student social class seemed to influence their interests in and attitudes towards Computing. Results of one-way analysis of variance of means indicate that there was significant difference between student social classes and their experiences in Computing as presented in Table 5.7 below.

Table 5.7 Students experiences in secondary school subjects by their students' social classes

Subject scales	Student social class	Mean	Std. Deviation	F	df	Sig.
Science	High Class	2.95	.63	2.78	2	.06
	Middle Class	2.82	.64			
	Low Class	2.92	.65			
Mathematics	High Class	2.77	.93	.12	2	.89
	Middle Class	2.76	.75			
	Low Class	2.78	.72			
Computing	High Class	2.82	1.01	4.77	2	.01
	Middle Class	2.81	.75			
	Low Class	2.64	.80			
Accounting	High Class	2.88	.99	1.72	2	.18
	Middle Class	2.55	.83			
	Low Class	2.48	.86			
Business Education	High Class	2.93	.97	2.11	2	.12
	Middle Class	3.05	.77			
	Low Class	2.94	.85			

Students who were in the high and middle social classes had more favourable experiences in Computing compared with their counterparts in the lower social class. This could be explained by the fact that middle and high-class students are more exposed to computers compared with lower class students who may not be able to afford to own a computer. However, there was no significant difference between the means of student experiences in Mathematics, Science, Accounting and Business Education and their social classes. Student social class did not influence their interests in and attitudes towards these subjects. Finally, student experiences by their age categories were analysed and results summarised in Table 5.8 below.

Table 5.8 Students experiences in secondary school subjects by their age brackets.

Subjects	Age bracket	Experiences		One way ANOVA results		
		Mean	Std. Deviation	F	df	Sig.
Science	18 to 25 years	2.84	.65	.35	2	.79
	26 to 30 years	2.85	.68			
	31 to 40 years	2.99	.36			
	41 and above	2.92	.91			
Mathematics	18 to 25 years	2.77	.75	2.42	2	.06
	26 to 30 years	2.56	.71			
	31 to 40 years	2.90	.71			
	41 and above	2.46	.96			
Computing	18 to 25 years	2.78	.76	5.59	2	.00
	26 to 30 years	2.42	.84			
	31 to 40 years	2.40	.83			
	41 and above	2.72	1.11			
Accounting	18 to 25 years	2.54	.85	.69	2	.56
	26 to 30 years	2.39	.83			
	31 to 40 years	2.45	.69			
	41 and above	2.63	.86			
Business Education	18 to 25 years	3.02	.80	.05	2	.98
	26 to 30 years	3.01	.87			
	31 to 40 years	3.09	.66			
	41 and above	3.00	1.00			

The results indicate that experiences of students in different age categories were significant in Computing. Students aged between 18 and 25 years had a higher mean of experiences compared with the rest. Therefore, students' age seemed to influence their interests and attitudes towards Computing. However, it was of interest to note that there were very few students in the older categories (18 to 25 years = 899; and 26 years and above = 100).

There were no significant differences between students by age for the remaining scales. Therefore, the age of students did not influence their interests and attitudes towards Science, Mathematics, Accounting and Business.

The next section describes results of findings on student opinions on the extent to which they liked or found secondary school subjects difficult.

5.3.2. Student opinions on the extent to which they liked or found secondary school subjects difficult

A list of secondary school subjects was presented to the students who were asked to choose the ones they most liked, least liked, found most difficult and found least difficult. In each case three subjects were chosen. Responses are shown in Figure 5.1 in percentages.

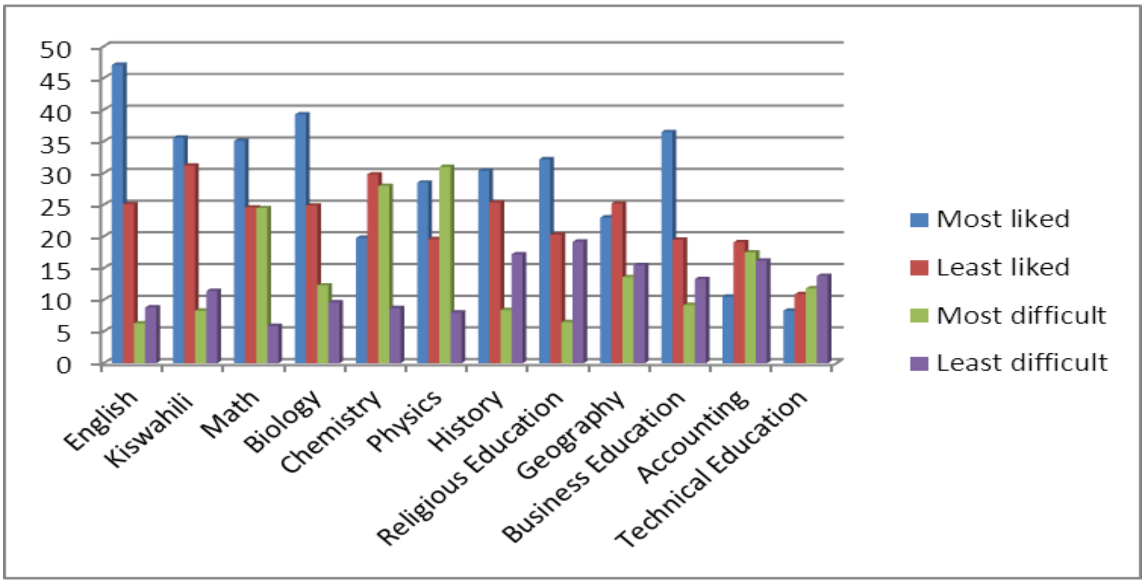

Figure 5.1 Comparison of students' liking and finding difficulties in secondary school subjects.

English had the highest proportion of students nominating it as the most liked subject followed by Biology and Business. On the other hand a higher proportion of students nominated Chemistry and Kiswahili as the least liked subjects followed by, History, Geography, Biology, English and Mathematics compared with the rest of the subjects. The most difficult subjects indicated by higher proportions of students were Physics followed by Chemistry and

Mathematics. The difficulty of these subjects was further confirmed when a lower proportion of students nominated them to be least difficult compared with other subjects. Subjects nominated by a higher proportion of students to be the least difficult compared with others were Religious Education and History. It is interesting to note that Physics, Chemistry and Mathematics, which are prerequisite subjects for enrolment in technology and engineering programmes, were either least liked or seen by students to be most difficult. Further results of analysis of responses by gender is summarised in Table 5.9 and detailed analyses in Appendix K, Table 10.3, Appendix L, Table 10.8 & 10.9 and Appendix M, Table, 11).

Table 5.9 Comparison of students' opinions on liking and difficultly of secondary school subjects by gender

Subject	Gender	Most liked %	least liked %	Most difficult %	Least difficult %	χ^2	df	Sig. (2-sided)
English	Male	48.3	31.0	9.5	11.2			
	Female	63.0	25.1	3.6	8.4	22.33	3	.00
	Total	**54**	**28.8**	**7.2**	**10.1**			
Kiswahili	Male	35.5	39.2	10.8	14.5			
	Female	50.1	31.0	7.8	11.0	18.38	3	.00
	Total	**41.2**	**36.1**	**9.6**	**13.2**			
Mathematics	Male	44.0	27.1	22.0	6.9			
	Female	30.6	27.6	35.9	5.9	25.09	3	.00
	Total	**39.0**	**27.3**	**27.2**	**6.5**			
Biology	Male	42.0	29.4	15.7	12.8			
	Female	51.7	28.0	11.8	8.4	9.86	3	.02
	Total	**45.6**	**28.9**	**14.3**	**11.1**			
Chemistry	Male	25.5	35.1	30.8	8.7			
	Female	18.7	33.6	35.2	12.5	8.21	3	.04
	Total	**22.9**	**34.5**	**32.4**	**10.1**			
Physics	Male	42.8	20.5	27.9	8.9			
	Female	16.1	25.8	48.3	9.7	71.47	3	.00
	Total	**32.7**	**22.5**	**35.6**	**9.2**			
History	Male	40.2	29.2	10.7	19.9			
	Female	32.6	34.5	9.8	23.1	5.83	3	.12
	Total	**37.3**	**31.2**	**10.3**	**21.1**			
Religious Education	Male	35.9	26.8	10.4	27.0			
	Female	49.7	24.7	5.0	20.7	18.25	3	.00
	Total	**41.2**	**26.0**	**8.3**	**24.6**			
Geography	Male	33.4	29.7	19.8	17.1			
	Female	23.	37.5	13.9	25.0	18.39	3	.00
	Total	**29.8**	**32.6**	**17.6**	**20.1**			
Business	Male	42.8	27.3	12.3	17.5			
	Female	52.3	20.9	10.8	16.0	7.36	3	.06
	Total	**46.5**	**24.8**	**11.7**	**16.9**			
Accounting	Male	16.5	32.2	24.8	26.6			
	Female	16.8	26.9	32.4	23.9			
	Total	**16.6**	**30.2**	**27.6**	**25.6**	4.83	3	.19
Technical and Industrial Education	Male	22.2	24.0	24.0	29.8			
	Female	12.7	24.9	30.1	32.4	6.87	3	.08
	Total	**18.5**	**24.3**	**26.3**	**30.3**			

The results indicate that higher percentage of male students most liked Mathematics, Chemistry, Physics and Geography and found these subjects less difficult compared with their female counterparts. Female students' relatively negative attitudes towards and low interests in these subjects could be related to them finding the subjects most difficult compared with their male counterparts. Females seemed to have higher interests in and more favourable attitudes towards subjects not related to technology and engineering compared with their male counterparts. Higher percentages of female students most liked English, Kiswahili, Biology and Religious Education and did not find them as difficult as males did. Chi Square tests revealed that these differences were significant. Gender of the students had an influence on their interests and attitudes towards Mathematics, Chemistry, Physics, Biology, English, Kiswahili, Geography and Religious Education.

Although this finding seems to differ from the earlier analysis of the experience of students in secondary school subjects (Section 5.3.1) which did not find significant differences between student gender and their experiences in science, it is important to note that the former analysis compared students experiences with science as a general subject while the latter split science into its various component subjects. Therefore, the finding of the latter analysis that students by gender have interests in different science subjects may well be adding important, more specific information. The later finding was also as proposed in the conceptual framework of the study in Chapter Three Section 3.7 and in the literature review in Chapter Three.

There were no significant differences between males and females in Business, Accounting, and Technical and Industrial Education. This finding reinforces the earlier analysis of student experiences in secondary school Business and Accounting (Section 5.3.1) which found no significant differences between student genders.

The analyses of student opinions per course of study on the extent they liked or found secondary school subjects difficult found that, apart from Biology and Technical and Industrial Education, there were significant differences between students by the course they were enrolled in and the extent they liked or found all the other secondary school subjects difficult. Table 5.10 presents a summary of the results of these analyses.

Table 5.10 Comparison of students' opinion on how they liked or found difficult secondary school subjects by course of study

Subject	Course	Most liked %	least liked %	Most difficult %	Least difficult %	χ^2	df	Sig.
English	Tech or Eng.	47.5	32.4	9.0	11.1			
	Business	61.6	24.4	5.1	8.9	18.31	3	.00
Kiswahili	Tech or Eng.	35.2	39.6	11.5	13.8			
	Business	48.7	31.5	7.3	12.5	17.39	3	.00
Mathematics	Tech. or Eng.	51.5	23.5	18.7	6.3			
	Business	22.5	32.2	38.4	6.9	85.16	3	.00
Biology	Tech. or Eng.	44.3	27.6	16.7	11.3			
	Business	47.1	30.7	11.2	11.0	5.50	3	.14
Chemistry	Tech. or Eng.	30.9	32.0	27.0	10.2			
	Business	12.9	37.5	39.6	10.0	42.09	3	.00
Physics	Tech. or Eng.	49.7	20.0	21.9	8.5			
	Business	11.5	25.3	53.0	10.2	156.85	3	.00
History	Tech. or Eng.	34.0	32.9	12.2	20.9			
	Business	41.7	28.7	8.0	21.5	7.77	3	.05
Religious Education	Tech. or Eng.	34.4	29.1	9.5	27.0			
	Business	49.0	22.3	6.9	21.8	17.08	3	.00
Geography	Tech. or Eng.	32.6	29.4	21.3	16.7			
	Business	26.3	36.2	12.9	24.6	18.60	3	.00
Business	Tech. or Eng.	29.2	32.1	17.0	21.7			
	Business	65.5	16.7	5.9	11.9	105.43	3	.00
Accounts	Tech. or Eng.	9.3	32.0	33.7	24.9			
	Business	25.5	27.7	20.1	26.6	36.19	3	.00
Technical and Industrial Education	Tech. or Eng.	21.8	23.9	25.1	29.2			
	Business	14.2	25.0	27.9	32.8	4.36	3	.23

A higher percentage of Technology and Engineering students most liked and found Mathematics, Chemistry, Physics and Geography less difficult as compared with their Business counterparts. On the other hand, a higher percentage of Business students most liked Business Education, Accounting, English, Kiswahili, History, and Religious Education subjects and found them less difficult compared with their Technology and Engineering counterparts.

This finding concurs with that resulting from the analysis of the students' experience in the subjects by courses of study (Section 5.3.1). Therefore, student interests in and attitudes towards secondary school subjects would seem to have influenced their enrolment in the current courses.

Additional analysis using Chi-square tests found no significant differences in liking or finding secondary school subjects difficult between students from different home locations, social classes, age brackets, institutional locations and year of study. Students by these categories had similar experiences in liking secondary school subjects as well as finding them difficult.

5.4. Usefulness of Science, Mathematics, Technology, Engineering and Business to students

Respondents were presented with a set of four statements and asked to choose appropriate alternatives that best represented their opinions about the usefulness of Science, Mathematics, Technology/ Computing, Engineering and Business courses. The four items of usefulness were whether having understanding of the subjects was important for their future career, personal development, social development and national development. The responses ranged from *Strongly Agree (SA)* which was coded four points to *Strongly Disagree (SD)* coded as one point.

Scales were developed by calculating the means of student opinions on the four items of usefulness per subject. The reliabilities of the scales were tested and all were found to be good (Cronbach's alpha >.80). As indicated by their z scores, all the scales were normally distributed ($-1.96 < z < 1.96$). Independent sample tests (t-tests) and ANOVAs were undertaken to find out whether there were differences in means of student opinions on usefulness of the subjects by gender; and by the courses they were enrolled in.

As presented in Tables 5.11 below, students generally agreed that it was useful to have an understanding of all the subjects (mean > 2.5 and also above the agree code of 3) for their future careers, personal development, social development and national development. Business in particular was the most useful subject followed by Technology/Computing, Science and Mathematics. It was interesting to note that Engineering was considered the least important among the subjects. Summary of analysis is presented in Table 5.11 and detailed analyses in Appendix K, Table 10.4, Appendix L, Table 11 and Appendix M, Table, 11.5).

Table 5.11. Summary of results of analysis of means of student opinions on usefulness of Science, Math, Technology/Computing, Engineering and Business by gender

Usefulness of	Gender	Descriptive statistics		Number	Reliability	Z	t- tests results		
		Mean	Std. Deviation	of variables	Cronbach's α	Scores	t	df	Sig.
Science	Male	3.26	.59						
	Female	3.06	.65	5	**.85**	-1.54	5.12	1	.00
	Total	**3.19**	**.62**						
Mathematics	Male	3.20	.63						
	Female	3.17	.65	5	**.89**	-1.37	.67	1	.55
	Total	**3.19**	**.64**						
Technology/ Computing	Male	3.32	.59						
	Female	3.43	.58	5	**.91**	-1.67	-2.61	1	.01
	Total	**3.36**	**.59**						
Engineering	Male	3.26	.79						
	Female	2.66	.84	5	**.94**	-1.48	10.57	1	.00
	Total	**3.04**	**.86**						
Business	Male	3.32	.61						
	Female	3.55	.61	5	**.94**	-1.56	-5.28	1	.00
	Total	**3.40**	**.62**						

There were significant differences between students by gender in regard to their means of usefulness of Science, Technology/computing, Engineering and Business. Compared to males enrolled in the same courses, female engineering students had higher mean in believing that Business and Technology/Computing were useful for their future careers, personal development, social development and national development compared with that of their male counterparts.

On the other hand, compared to females enrolled in the same courses, male engineering students had a higher mean in believing that science and engineering were useful for their future careers, personal development, social development and national development compared with that of their female counterparts. Females in particular held a wider range of views on the usefulness of Engineering and Science compared with males as indicated by their higher standard deviation for this subject. The gender differences in interests in engineering programmes and employment found in this section were as proposed in the conceptual framework of the study. The implication of lesser interests of females for engineering programmes and employment was conceptualised to be likely barriers to their enrolments in the course hence limiting their inclusion in human capital formation in this field. In regard to equity theory, it is implied that compared to males, females may have perceived more unfair future returns if they pursued engineering and science programmes. This was also found in the literature review

Similar to what was proposed in the conceptual framework of the study, an analysis of usefulness of the subjects to students enrolled in different courses indicates significant differences for science, engineering and business. Technology and Engineering students had higher means for usefulness of science and engineering compared with their Business counterparts. This indicates that Technology and Engineering students found science and engineering more useful for their future career, personal development, social development and national development compared with the views of Business students.

On the other hand, Business students had a higher mean for usefulness of business compared with Technology and Engineering students. Unsurprisingly they found business more useful for their future career, personal development, and social development and for national development compared with how Technology and Engineering students found it. In sum, students were enrolled in courses related to areas they perceived to be useful to them. These findings are summarized in Table 5.12 below.

Table 5.12 Summary of results of analysis of means of students' opinions on usefulness of science, Mathematics, Technology/Computing, engineering and business by course of study

Usefulness of	Course of study	Descriptive statistics		ANOVA Results		
		Mean	Std. Deviation	F	df	Sig.
Science	Techn & engineering	3.38	.51			
	Business	2.92	.64	109.44	1	.00
	Total	**3.18**	**.61**			
Mathematics	Techn. & engineering	3.23	.62			
	Business	3.13	.65	3.55	1	.06
	Total	**3.19**	**.63**			
Technology & Computing	Techn. & engineering	3.36	.58			
	Business	3.36	.60	.58	1	.45
	Total	**3.36**	**.59**			
Engineering	Techn. & engineering	3.47	.67			
	Business	2.47	.74	301.09	1	.00
	Total	**3.04**	**.86**			
Business	Techn. & engineering	3.12	.63			
	Business	3.75	.39	245.69	1	.00
	Total	**3.40**	**.62**			

It was further noted that Business students had higher standard deviation for their opinions on usefulness of science and engineering indicating that they held a wider range of views on usefulness of these areas compared with Technology and Engineering students. However, their standard deviation on usefulness of business was lower compared with that of their Technology and Engineering counterparts. This indicates that Business students did not hold wider range of views of usefulness of business compared with their Technology and Engineering counterparts. In summary, students had wider range of views about usefulness of areas that were not related to the courses they were enrolled in as compared with those related to their courses.

Independent t–tests were employed to identify if there were differences between students' opinions of usefulness of subjects by the year of their enrolment in TVET courses. This analysis found significant difference between first and third year student opinions on usefulness of science ($t = 2.82$; $df = 877$ and $p < 0.05$). First year students had a higher mean score (3.26) for the usefulness of science compared with third year students (3.14). As noted earlier (Section 5.3.1), the differences in appreciation of the usefulness of the science held by students' by year of study could be attributed to the recent enhancement of implementation of programmes aimed at strengthening of the teaching of science subjects in secondary schools. Third year students did not benefit in these programmes as much as first year students did since the implementation began when they were leaving school.

There were significant differences found between students enrolled in technical training institutions situated in different geographical locations and their opinions on usefulness of Technology and Computing ($F = 3.50$, $df = 2$ and $p < 0.05$). Students from rural-located institutions had a lower mean score (3.32) for their opinions of usefulness of Technology and Computing compared with those from city (3.40) and town (3.44) located institutions. This indicates that technology and computing was found to be less useful by students in rural-located institutions compared with those from institutions in the other locations. This could be as a result of lower penetration of technology and computing in rural locations, which are relatively underdeveloped as compared with city, and town locations. In addition, as noted in Section 5.2, most students were enrolled in institutions located in their home locations. They were also likely to have attended secondary schools in their home location which have disparities in technological developments.

The foregoing result is reinforced with the findings of analyses of student opinions about usefulness of the subjects by their home. This analysis found that geographical location of student homes influenced their opinions of the usefulness of Technology and Computing. There was significant difference between students from different home locations in their opinions on the usefulness of technology and computing ($F = 0.30$; $df = 2$ and $p < 0.05$). Students from homes in rural location had lower mean (3.34) of usefulness of Technology and Computing compared with those from town (3.44) and city homes (3.45). These differences could be as a result of disparities in technological developments as explained in the preceding findings.

When analysing the opinions of students from different social classes on usefulness of the subjects, it was found that there were significant differences in science ($F = 6.22$; $df = 2$ and $p < 0.05$) and engineering ($F = 2.96$; $df = 2$ and $p < 0.05$). Students from low social class had a higher mean (3.29) for usefulness of science compared with those from middle (3.14) and high class (3.00). It was further found that students from low and high social classes had higher means (mean = 3.14 and 3.13 respectively) of their opinions about usefulness of engineering compared with their counterparts in middle class (mean=3.00). Perhaps these differences could be attributed to higher proportions of lower social class (65 percent) and high social class (58 percent) of student enrolment in technology and engineering courses compared with those from middle social class (52 percent). It had been found by earlier analysis that student opinions on usefulness of science and engineering were influenced by the course they were enrolled in. Technology and engineering students had higher opinions about usefulness of science and engineering compared with business students.

The results of one-way analysis of variance indicate that there were significant differences for students' age and their means for the usefulness of engineering ($F = 2.84$, $df = 3$; $p < 0.05$). Students aged from 31 to 40 years (mean = 3.48) and 40 years and above (mean = 3.45) had higher means of usefulness of engineering compared with those aged from 26 to 30 years (mean = 3.33) and 18 to 25 years (mean = 3.36). As noted earlier, the distribution of students by age was not uniform as there were very few aged between 31 years and above.

Further results of analyses using two – way ANOVA, indicated no significant relationship between student mean of usefulness of engineering and their age brackets ($F = .8$; $df = 3$ and $p > 0.05$) but significant difference between students by course of study ($F = 45.94$; $df = 3$; $p = 0.00$). This analysis also indicate no interactions between student age and course of study in regard to the means of usefulness of engineering ($F= .23$; $df = 2$; and $p > 0.05$).

In the next section findings on student interests in technology, engineering and business areas are described.

5.5. Students interests in technology, engineering and business areas

The respondents were further presented with statements describing their possible interests in technology, engineering, and business-related areas and were required to indicate their responses ranging from *Strongly Agree (SA)* which was coded four points to *Strongly Disagree (SD)* coded one.

The items for technology and engineering were whether the student liked designing things, creating and constructing things, testing and modeling ideas; and experimenting. Those for business included marketing products and services; keeping accounting records and managing people. Other items from general areas, which were included in the study, were working as part of a team, venturing into new projects and solving problems.

Scales for each area were developed by calculating the means of student opinions on their respective set of interests. The reliabilities of the scales were tested and all were found to be reliable (Cronbach's alpha > .80). Further, the scales were within the range of a normal distribution (-1.96 < z 1.96).

The means for student interests in technological, engineering; business and general areas were analysed using two way-analyses of variance (ANOVA). Possible differences in student interests by gender and the courses they were enrolled in were analysed. Table 5.13 below presents the summary of the results. (Also, see Appendix K, Table 10.4, Appendix L, Table 11 and Appendix M, Table, 11.5 for detailed analyses).

Table 5.13. Summary of results of analysis of means of students' interests in Technology, engineering; business and general areas by gender

Area of interest	Number of Variables	Reliability	z	Gender	Descriptive statistics		Two Ways ANOVA Results		
		Cranbach's α			Mean	Std. Deviation	F	df	Sig.
Engineering	**4**	**.85**	1.40	Male	3.29	.60			
				Female	3.02	.67	9.48	1	.00
				Total	**3.19**	**.64**			
Business	**3**	**.88**	-1.25	Male	3.07	.70			
				Female	3.27	.64	.87	1	.35
				Total	**3.14**	**.69**			
General	**3**	**.82**	1.50	Male	3.42	.51			
				Female	3.40	.54	.43	1	.51
				Total	**3.41**	**.52**			

Generally students expressed high interest (mean > 3.0) in all three areas with the general area being the most liked and business area least liked. It is interesting to note that, although there was a difference between interest of students by gender in the technology and engineering area as shown in Table 5.13, this difference was particularly between male and female students enrolled in technology and engineering courses. A two-way analysis of variance indicated that there were significant differences in interests in engineering area between males (3.43) and females (3.24) enrolled in engineering and technology courses. This indicates that female students enrolled in technological and engineering programmes had less interest in the programmes compared with their male counterparts. This was as anticipated in the conceptual framework of the study. Further, the implication of this finding in regard to equity theory explained in Chapter Three Section 3.7 is that compared to males, females could have had more unfair experiences with engineering courses or perceived unfair future returns in the area leading to their lesser interests.There was no significant difference between means of interests of male and female students in the business area.

As summarised in Table 5.14, there were significant differences in interest in technology and engineering areas between students enrolled in different courses. Business students had a lower mean (2.92) for interest in the technology and engineering area compared with those enrolled in technology and engineering (mean = 3.34) courses. However, they had a higher mean (3.41) for interest in business area compared with their technology and engineering counterparts (2.93). It was noted that most students were enrolled in courses related to areas of their interests.

Table 5.14 Summary of results of analysis of means of students' interests in Technology, engineering; business and general areas by course of study

Total Area of interest	Course of study	Descriptive statistics		ANOVA Results		
		Mean	Std. Deviation	F	df	Sig.
Engineering	Tech. and Eng.	3.39	.57	94.66	1	.00
	Business	2.92	.63			
	Total	**3.19**	**.64**			
Business	Tech. and Eng.	2.93	.68	102.11	1	.00
	Business	3.41	.60			
	Total	**3.14**	**.69**			
General	Tech. and Eng.	3.41	.53	.20	1	.65
	Business	3.41	.51			
	Total	**3.41**	**.52**			

It was further noted from the standard deviations that students tended to have a wider range of views in interests in areas where they had less interest as compared with those where they had a higher interest. Technology and engineering students had a higher standard deviation (0.68) indicating that the group had a more diverse interest in business area compared with their business counterparts (0.6). On the other hand, business students had higher standard deviation (.63) indicating that they had a more diverse interest in the engineering area compared with their engineering counterparts (.57).

When analysing student opinions of interests in the three areas using independent sample t-tests for equality of means, it was found that the mean of third year students (3.45) was higher for interest in the general area compared with that of first year students (3.37) ($t = -2.09$, $df = 862.87$, $p < 0.05$). There seemed to be a relationship between students' year of study and their interests in the general area. These differences could be attributed to the differences in curricula requirement by year of study. In third year, the curriculum prepares students to solve problems in the society, and is focussed on application and evaluation skills. They are also required to develop a project proposal for self-employment in areas related to their course of study which may well enhance their appreciation of skills related to problem solving, team building and venturing in new projects which comprised the general area in this study. On the other hand, the curriculum for first year students is aimed at introducing the learners to their respective courses and providing basic principles of their course of study. At this level, students are not required to develop project proposals for self-employment.

In analysing students' interests in the three areas by the location of the institutions where they were enrolled, it was found that there were significant differences in their interests in business area ($F = 5.67$, $df = 2$, $p < 0.05$) and general area ($F = 3.52$, $df = 2$, $p < 0.05$). Students from institutions located in cities had a lower mean (3.02) for interest in the business area compared with those in other locations (town, 3.21; rural, 3.17). On the other hand, students enrolled in town institutions had higher mean (3.49) for interest in the general area compared with those from institutions located in cities (3.36) and rural locations (3.40).

The results of one-way analyses of variance indicated a significant difference between students from different age brackets and their interests in business area ($F = 2.69$, $df = 3$, $p < 0.05$) and no significant difference between their home location and social class in their interests in all the three areas. Students aged between 31 and 40 years had higher mean (3.31) for their interests in business area compared with the rest (18 to 25years (3.16); 26 to 30years (2.95); 41years and above (2.92)). The next section describes findings on analyses of student employment interests.

5.6. Student employment interests

Students were asked to indicate their interests by numbering up to three jobs they would prefer to do from a list from 17 occupational areas presented to them. Their first choice was coded one, the second coded two and the third coded three. Therefore, the means of employment interests as analysed from their responses and shown in Tables 5.15 and 5.16 should be interpreted as one up to 1.5 to represent first choices, from 1.5 to below 2.5 as second, and 2.5 and above as their third most preferred occupation. (Also, see detailed analyses in Appendix K, Table 10.5, Appendix L, Table 11.1 and Appendix M, Table, 11.6).

Table 5.15 students' Employment interests by gender

FIELD	MALES		FEMALES		TOTAL		Two ways Variance(ANOVA		
	Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation	F	df	Sig.
A manager	1.63	.79	1.44	.72	1.55	.77	.58	1	.45
Businessman/ Entrepreneur	1.79	.82	1.63	.83	1.73	.83	33.24	1	.00
Technology/engineering	1.61	.78	2.04	.89	1.74	.84	3.18	1	.05
Office work	1.95	.80	1.61	.76	1.81	.80	9.84	1	.00
Manufacturing	1.84	.82	1.97	.77	1.88	.80	2.13	1	.14
Banker, or financial institutions	2.04	.84	1.72	.75	1.91	.82	54.60	1	.00
Information Technology	1.98	.81	1.89	.78	1.95	.80	.20	1	.65
Armed forces(army, navy,etc)	1.81	.81	2.27	.83	1.95	.84	26.93	1	.00
Tourist industry	1.86	.78	1.83	.76	2.03	.81	1.98	1	.16
Shop work/ retail/whole sale	2.02	.815	2.18	.796	2.08	.81	2.44	1	.12
Accountant	2.18	.81	1.95	.79	2.10	.81	.46	1	.50
Others	2.14	.83	2.38	.92	2.20	.85	.05	1	.82
Agriculture(farming/gardening	2.17	.77	2.38	.72	2.25	.76	7.26	1	.01
Services (police, fire service,	2.24	.79	2.36	.79	2.27	.79	.49	1	.48
Teaching	2.35	.74	2.20	.82	2.30	.77	3.87	1	.05
Music /drama/media/art	2.30	.83	2.14	.80	2.31	.80	.75	1	.39
Health care/ medicine/ nursing	2.48	.736	2.19	.853	2.37	.79	17.82	1	.00
Hotels / catering	2.57	.72	2.42	.72	2.51	.72	1.44	1	.03

Management was the most preferred occupation followed by business/entrepreneur, technology and engineering and office work. As might be expected given the students' courses, the least preferred occupations were hospitality, health care, entertainment and teaching.

Two-way analyses of variance between subject effects, found that there were significant differences between student gender and their interests in eight occupations. Males enrolled in engineering courses had higher interests than their female counterparts for the technology and engineering, and agricultural jobs. Female engineering students had higher interests than male students in office work, health care, banking/finance, teaching, business and entrepreneur.

Apart from armed forces employment interests, other differences in employment interests were between males and females enrolled in engineering.

Further significant differences in student employment interests were found between their courses of study and eight occupational areas. Technology and Engineering students were more interested in armed forces, healthcare and technology and engineering jobs compared with Business students. On the other hand, Business students were more interested in office work, hospitality, banking, finance, accounting, tourism, and business and management jobs compared with their Technology and Engineering counterparts. Therefore, student course of study was related to their employment interests. There were interactions between gender and course of study in student interests in healthcare, medicine and nursing (F =3.74; df =1, p < 0.05). Table 5.16 presents a summary of analysis of student employment interests by course of study.

Table 5.16 Student employment interests by course of study

FIELD	Technology and engineering		Business		Two ways Variance(ANOVA		
	MEAN	ST Deviation	MEAN	ST Deviation	F	df	Sig.
A manager	1.77	.82	1.34	.65	31.15	1	.00
Businessman/ Entrepreneur	1.95	.81	1.52	.79	33.24	1	.00
Technology/engineering	1.45	.70	2.34	.78	140.03	1	.00
Office work	2.02	.78	1.61	.77	16.01	1	.00
Manufacturing	1.87	.83	1.91	.77	.06	1	.80
Banker, or financial institutions	2.27	.74	1.62	.76	4.09	1	.04
Information Technology	1.95	.82	1.94	.77	1.10	1	.30
Armed forces(army, navy,etc)	1.88	.82	2.07	.86	.76	1	.38
Tourist industry	2.19	.82	1.85	.77	12.64	1	.00
Shop work/ retail/whole sale	2.05	.816	2.11	.807	.19	1	.66
Accountant	2.40	.70	1.82	.81	45.29	1	.00
Others	2.00	.91	2.50	.67	1.96	1	.17
Agriculture(farming/gardening	2.24	.75	2.25	.77	.36	1	.55
Services (police, fire service,	2.20	.80	2.39	.76	3.24	1	.07
Teaching	2.31	.78	2.29	.76	.29	1	.59
Music /drama/media/art	2.38	.78	2.22	.82	3.25	1	.07
Health care/ medicine/ nursing	2.35	.804	2.41	.779	6.05	1	.01
Hotels / catering	2.60	.70	2.40	.74	2.80	1	.10

The differences of student employment interests by course of study and by gender were as proposed in the conceptual framework outlined in Chapter Three Section 3.7 of this study. The implication of these findings in relation to equity theory is that females could have possibly perceived engineering employment to have unfair future returns leading to their lesser interests in them.

Further one-way analyses of variance were done to find out if there were any differences between student employment interests and their home location, social class, age bracket, location of their institutions and years of study. The analyses revealed significant differences in student employment interests in some of the occupations between the locations of their homes, their social class, location of their institutions and their year of study. Table 5.17 presents the results.

Table 5.17 Student employment interests by home location, student social class, institutional location and year of study

Category	Occupations	Means			One Way Variance(ANOVA		
		City	Town	Rural	F	df	Sig.
HOME LOCATION	Teaching	2.33	2.57	2.25	2.22	2	0.02
	Music /drama/media/art	2.03	2.39	3.36	4.99	2	0.01
	Others	3.00	1.00	2.20	4.05	2	0.03
STUDENTS' SOCIAL CLASS		**High**	**Middle**	**Low**			
	Office work	1.71	1.74	1.95	3.55	2	0.03
	Armed forces(army, navy,etc)	1.44	2.01	1.86	2.39	2	0.04
	Hotels/catering	2.71	2.41	2.68	5.73	2	0.00
LOCATION OF INSTITUTION		**City**	**Town**	**Rural**			
	A manager	1.60	1.71	1.45	2.71	2	0.01
	Music /drama/media/art	2.17	2.48	2.37	2.49	2	0.02
YEAR OF STUDY		**1st year**	**3rd year**				
	Information Technology	1.86	2.02		3.93	1	0.05
	Music /drama/media/art	2.21	2.38		4.43	1	0.04

As indicated in the Table 5.17 above, there were significant differences between student interests in teaching jobs and their home location. Students from homes located in rural areas, had higher preferences for teachings jobs compared with students from city and town-located homes. It was also noted that students from homes located in towns had interests in teaching in the third most preferred bracket while students from the other home locations had their interests in teaching as the second most preferred. This indicates that students from town homes had lower preference for teaching jobs compared with those from homes in the other locations.

There was a significant difference between students by home locations and their means for interests in music, drama, media and art occupations. Students from city homes were more interested in music/drama/media and art compared with their counterparts from homes located in the other locations. Further, significant differences were found between students by their home locations in their interests in other occupations. Students from homes located in towns foremost preferred other occupations while those from rural-located homes second most preferred these occupations. However, students from homes located in cities had lesser interest in other occupations compared with their counterparts in other locations as they had them as third most preferred. In sum, the home location of students was related to their interests in teaching, music, art, drama and media and other occupations.

Additionally, student social class had an influence on their interests in office work, armed forces and hospitality occupations. Students from the high social class had higher interest in office work and armed forces compared with those from other classes. On the other hand, students from the middle social class had higher interest in hospitality occupations compared with those from other social classes.

Further analyses found that students enrolled in institutions located in cities had a significantly higher interest in management and music, art, drama and media occupations compared with those enrolled in institutions in the other locations.

Finally it was of interest to note that there was a significant difference between students by year of study and their interests in music, art, drama and media and information technology occupations. First year students had a higher interest in music, art, drama and media and information technology occupations compared with their third year counterparts.

In general, student interest in occupations is particularly complex and will be further examined in the multivariate analyses described in Chapter 6. The summary of findings of this chapter is presented in the next section.

5.7. Summary and implicarions of findings

The foregoing analyses found that students were mostly enrolled in TVET institutions located in the same locations as their homes. However, students from city institutions were more likely to enrol in their home-located institutions compared with students in town and rural institutions. It was also found that more females than males were enrolled in business courses and more males than females were enrolled in technology and engineering courses.

Students, in general, had positive interests in and attitudes towards secondary school subjects, science, mathematics, computing and technology, engineering and business programmes, tasks in areas related to engineering, business and general and various occupations. However, in some cases their interests and attitudes depended on their institutional location, courses of study, year of enrolment, home location, social class, gender and age.

There were significant differences between students categorised by location of their institutions in their interests in and attitudes towards science and mathematics subjects at secondary school, technology/computing programmes, business and general areas, and various occupations. Students enrolled in rural-located institutions had lower interests in and attitudes towards Science and Mathematics at secondary school and technology and computing programmes compared with those enrolled in city and town-located institutions. It was further found that students located in city institutions had lower interests in and less favourable attitudes towards business area compared with their counterparts from the other locations. They also had higher interests in occupations related to management, music, art, drama and media compared with those enrolled in institutions in town and rural locations. It was further found that students from town institutions had higher interests in general areas compared with those from city and rural institutions.

Students were found to have more interest in and favourable attitudes towards secondary school subjects, programmes, areas and occupations related to their courses of study compared with those not related. Technology and Engineering students were more interested in Science and Mathematics subjects, engineering and technology areas, programmes and related occupations compared with their Business counterparts. On the other hand Business students were more interested in Business Education and Accounting subjects; business programmes, areas and related occupations compared with their Technology and Engineering counterparts.

Students categorised by year of study had different attitudes towards and interests in science subjects at secondary school, science programmes, general areas and occupations. First year students had higher interests in and favourable attitudes towards science subjects and programmes; occupations related to music, art, drama and media and information technology compared with third year students. This was perhaps due to the recent implementation of government policies aimed at strengthening the teaching of science and mathematics subjects in secondary school. On the other hand third year students had higher interests in and favourable attitudes towards general areas compared with their first year counterparts. This difference could be attributed to the differences in their curriculum.

The results show that home location was related to student interests in and attitudes towards computing subjects at secondary school, technology/computing programmes, and various occupations. Students from town and city homes had higher interests in and favourable attitudes towards computing subjects and technology/computing programmes, compared with those from rural locations. They also had lower interests in teaching jobs compared with those from rural homes. In addition, students from city homes had higher interests in and favourable attitudes towards music, drama, media and art occupations compared with their counterparts from homes in the other locations.

The social class of students influenced their interests in and attitudes towards computing subject in secondary school, and hospitality-related occupations. Students from the lower class had lower interest and attitude towards computing subjects at secondary school compared with those from middle and high social classes. In addition students from the middle class had higher interest in and attitude toward hospitality occupations compared with their counterparts from the other social classes. It was also found that students from the high social class had higher interest in office work and armed forces compared with those from other classes.

There were gender differences in student interests in and attitudes towards various secondary school subjects, technology/ computing and engineering programmes and areas and various employments. Interestingly, these differences were between males and females enrolled in technology and engineering courses. Males had more favourable attitudes towards and interests in Mathematics, Chemistry and Physics subjects at secondary school level, engineering programmes, areas and occupations related to armed forces, technology and engineering, and agriculture compared with their female counterparts. Females had higher favourable attitudes towards and interested in Computing, Biology, Geography, English, Kiswahili and Religious education subjects at secondary school; technology/computing programmes and occupations related to office work, health care, banking/finance, teaching, business and entrepreneur compared with males. Thus males were more interested in areas related to technology and engineering courses compared with females. On the other hand females were more interested in areas related to business courses compared with males.

Finally, student age had an influence on their attitudes towards and interests in computing subjects in secondary school, engineering programmes and business areas. Students aged between 31 years to 40 had higher interests in and favourable attitudes towards business area compared with the rest of those of the other age brackets. On the other hand students aged between 18 and 25 years had higher interests and attitudes towards computing subjects compared with their counterparts from the other age brackets.

In the next chapter, student opinions on factors influencing their choice of TVET courses in general and causes of gender disparities in enrolment in technological and engineering programmes in particular will be analysed and described. In addition, student satisfaction in their current programmes will also be described.

CHAPTER SIX
STUDENT SATISFACTION IN AND FACTORS INFLUENCING THEIR COURSE SELECTION

6.1. Introduction

This chapter presents results of detailed analyses of student questionnaire items about their opinions on various factors that influenced their enrolments and also those responsible for gender disparities in technological and engineering programmes. It commences by describing student opinions about influences on their decisions to enrol in TVET courses including family and other people, government TVET system and policies, media and internet and their objectives for doing their course of choice. This is followed by their opinions concerning satisfaction with their current courses and on causes of gender disparity in technological and engineering programmes, and the summary of the findings on these opinions. Analyses of the prediction of the relative strength of these factors on enrolment in TVET courses form the last section of this chapter.

6.2. Students opinions on factors that influence their enrolments in TVET courses

6.2.1. Influence from family and other people

Respondents were asked to indicate on a four-point rating scale how various categories of family and other people and media and internet influenced their choice of the courses they were undertaking. The levels of the rating scale ranged from Very High (VH) coded four to none (N) coded one.

Based on Table 6.1, students indicated that influences from career advisors and their parents were the foremost in making their decisions to enrol in their courses as compared with that from other categories of people. This was followed by influences from their brothers and friends. They were neutral (mean = 2.5) on whether their sisters, male relatives mathematics and science teachers had influenced their decisions to enrol in their current courses. This was due to differences in direction of influence from these people on enrolment in the two courses (technology and engineering; and business). Also, female relatives and business teachers did not have a strong influence on student decisions to enrol in their current courses (mean < 2.5). This could be attributed to higher numbers of technology and engineering students compared with business students in the sample.

Table 6.1 presents a summary of the responses and detailed analyses are in Appendix K, Table 10.6, Appendix L, Table 11.2 and Appendix M, Table, 11.7).

Table 6.1 Results of analysis of students' opinions on influence from family and other people on their choice of courses by student gender.

	TOTAL		MALES		FEMALES		Two ways ANOVA Influence by Gender		
Family and other people Influence	**Mean**	**Std. Deviation**	**Mean**	**Std. Deviation**	**Mean**	**Std. Deviation**	**F**	**df**	**Sig**
A careers advisor	2.96	1.20	2.87	1.23	3.09	1.14	6.54	1	.01
Your mum	2.85	1.11	2.80	1.11	2.92	1.10	1.93	1	.17
Your dad	2.81	1.18	2.81	1.18	2.82	1.19	.12	1	.73
Your brother	2.63	1.12	2.58	1.14	2.72	1.08	1.93	1	.17
Your close friends	2.63	1.08	2.61	1.07	2.65	1.09	.90	1	.34
Your Mathematics teacher	2.51	1.18	2.61	1.16	2.33	1.21	2.44	1	.12
Your sister	2.51	1.13	2.45	1.13	2.63	1.12	3.64	1	.06
Your other male relative	2.50	1.10	2.45	1.09	2.60	1.11	3.52	1	.06
Your science teacher	2.49	1.16	2.66	1.16	2.19	1.15	7.104	1	.01
Your Business Education teacher	2.40	1.20	2.28	1.15	2.60	1.25	1.03	1	.31
Your female relative	2.29	1.10	2.19	1.08	2.47	1.11	6.58	1	.01

Further analysis of influences by gender found that female students were more influenced when making enrolment decisions for their current courses by their female relatives and career advisers compared with males. The differences in influence by female relatives could be explained by the fact that in most African culture young girls are influenced by their aunties and grandmothers in making decisions concerning their lives.

As indicated in Table 6.1, there were significant differences found between student gender and their being influenced to enrol to TVET courses by science teachers and career advisors. Male students were more influenced by their science teachers to make their decisions to enrol to their current courses compared with female students. On the other hand, female students were more influenced by their career advisors to enrol in TVET courses.

There were no significant differences found in influences on decisions between student gender to enrol in the current courses by their parents, brothers, sisters, male relatives, close friends, Mathematics teachers and Business teachers. Family and other people including parents, siblings, friends male relatives, Mathematics and Business teacher influences were not related to differences in gender enrolment in TVET courses. Differences in influences from family and other people by these categories on student gender decisions to enrol in TVET courses were by chance.

When analysing the responses by student course of study, there were significant differences found in influences on enrol in their current courses by subject teachers. This finding is presented in Table 6.2, which shows the summary of the analysis of influences from family and other people, by course of study.

Table 6.2 Results of analysis of student opinions on influence from family and other people on their choice of courses by courses of study

Family and other people Influence	Course of study	Mean	Std. Deviation	One way ANOVA influence by course		
				F	df	Sig
Career advisor	Technological or engineering Business	2.93 2.99	1.21 1.20	.39	1	.53
Your mum	Technological or engineering Business	2.84 2.85	1.09 1.14	.01	1	.93
Your Dad	Technological or engineering Business	2.83 2.79	1.18 1.19	.75	1	.39
Your brother	Technological or engineering Business	2.59 2.67	1.14 1.09	.01	1	.93
Close Friend	Technological or engineering Business	2.66 2.57	1.05 1.12	2.76	1	.10
Mathematics teacher	Technological or engineering Business	2.71 2.24	1.15 1.18	25.76	1	.00
Your sister	Technological or engineering Business	2.47 2.57	1.16 1.09	.00	1	.97
Male relative	Technological or engineering Business	2.48 2.52	1.09 1.10	.07	1	.80
Science teacher	Technological or engineering Business	2.85 1.99	1.11 1.08	98.82	1	.00
Business teacher	Technological or engineering Business	2.09 2.79	1.07 1.24	50.97	1	.00
Female relative	Technological or engineering Business	2.18 2.43	1.06 1.12	3.53	1	.06

Science and Mathematics teachers had higher influences on student decisions to enrol in technology and engineering courses compared with the influence of business teachers on business courses. On the other hand, Business Education teachers had higher influence on the enrolment decisions of students enrolled in Business courses. Therefore, Science, Mathematics and Business Education teachers had more influence on student decisions to enrol in courses related to the subjects they chose for further study.

It is important to note that there were no significant differences between technology and business students in their being influenced to enrol in their current courses by career advisers, parents, student siblings, friends, and relatives. Influences from people by these categories were similar for both genders in making their decisions to enrol in their current courses.

Other significant differences in influences from family and other people were found between students enrolled in different years of enrolment, social classes and age brackets. The results of analysis of two-way analyses of variance found significant differences in influences of decisions of students enrolled in first year and third year by their science teachers ($F = 4.71$, $df = 1$, $p < 0.05$) and career advisors ($F = 5.09$, $df = 1$, $p = 0.02$). First year students were more influenced by their sciences teachers (2.57) and career advisors (3.05) as compared with their third year counterparts (science teachers, 2.39; career advisors, 2.87). In addition the standard deviations of influences of third year students by their science teachers (2.61) and career advisors (1.23) were higher than those for first year students (science teachers, 1.14, career advisors, 1.18). These indicate that they had wider range of views on these influences compared with first year students.

There were significant differences between student by age bracket and their having been influenced to enrol in TVET courses by their mothers ($F = 3.40$, $df = 3$, $p = 0.02$). Students aged between 18 and 25 years and 26 to 30 years had higher means of influence by their mothers (2.88 and 2.67 respectively) to make their enrolment decisions compared with the rest (31 to 40 years (2.33); 41 years and above, 1.75). The results indicate that younger students highly depended on their mothers to make enrolment decisions compared with students in the other age brackets.

It was found that there were significant differences between fathers' influence on students decisions to enrol in TVET courses related to their social class ($F = 5.09$, $df = 1$, $p < .05$). Students who identified themselves as coming from the high social class were more influenced by their fathers (3.0) to enrol in TVET courses compared with those who identified themselves as coming from middle (2.9) and lower social classes (2.68).

6.2.2. Influence by media and internet

An analysis of other influences on students' decisions to enrol in TVET courses, including television, internet and newspapers, found that students were more influenced by newspapers (mean, 3.17) compared with TV and internet (2.96). There were significant differences in influence by TV and internet for students enrolled in different courses ($F = 5.21$, $df = 1$, $p = 0.02$), different years of study ($F = 6.99$, $df = 1$, $p < 0.05$). Technology and Engineering students were more influenced by television (TV) and internet as indicated by their higher mean (3.03) compared with their Business counterparts (2.86). Therefore television and internet had differential influence on students by course of study in their decisions to enrol in TVET courses.

It was also found that first year students were more (3.06) influenced by TV and internet compared with their third year counterparts (2.86) in making their enrolment decisions in their current courses. As indicated by their smaller standard deviation on their being influenced by TV and internet, first year students did not have wider range of views on this influence compared with third year students (1.09). Therefore, influence by television and internet to student enrolment decisions depended on their year of study.

There was a relationship between influences by newspapers on student decisions to enrol in TVET courses by their social classes. Significant difference was found between newspapers influences of student decisions from different social classes to enrol in TVET courses ($F = 3.77$, $df = 2$, $p < 0.05$). Students from higher social class were less influenced by newspapers as indicated by their lower mean of influence (2.42) as compared with those from middle (3.16) and low class (3.19). They also had higher standard deviation (1.24) of their being influenced by newspapers compared with those from middle (0.96) and low class (0.94). This indicates that their views on their being influenced by newspapers to enrol in TVET courses although higher, were more varied compared with the other social groups.

It is worth noting that there were no significant differences between student age, gender, home location and locations of training institutions and their decisions to enrol in TVET courses being influenced by TV, internet or newspapers. Therefore, differences in enrolment decisions in TVET courses by students by their age, gender, home location or institutional locations do not depend on TV, internet and newspapers.

6.2.3. Student objectives for doing the course

Respondents were asked to rate the importance of how five objectives influenced their enrolment in their current courses. They were asked to rank the objectives from most important (coded four) to least important (coded one). The following Table 6.3 presents a summary of the percentages of their responses.

Table 6.3 Summary of results of analysis of student responses on their objectives for doing the course

OBJECTIVES	Most important%	Important %	Less Importance%	Least Importance%
For advancement to higher education	47.0	25.1	10.6	17.3
To acquire a desired skill	64.0	19.9	9.6	6.5
To get employed	31.6	25.8	29.4	13.2
To get better salary	29.7	11.5	18.5	40.3

Most students were driven by their objective to acquire desired skill to enrol in TVET courses. Almost two thirds (64 percent) of the respondents indicated that the objective to acquire a desired skill was most important in their decisions to enrol in TVET courses. Their objective of advancement to higher education was nominated by almost half of the respondents as most important and slightly more than half of the respondents as important cause for their enrolment in the courses. Getting better salary was regarded as the least objective for their doing the courses.

Further analysis was done to find out whether there were differences in influences of individual objectives to do the courses by the courses they were enrolled in, their gender, age, social status, home location, location of their institutions and year of study. Table 6.4 present summaries of the findings on student objectives for doing the course by their course of study.

Table 6.4 Summary of results of comparison of Student objectives for doing the course by course of study

OBJECTIVE	Technology and Engineering				Business				CHI SQUARE RESULTS		
	MI %	I %	LSI %	LTI %	MI %	I %	LSI %	LTI %	χ^2	df	Sig.(2-sided)
For advancement to higher education	47.0	26.0	10.5	16.6	46.8	24.1	10.8	18.3	.63	3	.89
To acquire a desired skill	69.2	18.2	7.9	4.6	57.3	21.9	11.9	8.9	14.71	3	.00
To get employed	30.4	27.3	27.7	14.6	33.1	24.2	31.5	11.1	4.02	3	.26
To get better salary	32.4	10.4	18.4	38.8	26.3	13.1	18.4	42.2	4.34	3	.23

Where; MI = Most Important; I = Important; LSI = Less Important and LTI = Least Important

Chi-square test results showed significant differences in students objective to acquire desired skill by course of study (χ^2 = 14.71; df = 3; p < 0.05). A higher percentage of Technology and Engineering students (69 percent) indicated that their objective to acquire new skills was most important compared Business students (57 percent).

As presented in Table 6.5 below, there was a significant difference by student gender and their objective to advance to higher education (χ^2 = 11.21; df = 3; p < 0.05). A higher percentage of males (50 percent) indicated that their objective to advance to higher education was most important in influencing their decisions to enrol in their current courses compared with their female counterparts (43 percent). Gender was not significant for any of the other objectives.

Table 6.5 Summary of results analysis of comparison of Students' objectives for doing the course by gender

OBJECTIVE	MALE				FEMALE				CHI SQUARE RESULTS		
	MI %	I %	LSI %	LTI %	MI %	I %	LSI %	LTI %	χ^2	df	Sig. (2-sided)
For advancement to higher education	49.5	22.6	9.0	18.9	42.6	29.5	13.4	14.4	11.21	3	.01
To acquire a desired skill	63.8	20.4	9.6	6.2	64.2	19.1	9.7	7.0	.39	3	.94
To get employed	31.1	28.0	27.5	13.3	32.4	22.0	32.8	12.8	4.64	3	.20
To get better salary	32.0	12.0	19.2	36.8	25.7	10.8	17.2	46.3	7.32	3	.06

Where; MI = Most Important; I = Important; LSI = Less Important and LTI = Least Important

It was further found that there was a significant difference between students from different social classes and their having been influenced to enrol in the current courses by their objectives to acquire desired skills (χ^2 = 12.91, df = 6, p = 0.04). A higher percentage (75 percent) of students from high class indicated that their objectives to acquire desired skills were most important compared with those from middle class (66 percent) and low social class (62 percent).

6.2.4. Influence of Technical and Vocational Education and Training system and policies

Six statements about TVET policies and system were presented to the respondents who were required to indicate on a four-point scale how each influenced their decisions to enrol in their current courses. The ratings on the scale were; Very High (VH) influence coded four; High (H) influence coded three; Low (L) influence coded two; and No (N) influence coded one. Table 6.6 below presents a summary of the results of the responses.

Table 6.6 Student responses on Influence of Technical and Vocational Education and Training system and policies

TVET SYSTEM AND POLICY ISSUES	VH %	H %	L %	N %
Availability of Government TVET bursaries	20.3	19.5	25.8	34.3
Flexibility of TVET curriculum	16.1	38.6	28.1	17.2
Quality of training	39.7	44.3	10.8	5.3
Conducive learning environment	35.8	44.1	13.4	6.8
Geographical location of the institution I am enrolled in	30.1	38.5	18.5	12.9
Cost of the course	33.3	36.5	16.6	13.5

Quality of training and conducive learning environment had the highest percentage of students who indicated that they were highly influenced by the two in making decisions to enrol in their current courses. This was followed by the geographical locations of their institutions and cost of training. Availability of bursaries and flexibility of TVET curriculum had the least influence on student enrolment decisions. The majority of students (60 percent) indicated that availability of bursaries had either low or no influence on their decisions to enrol in their current courses.

One-way analysis of variance (ANOVA) results indicate significant differences between students by course of study in their decisions to enrol in their courses having been influenced by availability of bursaries ($F = 8.20$, $df = 1$, $p < 0.05$) and cost of the courses ($F = 3.72$, $df = 1$, $p < 0.05$). Business students had lower mean (2.14) of their responses indicating that that their being influenced by availability of bursaries was lower compared with Technology and Engineering students (2.34). A further analysis using two-way analyses of variance revealed that this difference was entirely between female students enrolled in the two courses ($F = 1736.46$, $df = 1$, $p < 0.05$). Female students enrolled in Business courses had a lower mean (2.08) indicating that the influence on enrol into their current courses by availability of bursaries was low. However, Technology and Engineering female students were neutral (mean = 2.5) as to whether their decisions to enrol in their current course had been influenced by availability of bursaries. This result indicated that availability of bursaries had more influence on female students enrolled in technology and engineering courses compared with those enrolled in business courses. This could perhaps be explained by the Government policy of awarding bursaries to all female students enrolled in technology and engineering courses. However, it is of interest to note that the beneficiaries of Government bursaries were on average, neutral as to whether its availability influenced their decisions to enrol in their respective courses.

It is important to note that there was no significant difference between male students enrolled in Technology and engineering and Business courses in their having been influenced to enrol in their respective courses by availability of bursaries (F = 0.62, df = 1, p >0.05). The means for having been influenced by availability of bursaries for Technology and Engineering male students (2.70) was almost the same as that of their Business (2.78) counter-parts. Males' decisions to enrol in Technology, Engineering and Business courses do not depend on availability of bursaries.

Students' enrolments in either Business or Technology and Engineering courses depend on the cost of the courses. There was significant difference between students enrolled in Business and Technology and Engineering courses and their having been influenced by the cost of their respective courses to make their enrolment decisions (F = 3.72, df = 1, p < 0.05). Technology and Engineering students had lower mean (2.83) indicating that their having been influenced by the cost of their courses for enrolment was lower compared with Business students (2.89). Perhaps this difference is as a result of higher cost of Technological and Engineering courses compared with business courses.

Finally, it was found that enrolments of students by home locations, students' social status, age students' year of study and location of their institutions do not depend on availability of bursaries. There were no differences in the means of influence on enrolment in their current courses between students by home locations, social class, and age students, year of study or location of their institutions. This finding is of interest since government bursaries also target students from poor families and therefore might be expected to have had high influence on enrolment of students from low social class compared with those from other classes an issue that requires further investigations.

6.2.5. Comparison of Students responses on their opinions of factors that influence their enrolments in TVET courses

In the foregoing, four possible influences on students' enrolment in their current courses have been discussed. Comparisons of these responses are discussed in this section with a view to find out the extent to which each factor influenced the students. These factors include influence from family and other people, influences from media and internet (TV, internet, newspaper), students' objectives to do the course, and influence from TVET policies and system. First, scales were developed for each factor by computing the mean of variables in the factor. All the developed scales were found to be reliable with Cronbach's alpha values more than 0.7. The distribution of each scale was found to be with the normal range (-1.96 < z <1.96).

Further, means and standard deviations of the scales more likely to be enrolled in including the possibilities of any differences in the scales between students' gender, age, students' social status, location of their homes, and location of their institutions, the courses they were enrolled in and their years of study. Table 6.7 presents summary of analysis of the scales by student gender.

Table 6.7 Summary of analysis of scales for causes of student enrolments in their current courses by gender

SCALE	Number of items	Reliability, α	z score	Descriptive statistics			Two Ways ANOVA Results		
				Gender	**Mean**	**Std. Deviation**	**F**	**df**	**Sig**
Family and other people	11	.90	-1.50	Male	2.54	.79	1.89	1	.17
				Female	2.59	.77			
				Total	**2.55**	**.78**			
Media and internet	2	.90		Male	3.04	.87	.02	1	.88
				Female	3.04	.90			
				Total	**3.04**	**.88**			
Student objective to do the course	4	.80	-1.24	Male	2.90	.64	2.33	1	.13
				Female	2.83	.60			
				Total	**2.87**	**.63**			
TVET system and policies	6	.79	-1.40	Male	2.78	.63	1.22	1	.27
				Female	2.82	.61			
				Total	**2.79**	**.62**			

It was found that students were generally most influenced by media and internet including television, newspapers and internet followed by their objectives to do the courses. Family and other people were the least in influencing students' decisions to enrol in their current courses.

As presented in Table 6.7, there were no significant differences between student gender and the four scales. However, as shown in Table 6.8 there was a significant difference between student course of study and their having been influenced by their objectives to enrol in their respective courses. Technology and Engineering students had higher mean for the scale of student objective in doing the course, indicating that they were highly influenced by this factor to enrol in their current courses compared with their Business counterparts.

Table 6.8 Summary of analysis of causes of student enrolments in their current courses by course of study

Causes of students current enrolment	Course of study	Technological or engineering		Two ways ANOVA Results		
		Mean	Std. Deviation	F	df	Sig.
Family and other people	Technological & Engineering	2.52	.78			
	Business	2.53	.79	.00	1	.96
Media and internet	Technological & Engineering	3.08	.87			
	Business	2.98	.89	1.67	1	.20
Student objective to do course	Technological & Engineering	2.91	.65			
	Business	2.82	.59	3.73	1	.05
TVET system and policies	Technological & Engineering	2.79	.62			
	Business	2.78	.62	.01	1	.91

Further one-way analyses of variance found no significant difference between influences of the four factors on students by their home location, social status, age, and location of their institutions (Refer to appendix I, Table 10.0). However, two-way ANOVA results indicated there were significant differences between students by their years of study in their having been influenced by media and internet, their objectives to do the courses and TVET policies and systems. Table 6.9 presents the summary of the results.

Table 6.9. Summary of analysis of causes of student enrolments in their current courses by year of study

CAUSES OF STUDENTS ENROLMENTS	Year of study	Mean	Std. Deviation	F	df	Sig
Influence from family and other people	First year	2.57	.81			
	Third year	2.54	.76	3.07	1	.08
Influence from media and internet	First year	3.12	.85			
	Third year	2.96	.91	7.16	1	.01
Influence from students ‘objective	First year	2.83	.61			
	Third year	2.92	.65	3.71	1	.05
Influence from TVET system and policies	First year	2.87	.59			
	Third year	2.72	.64	15.77	1	.00

First year students were more influenced to enrol in their current courses by media and internet (TV, internet and newspaper) and TVET system and policies compared with their third year counterparts. On the other hand, first year students were less influenced by their objectives to do the courses compared with their third year counterparts.

6.3. Student satisfaction with the current courses

Respondents were asked to state whether they would have chosen the same courses they were enrolled in if given a second chance. They were further asked to indicate whether they would prefer to pursue courses in the field of business, technology and engineering or other fields if their response to the previous question was not to choose the same course they were enrolled in given a second chance. Table 6.10 below presents the results of their responses.

Table 6.10 Satisfaction of students towards their courses

CHOICE OF COURSE WHEN GIVEN SECOND CHANCE		Frequency	percent
Choice of the current course	YES	788	85.9
	NO	129	14.1
If no, fields of choice	Business	84	35.9
	Technology and Engineering	98	41.9
	Others	52	22.2

A vast majority of the students (86 percent) would have chosen their current courses if given a second chance. This indicates that students were generally satisfied with their current courses. Slightly more than two-fifths (42 percent) of those who were not satisfied with the current course would prefer to enrol in technology and engineering courses while slightly more than a third (36 percent) would enrol in business and the rest in any other course. This indicates that student preferences for technology and engineering as an alternative area of study was higher compared with business courses.

When asked to specify the other areas they would have liked to enrol in, 86 students responded to the question and their responses are presents in Table 6.11 below.

Table 6.11 Summary of students' responses on their second preferred areas of study

Alternative area of study	Frequency	Percentage %
Technology and Engineering	25	28.4
Business/ Entrepreneur and finance	21	23.9
Medicine/ healthcare	15	17
Information Communication Technology	8	9.1
Armed forces	3	3.4
Media	3	3.4
Other assorted areas	11	12.5
TOTAL	86	100

More than a quarter (28 percent) would choose technology and engineering, and slightly less than a quarter would choose business, entrepreneur and finance. Health care and medicine was the third preferred option. The results indicate that technology and engineering area was the most preferred alternative followed by business, medical/ health care and information communication technology.

Further analysis was done to find out whether there were differences in satisfaction of the courses students were enrolled in by their gender, their course of study, age, home location, social class, location of their institutions and year of study.

There were significant differences in student agreement with choice of the same career if given a second chance between students by gender ($\mathcal{X}^2$= 3.27, df = 1, $p < 0.05$), home locations ($\mathcal{X}^2$ = 6.04, df = 2, $p < 0.05$) and student social class ($\mathcal{X}^2$ = 10.04, df = 2, $p < 0.05$). Interestingly, a higher proportion of engineering male students (88 percent) compared with females enrolled in the same courses (83 percent) indicated that they would choose the same course given a second chance. This indicates that female engineering students were less satisfied with their current courses. There were no differences found between male and female students enrolled in business courses, students enrolled in different courses, their age, location of their institutions and year of study in their responses to the same question.

However, a higher proportion of students from homes located in rural (88 percent) compared with those from town (84 percent) and city homes (80 percent) indicated that they would choose their current courses given a second chance. The results indicate that students from rural homes were more satisfied with their current courses compared with those from town and city-located homes.

Moreover, a lower proportion of students from the high social class (60 percent) compared with those from middle (85 percent) and low social classes (88 percent) indicated that they would choose their current courses if given a second chance.

Further, there was a significant difference between students by course of study and their responses on the broad area they would choose if they were not satisfied with their current courses (χ^2 = 53.06, df = 2, $p < 0.05$). A higher proportion of technology and engineering students (63 percent) indicated that they would choose courses in technology and engineering fields while a higher proportion of business students (56 percent) indicated that would choose courses in business fields. On the other hand, a lower proportion of technology and engineering students (15 percent) indicated that they would choose courses in business area while a lower proportion of business students (21 percent) indicated that they would choose courses in the technology and engineering area. Therefore, students were generally interested in the fields related to the courses they were enrolled in.

6.4. Student opinions on factors affecting gender parity in technological and engineering courses

Eight categories of statements describing possible factors that may influence gender parity in technological and engineering programmes were presented to the respondents who were asked to respond by indicating the extent to which they agreed or disagreed with a series of statements. The responses offered ranged from Strongly Agree (SA) coded four to Strongly Disagree (SD) coded one. Broad possible causes under investigation were; students' attitudes and interests towards the courses, cultural influence, employment interests, interests in science and Mathematics and effects from influence from family and other people. Others were influence from media and internet, TVET system and policies and individuals objectives to do the courses.

In order to get an overall score on each category, scales were developed by computing the mean score for the sets of variables in each category. The reliability of each scale was tested and found that all were high, ranging from 0.81 to 0.93. Since media and internet was only one item, no scale was developed for this category. The respective z scores for each scale indicate that they were all in the normal distribution range. The summary of analysis of the responses is presented in Table 6.12 and detailed analyses in Appendix N, Table 11.8.

Table.6.12. Summary of result of descriptive analysis of Students' opinions on factors that cause gender disparity in technological and engineering programmes

CAUSES	RANK	Mean	Std. Deviation	Number of items	Scale reliability α	z Scores
Attitudes and interest in courses	1	2.69	.94	3	0.93	-1.35
Family and other people influence	2	2.61	.69	6	0.87	-1.78
Employment interests	3	2.46	.75	3	0.81	-1.44
Interests in Science and Math	4	2.40	.87	2	0.88	-1.37
Media and internet influence	5	2.39	1.04	1	-	-1.27
Individual objectives	6	2.34	.82	3	0.88	-1.63
Cultural influence	7	1.96	.74	6	0.88	-1.81
TVET system and policies	8	1.94	.79	5	0.92	-1.90

In the opinion of students, their attitudes and interests in courses followed by influences from family and other people were the most important factors that caused gender disparity in enrolment in technology and engineering courses. Others factors were their employment interests and interests in science and mathematics. The least important cause among the possible factors in influencing gender disparity in technological and engineering courses was the TVET system and policies followed by cultural influences. Both scales had means of less than two.

It is important to note that despite the influence of media and internet having been seen by most students as not responsible for gender disparities in engineering courses, the higher standard deviation indicate that they had wider range of opinions over this compared with the rest of the factors. This is an issue that would be of interest for further investigations.

Further analysis was undertaken to find out whether there were differences in opinions on factors influencing gender parity in technological and engineering programmes by students' gender, home location, students social class, their age, year of study, course of study, and location of their institutions.

The results of analyses of opinions of students by gender on possible factors influencing gender disparity in technological and engineering programmes and results of two-way analyses of variance are summarized in Table 6.13.

Table 6.13 Comparison between student opinions by gender on possible factors influencing gender parity in technological and engineering programmes

Total factors scales	Gender	Mean	Std. Deviation	F	df	Sig.
Attitudes interests towards course	Male Female	2.80 2.51	.96 .88	21.33	1	.00
Cultural influence	Male Female	2.01 1.87	.75 .72	7.78	1	.01
Employment interests	Male Female	2.57 2.27	.73 .73	35.55	1	.00
Interests in science and Math	Male Female	2.39 2.40	.87 .86	.00	1	.95
Effects of influence from family and other people	Male Female	2.64 2.55	.68 .70	3.36	1	.07
Influence from media and internet	Male Female	2.47 2.23	1.03 1.03	6.63	1	.01
TVET System and policies	Male Female	1.92 1.99	.81 .77	1.75	1	.19
Individual's objectives in doing the course	Male Female	2.41 2.21	.83 .79	11.47	1	.00

The results indicate significant differences between students by gender and their opinions on whether attitudes and interests towards the courses, cultural influences, employment interests, media and internet and students objectives to do the courses influences gender disparity in technological and engineering courses. Female students were neutral (mean = 2.5) as to whether students' attitudes and interests influenced gender parity in technological and engineering programmes while male students agreed (mean = 2.8) on this aspect.

As reflected by their mean (approximately 2.0) students from both genders agreed that cultural influences did not influence gender disparity in technological and engineering courses. However, female students had a significantly lower mean indicating that their agreement on this finding was stronger compared with their male counterparts.

It was of interest to note that while male students agreed (mean > 2.5) that students' employment interests caused gender disparity in technological and engineering programmes, female students did not agree with this statement (mean < 2.5). Female students did not see the two genders as having different employment interests that could cause gender disparities in enrolment in technological and engineering courses.

Male students were almost neutral (2.47) as to whether media and internet caused gender disparity in technological and engineering programmes while females disagreed (2.23) with this statement. Female students had a significantly lower mean for influence from media and internet compared with their male counterparts.

It was further found that both genders disagreed (mean < 2.5) that individuals' objectives in doing the course influences gender parity in technological and engineering courses. However, female students had a significantly lower mean indicating that their disagreement with this statement was stronger compared with that of their male counterparts.

There were no significant differences between student gender and their opinions about influences of interests in science and Mathematics, people and TVET policies and systems on gender parity in technological and engineering programmes. Male and female students agreed that interests in science and Mathematics and TVET policies and systems did not cause gender disparity in technological and engineering programmes (both means < 2.5). However, they agreed that influence from family and other people did cause gender disparity (means > 2.5).

A one-way analysis of variance indicated that there was a significant difference between students' opinions by their courses of study on whether students' employment interests cause gender disparity in technological and engineering programmes. Technological and engineering students were almost neutral on whether students' employment interests caused gender disparity in technological and engineering programmes while Business students disagreed (mean < 2.5) on the same. Table 6.14 presents summary of results of analysis of students' opinions by course of study on factors influencing gender parity in technological and engineering programmes.

Table 6.14 Comparison between students' opinions by their courses of study on causes of gender disparity in technological and engineering programmes

Factors causing gender disparity in technological and engineering courses	Course of study	Mean	Std. Deviation	F	df	Sig.
Attitudes interests towards course	Technology & engineering	2.74	.95	2.44	1	.12
	Business	2.64	.93			
Cultural influence	Technology & engineering	1.93	.74	2.14	1	.14
	Business	2.00	.75			
Employment interests	Technology & engineering	2.51	.73	5.72	1	.02
	Business	2.39	.77			
Interests in science and Math	Technology & engineering	2.44	.86	3.12	1	.08
	Business	2.33	.87			
Effects of influence from family and other people	Technology & engineering	2.64	.69	2.10	1	.15
	Business	2.57	.70			
Influence from media and internet	Technology & engineering	2.39	1.03	.00	11	.97
	Business	2.39	1.05			
TVET System and policies	Technology & engineering	1.91	.79	2.02	1	.16
	Business	1.99	.80			
Individual's objectives in doing the course	Technology & engineering	2.36	.82	.93	1	.34
	Business	2.31	.82			

As indicated on Table 6.14 above, there were no significant differences between students by their courses of study and their opinions on whether students' attitudes and interests towards the courses, cultural influences, people's influences, media and internet and students objectives to do the courses caused gender disparity in technological and engineering courses. Students in the two courses of study expressed similar views.

It was also found that there were no significant differences found between students by their age, students' social classes, location of homes, location of their training institutions and year of study on their opinions on all the possible factors influencing gender disparity in technological and engineering programmes. Students across these categories expressed similar opinions.

6.5. Summary on findings of student opinions

Students in general indicated that their enrolment in TVET courses was influenced by family and other people, newspapers, television and internet, their objectives to do the course and TVET system and policies. Media and internet including newspapers, television and internet were believed to have had higher influence on student enrolments in TVET programmes followed by their objectives to do the courses. Family and other people were believed to be the least in influencing students' decisions to enrol in their current courses.

Among the family and other people, career advisors and parents were believed to have had the highest influence on student enrolment in TVET courses compared with rest of the family and other people, while female relatives had the least influence. Comparison of student opinions on media and internet influences found that newspapers were believed to have had higher influence compared with TV and internet.

It is important to note that student objectives of acquiring desired skills and advancement to higher education were believed to have had more influence on student enrolments in TVET courses compared with the other objectives. When analysing student opinions on influences of TVET system and policies, it was found that the quality of training and conducive learning environment were believed to have had high influence on their enrolments compared with other government policy areas. There were differences in student opinions categorised by their course of study, year of study social class, gender and age in their having been influenced to enrol in TVET courses by these factors.

Students categorised by course of study were influenced by their Science, Mathematics and Business Education teachers, television (TV) and internet, their objective to acquire new skills, and cost of their courses to enrol in TVET courses. Technology and Engineering students were more influenced by Science and Mathematics teachers, television (TV) and internet and their objectives to acquire new skills to enrol in their courses compared with their business counterparts. On the other hand, Business students were more influenced by their business teachers and cost of training to enrol in their courses compared with their technology and engineering counterparts. In sum, students were more influenced by teachers of subjects related to their courses of study to make their enrolment decisions.

Influences of enrolment in TVET courses of students categorised by year of study depended on their science teachers, career advisors, TV and internet, TVET system and policies and their objectives to do the courses. First year students were more influenced by their science teachers, career advisors, TV and internet and TVET system and policies to enrol in TVET courses compared with their third year counterparts. On the other hand, third year students were more influenced by their objectives to do the courses to enrol in TVET courses compared with their first year counterparts.

Enrolments in TVET courses by students categorised by social class depended on influences from their fathers, newspapers and their objectives in acquiring desired skills. Students from high social class were more influenced to enrol in TVET courses by their fathers and objectives to acquire desired skills compared with those from other social classes. In addition, they were less influenced by newspapers to enrol in the courses compared with those from middle and low classes.

The decisions of students by gender to enrol in TVET courses depended on influences from their female relatives, career advisors, science teachers and their objectives to advance to higher education. Male students were more influenced to enrol in TVET courses by their objectives of advancing to higher education, and science teachers compared with their female counterparts. In contrast, female students were more influenced by their female relatives and career advisors to enrol in TVET courses compared with their male counterparts. Bursaries were readily available to females in technology and engineering and this will be considered in greater detail in Chapter Seven.

The influence of mothers on student enrolment decisions depended on the age of the students. Students aged 30 years and below were more influenced by their mothers to make their enrolment decisions compared with those above 30 years.

Generally students were satisfied with their current courses of study. When asked other fields to choose, technology, and engineering students would prefer courses in technology and engineering fields to those from business fields. Conversely Business students preferred courses in business fields more than in technology and engineering fields. In sum, students preferred courses in the fields related to their current courses.

There were differences in satisfaction in their courses by students categorised by social class and home location. Students from rural homes were more satisfied with their current courses compared with those from city and town-located homes. Those from high class were less satisfied by their current courses compared with those from other classes.

Students had the opinion that gender disparity in enrolments in technological and engineering programmes were caused by their interests and attitudes towards the programmes and influences from family and other people. Cultural influences, TVET system and policies were not seen to have caused gender disparity in enrolment in technological and engineering programmes.

However, there were differences in opinions between students by gender and course of study in believing that some of the factors under study caused gender disparities in technological and engineering programmes. Technology and engineering students had stronger believes that student employment interests caused gender disparity in technological and engineering programmes compared with their business counterparts. In addition students by gender had different opinions on whether attitudes towards and interests in the courses, cultural influences, employment interests, media and internet and students objectives in doing the courses influenced gender disparity in technological and engineering course. In all the cases, male students had stronger beliefs that these factors caused gender disparity in technological and engineering programmes compared with their female counterparts.

The next section brings together all the factors discussed individually in an attempt to determine a hierarchy of predictors of enrolment in engineering and business courses.

6.6. Predicting enrolment in TVET programmes

The wide range of personal background, educational and occupational interest data collected from the 999 students enrolled in TVET programmes was used to predict their choice of either technology/engineering or business courses. The predictor variables were entered into a logistic regression equation with course of enrolment as the outcome variable. The predictor variables were grouped into 10 categories as outlined below.

1. *Background information and descriptive*: respondents' gender, year of study, social class[18], age, home location, location of the institution enrolled in;
2. *Experience in secondary school subjects-liking:* liking of twelve subjects including English, Kiswahili, Mathematics, Biology, Chemistry, Physics, Religious Education, Geography, History, Business, Accounting and Technical education;
3. *Experience in secondary school subjects-difficulty:* difficulty experience of twelve subjects including English, Kiswahili, Mathematics, Biology, Chemistry, Physics, Religious Education, Geography, History, Business, Accounting and Technical education;
4. *Usefulness of subjects:* respondent's opinion of usefulness of engineering, business, accounting, science, computing and mathematics;

[18] Three social classes namely lower, middle and upper social class were presented to the respondents who identified the categories they belonged to. A definition of social class was not given to them.

5. *Interests in areas:* respondent's interests in activities of three areas including engineering, business and general area;
6. *Influences from family and other people:* respondent's father, mother, brother, sister, male relative, female relative, friend, mathematics teacher, science teacher, business teacher and career advisor;
7. *Interests in employment:* respondent's interest in 18 occupations including shop attendant, office work, health care (nursing), service (police, fire brigade), armed forces, information technology, agriculture, banking and finance, hotels and catering, technology and engineering, manufacturing, teaching, theatre arts (music, drama), accountant, business entrepreneur, tourist, management and others as predictor variables;
8. *Influences from media and internet:* include influences from newspapers, and TV and internet;
9. *Individual's objectives for enrolment in courses:* respondent's objective to enrol in the course including to advance to higher education; to acquire desired skill; to get employed; and to get a better salary) and
10. *Influences from TVET systems and policies:* include influences on respondent's choice of course by availability of government bursary, quality of training, conducive learning environment and cost of course as predictor variables.

Given that the outcome variable was dichotomous (enrolment in either technology/engineering or business); the use of binary logistic regression analysis was required. The Nagelkerke's R square statistic was used to determine the percentage level of influence on the respective model that each category contributed towards enrolments in technical and vocational courses. The choice of the Nagelkerke's R^2 was due to its higher accuracy compared with Cox and Snell's R^2 which does not reach its theoretical maximum of one (Field, 2009). To find out whether the model overall results were a significantly good prediction of the outcome variable (enrolment in TVET courses) the Chi-square distribution was employed at the 5 percent confidence level (Field, 2009). Additionally, the Wald statistic was used to determine the significant contribution of each predictor variable in each of the logistic regression model equations.

Standardised[19] beta (β) value was used to measure how strongly each predictor variable influenced the criterion variable (Field, 2009). Thus, the higher the beta value the greater the impact of the predictor variable on the criterion variable. The size of β value is considered as the change in the criterion variable when the predictor variable changes by one unit of measure. This value represents the gradient of the linear regression line. Thus, a change of one standard deviation of predictor variable resulted in a change of one-beta standard deviations in the criterion variable.

Further, beta (β) values were used to determine the direction of the influence of predictor variable to outcome variable. Thus, a negative β value indicated that increase of predictor variable resulted in a decrease in outcome variable. On the other hand, a positive β value indicated that increase of the predictor variable resulted in increase in outcome variable (enrolment in business courses or engineering courses).

The same as use of beta values in linear regression, the odds ratio (Exp (B) value was used in binary logistic regression to explain the strength of prediction by predictor variables of the outcome variable. Field (2009) defines the odds ratio as an indicator of the change in odds resulting from a unit change in the predictor. The odds of an event occurring are defined as the probability of an event occurring divided by the probability of an event not occurring. Thus, change in odds or odds ratio is the odds after a unit change in the predictor divided by the original odds. If the value of the odds ratio is greater than one, then it indicates that as the predictor increases, the odds of the outcome occurring increases. On the other hand, if the value of odds is less than one, then it shows that as the value of predictor increases, the odds of the outcome decreases.

[19] Standardised beta (β) values, which are measured in units of standard deviation, are more accurate in prediction of influence of variables on outcome.

Since there was need to find out the effect[20] of each predictor variable on both categories of the outcome variable (business course enrolment; and technology and engineering course enrolment) separately, dummy coding of the outcome variables was used. This allowed assessing the influences of predictor variables on each category of the outcome while keeping the other as a dummy or baseline reference. Initially, engineering was coded 0 while business was coded 1. Thus, engineering was a dummy reference (Field, 2009). Thus, initial analyses found the effects of predictor variables on enrolment in business courses. However, in order to keep the influences on enrolment in business courses as baseline reference, the outcome variable was recoded into a new variable with this category coded as 0 and the coding of technology and engineering course enrolment remained as 1.Thus, the latter analyses provided effects of predictor variables on engineering enrolment.

The standard error (S.E) was used as a measure of the precision with which the regression coefficient was measured. Field (2009) defines standard error as the standard deviation of errors of prediction about the regression line. If a coefficient is large compared with its standard error, then it is probably different from 0. The larger the standard error for regression coefficient become, the less likely it is that a coefficient will be statistically significant (Field, 2009).

Given the large number of variables involved and the desire to examine the relationship of each category of predictor variables with the outcome variable separately, initial analyses were conducted separately for each of the 10 categories of the predictor variables. As detailed below, all predictor variables in each category were entered into the equation and variables found not to be significantly related to the outcome variable were progressively removed from the regression equation, until only significant variables remained. The results of the analyses were categorised into two sets. The first set summarised the tests for model equations developed for each category detailing the prediction success percentage, tests for significance and the respective Nagelkerke R^2.(Refer to Table 6.15).

[20] Positive effect was indicated by positive Beta value and odds ratio of more than 1. While negative effect was indicated by negative Beta value and odds ratio less than 1.

Table 6.15. Summary for tests of model equations for each category

No	Category	Tests for model equation				
		Predicted correct %			Omnibus tests	Nagelkerke
		Engineering	Business	Overall	χ^2	R^2
1	Background information and descriptive	77.4	54.1	68.0	101.36*	.15
2	Experience from secondary school subjects-liking	73.3	63.7	69	181.75*	.23
3	Experience from secondary school subjects-difficulty	82.4	53.8	69.2	12.01*	.08
4	Usefulness of subjects	90.9	81.9	87.1	536.29*	.68
5	Interest in areas	87.0	64.7	77.3	325.54*	.40
6	Influence from family and other people	65	78.1	71.2	315.27*	.37
7	Interests in employment	87.0	64.7	77.3	325.54*	.36
8	Influence from media and internet	87.6	16.5	56.9	4.45*	.01
9	Individual objectives to enrol in the course	89.0	21.5	59.1	19.04*	.03
10	TVET system and policies	84.9	26.0	60.0	28.48*	.05

For the Wald coefficient, an asterisk (*) indicates the predictor is significant ($p < 0.05$) for Course of study as the dependent Variable.

As summarised in Table 6.15, tests of the ten full models against their respective constants only, all models were found to be statistically significant indicating that their respective set of predictors significantly distinguished between influences on enrolment in technology and engineering courses; and business courses. The results further indicate that prediction success overall ranged from 57 percent for the media and internet (TV, internet and newspaper) model to 87 percent for the usefulness of subject model. Thus, the predictions were significant.

Comparing the values of Nagelkerke R^2 for each model, it was found that usefulness of subject model had the highest percentage of influence on enrolment in TVET courses compared with the other models. This was reflected in its having the highest R^2 value (.68) compared with the rest of the models. Interests in tasks in various areas followed this. The third, fourth, fifth and six most influential were from family and other people, interests in employment, and experience from secondary school subjects-liking and student background model respectively. The remaining models had lower than 10 percent contribution to prediction towards influences on enrolment in TVET courses. It is of interest to note that, unlike other studies where family and other people are the most influential in determination of differences in enrolments in technical and vocational courses, this study found that they were the third most influential.

Because all categories were significantly related to the enrolment, the second set of the results of the analyses reports on choice of course detailing the respective Wald tests for significant, odds ratios, beta values and standard errors when effects of the 10 categories were analysed separately. Table 6.16 presents results of regression analyses per category.

Table 6.16 Summary of effects of predictor variables to each outcome category

No.	Predictor Category	Predictors	Prediction tests per outcome categories				
				Business		Engineering	
			Wald	B(S.E.)	Exp(B)	B(S.E.)	Exp(B)
1	Background information and descriptive	Gender	83.02*	1.37(.15)	3.95	-1.37(.15)	.25
		Year of study	2.92	.25(.15)	1.29	-.25(.15)	.78
		Social class	7.79*	.41(.15)	1.51	-.41(.15)	.66
2	Experience in secondary school subjects -Liking	Liked Physics	26.31*	-.57(.11)	.57	.57(.11)	1.76
		Liked Math	14.63*	-.37(.10)	.69	.37(.10)	1.45
		Liked Chemistry	6.65*	-.27(.10)	.76	.27(.10)	1.31
		Liked Geography	5.10*	-.23(.10)	.79	.23(.10)	1.26
		Liked Kiswahili	3.72*	.17(.09)	1.18	-.17(.09)	.84
		Liked Accounting	6.99*	.35(.13)	1.42	-.35(.13)	.70
		Liked Business	49.67*	.72(.10)	2.05	-.72(.10)	.49
3	Experience from secondary school subjects-difficulty	Physics difficult	11.17*	.81(.24)	2.24	-.81(.24)	.45
4	Usefulness of subjects	Engineering	106.56*	-2.01(.19)	.13	2.01(.19)	7.44
		Science	18.86*	-1.02(.24)	.36	1.02(.24)	2.78
		Math	5.29*	-.50(.22)	.61	.50(.22)	1.65
		Business	115.91*	2.97(.28)	19.49	-2.97(.28)	.05
5	Interests in areas	Engineering	142.33*	-1.98(.17)	.14	1.98(.17)	7.27
		Business	139.61*	1.87(.16)	6.50	-1.87(.16)	.15
6	Influence from family and other people	Science teacher	160.27*	-1.14(.09)	.32	1.14(.09)	3.13
		Male relative	3.18	-.17(.10)	.84	.17(.10)	1.19
		Female relative	15.91*	.41(.10)	1.51	-.41(.10)	.66
		Business teacher	93.17*	.80(.08)	2.22	-.80(.08)	.45
7	Interests in Employment	Techn. and engineering	169.58*	-1.40(.11)	.25	1.40(.11)	4.07
		Information technology	3.05*	-.21(.12)	.81	.21(.12)	1.24
		Accounting	4.97*	.22(.10)	1.25	-.22(.10)	.80
		Hotel catering	3.95*	.27(.14)	1.31	-.27(.14)	.76
		Healthcare (nursing)	9.35*	.26(.09)	1.30	-.26(.09)	.77
		Service (police,) etc	6.51	.31(.12)	1.36	-.31(.12)	.74
		Business Entrepreneur	11.66*	.45(.13)	1.57	-.45(.13)	.64
8	Imedia and internet	TV or internet	4.44*	-.14(.07)	.87	.14(.07)	1.15
9	Individual objectives to enrol in the course	Acquire desired skill	13.81*	-.30(.08)	.74	.30(.08)	1.35
		Get better salary	4.77*	-.14(.06)	.87	.14(.06)	1.15
		Get employed	3.22	.14(.08)	1.15	-.14(.08)	.87
10	TVET policies and system	Quality of training	9.88*	-.36(.12)	.70	.36(.12)	1.44
		TVET Bursary	8.75*	-.20(.07)	.82	.20(.07)	1.22
		Conducive learning environment	19.33*	.49(.11)	1.63	-.49(.11)	.61

For the Wald coefficient, an asterisk (*) indicates the predictor is significant ($p < 0.05$) for Course of study as the dependent Variable.

6.6.1. Background information and descriptive category

The results in Table 6.16 demonstrate that differences in enrolment between business and engineering courses could be predicted using the respondent's gender and social class, but that year of study was not related to course of enrolment. The Wald statistic and odds ratios show that student gender was a significant predictor of course enrolment in TVET programmes with females more likely to choose enrolment in business courses and less likely to choose enrolment in engineering courses. Similarly, social class significantly predicted the course of enrolment with students in the lower social classes (Since low social class was coded 1) more likely to be enrolled in engineering, and students in the higher social classes (the higher class was coded 2)[21] being more likely to have enrolled in business courses.

6.6.2. Experience of secondary school subjects-liking category

The Wald test results for each predictor variable in the of experience in secondary school subjects-liking category indicate that Geography, Kiswahili language subjects and enabling secondary school subjects for engineering and business courses were significant predictors of enrolment in engineering and business courses. The respective beta values demonstrate that liking each subject had a positive influence on enrolment in the course related to the subject and a corresponding negative effect on the one not related to it. Students who liked Geography and subjects related to engineering including Mathematics, Physics and Chemistry were more likely to be enrolled in engineering courses compared with business courses. However, those who liked Kiswahili, which is a national and business language in Kenya and subjects related to business including business and accounting, were more likely to be enrolled in business courses compared with engineering courses.

[21] Since very few students were in high social class (1.6percent), and a majority being in low social class (64percent), the data was recorded into two groups of social classes by combining middle and high social classes to form higher social class. Thus, higher social class refers to a combination of middle and high social classes.

6.6.3. Experience in secondary school subjects-difficulty category

The Wald statistics demonstrate that difficulty experience in Physics subject was the only significant predictor variable for prediction of differences between enrolment in technology and business courses in TVET institutions in this category. Finding secondary school Physics difficult had a negative effect on enrolment in engineering courses but positive effect on business courses. The odds ratios demonstrated that the more students found Physics subject to be difficult at secondary school, the more they were likely to choose business courses instead of choosing engineering courses at TVET level.

6.6.4. Usefulness of subject category

In the usefulness of subject category, the Wald statistics demonstrate that usefulness of engineering, science, mathematics and business were the only significant predictors for differences between enrolments in engineering courses and business courses. The respective odds ratios indicate that students who found engineering, science and mathematics to be useful were more likely to be enrolled in engineering courses compared with business courses. As indicated by their higher odd ratio values, those who found engineering to be useful were more likely to choose engineering courses compared with those who found only mathematics or science to be useful. On the other hand, those who found business to be useful were more likely to enrol in business courses but less likely to enrol in engineering courses.

6.6.5. Interests in areas[22] category

Interests in engineering and business areas variables were found to be the only significant predictor variables in the interests of area category responsible for prediction of the differences in enrolments between engineering and business courses. Each variable had positive influence on enrolment in the respective courses related to it but negative influence on enrolment in unrelated course.

[22] The areas here means tasks and activities in engineering, business and general fields

The odds ratios further demonstrate that students who were more interested in the engineering area were more likely to enrol in engineering courses but less likely enrol in business courses. However, those who were more interested in the business area were more likely to enrol in business courses but less likely to enrol in engineering courses.

6.6.6. Influences of family and other people category

It was interesting to find that in the influences of family and other people category, only female relatives, science teachers and business teachers were significant predictors for differences in student enrolment in either engineering or business courses as demonstrated by the Wald statistics results. The results demonstrate that the influences on students by their female relatives had a positive effect on enrolments in business courses but a negative effect on enrolment in engineering courses. The odds ratios indicate that students who were more influenced by their female relative influences were more likely to be enrolled business courses compared with engineering courses.

Influences from secondary school subject teachers had a positive effect on student enrolment in the courses related to their teaching subjects but a negative effect on enrolment in the courses not related to their teaching subjects. As demonstrated by their respective odds ratios, students who were more influenced by their science teachers were more likely to choose enrolment in engineering courses but less likely to choose enrolment in business courses. In contrast, those who were more influenced by their business teachers were more likely to choose enrolment in business courses but less likely to choose enrolment in engineering courses.

6.6.7. Interests in employment category

In the interests in employment category, the Wald statistics demonstrate that six variables were significant in prediction of differences in outcome of enrolment between engineering and business courses. Two of the predictor variables including engineering employment interests and information technology employment interest had positive effects on outcomes of enrolments in engineering courses and negative effects on outcome of enrolment in business courses. Their respective odds ratios demonstrate that students who had interests in either of the employments were more likely to choose enrolment in engineering courses and less likely to choose enrolment in business courses. The result further indicated that, a higher number of students who had interests in technology and engineering employment were likely to enrol in engineering courses compared with those who had interests in the rest of the employments.

The other four predictor variables, which were significant in predicting differences in enrolments in engineering, and business courses were interests in various employments including accounting, business, hotel and catering; and health care. Student who were more interested in any of the four employments were more likely to be found enrolled in business courses compared with engineering courses. As expected, interests in service (police) employment were not found to be related to differences in TVET course enrolment.

6.6.8. Influences from media and internet

In the media and internet category, the Wald statistic indicates that TV and internet were the only significant predictors of differences in enrolments between engineering courses and business courses. As shown by odds ratio, TV and internet were more likely to influence more enrolments in engineering courses compared with business courses.

6.6.9. Individual’s objectives for enrolment in courses

It was further found that student’s objective to acquire a desired skill and to get better salary significantly predicted differences in enrolments between engineering and business courses. As indicated by the respective odds ratios, students who were more influenced by either of the two enrolment objectives were more likely to enrol in engineering courses but less likely to enrol in business courses. However, an individual’s objective to get employed was not related to course enrolment.

6.6.10. TVET systems and policies category

In the TVET system and policies category, three predictor variables were found to significantly predict the differences in outcome of enrolment in TVET courses. The perceived quality of training witnessed in TVET programmes significantly predicted (refer to the Wald statistic) the differences in enrolments in engineering and business courses. Its influence was positive for the outcome of enrolments in engineering courses and negative for the outcome of enrolment in business courses. As demonstrated by the respective odds ratios, when the quality of training in engineering programmes was higher, students were more likely choose to enrol in technological and engineering courses compared with business courses. The higher perception of quality of training in technological and engineering programmes could be as a result of the recent TVET reforms that were aimed at upgrading equipment and teachers' skills in these programmes with a view to establishing centres of excellence.

In the same category, availability of government bursaries significantly predicted the differences in enrolments between engineering courses and business courses. This variable had a negative effect on outcome of enrolment in business courses and positive effect on outcome of enrolment in engineering courses. Perhaps this finding could be attributed to the fact that bursary award targeted female students enrolled in engineering.

Further, as indicated by the Wald statistics, conducive learning environment[23] variable was found to significantly predict differences in enrolment in TVET programmes. The odds ratio further indicated that improving conducive learning environment for business programmes, was likely to result to more enrolment in business compared with engineering courses.

6.6.11. Combination of significant variables from all categories

Having found the results of influences of each of the 10 categories and their respective set of predictors of the outcome variable, there was a desire to determine the combined effect of the categories on the outcome variable. Since

[23] Conducive learning environment was not defined but depended on the respondent's perception.

the number of variables involved was large and some of the predictor variables were strongly related, creating possible collinearity issues, the variables were initially divided into two sets for the further analyses. The first set included all significant predictor variables found when conducting the logistic regression for each separate category. These variables were entered into a single equation and variables found not to be significantly related to the outcome variable were progressively removed from the regression equation, until only significant variables remained.

This analysis indicated that a test of the full model against a constant only model was statistically significant, therefore the predictors as a group significantly distinguished between influences in enrolment in engineering courses; and business courses (χ^2=471.13, df = 13; $p < .05$). Nagelkerke's R^2 of .82 indicated a very strong relationship between prediction and grouping. Prediction success overall was 92 percent (90 percent for engineering courses and 94 percent for enrolment in business courses). The Wald criterion demonstrated that only eleven predictor variables, which could be categorised into the following three groups, made significant contributions toward the prediction of the outcome variable:

1. *engineering related:* including interests in engineering area, usefulness of engineering, influence from science teacher, technology and engineering employment interest, usefulness of science, and physics difficulty experience;
2. *business-related:* including usefulness of business, interest in business area and influences from business teacher; and
3. *Others:* including student objective to acquire desired skill, quality of training and interest in health care (nursing) occupation.

Table 6.17 details the results of the analysis of predictor variables presented in ascending order of their effects on business courses and descending order of their effects on engineering courses based on the respective odds ratios.

Table 6.17. Summary of results of logistic regression for combined significant predictors from all categories

Predictor variables	Wald	Business		Engineering	
		B(S.E)	Exp(B)	B(S.E)	Exp(B)
Interest in engineering area	14.69*	-1.44(.37)	.24	1.44(.37)	4.20
Usefulness of engineering	16.63*	-1.14(.28)	.32	1.14(.28)	3.12
Influence from science teacher	24.93*	-1.03(.21)	.36	1.03(.21)	2.81
Technology and engineering employment interests	23.64*	-.97(.20)	.38	.97(.20)	2.63
Usefulness of science	2.85*	-.62(.37)	.54	.62(.37)	1.85
Liking of Geography experience	3.21	-.45(.25)	.64	.45(.25)	1.58
Individual objective to acquire desired skill	4.90*	-.43(.19)	.65	.43(.19)	1.53
Quality of training	3.76*	-.42(.22)	.66	.42(.22)	1.52
Interest in healthcare (nursing)	9.40*	.57(.19)	1.77	-.57(.19)	.57
Physics difficulty experience	6.09*	.66(.27)	1.94	-.66(.27)	.52
Influence from business teacher	19.59*	.89(.20)	2.42	-.89(.20)	.41
Interests in Business area	15.88*	1.43(.36)	4.19	-1.43(.36)	.24
Usefulness of business	27.44*	2.24(.43)	9.40	-2.24(.43)	.11

For the Wald coefficient, an asterisk (*) indicates the predictor is significant ($p < 0.05$) for Course of study as the dependent Variable.

The odds ratios in Table 6.17 above demonstrate that, apart from Physics difficulty experience predictor variable, increasing the rest of the predictor variables in the first two groupings of predictor variables will result on an increase in enrolment in the respective related courses and a decrease in enrolment of the unrelated courses. Students were more likely to enrol in engineering courses compared with business courses if they were influenced by the variables related to engineering. Conversely, they were likely to enrol in business courses compared with engineering courses if they were influenced by variables related to business. Moreover, those who find secondary school Physics difficult were more likely to be enrolled in business courses compared with engineering courses. This could be attributed to the requirement for enrolment in engineering courses that candidates must have passed secondary school Physics with at least grade C; and those who found it difficult were not likely to achieve this condition thus opting for other courses. The Wald statistics further demonstrated that liking of Geography at secondary school was not significantly related to course enrolment at TVET level.

The odds ratio values further indicated that students whose enrolment objective was to acquire desired skills were more likely to enrol in engineering courses compared with business courses. Perhaps the narrow student perception of the term skills to include only psychomotor skills could explain why engineering courses were more perceived to meet student objectives to acquire desired skills compared with business courses. Additionally, the odds ratio value indicated that students who were concerned with the conducive learning environment were more likely to enrol in business courses compared with engineering courses.

Lastly the results demonstrate that students with interests in health care (nursing) employment were more likely to be enrolled in business courses compared with engineering courses. Probably, this result could be attributed to the higher number of females enrolled in business courses since nursing is perceived as a feminine course.

6.6.12. Combination of non-significant and excluded variables from all categories

The second set of regression analyses included all variables not included in the previous analyses, that is, those variables not included in the separate analyses for each of the 10 categories as well as those excluded in the model equation for combined significant predictors. As noted in the previous section, this was necessary since the number of variables involved in the analysis of separate categories was large and some of the predictor variables were strongly related, creating possible collinearity issues. These variables were entered into a single equation and variables found not to be significantly related to the outcome variable were progressively removed from the regression equation, until only significant variables remained.

It was of interest to find that a model with prediction power of 45 percent (R^2=0.45), which was significant (Chi = 71.49, df = 21, $p < 0.05$) in prediction of outcome variable, was established with a set of ten predictor variables. However, it is important to note that the variance explained ($R^{2)}$ of this model was lower compared to that of the previous model found when all significant variables were included in the analysis (R^2 = .82). This indicated that the previous model was stronger and thus these variables were considered to have been the most important predictors of differences in enrolment in the two courses. However, as noted earlier, it is should be recognised that there was multi-collinearity issues that led to exclusion of some of the variables.

As summarised in Table 6.18, the respective Wald statics in the second model indicated that 13 of the predictor variables significantly contributed towards prediction of the differences in outcomes of enrolments between engineering and business courses. In Table 6.18, the results of the analyses are presented in order of their relative prediction strength with respect to business outcomes and descending order of their importance with respect to engineering outcomes. With respect to business, the effects of the predictors are arranged from the lowest to the highest while for engineering, they are arranged from the highest to the lowest as indicated by the respective odds ratios.

Table 6.18. Summary of results of logistic regression analyses for non-significant predictors and those excluded from all categories

		Business		Engineering	
Predictor variables	**Wald**	**B(S.E.)**	**Exp(B)**	**B(S.E.)**	**Exp(B)**
History difficulty experience	10.12*	-1.43(.45)	.24	1.43(.45)	4.19
Male relative influence	10.02*	-1.36(.43)	.26	1.36(.43)	3.90
Individual objective to get employed influence	5.48*	-.90(.39)	.41	.90(.39)	2.47
TV and internet	11.20*	-.79(.24)	.45	.79(.24)	2.21
Agricultural employment interests	4.20*	-.71(.35)	.49	.71(.35)	2.03
Brother influence	4.14*	-.69(.34)	.50	.69(.34)	1.99
Technical education liked	2.77	-.62(.37)	.54	.62(.37)	1.86
Math teacher influence	3.84*	-.60(.31)	.55	.60(.31)	1.82
Newspaper influence	5.00*	.60(.27)	.55	-.60(.27)	1.82
Availability of bursary	4.65*	-.70(.25)	.56	.70(.25)	1.80
History liked	4.15*	.72(.36)	2.06	-.72(.36)	.49
Interest general area	5.14	.78(.35)	2.19	-.78(.35)	.46
Shop employment interests	2.98*	1.07(.62)	2.92	-1.07(.62)	.34
Service occupation interests	4.73	1.11(.51)	3.02	-1.11(.51)	.33
Biology liked	16.46*	1.72(.42)	5.58	-1.72(.42)	.18
Sister influence	12.92*	1.86(.52)	6.42	-1.86(.52)	.16

For the Wald coefficient, an asterisk (*) indicates the predictor is significant (p < 0.05) for Course of study as the dependent Variable.

The results indicated that influences from brothers, male relatives, mathematics teachers, TV and internet, History subject difficulty, individual objective to get employed, agricultural employment interests, newspaper and availability of a bursary had positive effects on the outcome of enrolment in engineering courses and negative effect on the outcome of enrolment in business courses. Students influenced by these variables were more likely to be enrolled in engineering courses compared with business courses.

By contrast, odds ratios and the Wald statistics demonstrate that influences from sisters, liking of Biology and History subjects in secondary school, and interests in shop employment had positive effects on the outcome of enrolments in business and negative effects on the outcome of enrolment in engineering courses. Thus, students influenced by these variables were more likely to be enrolled in business courses compared with engineering courses. It is of interest to note that this finding reveals that, at the family level, there were further differences in influence on student enrolments to TVET courses apart from female relatives as found earlier. Brothers' and male relatives' influences were stronger for enrolment in technological and engineering courses while sisters' influences were stronger for enrolment in business courses. These results indicated to some extent the possibility of gender stereotyping of TVET courses at the family level.

Lastly, the results indicate that liking of technical education subjects at secondary school level, interests in general area and interests in service occupation were not related to enrolment in TVET programmes.

The findings presented in Section 6.6 indicate that influences on student choice of courses differ in their relative importance and their effects on course selection generally and by student gender. There are stronger influences on females to enrol in business courses compared to engineering courses. This concur with the conptualisation of the study in Chapter Three Section 3.7 that compared to males, females face more barriers to enrolling in engineering courses.

6.7. Summary

Bivariate logistic regression analyses revealed that the degree of prediction varied between factors that influenced enrolment in either of the two courses (engineering or business). For instance, gender was more likely to predict differences in enrolment in the two courses compared with social class. However, these two variables were not included in the most important variables that significantly predicted enrolment in the two courses.

Based on the bivariate logistic regression analyses, the best model for prediction of enrolment had 6 positive predictors for engineering enrolment and 4 positive predictors for business enrolment. This model had the highest R^2 and included the most important significant predictors from all categories. These predictors are listed below starting from the most important to the least important.

a) Positive predictors to engineering enrolment

1. Interests in engineering area/course and field,
2. Influence from science teachers,
3. Interests in technology and engineering employment,
4. Interests in science,
5. Individual objective to enrol and
6. Quality of training.

b) Positive predictors to business enrolment

1. Interests in business area/course and field,
2. Influence from business teacher,
3. Less interest in science (Physics difficulty) and
4. Interests in healthcare (nursing) employment.

Interests expressed in either usefulness of subjects or interests in activities related to fields/areas were ranked the foremost factors in prediction of enrolment in TVET courses followed by influences from respective subject teachers (secondary school science or business). A total of 13 other positive significant predictors comprising 9 for engineering and 4 for business were included and ranked in the second best model. Interestingly, availability of a bursary was not among the first model of significant predictors to engineering enrolment but in the second model. The lower ranking of availability of a bursary as a predictor of engineering enrolment could be due to its limitation to special categories of students. Influences from mathematics teachers, brothers, TV and internet and newspapers were also among the positive predictors to engineering enrolments in second model.

Influences from sisters, interests in non-engineering secondary school subjects (such as Biology and History) as well as interests in non-engineering employments were included in the second model as positive significant predictors for business enrolment.

As noted previously, variables that had positive effect on one of these courses had a corresponding negative effect on the other course. Thus, it seems that competing interests and influences were responsible for enrolment in the two courses.

The following chapter will analyse the HOD opinions on factors causing gender disparity in engineering courses and their suggestions on relevant interventions to address them.

CHAPTER SEVEN

HEADS OF DEPARTMENTS OPINIONS AND PERSPECTIVES ON GENDER

7.1. Introduction

This chapter describes the results of the analysis of the data collected from the Head of Department (HOD) questionnaire. It commences with a description of the demographic information about the HODs (gender and age) together with their department and geographical location of their institution. This is followed by their opinions on the possible causes of gender disparity in enrolment in technological and engineering courses. Then a comparison between these opinions and student opinions on the same issue, other gender issues affecting TVET and possible interventions to enhance gender parity in TVET programmes is presented. Finally, the summary of the chapter is provided.

7.2. Demographics and institutional information

All 64 Heads of Departments (HODs) in technology, engineering and business disciplines drawn from 16 technical training institutions spread across seven provinces in Kenya responded to the questionnaire. Most HODs (89 percent) were males. A significant majority (77 percent) of the HODs were aged 41 years and above while 16 percent were aged between 31 and 40 years and very few were 30 years and below.

Approximately a half (52 percent) of the respondents was working in institutions located in towns while a quarter (25 percent) and slightly more than a fifth (22 percent) were working in city and rural institutions respectively. Most HODs (83 percent) were heading technological and engineering departments while the remaining 17 percent were heading business departments. This indicates that these technical training institutions had more engineering departments compared with business departments. The headship of technological and engineering departments comprised 87 percent males and 13 percent females. All females were heads of technological and engineering departments. The majority of males (81 percent) headed technological and engineering departments while the remaining (19 percent) headed all the business departments. Therefore, there was gender difference in headship of engineering, and business departments in technical training institutes as males dominated in the headship of both types of departments.

Table 7.1 below presents a summary of HODs' demographic information.

Table 7.1. Heads of Department demographic information

CLASIFICATION OF HOD'S		Frequency	Percentage %	Engineering. %	Business %	Total Male %	Total Female %
GENDER	Male	57	89.10	86.80	100.00	100.00	0.00
	Female	7	10.90	13.20	0.00	0.00	100.0
	Total	**64**	**100.00**	**100.00**	**100.00**	**100.00**	**100.0**
AGE BRACKET	Up to 30years	5	7.80	9.40	0.00	7.00	14.30
	31 to 40 years	10	15.60	17.00	9.10	14.00	28.60
	41 years & above	49	76.60	73.60	90.90	78.90	57.10
	Total	**64**	**100.00**	**100.00**	**100.00**	**100.00**	**100.0**
DEPARTMENTS	Eng.& tech	53	82.80	100.00	0.00	80.70	100.0
	Business	11	17.20	0.00	100.00	19.30	0.00
	Total	**64**	**100.00**	**100.00**	**100.00**	**100.00**	**100.0**
GEOGRAPHICAL LOCATION OF THE INSTITUTION	City	16	25.40	28.80	9.10	26.30	16.70
	Town	33	52.40	50.00	63.60	49.10	83.30
	Rural	14	22.20	21.20	27.30	24.60	0.00
	Total	**64**	**100.00**	**100.00**	**100.00**	**100.00**	**100.0**

The next section presents results of analyses of HOD's opinions on causes of gender disparity in technological and engineering programmes. This is followed by a section that provides results of analyses of HOD's responses on other issues concerning TVET. In both cases responses offered ranged from Strongly Agree coded four, to Strongly Disagree coded one.

7.3. HOD opinions on causes on gender disparity in technological and engineering programmes

The respondents were asked to respond to eight groupings of statements describing possible factors that may have caused gender disparity in technological and engineering programmes by indicating the extent to which they agreed or disagreed with each of the statements presented. The eight broad possible causes under investigation were; student attitudes and interests in the courses, cultural influence, employment interests, interests in science and mathematics, effects of influence from family and other people, influence from media and internet, TVET system and policies, and individuals' objectives in doing the courses.

For each category, mean scores of the items in the respective grouping were calculated. On the 1-4 categories used, mean scores above 2.5 were taken as agreement; scores below 2.5 as disagreement, with a mean of 2.5 representing a neutral position between agree and disagree. The reliability of each scale was tested and found that six were acceptable (α > 0.7). The other two scales (individual objectives in doing the course and employment interests) had reliabilities above 0.5 but less than 0.7, and were therefore weaker than the others. The z scores for the scales ranged from -1.61 to 1.71, indicating that the scales were normally distributed. The summary of analysis of the responses by each scale is presented in Table 7.2 and detailed analysis for each factor is in Appendix J, Table 6.9.4.

Table 7.2. Summary of result of descriptive analysis of HODs' opinions on factors that cause gender disparity in technological and engineering programmes

Factors causing gender disparities	Rank	Mean	St. Deviation	Number of variables	Reliability, α	Z scores
Individual Objectives	1	2.98	0.35	6	.61	1.40
Influence from family and other people	1	2.98	0.50	6	.81	1.52
Interests in course	3	2.85	0.66	3	.65	-1.30
Interests in science mathematics	4	2.81	0.62	2	.82	-1.61
Employment interests	5	2.44	0.41	3	.65	1.71
Cultural influence	6	2.19	0.50	6	.70	-1.50
Influence from media and internet	6	2.19	0.89	1	.78	1.32
Influence from TVET system and policies	8	1.91	0.58	5	.86	-1.25

HODs indicated that they agreed (mean > 2.5) that influence from family and other people, individual's objectives in doing the course, student interests in the course and science and mathematics are the major factors that cause gender disparity in technological and engineering programmes. They were almost neutral as to whether student employment interests caused gender disparity in enrolment into technological and engineering programmes. As indicated by their means on respective scales, on average the respondents disagreed that media and internet, TVET system and policies and cultural influences caused gender disparity in technological and engineering programmes.

It was of interest to note that the standard deviation of HODs opinion concerning their beliefs as to whether influence from media and internet caused gender disparity in technological and engineering programmes was higher (0.89) compared with those of the rest of the factors. About a quarter of HODs (24 percent) strongly disagreed, two fifths (41 percent) disagreed while slightly more than a quarter (28 percent) and less than a tenth (7 percent) agreed and strongly agreed respectively that media and internet caused gender disparity in enrolment into technological and engineering programmes. This indicated that they had wider range of views concerning this factor compared with the rest. It was also noted that HODs had narrower views (smaller standard deviation = 0.35) concerning whether student objectives in doing the courses caused gender disparities in technological and engineering programmes compared with the rest of the factors. A vast majority of HODs (87 percent) agreed while 5 percent strongly agreed that student objectives in doing the course caused gender disparity in technological and engineering programmes. Only 8 percent of HODs disagreed and none strongly disagreed on this issue.

Further analyses' using independent sample t- tests for differences between means indicated that there was a significant difference between HODs by gender and their opinion on TVET system and polices as possible cause of gender disparity in technological and engineering programmes. Female HODs had a higher mean (2.43) in believing that the TVET system and policies caused gender disparity in technological and engineering programmes compared with their male counterparts (1.85), although both were below the neutral point. This indicates that males had a stronger disagreement on whether gender disparity in the above programmes was caused by the TVET system and policy compared with their female counterparts. In addition, there was a significant difference between HODs by gender and their belief that student individual objectives in doing the course caused gender disparities in technological and engineering programmes. Male HODs had a higher mean (3.01) in believing that individual objectives in doing the course caused gender disparities in technological and engineering programmes compared with their female counterparts (mean = 2.74). Table 7.3 presents a summary of the results of analysis of HOD opinions on causes of gender disparity in technological and engineering programmes by gender.

Table 7.3. Comparison between HOD opinions by gender on possible factors influencing gender parity in technological and engineering programmes

Factors causing gender disparity in technological and engineering courses	Gender	Mean	Std. Deviation	t	df	Sig.
Attitudes interests towards course	Male	2.85	.64	-.18	7.05	.86
	Female	2.90	.81			
Cultural influence	Male	2.20	.51	.45	61	.69
	Female	2.11	.44			
Employment interests	Male	2.41	.40	-1.65	62	.10
	Female	2.67	.37			
Interests in science and math	Male	2.79	.62	-.85	61	.40
	Female	3.00	.65			
Effects of influence from family and other people	Male	2.99	.52	.79	62	.43
	Female	2.83	.33			
Influence from media and internet	Male	2.10	.88	-1.94	62	.06
	Female	2.83	.75			
TVET System and policies	Male	1.85	.54	-2.59	62	.01
	Female	2.43	.71			
Individual's objectives in doing the course	Male	3.01	.35	1.99	62	.05
	Female	2.74	.25			

There were no significant differences between HODs by gender and their opinions on whether student interests and attitudes towards the course, cultural influences, and student employment interests, interests in science and mathematics, effects of influence from family and other people, media and internet caused gender disparities in technological and engineering programmes ($p > 0.05$). Both male and female HODs had similar opinions on these issues. Table 7.4 presents a summary of analyses of HOD opinions by department on causes of gender disparity in technological and engineering programmes.

Table 7.4. Comparison between HOD opinions by department on causes of gender disparity in technological and engineering programmes

Factors causing gender disparity in technological and engineering courses	Department	Mean	Std. Deviation	df	F	Sig.
Attitudes interests towards course	Engineering and technological Business	2.83 2.96	.70 .35	1	.29	.59
Cultural influence	Engineering and technological Business	2.18 2.24	.51 .50	1	.08	.77
Employment interests	Engineering and technological Business	2.48 2.24	.39 .45	1	2.54	.12
Interests in science and math	Engineering and technological Business	2.81 2.82	.63 .64	1	.04	.85
Effects of influence from family and other people	Engineering and technological Business	2.99 2.89	.49 .58	1	.53	.47
Influence from media and internet	Engineering and technological Business	2.26 1.91	.93 .70	1	.71	.40
TVET System and policies	Engineering and technological Business	1.88 2.05	.60 .47	1	1.87	.18
Individual's objectives in doing the course	Engineering and technological Business	2.94 3.17	.34 .34	1	3.00	.09

There was no significant difference between HODs by department they were heading, or their age on their opinions of whether the eight factors under investigation caused gender disparity in technological and engineering programmes ($p > 0.05$). HODs, by age and type of department had similar views on the eight possible causes of gender disparity in technological and engineering programmes.

However, there were significant differences between HODs by location of institutions with their views on whether cultural influences ($F = 3.32$, $df = 2$, $p < 0.05$) and influence from family and other people ($F = 3.29$, $df = 2$, $p < 0.05$) caused gender disparity in technological and engineering programmes. The HODs from rural-located institutions were, almost neutral (mean = 2.47) concerning the effect of cultural influences on gender disparity in enrolment in technological and engineering programmes compared with those from town (mean = 2.06) and city-located institutions (mean = 2.23) both of which disagreed that there were cultural influences on gender disparity in the programmes. Therefore, the possibilities of cultural influences causing gender disparity in technological and engineering programmes may depend on location of the institutions.

HODs from city institutions agreed more (mean = 3.22) that family and other people's influence caused gender disparity in enrolment in technological and engineering programmes compared with their counterparts from town (2.84) and rural-located institutions (3.05).

7.4. Comparison between heads of department and student opinions on causes of gender disparity in technological and engineering programmes.

When comparing the opinions of the HOD and student responses on the causes of gender disparity in technological and engineering programmes, it was found that both agree that influence from family and other people and interests in and attitudes towards the courses were the major causes. Other causes of gender disparity in technological and engineering programmes were individual objectives in doing the course, and student interests in science and mathematics. In both cases, HODs had agreed while students disagreed on the two causes (See Table 7.5).

The difference in opinions between HODs and students on whether student objective for doing the course caused gender disparities in technological and engineering programmes could be attributed to the interpretation of the question by the two groups. The HODs' questionnaire asked why people enrolled in their departments but did not have gender difference items, while the student questionnaire included specific gender items. Therefore, HODs seemed to have given their opinions on why students enrol in their courses rather than whether there were gender differences.

Table 7.5. Comparison between HODs and students opinions on causes of gender disparity in technological and engineering programmes

	HODs		STUDENTS	
CAUSES	**Mean**	**Rank**	**Mean**	**Rank**
Influence from family and other people	2.98	1	2.61	2
Individual Objectives	2.98	1	2.34	6
Students attitudes and interests in the courses	2.85	3	2.69	1
Students' interests in science and mathematics	2.81	4	2.40	4
Students' employment interests	2.44	5	2.46	3
Influence from media and internet	2.19	6	2.39	5
Cultural influence	2.19	6	1.96	7
Influence from TVET system and policies	1.91	8	1.94	8

It was interesting to note that while HODs believed that interests in science and mathematics caused gender disparities in technological and engineering programmes, students disagreed on this issue. However, results of analysis of student interests in secondary school subjects (Chapter Five Section 5.3.2) indicate that there were gender differences in mathematics and science subjects especially Chemistry and Physics. Female students were less interested in these subjects compared with males. In addition, they least liked Mathematics, Chemistry and Physics and found these subjects most difficult compared with how the males found them. In addition female students did not find science as useful to their future careers, personal development, employment, social and economic development as male did (Chapter Five Section 5.4). Mathematics, Physics and Chemistry are also pre-requisite subjects for enrolling into technological and engineering programmes. Therefore, the HODs opinion on this issue seems to concur with the earlier analysis of student interests. The opinions of both HODs and students on causes of gender disparities in engineering courses were as proposed in the Chapter Three Section 3.7 in which it was conceptualised that gender disparities in education is a result of combination of factors from both inside and outside the school system. This was also found in the literature review presented in Chapter Three Section 3.5 and 3.6. The implications of these findings also concur with earlier suggestion in Chapter Three Section 3.7 that the gender differences in influences on course selection potentially directed females in non engineering courses and were the causes for their exclusion in human capital formation in this field.

It was also found that students agreed while HODs disagreed in believing that student interests in and attitudes towards the course were the cause of gender disparities in enrolment into technological and engineering programmes. In addition both HODs and students were almost neutral on their opinions in believing that student interests in employment were possible causes of gender disparities in technological and engineering programmes. The least believed causes of gender disparity in technological and engineering courses were influence from TVET system and policies, followed by cultural influences and influences from media and internet. Both HODs and students did not see the three as causes of gender disparity in technological and engineering programmes.

7.5. HOD opinions on other issues concerning gender parity in TVET

Four statements about enrolment and training of students at diploma courses in the technological/engineering and business programmes were presented to HODs who were required to respond on the extent they agreed or disagreed with the statements. The summary of analysis of their responses is presented in Table 7.6.

Table 7.6.Summary of results of analysis of HOD responses on issues concerning gender parity in TVET

Issues concerning gender parity in TVET courses	Mean	Std. Deviation
Dropout rate of female students in Technological and Engineering is more than males'	2.63	1.05
Female students in Technological and Engineering courses cannot work independently compared with males	1.89	.83
Dropout rate of male students in Business and Accounting courses is more than females'	1.73	.73
Male students in Business and Accounting courses cannot work independently compared with females	1.63	.75

These results suggest that HODs consider that female students have the same ability to work independently in technological and engineering courses as their male counterparts (mean < 2.5). Therefore, as indicated on Table 7.6, the agreement (mean > 2.5) by HODs that dropout rate of female students enrolled in technological and engineering programmes was more than that of males is of great interest. Additionally, as noted earlier in Chapter Five, Section 5.5, female students enrolled in engineering programmes had lower interests in the programmes compared with their male counterparts. Therefore, the belief would seem to be that the higher dropout rate of female students is more likely to be due to lesser interest rather than ability.

It was further noted that there was a higher standard deviation of the mean of HODs opinion on whether dropout rate of females enrolled in technological and engineering programmes was more than that of males compared with the other issues. This indicates that HODs had wider range of views on this issue. In particular, about one third (33 percent) and a half (51 percent) of HODs strongly agreed and agreed on this statement respectively. A tenth (10 percent) of HODs disagreed on this statement and very strongly disagreed.

The analysis further indicates that HODs believed that both genders had the ability to pursue business courses. They disagreed that dropout rate of male students enrolled in business and accounting was more than that of females (mean < 2.5). In addition they believed that both student genders can work independently in both business and accounting courses (mean < 2.5).

The results of a one-way analysis of variance found significant differences between the opinions of HODs by location of institutions about whether female students in technological and engineering courses could not work independently compared with males ($F= 4.57$, $df = 2$, $p < 0.05$). HODs from institutions located in cities strongly disagreed (mean, 1.38) with this statement while those from town (mean, 2.06) and rural (mean, 2.08) located institutions disagreed. In summary, HOD opinion about the ability of female students in technological and engineering programmes to work as independently as males depended on the location of the training institution.

Additional investigations by one-way ANOVA revealed that there were no significant differences between HODs by their age, and the department headed on their opinions on the four issues about gender parity in TVET ($p > 0.05$). HODs by these categories had similar opinions on issues concerning gender parity in TVET programmes.

7.6. HODs opinions on measures to enhance gender parity in TVET courses

Eight possible measures to enhance gender parity in TVET were presented to the HODs who were asked to choose four measures from the list they thought would be most likely to improve gender parity in their courses. They were to assign ranks indicating how important the measures were in their opinion. The ranks ranged from four representing most important; to one representing least important measure. The results of the analysis of their responses are summarised in Table 7.7, in descending order of importance according to the HODs.

Table 7.7. HOD's General opinion on possible measures to ensure gender parity in TVET Courses in order of importance

Measures to ensure gender parity in TVET courses	Mean	Std. Deviation
Increase award of bursaries and scholarships to improve gender equity	3.52	1.09
Collaboration of training institutions with careers, guiding and counselling departments in schools	3.43	.99
Undertake promotional activities to popularise TVET programmes	3.25	1.19
Use of role models to encourage enrolment in the programmes	3.05	1.20
Improve the training environment, facilities and equipment to attract both genders	2.97	1.30
Make curriculum flexible and suitable for both genders	2.79	1.30
Development and implementation of institutional gender policies	2.77	1.24
Use of affirmative action in admission	2.31	1.25

HODs believed that increasing bursary awards and scholarships, followed by collaboration between training institutions with careers, guidance and counselling departments in schools; and undertaking promotional activities to popularise TVET programmes were the most important measures. Other measures that were believed to be more important were use of role models to encourage enrolment in the programmes; improve training environment, facilities and equipment to attract both genders and make curriculum flexible and suitable for both genders. Among the suggested measures, the least important was use of affirmative action in admission.

Results of a one-way ANOVA, found that there was significant difference between HODs by the location of their institutions on their opinions on enhancing training institutions collaborations with careers, guidance and counselling departments in schools as a measure to enhance gender parity in TVET programmes ($F = 3.67$, $df = 2$, $p < 0.05$). HODs from institutions located in cities had higher mean (3.93) for their opinion on the measure compared with those from town (mean = 3.07) and rural institutions (mean = 3.5). This means that enhancing of collaborations with careers, guidance and counselling departments in schools as a measure to enhance gender parity in TVET programmes are believed to be more applicable in institutions located in cities compared with those in the other locations. In addition there were significant differences found between HODs by location of institutions in believing that making curriculum flexible and suitable for both genders would achieve better gender parity in technological and engineering programmes ($F = 3.74$, $df = 2$, $p < 0.05$). HODs from institutions in rural location had a lower mean (2.46) compared with those from city (mean 3.47) and town (mean 3.17) in believing that making curriculum flexible and suitable for both genders would achieve better gender parity in technological and engineering programmes.

From the foregoing, the Heads of Department opinions seem to suggest that priority be given to bursary awards and collaboration of training institutions with careers, guidance and counselling departments in schools to enhance gender parity in TVET programmes. However, it would be important that subject teachers who influence student enrolment decisions in TVET courses should be sensitised about the importance of the courses and careers available. As found earlier in Chapter 6ive (Section 6.2.1), science, mathematics and business teachers have influence on the students' decisions to enrol in TVET courses.

When asked other measures they thought could be implemented to assure gender parity in TVET courses, 19 HODs responded to the question and one of them suggested two possible measures. Table 7.8 presents a summary of their responses.

Table 7.8. Analysis of HODs' opinions on other possible measures to enhance gender parity in TVET programmes

Other Suggested Measures	Frequency
There's need for affirmative action in admission, and bursary awards action covering both male/females students	6
Encourage females to take science and mathematics seriously	4
Sensitise parents, teachers, female students and the society on importance of science, technology and engineering	3
Equip and upgrade TVET institutions	3
Assure employability of TVET graduates	2
Encourage females to pursue technological and engineering courses	1
Increase government funding to institutions so that they can reduce fees	1
TOTAL	**20**

The most frequently suggested alternative measure was the need for affirmative action in admission and bursary awards covering both genders. This would ensure that equal opportunities are given to both genders to pursue TVET programmes. HODs suggested that both genders should be awarded bursaries and have lower admission requirements for courses dominated by the respective opposite gender. They suggested that male students enrolled in female dominated fields such as hospitality, secretarial and clothing technology should have their admission requirements in the courses lowered and be awarded bursaries to encourage their increase in enrolment in these courses. They believed that this would ensure that discrimination of male students is avoided in affirmative action policies.

Other important measures suggested by at least three respondents were encouragement of females to take science and mathematics more seriously; sensitisation of parents, teachers, female students and the society on importance of science, technology and engineering; and equipping and upgrading of TVET institutions. There were measures suggested by less than three respondents. These were assurance of employment opportunities to the TVET graduates, improvement of terms of employment for science based careers, equipping of institutions with modern equipment and finally, the need for the Government to increase funding of TVET institutions so that the latter should lower fee charges to the students.

The implication of HODs opinions is that a multi-faceted approach would be required to enhance gender parity in engineering, an approach that was suggested both in the conceptual framework and literature review. It was conceptualised that, this approach could improve female inclusion human capital formation in engineering field.

The following section presents the summary of findings from the analyses of HOD responses on causes of gender disparity in enrolment into technological and engineering programmes, issues concerning gender in TVET programmes and measures to ensure gender parity in TVET programmes.

7.7. Summary of findings from analysis of HOD responses

The foregoing analyses indicate that there were gender disparities in headship of engineering, and business departments in technical training institutes under study. Males dominated in the headship of these departments.

A comparison between HODs opinions and student opinions on causes of gender disparity in technological and engineering programmes found that, on average, both groups agreed that influences from family and other people and interests in the course were the major causes. This was followed by individual objectives in doing the course, student interests in science and mathematics and employment interest. Even though both groups did not believe that culture and TVET system were not barriers to female enrolments in engineering courses, cultural barriers were more likely to be in rural-located institutions compared to the other locations. Compared to other HODs, those from rural-located institutions had weaker belief that cultural influences did not cause gender disparity in enrolment in engineering programmes. Further, both HODs and students held negative stereotype views in regard to employment of female engineers.

It was of interest to find that HODs believed that both male and female students worked independently in engineering and business courses. They also believed that female students had a higher dropout rate in engineering courses compared with their male counterparts. These indicate that the higher dropout rate of females from engineering programmes was likely to have been caused by other factors other than their ability.

With regard to addressing gender disparities in engineering, HODs believed that the most important measures were increasing bursary awards and scholarships, followed by strengthening career guidance in schools; and undertaking popularisation of engineering courses to schools and general public. The use of role models for girls and improving the quality of training were also believed to be important measures. Other measures were encouraging females to take science and mathematics and assurance of their employment in engineering. However, they believed that lowering of admission criteria for girls as an affirmative action discriminated males and thus proposed broadening of this measure to include males interested in female dominated courses.

In the next chapter, enrolment trends in TVET courses will be analysed and described and the effectiveness of the government bursary scheme targeting gender parity in technological and engineering programmes evaluated. This will test the beliefs by HODs about enrolments and dropout rates in TVET programmes.

CHAPTER EIGHT
ENROLMENT TRENDS IN TVET COURSES IN KENYA

8.1. Introduction

In this study, the opinions of students and Heads of Departments were sought on the factors that contribute to gender disparities in technology and engineering courses including enrolment and dropout. The findings can be used in conjunction with trends in enrolment and dropout that will be elaborated in this chapter, to suggest reasons for the trends. In addition, as explained in Chapter Three Section 3.4, a bursary scheme was introduced in 2007 with the aim to enhance gender equity in technology and engineering programmes as well as equity in TVET programmes generally. The scheme targeted female students enrolled in engineering, and all TVET students including those from poor households, HIV/AIDS orphans, and those with special needs (Republic of Kenya, 2005a).

This Chapter presents a detailed analysis of student enrolment data in technological and engineering programmes and business programmes in eight technical training institutes spread across three types of locations in Kenya that is cities, towns and rural areas. As noted in Chapter 4 Section 4.7, the eight were the only institutions that had well maintained and updated enrolment data from 2004 to 2010[24] out of the 16 institutions surveyed.

Differences of student enrolment and dropout in both engineering and business programmes are compared by location, gender and course of study. The results of these analyses are presented in three sections. The first and second sections provide separate analyses of trends of enrolment and dropout in engineering as well as business programmes in TVET institutions. The third section compares the enrolment and dropout trends in engineering with those of business programmes.

[24] This was the most recent data available.

8.2. Trends of enrolment and dropouts in technological and engineering programmes in technical training institutes in Kenya

The eight technical training institutions whose enrolment data were collected and analysed from the Ministry of Education, Science and Technology enrolment records, consisted of two from city locations, two from towns and four from rural locations. Therefore, the data presented a wide perspective of institutional backgrounds in Kenya (See Appendix B). However, while all the eight institutions had complete information on enrolment, only seven of them had complete information on dropouts. Thus, eight were included in enrolment analysis and seven for dropout analysis.

The data from these institutions indicated that most of the female technology and engineering students were enrolled in information technology departments. The data also indicated that enrolments in technology and engineering programmes in town located institutions which were also centres of excellence was mainly in Automotive, Mechanical and Electrical engineering courses. The rest of institutions had most of their technology and engineering students enrolled in information technology courses.

According to the Ministry of Education, Science and Technology records the identification of centres of excellence in technology and engineering took place in 2005 and the classification was based on institutions having relatively better training equipment, facilities, highly qualified teaching staff and conducive learning environments.

8.2.1. Enrolment trends in technological and engineering programmes

The analysis of enrolment data in technological and engineering programmes reveals that there was growth in enrolment in these institutions from 2004 to 2010. The total enrolment in these programmes in eight institutions rose from 1,410 in 2004 to 2,007 in 2010, hence an overall growth of 42 percent (597 students). See Table 8.1 for enrolment analyses for engineering programmes.

Table 8.1. Comparison of trends in enrolment in engineering courses by location and gender

LOCATION	VARIABLES	YEAR 2004	2005	2006	2007	2008	2009	2010
Overall	Female Enrolment	338	354	375	354	350	360	408
	Female Increase %	-	4.73	5.93	-5.60	-1.13	2.86	13.33
	Male enrolment	1072	1198	1367	1371	1347	1447	1599
	Male increase %	-	11.75	14.11	0.29	-1.75	7.42	10.50
	Total enrolment	1410	1552	1742	1725	1697	1807	2007
	Total Increase %		10.07	12.24	-0.98	-1.62	6.48	11.07
	Proportion of Females %	23.83	22.81	21.53	20.52	20.62	19.92	20.33
	Proportion of Males %	76.03	77.19	78.47	79.48	79.38	80.08	79.67
Rural	Female enrolment	7	11	11	21	31	39	56
	Female increase %	-	57.14	0.00	90.91	47.62	25.81	43.59
	Male enrolment	108	182	226	291	328	369	381
	Male increase %	-	68.52	24.18	28.76	12.71	12.50	3.25
	Total	115	193	237	312	359	408	437
	Total increase%	-	67.83	22.80	31.65	15.06	13.65	7.11
Town	Female Enrolment	35	50	78	85	76	106	164
	Female increase %	-	42.86	56.00	8.97	-10.59	39.47	54.72
	Male enrolment	341	354	500	488	493	525	640
	Male increase %	-	3.81	41.24	-2.40	1.02	6.49	21.90
	Total	376	404	578	573	569	631	804
	Total Increase%	-	7.45	43.07	-0.87	-0.70	10.90	27.42
City	Female enrolment	296	293	286	248	243	215	188
	Female increase %	-	-1.01	-2.39	-13.29	-2.02	-11.52	-12.56
	Male enrolment	623	662	641	592	526	553	578
	Male increase %	-	6.26	-3.17	-7.64	-11.15	5.13	4.52
	Total	919	955	927	840	769	768	766
	Total Increase %	-	3.92	-2.93	-9.39	-8.45	-0.13	-0.26

The highest percentage increase in enrolment in technological and engineering programmes was witnessed in 2006 (12 percent) while the lowest was in 2008 (-2 percent). The enrolments in these programmes increased in 2009 and 2010. When analysing by gender, it was found that both male and female students recorded the lowest increase in enrolment in 2007 and 2008 compared with the other years.

As will be seen in the other sections of this Chapter, lower proportions of student enrolment increase and relatively higher dropout trends were consistently found in 2008 for both engineering and business students which in all likelihood was a result of post-election violence witnessed in the year. A study on the effect of inter-tribal post-election violence conflict trauma on academic performance among secondary school students in Mt. Elgon district in Kenya, found that 98 percent of 90 students sampled registered a drop in examination performance and girls were more likely to drop out from schools compared with boys (Nasongo and Muola, 2011). Further, an analysis of the post-election conflict with focus on the internal and global responses to Internally Displaced Persons found that the violence disrupted the education of students as some schools and colleges were closed (Atanda and Iyi, 2011).

As indicated in Table 8.1 above as well as Figure 8.1 below, male students dominated the enrolments in all years. In 2004 and 2010, males comprised 76 percent and 80 percent of the total enrolments respectively. The proportion of female enrolment dropped from 24 percent in 2004 to 20 percent in 2010. Thus, the government bursary scheme that was implemented from 2007 had not achieved the goal of enhancing gender parity in enrolment in technological and engineering programmes. See Figure 8.1 below.

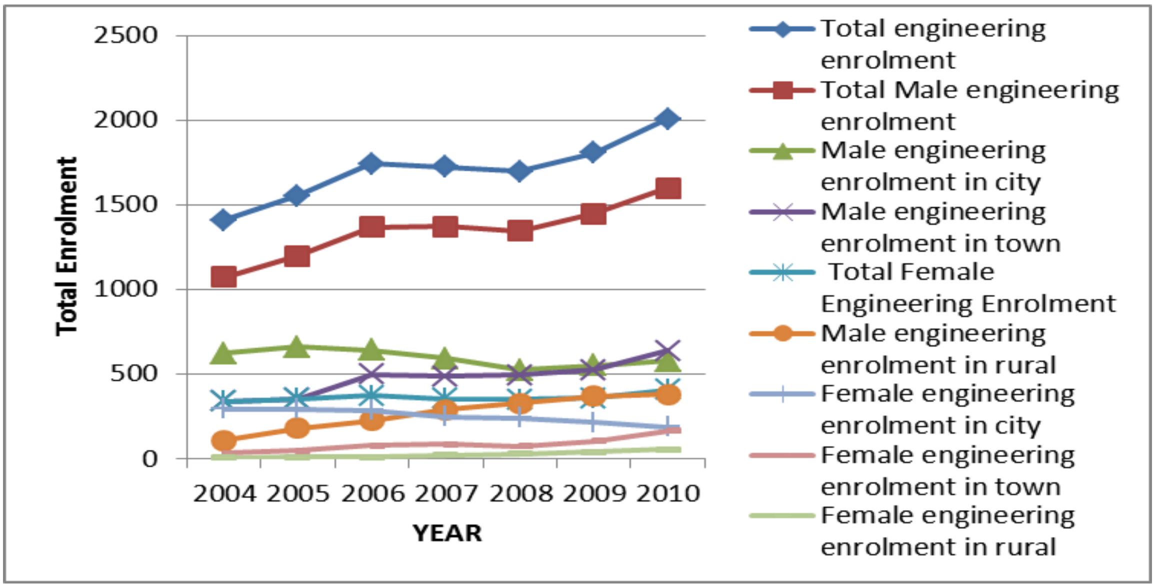

Figure 8.1. Comparison of trends in enrolment in engineering courses by location and gender

Further analysis found that the enrolment of females in technological and engineering programmes rose from 338 to 408 in 2004 and 2010 respectively. This indicates an increase of 70 students (21 percent) of female enrolment for a seven year period. On the other hand, males' enrolment increased from 1072 in 2004 to 1599 in 2010 indicating an increase of 527 students (49 percent). Therefore, males' percentage increase in enrolment in engineering programmes over the seven year period was higher compared with that of females. This finding is consistent with what was found in Chapter Six and Chapter Seven; the liturature review and proposal made in the conceptual framework of the study that compared with females, males were more likely to be enrolled in engineering courses.

When analysing the trends of enrolment in technological and engineering programmes by the location of institutions it was found that there was growth in enrolment in rural and town institutions and a decrease in enrolment in city institutions from 2004 to 2010. During this period, enrolment in technological and engineering programmes in rural areas and towns increased by 280 percent (322 students) and 114 percent (428 students) respectively while that of city institutions decreased by 17 percent (153 students).

When asked the reasons for the decrease in enrolment trends, one of the principals of technical training institutes located in a city cited competition from higher colleges and late recruitment of students[25]. In the city, there are other higher learning institutions offering similar programmes to technical training institutes[26].

The increase in numbers of students in town institutions was higher compared with institutions in other locations. Figure 8.1 and Table 8.1 above indicate that there an increase for both male and females enrolled in technology and engineering between 2007 and 2010 when the bursary was in force. However, this was different from city and town located institutions even though students in these institutions also benefitted from the bursary scheme. Both institutions located in towns had been upgraded to centres of excellence in technological and engineering programmes and also were in the process of being upgraded to national polytechnic status. Figure 8.1 also indicates that there was less

[25] The principals reported that some of technical training institutes located in city recruited students in January a year after the release of results of the Kenya Certificate of Secondary Education (KCSE) while other institutions in town and rural locations recruit either in May or September yearly. The KCSE is the qualification required for entry into diploma programmes and the results are released every February.

[26] The higher level colleges located in Nairobi city where the two technical training institutes in this study were located are the Kenya Polytechnic University College which was upgraded to its current status in 2007 and the Kenya Technical Teachers College. Before upgrading, the Kenya Polytechnic was the largest and oldest national polytechnic in Kenya and offering same programmes as those of technical training institutes which were retained after upgrading. In addition, the Kenya Technical Teachers College which is located in the city, offer similar programmes as technical training institutes in addition to its core mandate of training technical teachers hence competing in recruitment of students.

increase in technology and engineering enrolments in town located institutions between 2006 and 2007 even though they were centres of excellence. Thus, the higher increase in engineering enrolments in these institutions between 2008 and 2010 could be more likely due to a combination of both availability of a bursary and their status as centres of excellence. Students were more likely to give priority to enrolling in centres of excellence which had better provision of human resources, training equipment, facilities and learning environment compared with other institutions as cited earlier.

This finding is reinforced by the analysis of enrolment trends of Kaiboi technical training institute, which is in a rural location and had been upgraded to be a centre of excellence in engineering. This institution had a relatively higher increase in student enrolment (196) in technological and engineering programmes between 2004 and 2010 compared with Ol'lessos (84), Masai (33) and Mathenge (9) technical training institutes which were all in rural locations. This finding validates the opinion of Head of Departments in Chapter Seven, Section 7.6 that improvement of teaching environment, facilities and equipment and provision of bursaries and scholarship could enhance female enrolment in engineering. Also, in Chapter Six, Section 6.6.10 and 6.7, availability of a bursary and quality of training were found to be significant predictors of engineering enrolment. The implication of these findings is in line with the suggestions made in the conceptual framework of this study in Chapter Three Section 3.7 and in the literature review in Chapter Three Section 3.6 that addressing gender disparities in engineering would require acombination of different measures. This has the potential of enhancing the inclusion of females in human capital formation in engineering fields.

Further analyses of enrolment in technological and engineering programmes by gender by location of institutions found that male students dominated the enrolments in all institutions in all locations during the seven year period under study. This finding reflects that in Chapter Five, Section 5.2, and Chapter Six, Section 6.6.1 that compared to females, males were more likely to be enrolled in engineering.

The proportions of female enrolments in technological and engineering programmes was consistently lower in rural-located institutions from 2004 to 2010, compared with those of town and city-located institutions during the same period of time. This could be as a result of stronger cultural influences in rural locations compared with those of the other locations such as low value placed on the education of girls, early marriages, female domestic roles and gender stereotyping of female engineering. As noted in Chapter Three, Sections 3.5.1 and 3.5.6, research undertaken in arid districts in Kenya found that female education is less valued compared with males (Ruto, et al, 2009) and that girls spend more time in domestic roles at expense of education (World Bank, 2005). This finding reinforces the opinions of HODs in Chapter Seven section 7.3 that cultural stereotyping as the cause of gender disparity in technological and engineering programmes was more likely to be found in rural-located institutions compared with institutions in town and city locations. This is further reinforced by the fact that one of the institutions in a rural location did not enrol any female students in engineering programmes during the seven-year period. This was in line with the suggestion made in the conceptual framework of the study in Chapter Three Section 3.7, that cultural influences could cause gender disparities in engineering thus limiting the inclusion of females in human capital formation in this field. The implication of this finding in relation to equity theory as conceptualised in this study is that culture in rural locations could have presented unfair experiences with engineering and also caused females to expect unfair returns from these fields.

8.2.2. Trends in dropout in technological and engineering programmes

Analysis of trends in dropout indicates that the number of students who dropped out of technological and engineering programmes decreased from 2004 to 2010. See Table 8.2 for summary of analysis of all dropout trends.

Table 8.2 Comparison of dropout in engineering by location and gender

		YEAR						
LOCATION	**VARIABLES**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**
Overall	**Total dropout**	798	746	711	609	667	583	576
	% dropout	56.60	48.07	40.82	35.30	39.35	32.26	28.70
	Female	263	212	206	123	189	158	124
	% dropout	79.22	61.10	56.13	34.75	54.00	43.89	30.39
	Male	535	534	505	486	478	425	452
	% dropout	53.66	49.31	41.53	35.45	35.49	29.37	28.26
Rural	**Total percentage**	99	97.8	82.56	87.77	79.63	69.22	65.5
	Female percentage	100	100	98.29	96.86	97.31	95.52	94.59
	Male percentage	98	96	71.07	82.29	75.58	65.74	61.03
Town	**Total percentage**	2.66	1.73	3.63	2.64	10.2	2.42	3.86
	Female percentage	8.57	8	6.41	5.88	22.64	2.64	6.1
	Male percentage	2.05	0.85	3.2	1.84	4.67	2.29	3.28
City	**Total percentage**	82.1	70.3	70.01	69.29	74.77	58.88	65.93
	Female percentage	87.5	75.5	74.05	74.19	74.07	50.7	58.51
	Male percentage	79.5	69.6	69.93	64.86	75.1	67.45	68.34

In 2004 there were 798 students (57 percent of the total) who dropped out of technological and engineering programmes. This dropout was higher compared with those who dropped out of these programmes (576 students, being 29 percent of the total) in 2010. Perhaps this could be attributed to implementation of policies on TVET reforms.

The analysis of the trends in dropout by gender indicated that, with the exception of the year 2007, the dropout rate of female students in technological and engineering programmes was higher compared with males. This finding is both in line with HOD responses (See Chapter Seven Section 7.5) that they believed the dropout rate of female students in these programmes was higher than those of males and the suggestions made in the conceptual framework of the study.See figure 8.2 below.

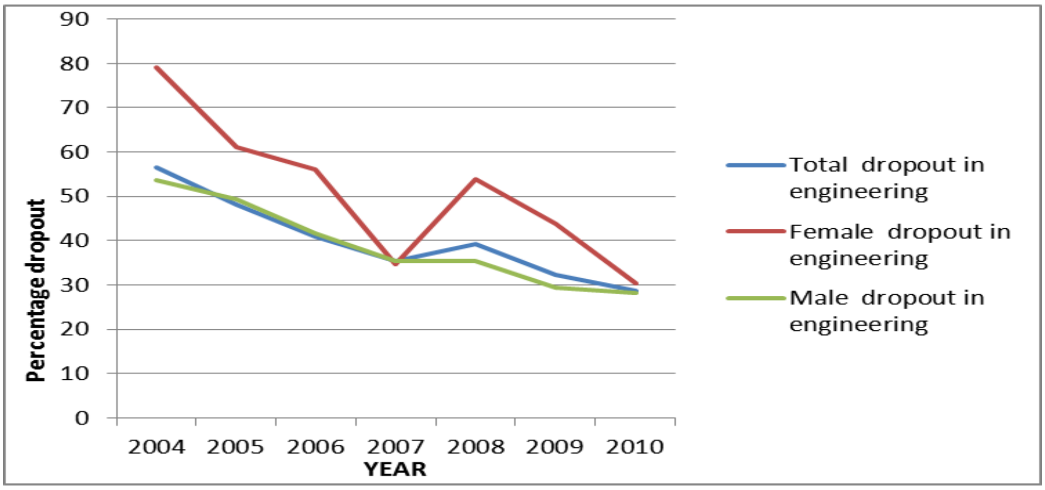

Figure 8.2. Proportion of engineering dropout by gender

It was of interest to note that the percentage dropout for females in technological and engineering programmes improved from 79 percent in 2004 to 30 percent in 2010. This improvement, especially in the latter years, could be attributed to the bursary scheme implemented in 2007 targeting female students enrolled in these programmes. The scheme seemed to have improved the retention of female students in technological and engineering programmes. As observed in Section 8.2.1 there was a general trend in high dropout of students especially females in 2008.

When analysing dropout rate in technological and engineering programmes by the location of institutions, it was found that there was a higher dropout rate in technological and engineering programmes in rural areas compared with those in town and city-located institutions. In addition, institutions in rural locations had the highest female dropout rate in technological and engineering programmes between 2004 and 2010 compared with city and town locations during the period. This could be due to cultural influences as cited earlier. Trends in city and town-located institutions indicate that dropout rates in technological and engineering programmes for females was higher compared with that of males in most of the years though lower or almost similar in some years. See Figure 8.3 below.

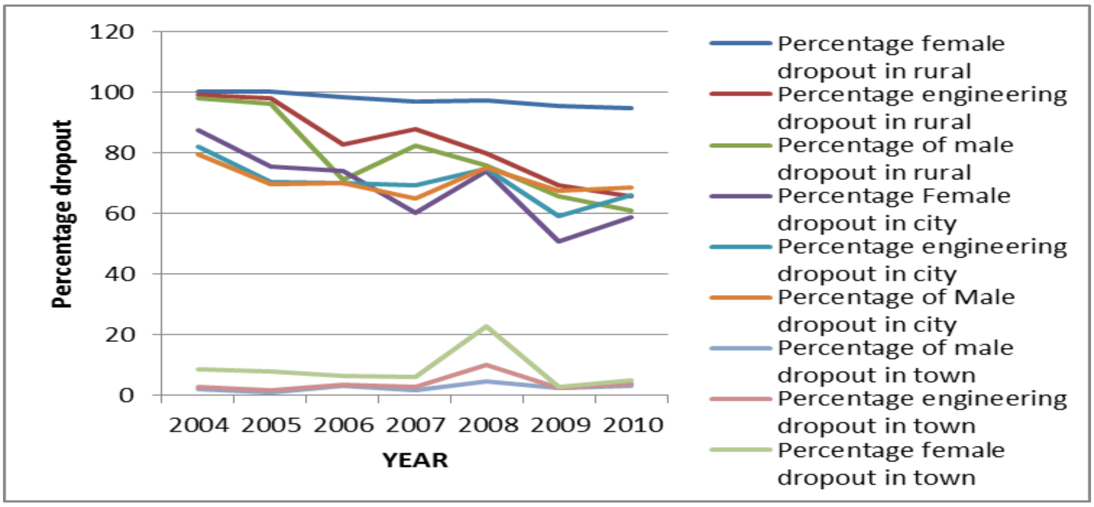

Figure 8.3. Comparison of proportion of student dropout of engineering courses by gender by location of institution

The lowest dropout rates were in town institutions, which was likely due to their new status as centres of excellence in technological and engineering programmes as noted earlier in Section 8.2.1. Low pass rates in examinations was cited by the principals to be one of the major causes of dropout in TVET institutions. When asked the reasons for dropout, six principals cited examination failures and low quality of training as a result of inadequate equipment, facilities and qualified staff, five cited fees including inconsistencies and delays of disbursement of bursaries by the Government, two cited drug abuse, early marriages and pregnancies. An interesting problem cited by the principals was that some of the engineering teachers in rural and city institutions held diploma qualifications yet they were teaching at the same level. A study on training needs assessment of national polytechnic lecturers in Kenya drawing sample from two large national polytechnics found that 16.7 percent of the lecturers in engineering department were teaching courses that were at same level of their highest academic qualifications (Opwora, 2006).

8.3. Trends of enrolment in business programmes in technical training institutes in Kenya

8.3.1. Trends of enrolment in business programmes

There was an increase in enrolment in business programmes from 832 students in 2004 to 1734 students in 2010 thus indicating about a 108 percent increase (See Table 8.3).

Table 8.3. Comparison of trends in enrolment in business courses by location and gender

LOCATION	VARIABLES	YEAR						
		2004	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**
Overall	Female Enrolment	403	416	570	746	912	1020	952
	Female Increase %	-	3.23	37.02	30.88	22.25	11.84	-6.67
	Male enrolment	429	431	529	646	735	784	782
	Male increase %	-	0.47	22.74	22.12	13.78	6.67	-0.26
	Total enrolment	832	847	1099	1392	1647	1804	1734
	Total Increase %		1.80	29.75	26.66	18.32	9.53	-3.88
	Proportion of Females %	48.44	49.11	51.87	53.59	55.37	56.54	54.90
	Proportion of Males %	51.56	50.89	48.13	46.41	44.63	43.46	45.10
Rural	Female enrolment	39	75	121	192	258	289	272
	Female increase %		92.31	61.33	58.68	34.38	12.02	-5.88
	Male enrolment	33	71	117	159	186	223	259
	Male increase %		115.15	64.79	35.9	16.98	19.89	16.14
	Total	72	146	238	351	444	512	531
	Total increase%		102.78	63.01	47.48	26.50	15.32	3.71
Town	Female Enrolment	165	112	142	174	201	234	198
	Female increase %		-32.12	26.79	22.54	15.52	16.42	-15.38
	Male enrolment	159	119	142	168	187	198	193
	Male increase %		-25.16	19.33	18.31	11.31	5.88	-2.53
	Total	324	231	284	342	388	432	391
	Total Increase%		-28.70	22.94	20.42	13.45	11.34	-9.49
City	Female enrolment	199	229	307	380	453	497	482
	Female increase %		15.08	34.06	23.78	19.21	9.71	-3.02
	Male enrolment	237	241	270	319	362	363	330
	Male increase %		1.69	12.03	18.15	13.48	0.28	-9.09
	Total	436	470	577	699	815	860	812
	Total Increase %		7.80	22.77	21.14	16.60	5.52	-5.58

It was also noted that, although there was a steady increase in enrolments from 2004 to 2009, there was a drop in enrolments in 2010. The percentage increase in enrolment rose to 30 percent in 2006 but dropped to 27 percent in 2007 and further declined to minus 4 percent in 2010. It may appear that while the drop in percentage increase in enrolment in business programmes in 2007 and 2008 may have been caused by the political instability as explained earlier in Section 8.2.1, the previous growth trend did not recover. The continued drop in percentage increase in business courses after the election year could be potentially due to the government's policies, which focused on restoring the core mandate of technical training institutions which was to provide technological and engineering skills to the youth for economic development. Business programmes were not part of the core mandate of these institutions, but were later introduced to provide entrepreneurial skills required for self-employment as per the recommendations of *the Kamunge Report of 1988* (Republic of Kenya, 1988).

Further analysis of the enrolment trends indicates that there was slightly higher number of male than female students enrolled in business 2004 and 2005. However, the trend reversed from 2006 to 2010 where female students maintained significantly higher proportions of enrolments in business programmes compared with males. See Figure 8.4 and Table 8.3.

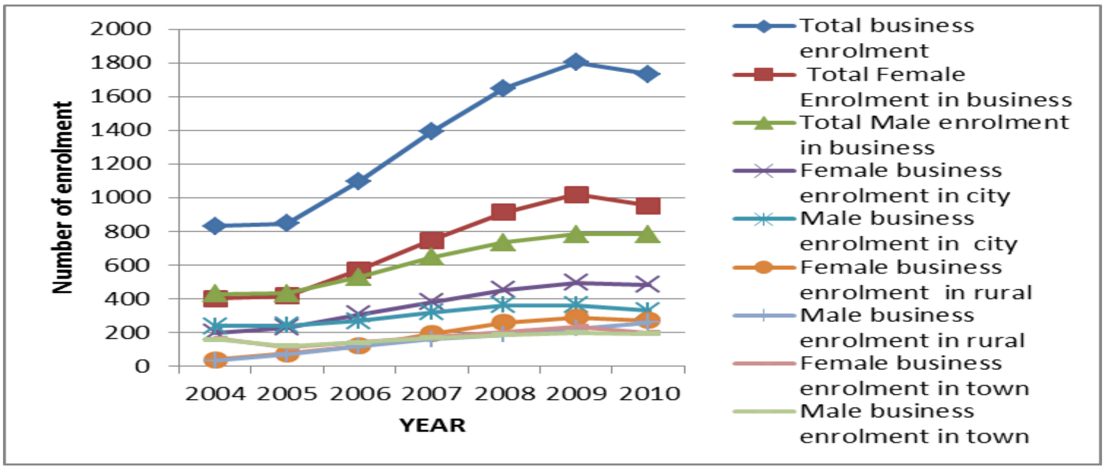

Figure 8.4. Comparison of trends in enrolment in business courses by location and gender

The highest increase in proportions of enrolment in business programmes for both genders was in 2006 but dropped from 2007 to 2010 as explained above. Both genders recorded a decrease in enrolment in business programmes in 2010.

The results of the analysis of business enrolments by location of institutions reveal that there was increase in enrolment in business programmes between 2004 and 2010 in all locations. Institutions in rural locations recorded relatively higher proportions of increase in enrolment in business programmes in the seven-year period compared with the institutions in town and city locations even though the rate of their increase dropped. The higher increase in enrolment in business programmes in rural-located institutions is possibly due to their lower capacities to offer technological and engineering programmes and hence opting to invest more in business programmes which do not require the same expensive equipment as engineering.

It was found that town-located-institutions had the lowest increase of number of students enrolled in business programmes (6 students, less than one percent) between 2004 and 2010 compared with those from city (376 students, 522 percent) and rural (459 students, 105 percent) located institutions. It was noted from Figure 8.4 and Table 8.3 above, that institutions in town location had less emphasis on business rather than engineering programmes compared to other institutions. Perhaps having been selected as centres of excellence in technological and engineering programmes, the town institutions continued with a greater emphasis on engineering programmes.

It was noted that institutions in city and town locations had their highest percentage increase in business enrolment in 2006 and this dropped during 2007 and 2010 period. In addition, the percentage increase in business in rural-located institutions indicates a higher drop in increase in enrolment in 2008 and the trend persisted until 2010. The government policies geared towards the restoration of the core mandate of the training institutions of prioritising technological and engineering programmes, referred to above, may also have contributed to the continuous drop in percentage increase for 2009 and 2010 in business including the drop of enrolment in rural-located institutions.

When analysing the trends in enrolments in business programmes by gender by location, it was found that females dominated enrolment proportions in rural and town-located institutions during the seven-year period. However, the trend in city-located institutions indicates that the proportions of males were higher than that of females in the first two years. This trend changed in the latter five years where females' proportion of enrolments was higher compared with that of males. By 2010 female students dominated enrolments in business courses in all locations.

8.3.2. Trends in dropout in business programmes

An analysis of trends in dropout rates in business programmes reveal that there was an increase in the number of dropouts from 2004 (243 students, 29 percent) to 2009 (763 students, 42 percent). In 2010, there was a decrease in the number of students who dropped out of business programmes (37.02 percent). When comparing by proportions of dropout it was found that the lowest was in 2004. There was growth in proportions of dropouts in 2005 and 2006. The largest number of dropout was in 2008.However, the latter years witnessed a decline in the dropout trends. (Refer to Table 8.4).

Table 8.4 Comparison of dropout in business by location and gender

LOCATION	VARIABLES	2004	2005	2006	2007	2008	2009	2010
Overall	Total dropout	250	407	538	537	708	795	666
	% dropout	30.05	48.05	48.95	43.2	42.99	44.07	38.41
	Female	79	194	287	307	413	431	377
	% dropout	29.21	46.64	50.41	41.2	45.26	42.29	39.55
	Male	171	213	251	230	295	364	389
	% dropout	39.81	49.5	47.86	45.75	40.14	46.37	37.02
Rural	Total percentage	70.00	59.14	58.94	44.23	22.85	39.38	28.85
	Female percentage	62.07	56.86	58.02	40.14	17.5	25	15.76
	Male percentage	80.95	61.9	60	49.57	30	57.06	41.08
Town	Total percentage	3.09	6.93	8.45	5.85	3.09	7.87	3.84
	Female percentage	3.03	7.14	8.45	8.05	3.98	9.83	3.54
	Male percentage	3.14	6.72	8.45	3.57	2.14	5.56	4.15
City	Total percentage	45.41	68.94	71.58	70.82	72.52	67.09	64.29
	Female percentage	27.14	69.43	72.96	71.84	71.08	69.62	67.63
	Male percentage	60.76	68.46	70	69.59	74.31	63.64	59.39

There was a higher percentage of female students compared with male students who dropped out of business programmes in 2006, 2008 and 2010. On the other hand, a higher percentage of male students compared with female students dropped out of business programmes in 2004, 2007 and 2009. See Figure 8.5.

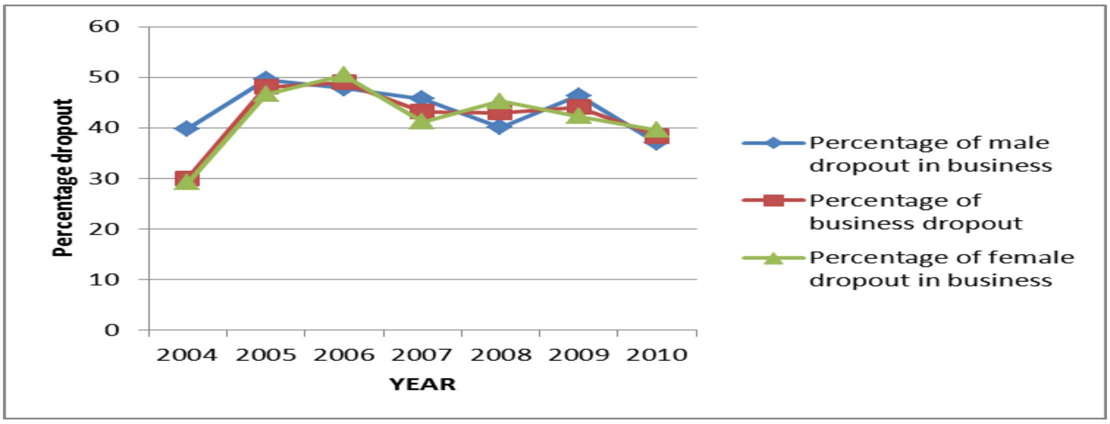

Figure 8.5. Proportion of engineering dropout by gender

In 2005 the difference in dropout between male and female students was negligible. The result indicates no relationship between the proportions of male and female students who dropped out of business programmes during this period. There was no apparent reason for the differences in dropout rates between females and males during the years under study. This finding reinforces the results of analysis of opinions of HODs in Chapter Seven, section 7.3 where they voiced the opinion that there were no differences in dropouts of male and female students in business programmes.

When analysing by location of institutions, it was found that there was an increase in number of students who dropped out of business programmes between 2004 and 2009 in all locations. However, there was a decline in number of student dropout in all locations in 2010.

It was further found that institutions located in towns had lower proportions of dropouts in business programmes compared with institutions in city and rural locations in all the seven years under study (see Figure 8.6). As noted earlier, having been earmarked for upgrading to the national polytechnic status, town institutions may have attracted and recruited the best students compared with the other institutions in city and rural locations. The perception of the city principals was that city-located institutions were disadvantaged by the late recruitment of students compared with those from institutions in other locations. Late recruitment possibly meant drawing from a pool of lower calibre students.

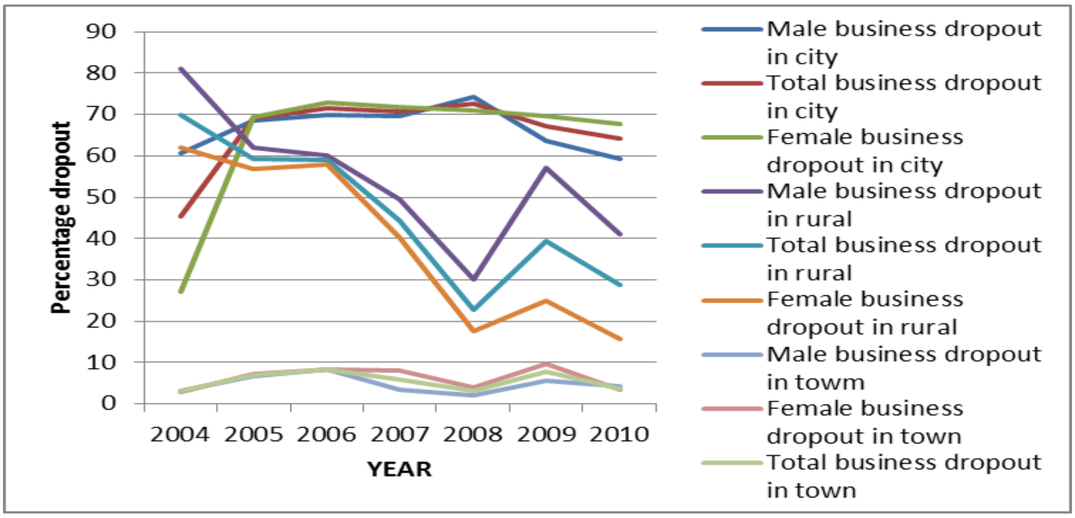

Figure 8.6 Comparison of proportion of dropout by course by gender

In comparing the proportions of dropout between males and females in the same locations, it was found that females in rural located institutions had lower proportions of dropout in business compared with their male counterparts.

It was of interest to note that, in both city institutions, the proportions of male compared with female dropouts in business programmes were higher in some years and lower in others therefore indicating no differences in these dropouts. The differences between the proportion of males and female dropout in town located institutions were not significant.

8.4. Comparison between trends in enrolments and dropouts by course of study

8.4.1. Comparison of trends in enrolment by course of study

Comparison of trends in enrolment in technological and engineering programmes with those of business programmes indicated that there was higher number of students enrolled in technological and engineering programmes in all seven years of investigations compared with that of business programmes in the same period. (Refer to Figure 8.7).

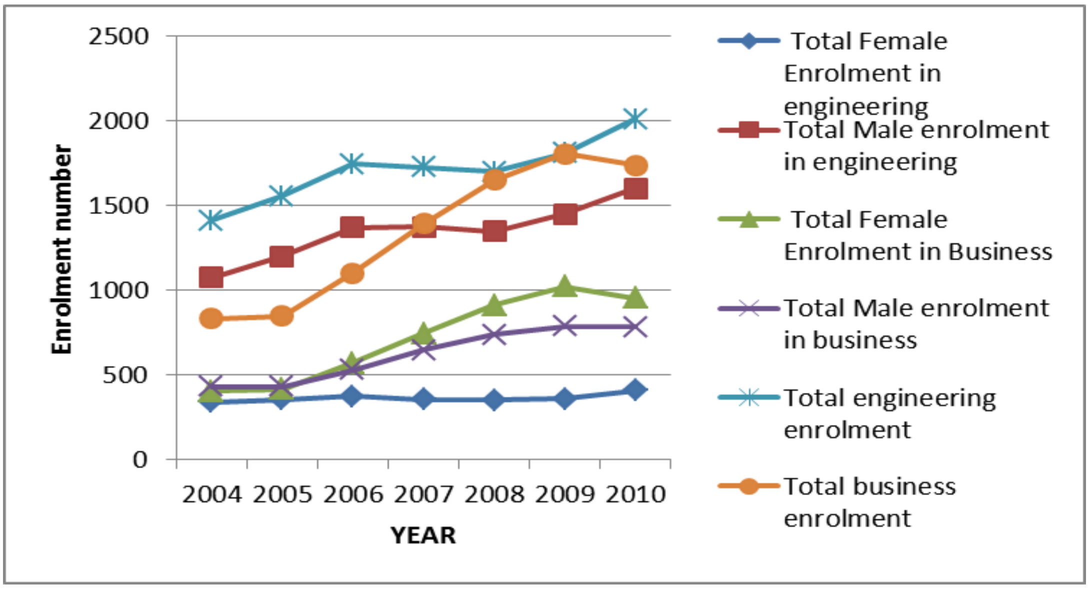

Figure 8.7 Comparison of enrolment by course by gender

The results also indicate that there were higher numbers of female students enrolled in business programmes compared with their counterparts in technological and engineering programmes in more recent years. It was also noted that a consistently higher number of males were enrolled in technological and engineering programmes compared with those enrolled in business programmes. This finding reinforces that of the analysis of student interests in and attitudes towards programmes (Chapter Five, Section 5.2) finding that male students had higher interests in technological and engineering programmes compared with their female counterparts. In addition, a higher proportion of female compared with male students indicated that business courses were more useful for their future career, personal development, economic and social development (Chapter Five, Section 5.4).

Further comparison of enrolments by programme of study by location indicate that enrolments in technological and engineering programmes were higher than those of business programmes from 2004 to 2006 in rural and from 2004 to 2007 in city locations, but were lower from 2008 to 2010. See figure 8.8.

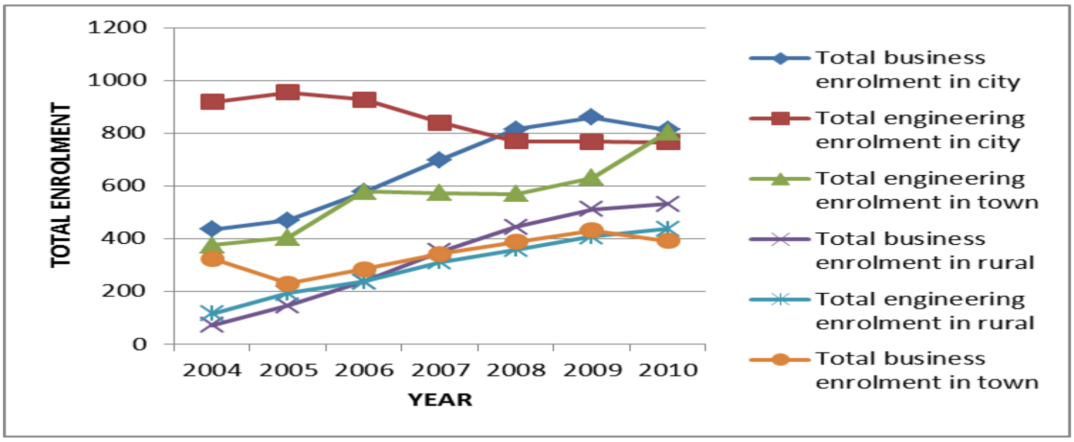

Figure 8.8. Comparison of enrolment by course by institution location

On the other hand, institutions in town locations maintained higher levels of enrolments in technological and engineering programmes compared with the enrolments in business programmes for the reasons given above.

There were higher percentage increases in male enrolments in business programmes compared with that of technological and engineering programmes in institutions in rural locations in all seven years. However, in institutions located in towns and cities, the percentage increase in male enrolments in technological and engineering programmes was higher in some years and lower in others compared with business programmes during this period. These indicate that there was no significant difference in percentage increase in male enrolments between engineering programmes and business programmes in city and town institutions.

8.4.2. Comparison of trends in dropouts by course of study

Further comparison of dropout rate by programme of study indicated that there were higher proportions of dropouts in technological and engineering programmes in the earlier years (2004 to 2006) compared with those of business students during the same period. However, proportions of dropouts in technological and engineering programmes were lower in the latter years (2007 to 2010) compared with those of their business counterparts. Perhaps these could be attributed to influence of government policies aimed at restoration of mandates of technical training institutions that were implemented during the

2007 to 2010 with more emphasis of improving the quality, relevance and access to technological and engineering programmes compared and a lack of emphasis on business programmes.

The proportions of female dropout in engineering programmes were found to be higher compared with the proportion of dropouts in business programmes in all years apart from 2007 and 2010. However, the trends indicated a significant improvement in dropout of female students in technological and engineering programmes during the seven-year period.

From 2005 to 2010, the proportions of males who dropped out of technological engineering programmes were lower compared with business programmes. This was consistent with the results of the analyses of student interest in and attitudes towards engineering areas, occupations and secondary school subjects that found that males were more interested in technological and engineering areas, related occupations and enabling subjects compared with business areas. In addition, females generally were found to have had a greater interest in business occupations compared with technological and engineering occupations.

When comparing dropout by programme by location, it was found that student dropout in technological and engineering programmes was higher than that in business programmes in institutions located in rural and town locations in most of the years. In contrast, there were lower dropout rates in technological and engineering programmes compared with those in business programmes in institutions located in towns for a period of five years. Dropouts in technological and engineering programmes were higher compared with those of business programmes in institutions located in towns in 2008. However, in 2010, the dropouts in both programmes in town institutions were almost the same. Town-located institutions had lower dropout trends in technological and engineering programmes than in business programmes in most of the years compared with rural and city-located institutions.

Further comparison of dropout by gender found that there were higher dropouts of female students in technological and engineering programmes compared with business programmes in institutions in rural locations. The same trend was noted in city locations in four years (2004, 2005, 2007 and 2008). However, in the two latest years (2009 and 2010) the proportion of female dropouts in technological and engineering programmes was lower compared with that in business in institutions in city locations. See Figure 8.9.

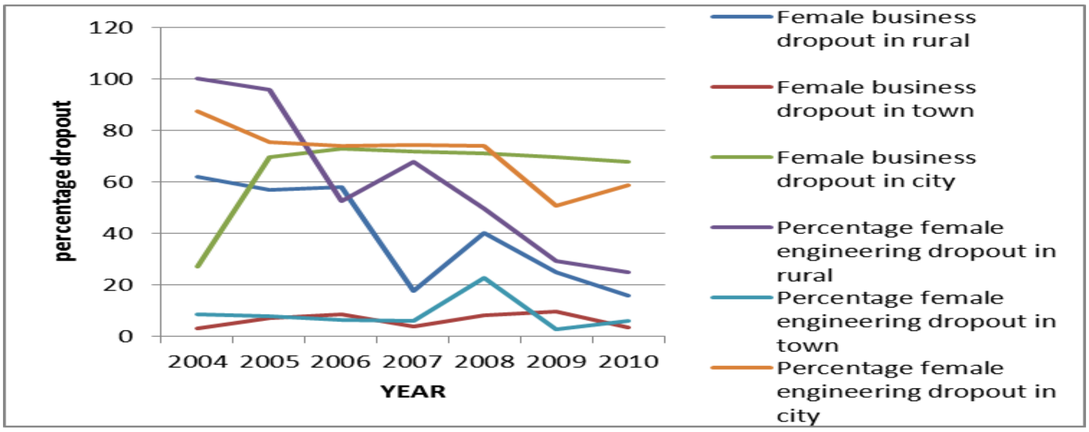

Figure 8.9. Comparison of proportions of dropout by course by gender

The dropout of female students from engineering programmes compared to business programmes in town locations was higher in some years and lower in others. These trends do not indicate significant differences between city and town-located institutions. However, in rural locations females were significantly more likely to drop out of technological and engineering programmes than business programmes.

It was found that a higher proportion of males dropped out from technological and engineering programmes compared with business programmes in rural locations. See Figure 8.10 below.

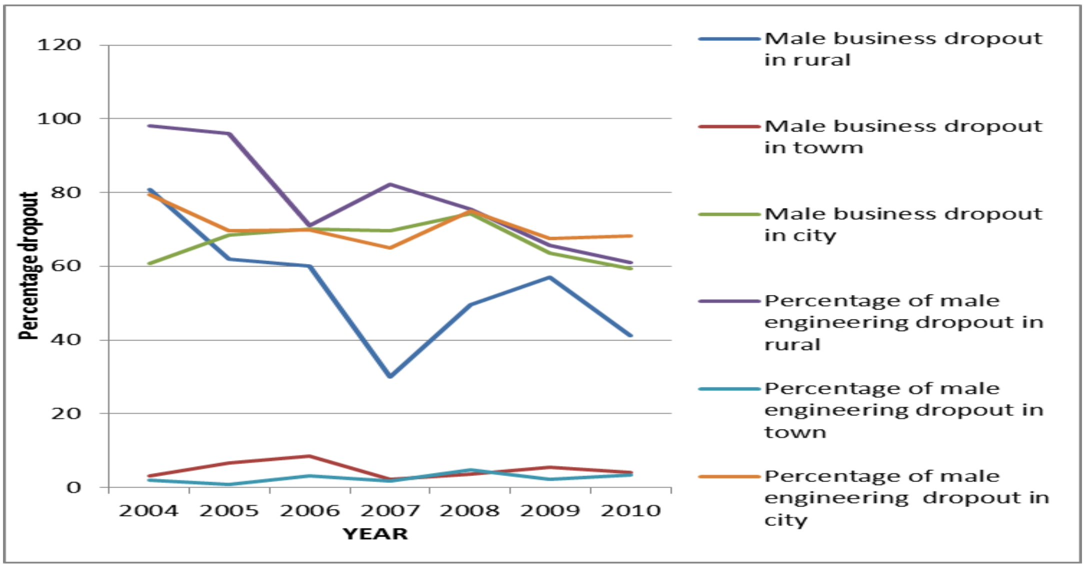

Figure 8.10. Comparison of proportions of dropout by course by gender

Further, the dropout of males from technological and engineering programmes in city location was higher compared with business programmes in all years except 2007 and 2010. However, town-located institutions recorded a lower percentage dropout of male students from technological and engineering programmes compared with those in business programmes from 2004 to 2009. This indicates that males were more likely to dropout from technological and engineering programmes compared with business programmes in city and rural-located institutions. However, they were more likely to be retained in technological and engineering programmes compared with business programmes in town-located institutions. As discussed in Section 8.2, the town-located institutions in this study were also centres of excellence in technology and engineering and had relatively high qualified staff, better equipment and facilities and were more likely to have better training quality compared to the other institutions.

8.5. Summary of findings of analyses of trends in enrolment and dropouts in technological, engineering and business programmes

Results of analysis of enrolment data in technical training institutes indicate that although over time there was an increase in engineering enrolment for both genders; male students dominated the enrolments in all the years, with the proportion of female enrolment dropping from 24 percent in 2004 to 20 percent in 2010. It was found that the increase of female enrolment in engineering was higher during the years when the bursary scheme was in place compared to the previous years.

Notably, the proportion of female enrolments in engineering programmes was consistently lower with higher dropout rate in rural-located institutions compared with other institutions. As was suggested above, this could have resulted from stronger cultural influences such as less value of girls' education, gender domestic roles, and gender engineering stereotyping in rural locations compared with city and town locations.

An important finding is that institutions which had been upgraded to the centres of excellence status in engineering fields had higher proportions of engineering enrolment generally, and higher proportions of females in these courses compared with other institutions. Moreover, the dropout rate of students in these courses was lower both generally and by gender compared with other institutions. However, the proportion of business students in these institutions was lower compared with their engineering counterparts and also compared with the other institutions. The centres of excellent status may have given these institutions the advantage of recruiting the best students and were provided with adequate training facilities, equipment and relatively higher qualified staff. In addition, they had more focus on engineering programmes compared with business programmes. This could explain the maintenance of a lower percentage increase in enrolment in business courses.

This finding confirms the results illustrated in Chapter Six (Sections 6.6.10, 6.6.11 and 6.7) that quality of training was one of the six most important significant predictors of engineering enrolment. Also, in Chapter Seven, Section 7.6, Head of Departments stressed the need of upgrading institutions equipment, facilities and improving training environment as important measures to enhance gender parity in engineering courses.

It was found that the dropout of female students in engineering programmes was generally higher compared to that of males confirming the beliefs of HODs as found previously. However, it had decreased during the period the bursary scheme was in place indicating that the scheme had a positive influence on retention of female students in these programmes confirming the beliefs of HODs that bursary could improve gender parity in engineering.

Finally, it was found that female students had shown a relatively higher level of dropout in engineering programmes compared with business courses while males had higher dropout in business programmes compared with engineering programmes. The differences between the two genders in their interests in the courses could be one of the possible reasons that could explain the differences in their dropout rates. In Chapter Five, Section 5.2, females were found to have had lesser interests in technological and engineering programmes compared with their male counterparts.

The next chapter draws together the findings from chapter five to eight.

CHAPTER NINE
FINDINGS

9.1. Introduction

Technical and Vocational Education and Training (TVET) has become one of the key policy priorities in education and training in Africa (McGrath, 2011, Bennell, 2003). In Kenya, key TVET areas including science, technology, engineering and innovation have been identified as major platforms in facilitating the achievement of the country's vision of becoming a prosperous and industrial nation by the year 2030. Thus, as the major economic driver, this sector is expected to generate a wide range of job opportunities. However, there is serious gender imbalance in enrolment in engineering programmes offered in TVET institutions with the proportion of female students being much lower compared with males. The low participation of women who comprise over 50 percent of the national population is a major concern since it will not only deny them job opportunities but also make the achievement of the *Vision 2030* difficult. Studies exploring the difference in enrolment by gender in Kenya focus on university education and secondary education but there is no study looking into the TVET level. Since it is found that factors influencing gender disparities differ by education level, country and region, studies undertaken in different contexts cannot be generalised (UNESCO 2011). Therefore, the absence of enrolment information at TVET level is a challenge for policy formulation and review.

The purpose of this study therefore was to address the gap by analysing the factors influencing gender enrolment in technological and engineering courses, their differences in influences by gender and course of study and their relative importance. Further, the study suggested appropriate measures to move towards gender parity in engineering courses as well as evaluating the measures put in place by the Government. The study compared enrolments in two courses of interest, that is engineering, and business courses hereafter referred to as "the two courses" or "both courses". Business course was included so that problems identified in both courses could be attributed to TVET and other problems being recognised as specific to engineering.

This chapter presents the findings based on the opinions of 999 diploma students enrolled in the two courses and 64 Heads of Departments (HODs) in 16 technical training institutions in Kenya collected using two sets of questionnaires. Further, included in the findings are the results of analysis of enrolment data in TVET institutions.

The chapter sections are aligned with the five research questions underpinning this study as outlined below:

1. Are there differences in the factors attracting students to the two courses, in general and by gender?
2. What are the perceived barriers to female enrolment in traditional technological and engineering courses?
3. What is the relative importance of factors that influence female enrolment in engineering courses?
4. What are the appropriate measures that can be implemented to enhance gender parity in technological and engineering courses?
5. Has the government's bursary scheme improved retention of female students in traditional engineering and technological courses?

The following ten areas of interest are identified and discussed in the first three sections of this chapter in relation to course selection.

1. student background (including their home location, social class, gender, age, institution location, course enrolled in and year of study),
2. student interests and attitudes towards secondary school subjects,
3. student interests in tasks in areas (including engineering area, business area and general area),
4. student interests in engineering and business course,
5. student employment interests,
6. influence from media and internet (information channel),
7. influence from family and other people,

8. student objective in doing the course chosen,
9. influence from TVET system and policies and
10. cultural influences.

In the fourth and fifth sections of the chapter, the suggested measures to enhance gender parity in engineering courses are outlined followed by the effects of the government bursary scheme on improving gender parity by enhancing access and retention of females in engineering courses. Unless otherwise indicated any differences reported below are statistically significant

9.2. Are there differences in the factors attracting students to engineering and technological, and business courses, in general and by gender?

9.2.1. Student backgrounds

Analyses of student backgrounds indicated that apart from student year of study, all other background variables were related to student enrolment in the two courses. In addition, a higher proportion of students from homes in rural locations were enrolled in the two courses which reflect the population distribution in Kenya. Approximately two-thirds (67.7 percent) of the Kenyan population resides in rural locations (Kenya National Bureau of Statistics (2010). It was also found that students were more likely to enrol in institutions in their home locations.

A higher proportion of female student respondents were enrolled in engineering courses in town-located institutions. This finding was reinforced with that of documentary analyses of trends of student enrolments in engineering courses which showed higher proportion of female students enrolled in engineering courses in town-located institutions. This could be attributed to the expected higher quality of training in engineering courses in town-located institutions compared with those in rural and city locations since the former had been upgraded to the centres of excellent status in engineering programmes. Quality of training is one of the major challenges in Kenya. The Ministry of Science and Technology (2008) reported that most institutions had obsolete, or inadequate training equipment, and teachers with lower professional qualifications in technology and engineering areas.

It was found that a higher proportion of the student group who identified themselves as ‘low social class’ were more likely to enrol in engineering courses and less likely to enrol in business courses. On the other hand, higher proportions of the student group who identified as upper social class and middle social class were more likely to enrol in business courses and less likely to enrol in engineering courses.

There were no relationships found between differences in student enrolment in the two courses with other student backgrounds including their age, year of study, home location and institution location.

9.2.2. Student interests

Most of the results of student interest variables are as would be expected, but it was important to include them in the analyses so that their strength could be compared with other variables likely to affect choice of course.

A higher proportion of students were found enrolled in courses they were interested in and that they also had more interest in the prerequisite subjects of the courses while at secondary school. They were also more interested in tasks and employment related to the courses.

Engineering students liked Mathematics, Chemistry and Physics more than other subjects and found them less difficult. They also found Science, Mathematics, engineering subjects useful for their personal development, future career, social development and national development. With regard to tasks and employment interests, these students had higher levels of interest in engineering tasks as well as employment in areas such as technology and engineering, manufacturing and the armed forces. As anticipated, regression results predicted that student who liked Mathematics, Chemistry and Physics most and found these subjects less difficult and those who had high interests in engineering tasks and related employments were most likely to be enrolled in engineering courses.

Business students liked Accounting and Business more than other subjects and found them less difficult but more useful for their personal development, future career, social development and national development. They had higher level of interest in business tasks, as well as management, business entrepreneur, healthcare (nursing), office work, banking and finance, music/drama, tourist, accounting, and hotel employment. Regression analysis expectedly predicted that, students who liked Accounting and Business subjects most and found them less difficult, and those who had higher level of interest in business tasks and related employment were most likely to be enrolled in business courses.

So, while it is not surprising that students were found enrolled in courses related to the secondary school subjects for which they showed greatest interest, it does emphasise the importance of school experience in course choice. Moreover, their satisfaction with the courses they had chosen as well as being interested in the related tasks and employment, demonstrates how important these interests are to course selection.

However, when comparing genders of engineering students only, this study found that female students enrolled in these courses had liked STEM subjects less throughout their schooling, were still less interested in their current courses, and were less interested in related activities and employment. However, they liked most English, Kiswahili, and Religious Education and found these subjects and Accounting less difficult. Besides, compared with their male counterparts, female engineering students saw engineering subjects as less useful for their future career, personal development, social development and national development. Moreover, apart from information technology, most of the types of employment they were interested in were not related to engineering including business entrepreneurship, accounting, banking, finance and office work. The consistent findings above suggest a deep problem with female interest in, and predisposition to undertake, engineering that needs to be addressed, a problem that is highlighted by its absence in the context of business, where a higher proportion of female students in general were enrolled in business courses. This problem was also predicted in the conceptual framework of the study in Chapter Three Section 3.7.

9.2.3. Family and other people influences

Influences from family and other people were found to be related to student enrolment in the two courses. At least half of the students enrolled in both courses believed that their parents, brothers, friends and careers advisors influenced their enrolment decisions. The most influential was careers advisors followed by parents, brothers, close friends and mathematics teachers. However, there were differences found in influences on student enrolments between the two courses. As expected, a higher proportion of engineering students believed that they were influenced by their science teachers and mathematics teachers to enrol in their courses, while a higher proportion of business students believed that they were influenced by their business teachers to enrol in their current courses. These findings are reinforced by results of regression analysis in that students who were influenced by brothers, male relatives, mathematics teachers and science teachers were most likely to enrol in engineering courses and less likely to enrol in business courses; and that those who were influenced by their female relatives and sisters were most likely to enrol in business courses but less likely to enrol in engineering courses.

There were gender differences in influences on enrolment in the two courses by female relatives, career advisors and science teachers. A higher proportion of female students believed that they were influenced to make their enrolment decisions in their current courses by their female relatives and career advisors. In contrast a higher proportion of male students believed that they were influenced most by their science teachers to enrol in their current courses. Further, female students enrolled in engineering courses compared with their male counterparts, were more influenced to enrol in their courses by their mothers, sisters, and female relatives and careers advisors. However, compared with female students in business courses, female engineering students were less influenced to enrol in their courses by their female relatives and business teachers but more influenced by their male relatives, friends, science teachers, mathematics teachers and careers advisors. Again, this was expected due to course effects. Males are believed to be knowledgeable in engineering and teachers of prerequisite secondary school subjects have positive influence on students to enrol in the related courses.

There were no significant gender differences in influences from students' fathers indicating that their influences were not related to gender differences in enrolment in the two courses.

Student objectives to do the course were related to their enrolments in the two courses. The majority of students stated that getting a better salary did not influence their enrolment decisions but their objectives were to acquire desired skills, to get employed, and to advance to higher education. This was expected due to high rate of unemployment in Kenya. Interestingly, a majority of the students who were influenced by their objective to acquire desired skills were enrolled in engineering courses. Further, the results indicated that students who were influenced by their objective to get better salary were more likely to be enrolled in engineering courses compared with business courses. There were no differences by course of study in influences from student objectives to advance to higher education and to find employment.

There were no gender differences in other student objectives to enrol in their courses including to get employed, get better salary, and acquire desired skills.

9.2.4. Media and internet influence

A majority of students enrolled in both courses believed that they were influenced by newspapers, TV and internet to enrol in their respective courses. Interestingly, compared with TV and internet, a higher proportion of students were influenced by newspapers to make their enrolment decisions.

9.2.5. TVET system and policies

With respect to TVET system and policies, a higher proportion of students believed that they were most influenced by quality of training, followed by what they perceived as a conducive learning environment, and geographical location of their respective institutions. Furthermore, they believed that availability of bursaries was least important of the significant variables in influencing their enrolments. Bursaries were not open to all students but only those from what were seen as disadvantaged groups such as females enrolled in engineering courses, students from poor households and those with special needs. Thus, and as expected, compared with females enrolled in business, a higher proportion of females enrolled in engineering courses were influenced by the availability of a bursary. On the other hand, a higher proportion of business students were influenced by the cost of training and what they saw as a conducive learning environment to enrol in their respective courses. Training costs for engineering courses are generally higher compared with those of business courses. Atchoarena and Delluc, (2001) observed that part of the reason for higher costs of TVET engineering courses is that the class sizes are much smaller than in general education and the cost of equipment is higher. However, it was noted that cost of training was not related to gender differences in enrolments in the two courses.

There were no differences between student enrolments in the two courses in general or by gender caused by influences from the TVET curriculum.

9.3. What are the perceived barriers to female enrolment in traditional engineering and technological courses?

Student backgrounds including their social classes, age, home location, institutional location, and year of study, were perceived not to be barriers to female enrolment in engineering courses. In addition, both Heads of Departments and students agreed that TVET system and policies, student objectives to enrol in courses, influences from TV, internet and newspapers were not barriers to female enrolments in engineering courses.

However, the females' lower interests in science and mathematics coupled with their higher interests in business-related subjects at secondary school were perceived to be barriers to their enrolment in engineering courses. Both students and Heads of Departments concurred.

Additionally, the two groups agreed that females exhibited a lower interest in engineering courses and that this was a barrier to their enrolments in the courses. This was further reflected in their lower level of interest in engineering tasks and higher level of interest in business tasks as noted previously. Moreover, although the analyses of government data and the beliefs of Heads of Departments concurred that the dropout rate of females in engineering courses was higher than that of males, there was no difference between female and male students in their ability to work independently in technological and engineering programmes. Therefore, the higher dropout rate of female students was more likely to be due to lower level of interest in the course rather than ability and possibly to other unmeasured, variables. In addition, student responses demonstrate that they were enrolled in courses they had high level of interest. Thus, the higher proportion of female students in business courses as indicated by government enrolment data is evidence that they were more interested in these courses compared with engineering courses.

With respect to employment, both students and female Heads of Departments believed that female lower levels of interests in technology and engineering employment caused gender disparities in these courses. Further, and as previously discussed, compared with males enrolled in the same courses, females enrolled in engineering courses were found to be less interested in technology and engineering related employment but more interested in non-technology employment. Thus, females' lower level of interest in employment in technology and engineering and preference for other types of employment were perceived to be possible barriers to their enrolments in engineering courses.

High level of influences from their business teachers, coupled with lower levels of influences from their science teachers, mathematics teachers, brothers, male relatives, and occupational role models were perceived to be barriers to female enrolments in engineering courses. Although both students and Heads of Departments believed that people in general including parents, secondary school teachers, brothers and sisters, relatives, peers, and occupational role models caused gender disparities in engineering enrolments. Analyses of student opinions on what caused their enrolments revealed that influences from career advisors, peers and parents were not responsible for gender differences in enrolments in the two courses. These findings were further reinforced by results of regression analyses that students who were influenced by science teachers, mathematics teachers, brothers, and male relatives were likely to be enrolled in engineering courses compared with business courses while those who were influenced by their business teachers, sisters and female relatives were more likely to be enrolled in business courses compared with engineering courses.

It was surprising to note that a majority of students and Heads of Department did not believe that cultural influences caused gender disparities in engineering courses. However, the cultural stereotype scale had six items of potential causes of gender disparities in engineering enrolments, and both students and Heads of Departments believed that five of them did not cause gender disparities in engineering courses (Refer Appendix N, Table 11.8 and 11.9). However, Heads of Department agreed while students were neutral in believing that gender disparities in engineering were caused by beliefs that engineering courses were more suited to males than to females. While female students did not believe that gender disparities in engineering occurred as a result of beliefs that engineering courses are more suited to males than to females, male students did believe this. This indicates the gender stereotype beliefs in engineering courses were held by male students. In addition, both students and Heads of Departments believed that the cause of gender disparity in engineering enrolment was due to the beliefs that technological and engineering related jobs were more important for males than for females, and that males become excellent technologists and engineers compared with females. These beliefs also demonstrate that cultural stereotypes were perceived to have contributed to gender disparities in engineering courses. However, these findings raise questions as to whether females did not want to suggest they find the courses or the types of work intimidating because of male colleagues/peers. Besides, given the negative stereotypes in play from the majority of male students and the Heads of Departments, it appears that females did not want to suggest that the classroom environment was not conducive. Thus, indicating a need for further studies to uncover the difficulties female face in engineering employment and classrooms environments.

9.4. What is the relative importance of factors that influence female enrolment in engineering courses?

Factors that influence female enrolment in engineering courses can be grouped into two main categories including those with positive effects and those with negative effects. Based on findings of regression analyses of student opinions, the six most important factors that positively influenced female enrolments in engineering courses in order of their importance are presented in Table 9.1. This was derived from a regression model which included these factors when all significant influences on enrolment were entered into a regression equation. Besides, the model comprising these factors had the highest R^2 compared to other models indicating that the model was relatively stronger. As shown in Table 9.1, the factor which had the highest influence is ranked 1 while that which had the lowest influence is ranked 6.

Table 9.1 Factors that positively influenced female enrolments in engineering courses

Positive influences	Ranking
Students attitudes towards and interests in engineering courses/areas	1
Influence from family and other people (science teachers teachers)	2
Student employment interests (technology and engineering employment)	3
Students' interests in science	4
Individual Objectives to enrol in the course (to acquire desired skills, get employed)	5
Quality of training	6

It is of interest to note that although the availability of bursaries, influence from mathematics teacher and media were not among the most important factors, they were significant predictors of engineering enrolment. Student positive interests in and attitudes towards engineering courses/area, was the most influential. This was followed by influences from family and other people (science teachers).

The relative strengths of factors that negatively influenced female student enrolment in engineering courses as ranked by regression analyses results, comparison of means of students and Heads of Departments opinions are presented in Table 9.2. Comparison of the three rankings demonstrates that regression ranking concurred with at least one of the other two on the relative importance of each of the first four factors presented as “overall rank” in the table. Thus, precedence was given to the regression ranking in deciding the final ranking. The most important negative factor was interests in and positive attitudes towards business course/area and less interest in engineering course/area followed by influence from family and other people (business teachers, female relatives and sisters). Although cultural influences were not included in the regression equation as well as not believed by both students and Heads of Departments to be barriers to female enrolments in engineering courses, it was found that the majority of the respondents held negative cultural stereotypes about employment for female technologists and engineers. This demonstrates that cultural influences were barriers to female enrolments in the courses.

Table 9.2 Factors that negatively influenced female enrolments in engineering courses

	HODs		STUDENTS		Regression	Overall
Negative influences	**Mean**	**Rank**	**Mean**	**Rank**	**Rank**	**Rank**
Students interests in business courses/area and less interests in engineering/technology	2.85	2	2.69	1	1	1
Influence from family and other people(business teachers)	2.98	1	2.61	2	2	2
Student negative attitudes towards and low interests in science and mathematics	2.81	3	2.40	4	3	3
Student interests in business and other employment / less interest in engineering employment	2.44	4	2.46	3	4	4
Interest in non-engineering related secondary school subjects	-	-	-	-	5	5
Cultural influences and stereotypes	2.19	6	1.96	7	-	-

9.5. What are the appropriate measures that can be implemented to enhance gender parity in technological and engineering courses?

A majority of Heads of Departments (HODs) responded that increasing bursary awards and scholarships was the most important measure for enhancing gender parity in engineering courses. This was reinforced by an evaluation of the bursary scheme implemented by the Government presented later in this chapter found that it was effective in increasing the number of females enrolled in engineering courses as well as their retention.

Moreover, Heads of Departments believed that lowering the qualifications requirements for admission into engineering courses for females could enhance gender parity in the courses. Interestingly, they also recommended the same measure for male students in female dominated courses citing that this would avoid discrimination.

Heads of Departments further held the opinion that collaboration between training institutions with careers, guidance and counselling departments in schools could enhance gender parity in engineering courses. This is reinforced in that students believed that career advisors had the highest influence on their enrolment in their current courses compared with influences from the rest of the people.

Another measure perceived by Heads of Departments to be important in ensuring gender parity in the programmes was promotion of engineering programmes as well as sensitisation of female students, their parents, teachers and the society (key stakeholders) on the importance of science, mathematics, technology and engineering for students in general and by gender. They further suggested that the use of role models could inspire secondary school girls into the liking of STEM subjects and related employment.

Heads of Departments further held that improving the training environment, facilities and equipment would enhance gender parity in the courses. This is reinforced in that institutions that had upgraded their training facilities and equipment to centres of excellence status had a higher increase in proportions of female enrolments and reduction of their dropout from engineering courses. Further findings from regression analyses of student opinions demonstrate that quality of training enhanced enrolment in engineering courses.

Finally, institutionalisation of gender policies in all learning institutions was believed by most Heads of Departments to contribute towards enhancing gender parity in these programmes.

9.6. Has the government's bursary scheme improved retention rates in traditional engineering and technological programmes?

The Government of Kenya introduced the TVET bursary scheme in 2007 with the major goal of enhancing equity in enrolment in TVET courses. Among the main beneficiaries of the bursary scheme were female students enrolled in engineering courses. The scheme aims at ensuring gender parity in these courses. However, gender parity in engineering courses has not been achieved (Republic of Kenya, 2007a, UNESCO, 2011). Analyses of Government documents on enrolment data for seven technical training institutions surveyed confirmed that male students dominated the enrolments into technological and engineering courses. Further, it was found that the proportions of females had decreased over the period from 24 percent of the total enrolments in 2004 to 20 percent in 2010. This was despite having recorded a higher proportion increase between 2007 and 2010 (16 percent) when the bursary scheme was in place compared with 5 percent in the previous years (2004 and 2007). Thus, even though HODs believed that Bursary scheme was the most effective measure to enhance gender parity in engineering courses, it was impossible to judge given the overall increase in enrolment.

There was concurrence between the beliefs held by Heads of Departments and government enrolment data that dropout rate of females in engineering courses was more than that of males. However, the Government enrolment data further demonstrates that the gap between the two trends narrowed in 2010. In 2006 (A year before the bursary scheme was introduced) the dropout rates for female and males in technological and engineering programmes were 56 percent and 42 percent respectively. However, in 2010 (three years after introduction of bursary scheme) the dropout rates were 34 percent and 33 percent for females and males respectively. Thus, disbursement of bursaries to female students enrolled in engineering courses contributed towards enhancement of their retention in the courses. Given there is evidence in the literature (Rubineau, Cech, Seron and Silbey, 2011) to indicate females have less to lose in dropping-out of engineering courses than males it would appear that a bursary scheme is an effective counter to this.

The findings in this Chapter are in line with the conceptualisation of the study presented in Chapter Three Section 3.7. The findings imply that causes of gender disparities in engineering are braod and require a multiple of measures for improvement.

9.7. Summary of the chapter

The findings demonstrated that there were some similarities and differences in influences on student enrolments between the two courses. Similarities included influences from careers advisors, parents, and friends, interests in the general area, newspapers, and student objectives to advance to higher education, the TVET curriculum, and geographical location of the training institution.

Some of the differences were to be anticipated. For instance, student enrolments in both courses were influenced by interests in their respective courses, the prerequisite secondary school subjects (science, mathematics, accounting and business), the subject teachers and related employments. Other differences were less anticipated. Higher proportions of engineering students were influenced by brothers and male relatives, their objective to acquire a desired skill, get employed and get better salary, availability of bursary, and quality of training and identified themselves as coming from lower social class. On the other hand, higher proportions of business students had more interest in languages, History and Religious subjects at secondary school, and were influenced to enrol in their courses by their female relatives, sisters, cost of training, and a conducive learning environment.

A number of factors were responsible for gender differences in choice of courses. Compared with the males enrolled in the same courses, a higher proportion of females in engineering courses stated they were less interested in secondary school science and mathematics subjects, technology and engineering employments, tasks in engineering areas including designing things, experimenting and constructing things, and engineering courses. Additionally, compared with their male counterparts, female engineering students were more interested in languages, Religious education, Computing and Accounting subjects, business and non-engineering employments. Such a balance of female interests in school subjects could be seen as a relative lack of focus on learning relevant to engineering courses and careers.

The perceived barriers to female enrolments in engineering courses included, a lack of occupational role models, lower interests in secondary school science and mathematics, lower interest in technology and engineering employments and tasks in engineering areas, and negative cultural influences. In addition, they had higher level of interest in secondary school subjects and employments not related to technology and engineering and had higher influences from their business teachers, female relatives, and sisters.

Factors influencing female enrolments in engineering courses may be either positive or negative. In order of their relative importance the six foremost factors that were perceived to have positive effect were:

1. Interests in engineering area/course and field
2. Influence from science teachers
3. Interests in technology and engineering employment
4. Interests in science
5. Individual objective to enrol.
6. Quality of training

Other factors which had significant positive effect in engineering enrolment were availability of bursaries, influence from mathematics teachers, newspapers, TV and internet and student social class.

On the other hand, the 5 most important factors that were perceived to negatively influence female student enrolment in order of importance starting with most important were:

1. Interests in and positives attitudes towards business course/area and less interests in technology and engineering courses/area,
2. Influence from family and other people (especially business teachers),
3. Lower level of interests in science and mathematics,
4. Interest in non-technology and engineering related employment,
5. Interests in business-related and non-engineering subjects at secondary school.

Cultural stereotyping about female engineers negatively influenced their enrolment in engineering. However, it was not ranged among the five most important factors.

Heads of Departments believed that appropriate measures for enhancing gender parity in engineering programmes include: increasing bursary awards and scholarships, collaboration between training institutions with careers, guidance and counselling departments in schools, undertaking promotional activities to popularise TVET programmes, encouraging female students to take science and mathematics courses at school. In addition, they held that sensitization of secondary school female students and their parents, science teachers, and the general public on the importance of technology and engineering careers including the related employment opportunities will enhance gender parity in engineering courses. Also of importance was their belief that use of role models and affirmative action involving lowering admission requirements for female students interested in engineering courses would enhance gender parity in these courses. However, in order to avoid discrimination, they proposed similar affirmative action measures for male students to encourage their access to female dominated courses. They further believed that improving the quality of training and use of TV, internet and newspapers to popularise engineering programmes will enhance gender parity in the courses. Finally, institutionalisation of gender policies was believed to be one of the possible measures that would lead to achievement of gender parity in the courses.

In regard to evaluation of the government's bursary scheme put in place as a measure to enhance gender parity, the study found that the scheme raised the number of female students enrolled in engineering programmes but did not realise gender parity. Their proportion increase was lower compared with the corresponding proportional increase of their male counterparts. Secondly, the attraction of the engineering courses, even for the students actually enrolled in them, was lower for the females than for the males, indicating differential interest and attitude problems that will need to be addressed if gender parity is to be achieved in these courses. However, it is important to note that the bursary scheme reduced a relatively high dropout rate of female students in engineering courses to almost the same level as that of their male counterparts. The presence of student dropouts in some proportions even when bursary were held demonstrate that apart from the cost of training, other factors could be responsible for dropouts of both genders from engineering courses including the level of their interests in the courses, and the quality of training received.

The next chapter presents discussions of these findings, conclusions and recommendation for further studies.

CHAPTER TEN

DISCUSSION, CONCLUSION AND RECOMMENDATIONS

10.1. Introduction

This chapter relates the key findings of this study with those of the current literature and makes specific conclusions and recommendations for action. The outcomes and recommendations focus on three themes based on the research questions as follows:

1) Influences on enrolment in TVET courses,
2) Raising the interest of female secondary school students in technology and engineering areas and
3) Encouraging female enrolment in technology and engineering courses.

10.2. Influences on enrolment in TVET courses

This section compares the findings of influences on enrolment into engineering courses and business courses at TVET level in Kenya, in general and by gender.

10.2.1. Influences on enrolment in TVET courses in general

As detailed in the literature review, there have been some substantial empirical work in the area of technology and engineering enrolments at tertiary level both globally and in the African region. However, the studies rarely discuss or draw attention to whether the factors that influence enrolment in engineering are different to those that influence student enrolments in other subjects. Yet comparison is a powerful tool and may provide insights that will assist in addressing issues of importance to engineering. Secondly, as observed by Prieto et al (2011, p.82), the majority of the reports on engineering enrolment reveal the multi-dimensionality of the problem and the need to consider it more holistically. In addition, the ongoing debate about technology and engineering enrolments at tertiary level would benefit from accurate establishment of the degree to which the different factors influence decision making and how they are linked, in order to achieve better understanding of the phenomenon as a means to inform action (Prieto et al, 2011). It is generally recognised that studies undertaken in different national contexts and at different levels of education cannot be generalised (UNESCO, 2011). Thus, for the access and equity issues to be effectively addressed there is need to undertake studies in the specific national context and level of education affected. However, as acknowledged by the Ministry of Science and Technology (2008), very little research has been done at the TVET level in Kenya thus requiring urgent investigation at this level of education with a view of informing policy.

Existing literature indicates that there is a linkage between enrolment in engineering courses at the university level and student interests in Science and Mathematics at both primary and secondary school levels. Findings by Prieto et al (2011, p.82) indicate that, for Australia, university engineering students and professional engineers alike generally relate their reasons for becoming engineers to an almost innate liking of Mathematics and Science. They found that both university engineering students and professional engineers liked secondary school Mathematics, Physics and Chemistry more as compared with English, Biology, and Business/Law subjects. A study on factors influencing year 9 career choices found that students who chose information technology careers had liked STEM subjects at school (ETB, 2005). In Sub-Sahara Africa, Bunyi (2008) noted that enrolments of female students in higher education STEM courses depended on their liking and performance in science and mathematics at school level.

There is evidence in my study demonstrating that the same linkage exists between student interests in secondary school subjects and their choice of courses at TVET level. It was found that students enrolled in TVET courses related to their secondary school subject interests. A higher proportion of engineering students liked secondary school Mathematics, Physics and Chemistry subjects most and found these subjects least difficult while a higher proportion of business students liked Accounting and Business subjects most and found them least difficult. Further evidence from my study shows that student interests in specific secondary school subjects was likely to both influence them towards related courses and away from choosing courses not related to these subjects. For example, students who had interests in Business and Accounting subjects were less likely to enrol in engineering courses at TVET level. They also avoided courses where prerequisite subjects were perceived to be more difficult. The latter finding reflects that of Johnson and Jones (2006), that before high school students make decisions for choice of courses of study, they often compare engineering to alternate paths that have a less formidable curriculum. In my study, I found that, student choice of courses is not only affected by their interests in the related prerequisite secondary school subjects but also their interests in the unrelated subjects. While the former have positive effects on choice of course, the latter have negative effects on the choice of course.

Further evidence from the present study demonstrates that student choice of TVET courses is influenced by their perceptions of usefulness of the subject and interests in the course as well as the related employments. Engineering students were found to have had higher interests in engineering activities including designing things, constructing things and experimenting, and the perception that engineering, science and mathematics were more useful for their future careers and personal development. They liked engineering-related employments more when compared with business-related employments. As expected, business students expressed higher interest in business courses and related employments. This reflects the finding of a related study in the USA that the common reason that young people become attracted to a career field is that the career appeals to their intellect and emotions: they are intellectually aware of the benefits of the work and emotionally committed to the work because of its personal relevance to their lives (Brown, 2001). In Australia, Miralles (2004) found that enrolment in technical and vocational education was strongly linked to an understanding of the diversity of training outcomes and range of programmes available. The present study further argues that student interests in tasks, courses and employment-options are likely to have negative effects on enrolment in courses not related to these interests.

Another key factor influencing student choice of courses at tertiary level is the influence of family and other people such as family members, relatives, friends, secondary school teachers and carrier advisors. The current literature demonstrates that these influences vary depending on the category of person. For example, in the UK, a study by West Midlands Education and Training Department (2004) found that almost a half of the students (48%) pointed out that their most influential information came from their parents, followed by other family relations (11%), and the school careers advisor (10%). In the USA, Kerka (2000) asserted that parent influence was found to be the most important and that the absence of their support, guidance, and encouragement could lead to the inability to develop and pursue a specific career focus. In addition, it could lead to withdrawal of financial and emotional support for a career path not of the parent’s choice. However, a study in Australia on enrolments at technical and vocational level by Miralles (2004) found that teachers were the most often cited means of finding out about vocational education and training. In addition they were also cited as the most trusted sources of information. In a further study looking at universities, schools and professional engineers Prieto et al (2011) found that secondary school students perceived that their main sources of information about engineering careers were science teachers, careers advisors, and the TV and/or internet replacing fathers and brothers who were identified as the main source for primary school students. Patton (2005) found that in Australia, the school counsellors and careers advisors are two principal resources students use for selection of appropriate careers path to pursue.

Evidence from the present study demonstrates that in Kenya, career advisors have the most influence on student enrolment at TVET followed by parents, siblings and friends. However, neither careers advisors nor parents are responsible for differences in the choice of course. Here the influence of the respective secondary school subject teachers (science and business) was most responsible for differences in choice of the respective courses followed by influence from mathematics teachers, female relatives, brothers and sisters. Whereas influence from science teachers, mathematics teachers and brothers had a positive effect on engineering enrolment, influence from other categories of people had negative effects on enrolment in these courses but positive effect on enrolments in business courses. The tendency of students who are interested in engineering courses to seek advice from males and those interested in business courses to seek advice from females, could be due to the same perception held at international level that males are more knowledgeable and interested in engineering while females are more interested in business. In Australia, Prieto et al (2011) found that primary school students believed that males were more knowledgeable about engineering, and that secondary school students believed that males generally would be more interested in engineering. Thus, the conclusion drawn in the present study is that, while careers advisors and parents were important for student access to education at TVET level, the differences of choice of courses was due to a combination of both positive and negative influences mostly from secondary school teachers (science teachers, mathematics teachers and business teachers). In addition, those students who are interested in engineering courses are more likely to seek the views of their male family members and relatives rather than their female family members and relatives while those with interests in business courses are likely to seek advice from the latter group.

The importance of media and internet in influencing enrolments into TVET courses is evident in the findings of this study. The TV, internet and newspapers were seen by a majority of students to have provided them with information that led to their enrolments in both courses. However, most students indicated that they were more influenced by newspapers compared with TV and internet. This finding is different from that of the National Science Board (2006) that in many countries, including the USA, most adults find information about careers including science and technology mainly from watching television. Similarly, the National Science Board (2006) found that in 2004, the internet was the second most popular source of news about careers including science and technology. The difference could be attributed to the fact that the majority of Kenyans live in rural areas (Kenya National Bureau of Statistics, 2010) where access to internet is limited (Juma, 2012; The Communication Commission of Kenya, 2011)[27].

[27] Juma (2012) found that a major constraint for rural internet penetration is the low penetration of computers along with basic IT education and that while PC penetration in urban Kenya is increasing

Thus, use of media in relaying careers information depends on the prevailing socio-economic development stage in the region or country. In developed countries, TV and internet were the most important while in developing countries like Kenya where internet penetration is low and accessibility to television is limited, the newspaper remained the most important in relaying careers information.

Evidence from my study demonstrates that enrolment in TVET was influenced by the student objectives in enrolling. The main objectives given by most students who were enrolled in the two courses were to get employment, to acquire desired skills and to advance to higher education. However, the majority of students were not influenced by the objective of getting a better salary in making their enrolment decisions. The latter finding was different from that of the National Grid (2009) as well as ETB (2009) that pay was one of the most important factors in student careers choice. The difference could be due to the unemployment rate in Kenya which is high, especially among youth, and therefore getting a better salary would not be expected to be as important to students. According to the Institute of Economic Affairs (2011), 72 percent of the unemployed in Kenya are under age 30 while 51 percent are under age 24, making Kenya's unemployment problem a youth problem. However, there were similarities in some of these findings with those of Miralles (2004) that in Australia, the main purpose for enrolment in technical and vocational courses was getting a job rather than achieving promotion and that the owners of small businesses aimed at getting business skills that would enhance their business profitability. Thus, while student choice of careers depends on their individual needs, it may vary depending on the prevailing economic situation which differs by country.

Interestingly, a higher proportion of engineering students compared with business students indicated that they were influenced by their objective to acquire a desired skill. This difference could be as a result of the general

considerably, its penetration in rural areas is very slow. The Communication Commission of Kenya (2011) reports very low usage of internet in rural Kenya despite improvements in access.

misconception about skills to mean psychomotor skills which are perceived to be related to engineering.

There was evidence from the present study demonstrating that student social class influences their choice of courses at TVET level. A higher proportion of students who identified themselves as coming from a lower social class were enrolled in engineering courses while a higher proportion of those who identified themselves as coming from middle and upper social classes were enrolled in business courses. The findings of my study were in line with those of Kerka (2000) that in the USA socioeconomic status determines choice of courses with upper classes more likely to enrol in business and management courses. However, it differed from the findings of other studies in that compared with business students, a higher proportion of engineering students believed that they were influenced by their objective to acquire better salary to make enrolment decisions implying that technology and engineering jobs are well paying. However, as discussed previously, it should be noted that student objective of getting a better salary was not important to the majority of the Kenyan students. In the UK, the National Grid (2009) found that the society perceived engineering to be a dirty and low paid job.

In my study, I further found that differences between student enrolments by course of study at TVET level were not related to the location of institutions, student homes, age, or year of study. This finding was in agreement with that of Prieto et al (2011) who found that location of institution was not related to student choice of courses in Australia. However, my finding that students were more likely to enrol in institutions that were in the same location as their homes was specific to Kenya.

Differences in student choice of the two courses found in my study were related to quality of training, its environment, related costs, and availability of bursaries. A higher proportion of engineering students indicated that they were influenced by the quality of training and availability of bursaries while a higher proportion of business students indicated that they were influenced by what they saw as a conducive learning environment and cost of training. The difference in perception of quality of training between students enrolled in the two courses could be a result of the greater focus placed to engineering courses by the government which was implementing the policy of creation of centres of excellence in these areas. The Republic of Kenya (2005b, p. 50-53), gave the policy direction for addressing the quality and relevance challenge in TVET programmes through creation of centres of excellence in technology and engineering trades. In addition, the policy paper committed the government to offer bursaries and scholarships to enhance equity and access in engineering courses. As expected, choice of courses was not influenced by the curriculum since it is similar in both flexibility and duration.

10.2.2. Influences on enrolment in TVET courses by Gender

In this study, I found that compared with males enrolled in the same courses, female students enrolled in engineering and technology courses had liked STEM subjects less throughout their schooling and were less interested in their current courses as well as related activities and employment. All these findings were consistent, indicating a deep problem. However, lesser female interests in STEM subjects, courses and related employment are not new phenomena. Studies by Watt (2005), Forgasz (2006) and Helme and Lamb (2007), indicated that gender has a significant effect on student career aspirations and subject selection and that, compared with females, males are more likely to continue in STEM study irrespective of past performance in mathematics. The National Grid (2009) found that in the UK, girls were less interested than boys in engineering employments, but more interested in becoming a medical doctor, pop star, shop worker, teacher and actress. Moreover, EPP-Center (2010) found that boys were more likely than girls to choose all the three GCSE science subjects including Physics, Chemistry and Biology. In Australia, the Engineering and Technology Board (2005) found that a higher proportion of young males demonstrated real interests in learning science, technology and mathematics compared with their female counterparts. Further Prieto et al (2011) found that there was a correspondingly significant difference in both interest and perceptions of engineering by primary school boys and girls, with boys scoring higher on both scales. In the USA, Bae, Choy, Geddes, Sable and Snyder (2000) reported that females continued to outperform males in reading and writing and males continued to outperform females in math and science in elementary and secondary grades, and that enrolment in undergraduate and graduate degree programmes were still gender traditional with females being underrepresented in professional degree programmes.

With respect to influences from family and other people, I found that secondary school science and business teachers, careers advisors, students' female relatives and their sisters were responsible for differences of their choice of courses at TVET level by gender. Female students were less influenced by their science teachers but more influenced by the other groups of people in making their enrolment decisions. It should be noted that apart from influences from careers advisors which were not related to differences in choice of courses, influences from business teachers, female relatives and sisters were found to be in favour of enrolment in business courses rather than enrolment in engineering courses. As noted previously, female students tend to have a close relationship to their sisters and female relatives. In addition, there's a general perception that females are more interested in business compared with engineering.

There is evidence from my study that the influence of cultural stereotypes about technology and engineering employments was evident in differences in enrolments in the two courses by gender. Both Heads of Departments and male students responded that compared with females, males can be excellent engineers. In addition, they perceived that engineering courses were more suited to and important for males than for females. However, a majority of female students did not support these beliefs indicating that they did not hold the gender stereotypes. While responses of both male students and HODs were in line with findings of other studies, the responses of female students were different.

Bunyi (2008) noted that the socio-cultural beliefs, norms, values, attitudes and practices that are hostile to the education and training of women have been found in nearly all societies in Sub-Sahara Africa leading to low expectations of women's performance generally but particularly in science, mathematics, technology and engineering. As noted in Chapters One and Three, Franzway et al (2009) observed that studies carried out in Australia and overseas, point out that characteristics of an entrenched masculine culture are the main reason for women's lower representation in engineering. Male, Bush and Murray (2009) add that there was gender stereotyping found among Australian engineers population. UNESCO (2011) noted that women face barriers to obtaining jobs for which they have the skills and qualifications. In Australia, Prieto et al (2011) found that teachers held less positive views of females in engineering. Kosteas (2013) found that holding more traditional attitudes towards gender roles is related to a lower probability of women participating in post schooling training. It is therefore possible that when female students become aware of the stereotypes from their teachers and the society in general, they may be discouraged to pursue science, technology and engineering studies at a TVET level.

In regard to the relative importance of factors influencing female enrolments in engineering courses, my study found their interests in and attitudes towards the courses, which include how they liked and valued them to be the most important in both positive and negative directions. Similarly, Prieto et al (2009) found that researchers had singled out student interests and attitudes to be the most important in influencing enrolments in engineering courses. The findings also agree with that of ETB (2009) that being valued was viewed as the single most important element in career choice with enjoyment being second. However, while the finding of my study did not find salary or pay to be important in influencing enrolment, ETB (2009) found that pay was the third most important factor in choice of courses. As discussed previously, the difference could be attributed to the level of unemployment, which is a major challenge in Kenya.

In this study, I further clarify that, apart from their interests in the courses, other interests are less important in influencing female student enrolments in engineering courses compared with influences from secondary school teachers. Influences from science and mathematics teachers (positive effects) and those of business teacher (negative effects) were relatively more important compared with the respective employment interests, and interests in secondary school subjects. Further, my study demonstrates that availability of bursaries was one of the significant positive influences on female student choice of course while cultural stereotype was the least important negative influence on female student enrolment to engineering courses.

10.3. Raising the interest of female secondary school students in engineering areas.

This section presents discussion that will focus on three areas that can be used to inspire secondary school female students to enrol in engineering courses. The areas are:

1) Addressing secondary school subject interests,

2) Informing secondary school teachers, career advisors and parents and

3) Promoting engineering.

10.3.1. Addressing secondary school subject interests

One of the findings in this study is that female students have a lower level of interest in secondary school Mathematics, Physics and Chemistry coupled with higher interest in business and art based subjects. The differences in secondary school subject interests were perceived to be barriers to their enrolments in engineering courses. A major reason to support this is that my study found that there was a link between student interests in secondary school subjects and their enrolments in the two courses at TVET level. Thus, inspiring females into engineering will best begin at least as early as secondary school and more specifically in the first two years before they make their subject selections[28]. Similar suggestions were made in Australia by Prieto et al (2011) that inspiring students into engineering courses could best begin at an early stage of education especially at primary and lower secondary school level. There is further evidence from this study supporting this suggestion. Heads of

[28] In Kenya, Mathematics is a compulsory subject throughout secondary school and students must select at least two science subjects in the third Form.

Departments responded that raising interests of female students in mathematics and science will appropriately enhance their enrolments in engineering courses. Thus, this study suggests that implementing programmes that would address the lack of interest and disinclination of female students in science and mathematics starting from primary school and throughout secondary school level may inspire their future decisions to take up engineering careers.

Further evidence from my study indicates that students are likely to choose courses at TVET level whose prerequisite secondary school subjects are perceived to be important to them, and not likely to choose courses whose prerequisite secondary school subjects were not important to them. For example, the present study found that students who found science, engineering and mathematics subjects useful for their future career and personal development were more likely to enrol in engineering courses but less likely to enrol in business courses. This finding is similar to that of Prieto et al (2011) that in Australia, there was a link between the perceived usefulness of the mathematics and science subjects to students enrolment decisions in STEM courses at university level.

The present study further found that compared with males, a higher proportion of female students did not find engineering subjects useful for their personal development and future careers. This means that they did not imagine themselves as potential engineers and this could be due to the current perception in the society that engineering is meant for males and not females. Role models may counter the prevailing social phenomenon of females as less suitable for engineering courses and set an example to challenge the current gender stereotypes. Therefore, involvement of female scientists, technologists and engineers as role models to talk to secondary school girls may address female lack of interest in engineering careers as well as give them some confidence in pursuing these careers. There is strong evidence in my study to support the use of role models in stimulating female interests in engineering courses at TVET level. Heads of Departments proposed use of role models as one of the measures that would appropriately enhance gender parity in the courses. In addition, a majority of students and Heads of Departments responded that lack of role models for girls was a factor creating gender disparities in engineering course enrolments. These findings are similar to those of Griffin (2007) and the Forum for African Women Educationalists (FAWE 2004) that in Sub-Sahara Africa, many secondary schools had inadequate female STEM teachers to serve as role models for the girls. Studies on gender enrolments in STEM courses point out that role models can be used to raise female student interest in STEM courses. In Australia, Prieto et al (2011) stated that the perception that engineering is a male dominated profession can be addressed by use of role models to inspire young girls. In Sub-Sahara Africa, Bunyi (2008) found that use of role models in science subjects and increasing the proportion of females in administrative positions at the universities could inspire more females to take up STEM courses at universities.

Additionally, because the use of outreach programmes has been found to be effective in addressing the general student lack of interest in STEM courses and occupations, such programmes are another alternatives solution to the problem. For instance, in Australia, Husher (2010) found that outreach programmes had high positive impact on both male and female students who had negative attitudes towards STEM fields. However, she found that the impact of these programmes on males was higher. In the U.S.A, Bayer Corporation (2010) found that pre-college science, technology, engineering and math (STEM) education programmes had inspired all students and grew the innate interests all children had for these subjects, particularly girls and underrepresented minorities. They not only provided positive, real-life individuals in STEM careers for students to get to know, and make the fields more accessible but also introduced the students to the numerous career opportunities available for them in the fields.

10.3.2. Informing secondary school teachers, career advisors and parents

As detailed in the literature review, there is evidence that career advisors, parents and secondary school science teachers play a significant role in influencing student career choices at tertiary level. Secondly, it is evident that in general, they have limited information about what engineering is the careers available and have negative views about female technologists and engineers. For example, in the UK, the National Grid (2009, pp.8-9) found that, even though teachers and parents claimed knowledge about engineering, they relied on underlying prejudices and stereotypes that could negatively affect their support for student enrolment in the courses. According to the National Grid (2009, p. 9), parents and secondary school teachers viewed engineering as:

1) ‘Menial’ or ‘blue collar’

2) *For men not women.*

In Australia, Prieto et al (2011, p. 86) found that both science teachers and careers advisors indicated that they had little knowledge about the diversity of engineering specialisations and that teachers were negative about having women in engineering.

Although in my study the knowledge and perception of career advisors, parents and secondary school teachers about engineering were not obtained, there is evidence to demonstrate that these need to be enhanced. Heads of Departments recommended the need to sensitize secondary school female students and their parents, science teachers, and general public on importance of technology and engineering and employment opportunities in the area in order to enhance gender parity in the courses at TVET level. They also recommended the need for collaboration between training institutions and careers, guidance and counselling departments at secondary school level as one of the key measures for enhancing gender parity in engineering courses at TVET level. Besides, while influences from secondary school teachers were responsible for differences in enrolments in the two courses, careers advisors and parents were found to be the most responsible for student decisions to enrol in TVET courses even though their influences were not related to differences found in choice of courses in general. Thus, development and implementation of programmes that can bring about a change in the culture of careers-advice for females as well as broadening the understanding of engineering careers targeting secondary school teachers, careers advisors and parents may broaden the scope for females’ careers choices.

10.3.3. Promoting engineering

This study further found the existence of misconceptions in the society that engineering is meant for men and not for women. There are strong grounds in this study to support this assertion. As discussed earlier, higher proportions of Heads of Departments and students responded that engineering is most important to and meant for males rather than females, and that males can be excellent technologist and engineers compared with females. Why then would the female students not be discouraged to enrol in these courses when they are made aware of these views from the Heads of Departments and their peers? If Heads of Departments, a majority who are heading engineering departments could have such misconceptions, how more would be expected within the general public? As detailed in the literature review, the public has little information about careers available in STEM and holds misconceptions that discourage female students from pursuing engineering courses. Thus, promotional programmes aimed at addressing the cultural stereotypes in the society about female technologists and engineers as well as popularising these careers to secondary school female students and the general public may bring about a change in careers advising that could result in future improvement of the proportions of females enrolled in these courses. Heads of Departments recommended the need to sensitise female students and the general public to the importance of engineering and employment opportunities in the area. Other studies have made similar recommendations. In the UK, the National Grid (2009) recommended that the society as a whole must be made to change its perception of mathematics and science, the importance of the work of engineers, and gender roles. In Australia, Prieto et al (2011) found similar opinions from a majority of teachers, professional engineers and engineering students, who concurred that school promotion, was important in influencing student career choices and that this could best be done by use of TV and internet.

However, as discussed previously, newspapers are the most popular media for career promotion in Kenya. Thus, adequate information regarding popularity of media may be important in making decisions on effective channels to be used in dissemination of careers information.

Findings from the present study further demonstrate that females and males have the same ability to pursue engineering courses. A majority of Heads of Departments strongly disagreed that females who had enrolled in technological and engineering courses could not work independently as compared with their male counterparts. This finding is similar to the observation made by Franway et al (2009) that in Australia, women were as competent as their male counterparts in the technical dimensions of engineering. If female students in primary and secondary schools are made aware of this information they may be encouraged to enrol in these courses since, as found by Johnson and Jones (2006), students are likely to enrol in courses they believe they can manage.

10.4. Encouraging female enrolment in engineering courses

In this section, three possible measures to encourage female enrolment in engineering courses as synthesised from the findings of this study have been discussed. These include affirmative action, training quality and environment and employment opportunities for female technologists and engineers.

10.4.1. Affirmative action

Affirmative action refers to a combination of policies and procedures aimed at not only the elimination of discrimination against disadvantaged groups including ethnic minorities, poor households and women (Onsongo, 2009) but also providing an advantage to these groups. In Kenya, Onsongo (2009) found that an average of 300 female candidates benefitted annually from the lower cut off points for course admission as affirmative action introduced by the Joint University Admission Board. Bunyi (2003) found that 462 female students had benefited from the same programme in 2003. There is evidence from my study that demonstrates that similar measures could be undertaken at TVET level to encourage female student enrolments in engineering courses. Heads of Departments responded that lowering admission requirements for female students will enhance gender parity in engineering courses. However, care should be observed to protect the egos of the beneficiaries of this policy.

Morley (2006) warns that lowering admission criteria for female students perpetuates the myth that women are inferior to men and therefore may discourage some of them from joining university colleges. It is also perceived as a form of discrimination against men and boys (Morley, 2004). Similar expression of feelings of discrimination was noted in the present study, where some of the Heads of Departments proposed that affirmative action should be broadened to include lowering admission requirements and providing bursaries for males to access the female dominated courses. Hence, there is a need to implement programmes that would be appreciated by both genders as well as create confidence in the beneficiaries.

Pre-entry programmes aimed at improving female grades in the prerequisite science and mathematics subjects may not only boost their confidence in pursuing engineering careers but also address the expression of unfairness that could emanate from males. A similar programme was successfully implemented in Dar es Salaam University in Tanzania. FAWE (2001) observed that in Dar es Salaam University, the proportion of females admitted without affirmative action in the year 2000/2001 in the faculty of science increased from 15 percent to 27 percent as a result of introduction of a pre-entry programme where girls, who had not attained the cut-off points, underwent a six weeks remedial programme. An assessment of the performance of the students who participated in this programme revealed that they performed very well and this encouraged more enrolments (FAWE, 2001).

In 2007, the Kenyan Government introduced a bursary scheme as part of the affirmative policy measure to enhance access and equity in engineering courses at TVET level. This was part of the implementation of the Sessional Paper number one of 2005, a policy framework for education, science and research. The scheme targeted female students enrolled in engineering courses, students from poor households and those with special needs. The findings of the evaluation of the bursary scheme in this study gives strong grounds to support its use as a measure to encourage female student enrolments in engineering courses at TVET level. Heads of Departments responded that the bursary scheme was the most important measure in addressing gender parity in engineering courses. Availability of bursaries was also found to be among the factors that positively influenced female enrolments in engineering courses even though it was rated by students as the least among other significant factors such as interest in the course, employment, influence from secondary school teachers, and interest in secondary school science and mathematics subjects. In addition, compared with female students enrolled in business courses, a higher proportion of female students enrolled in engineering courses indicated that they were influenced by availability of bursaries to make their enrolment decisions. Moreover, the percentage increase of female students enrolled in the engineering courses during the period when bursaries were available was higher compared with the previous period, and that female dropout rates in these courses reduced to a level similar to that of males.

A review of the current literature indicates that the use of scholarships and bursaries to enhance equity in general and by gender in STEM courses has been underscored by other studies at university level. For example, Businge (2005) noted that in Uganda, 25 women were given scholarships annually to study science and technology related courses at university level. In Australia, Prieto et al (2011) found that a majority of university students and professional engineers were of the view that provision of scholarships and subsidisation of HECS fees at university level had a relatively quick impact on increasing engineering enrolments. Based on these findings, the present study suggests that enhancement of bursary award schemes and scholarships may be an effective and relatively quick method of encouraging female enrolments in engineering courses.

10.4.2. Training quality and environment

Evidence from my study demonstrates that improving the quality of training would be very likely to enhance gender parity in engineering courses. Heads of departments suggested that improving the quality of training including upgrading of training equipment and facilities would appropriately enhance gender parity in engineering programmes. There are strong grounds to support this suggestion. A higher proportion of female engineering students were enrolled in institutions located in towns where engineering courses had been upgraded to centre of excellence status. Further, I found in this study that the dropout rates for both females and males were lowest in these institutions indicating that the quality of training was important in retention of engineering students. The Ministry of Higher Education, Science and Technology, Kenya (2008) concurred that the quality of training in engineering courses is a challenge since most institutions had old and out-dated training equipment, as well as unqualified teaching staff. The role of quality of education in influencing enrolment at secondary school level has been underscored by other studies. Bunyi (2008) found that in sub-Sahara Africa, lack of science laboratories and equipment in girls' secondary schools and gender-insensitive pedagogy caused poor performance of girls in secondary schools. Similarly, Darling-Hammond, (2007) found that students' interests in science and mathematics subjects depended on the quality of teaching of the subjects, which includes relating what the students learn and real world. UNESCO (2010) links gender disparities in technical and vocational education to low quality of teaching of science and mathematics at secondary school level. Thus, enhancing the quality of engineering programmes at TVET level as well as science and mathematics subjects at secondary school level may raise the proportion of future female enrolments in engineering courses at TVET level.

Ensuring a conducive training environment is another area to be explored in order to encourage student enrolments in engineering courses. Studies in the STEM area point out that both training and employment environments are not conducive for female students. In Australia, Gill et al (2008) found that the hostile work environment was a challenge for enhancing gender equity in engineering education. UNESCO (2011) pointed out that in some countries, especially those affected by conflict, training environments were characterised by gender stereotypes, sexual violence and attacks by groups opposed to gender equity in education to keep girls out of school. In the present study, there were no differences found between students by gender with their having been influenced by what they perceived as a conducive learning environment. This was a positive indicator that needed to be maintained. Heads of Departments agreed in their suggestion that improving the learning environment would enhance gender parity in the programmes. Thus, programmes that would improve learning environments for females in science and mathematics subjects in school and maintaining the same at tertiary level may encourage their increase in access to and retention in pursuing engineering courses.

10.4.3. Employment opportunities for female technologists and engineers

As found by my study, Heads of Departments recommended the need to assure TVET graduates employment as well as improve their terms and conditions of working. These imply that they perceived that employment opportunities for TVET graduates were limited. Based on the finding of this study, females were more likely to be affected since the society in general was found to hold negative views about their employment in technology and engineering occupations that had higher job opportunities compared with other occupations. In addition, females were found to have had lower interest in technology and engineering employments. Studies done in other countries indicate that female technologist and engineers have been denied employment opportunities in their professions (Cohen and Deterding, 2009; UNESCO, 2011). Thus, programmes to assure employment of female technologists and engineers as well as raising interests of females in general in these employments may encourage more enrolment in the courses. Since there is strong Government policy towards achieving this end, which is also embodied in the current constitution, actualising this requirement by enacting and implementing relevant legal frameworks and employment policies could in the long run address this challenge.

10.5. Contribution of the study to the knowledge base

In view of the foregoing discussions, influences on enrolment in TVET courses in general and by gender are complex multifaceted and contextual. However, some overlap and cut across different regions and levels of education. While most of the findings of this study appear similar to studies done at both regional and international levels, the uniqueness of this study is that I have not found a similar study conducted at the same level of education in Kenya. The potential of this study to contribute to the policy making process is indisputable.

Further, the findings have to be understood within the socio-economic and political challenges facing many developing countries, Kenya included. This explains why in developed countries television and the internet were the most important tools in relaying information about different careers yet in a developing country like Kenya where television and internet are expensive and still a luxury confined mostly in urban areas, the newspaper was the tool of choice. Also, pay was not a major focus for decision making in career choice in Kenya where the youth were mainly concerned with securing employment first regardless of the pay differentials. This is consistent with unemployment being a major challenge in developing countries. *The Human Development Report* (UNDP, 2010) confirms this and recognises that youth unemployment in Kenya is currently its greatest development challenge.

This study found that the major barrier to female enrolment in engineering courses is their lower levels of interest exhibited even by those already enrolled in the courses. These included lower levels of interests in the prerequisite secondary school subjects, the courses, engineering activities and employment.

An important finding of this study is that enrolment in TVET courses in Kenya was related to students' home locations. Most students were enrolled in institutions that were in their home locations. Thus, within the current spirit of devolved government in Kenya, as postulated in the constitution, where decentralization forms the main focus of the current governance system, this finding indicates the need to increase the number of technical training institutions especially in rural areas where the majority of Kenyans live if enrolment in TVET courses is to be increased.

10.6. Conclusions

The Kenyan development agenda is underlined in its *Vision 2030* which aspires to transform the country into a newly industrialising, middle-income status that would provide high quality life to all its citizens by the year 2030 (Government of the Republic of Kenya, 2007a). The *Vision* is hinged on social, economic and political pillars. The aim of the economic pillar is to improve the prosperity of all Kenyans by implementing an economic development programme that targets an achievement of the Gross Domestic Product (GDP) growth rate of 10 percent per year with effect from the 2012. The platforms for this pillar are science, technology and innovation (STI); infrastructure; energy; human resources development; and macroeconomic stability (Republic of Kenya, 2007b).

Among these platforms, science, technology and innovation, and infrastructure development have been given first priority leading to a large range of employment opportunities in the sector. However, the supply of skills in technology and engineering are less than the employment demands thus the country has to import skills which is not only expensive but also can derail development. For example, there is rising concern over acute shortage of workers in building industry where overseas contractors who have taken up most of the infrastructure contracts in Kenya have to import some of their skilled workers, yet unemployment in Kenya is very high (Michira, 2013). Conversely, there is a large pool of business and commercial workers, which is more than the market demand leading to high rate of unemployment. UNDP (2010) blamed the high rate of youth unemployment in Kenya on a mismatch between the skills of the unemployed and the skills requirements of potential employers and ineffective communication of available careers.

The gap between supply and demand of employment skills poses a challenge to education which bears the responsibility for the creation of a balance of adequately skilled human resources for all sectors of economy. This is compounded further with the acute gender differences in engineering enrolments at TVET level where females are far less represented despite the current constitution’s requirements that employment should ensure at least a third of each gender in all areas of the economy as well as by the high demand for technologists and engineers. These differences in enrolments are reflected in employment where the proportion of unemployed females is higher compared with that of males. According to UNDP (2010), the unemployment rate of females aged between 15 and 34 years in Kenya in 2005/2006 was 14.3% compared with 11.2% for males. These differences undermine the spirit of the Kenya Constitution (Revised in 2010), the *Vision 2030* and the Millennium Development Goals in that it denies female economic empowerment and inclusion. The conclusion drawn from this study is that youth unemployment could be addressed if education policies that require enhancement of skill provision in market driven courses targeting both genders were formulated and implemented. Basing these policies on influences on student enrolment in TVET courses as identified in this study could improve their effectiveness.

However, while education managers formulate and review policies to address the differences in skills, they should recognise the problem of shifting the workforce from one area of study to another which may result in diseconomies in which females may not get work or not get work that is satisfying and sustainable. Thus, growing a pool of skilled workers as a whole as well as shifting the balance and specifically targeting engineering areas that have a larger range of opportunities for female workers and that can be valued within families including soft rather than hard transitions may solve the skills gap being experienced.

Further consideration needs to be given to the many factors that combine in a complex way in influencing student choice of careers at tertiary level. The conclusion drawn from this study lays emphasis on this suggestion by demonstrating the need for addressing the complex nature of influences on enrolment which require an all-inclusive multifaceted approach to deal with issues raised in the previous discussion emanating from schooling, TVET level, employment, government and key stakeholders. This suggestion is in line with that of Robeyns (2010) and Unterhalter (2012) that gender inequality in education could best be addressed by applying broad approaches to education which takes into account all sources of inequities in people's lives and in the society generally. This was also implied by suggestions made in the conceptual framework of the study in Chapter Three, Section 3.7.

Therefore, a complete solution must include all the key actors, starting with school students, including their parents, teachers, careers advisors, the schools they attend, and government policies on training and employment. Moreover, a long term solution can only occur if the society as a whole changes the way it perceives the possibilities of females becoming successful technologists and engineers. This suggests that there is no quick solution to the enrolment challenge. Thus, following Prieto et al (2011), this study suggests a three-prong approach targeting what can be done in a short term, medium term and long term in attempting to provide solutions to the problem.

10.6.1. Short Term Measures

The skills gap for engineering employment in general and by gender in particular would continue to widen if no intervention of any kind is undertaken. As the country scales up its investment in the sector coupled with the emergence of new technologies, the need for skilled technologists and engineers will increase thus widening the gap that is currently experienced. Based on the previous discussions, implementing programmes that would provide incentives for students in general and female enrolment in engineering courses in particular, may attract more enrolments in the short term. These programmes could include those proven to have had positive effects on enrolments such as bursary awards and scholarships, and pre-entry upgrading courses targeting those with lower admission scores but having interests in engineering courses. In addition, improving the training quality and environment especially in engineering courses, which are valued by females and their families, may also attract more enrolment in the short term. As discussed earlier, females were more attracted to engineering courses in institutions that were perceived to have had better quality of training compared with the rest. The quality of training gives them an assurance of success if enrolled. Moreover, females who were already enrolled in engineering were happy with what they perceived as a conducive training environment, hence enhancing these conditions may both retain those who are enrolled and attract additional enrolments.

10.6.2. Medium Term Measures

Gender stereotypes and misconceptions about careers in engineering tend to restrict female student understanding of their own career options. Making informed decisions would be successful if students access accurate information about pathways, careers and employment demand. This information would best be supplied through their teachers (science and mathematics teachers) who are not only close to them but also most responsible for differences in their career choices. Additionally, careers advisors would be important in relaying this information since they are the most influential for student decisions to enrol in TVET courses. Unfortunately, to some extent they are affected by cultural stereotypes about engineering that tend to draw females away from enrolling in these courses and have limited information about these careers. Thus, development and implementation of programmes that bring about a change in the culture of careers advising targeting secondary school science, and mathematics teachers, and career advisors may improve information supply for female student decision-making. These programmes should also be extended to Heads of Departments in training institutions since they are responsible for student admissions to the courses. Including packages of information about engineering careers in the programmes could better inform them of the wide range of careers in these areas.

However, careers guidance may not be effective unless female students have the capacity to imagine themselves as future technologists or engineers. Thus, programmes that would build female student confidence in engineering careers as well as the prerequisite secondary school subjects for these careers, if implemented, may improve their perception about these careers. Females need to understand engineering careers as well as the abilities of both genders to undertake them. As detailed in the discussions, the programmes that create confidence in female students to pursue engineering courses may include several strategies including but not limited to providing role models and mentors to secondary school girls including organizing school visits by professional female scientists, engineers and technologists, improving the quality of teaching of secondary school science and mathematics subjects and popularisation of engineering through appropriate media campaigns.

10.6.3. Long Term Measures

The first two sections demonstrate that several measures can be implemented to address the skills gap in both short term and medium term. However, as noted earlier, a long-term solution should address all the barriers to female enrolments in engineering programmes. An important finding of this study is that interests in careers begin at an earlier stage of education. Therefore, addressing girls' lack of interest in science and technology and disinclination to focus on related studies at both primary and secondary school levels, may lay a foundation for their future career choice. Thus, there is a need for programmes that build student confidence and liking for such subjects as mathematics and science, even in primary school. Similarly, choice of science subjects in secondary school could be increased through such programmes. While mathematics is compulsory, its importance as well as that of science could be reinforced throughout secondary school. These programmes may lead to possible future increase in enrolments in engineering courses.

As these programmes are undertaken, other programmes to address cultural stereotypes in the society need to be developed and implemented with a view of changing the attitudes of the key stakeholders towards female technologists and engineers as well as providing adequate information about these careers. The good will of the Government, as demonstrated by the constitutional requirements in employment and its gender policies as outlined in the *Vision 2030*, is strength towards this end. Thus, reinforcing these requirements with appropriate legislation, and strategies may provide a long-term solution to the skills gap currently experienced. Since it was noted earlier that unemployment is a major problem in Kenya, especially for girls, programmes that will enhance female placement and internships in engineering occupations which are valued by them as well as their families may encourage their increased enrolments in these courses in the long term.

10.7. Limitations of the study

One of the limitations of the study was that the sample was limited to Heads of Departments and their students enrolled in diploma courses in engineering and business areas at TVET level and in their first and third year of study. The opinions of some of the key stakeholders including primary and secondary school students, teachers, careers advisors, parents, employers, the professional engineers and graduates of TVET courses were not sought. These limitations were as a result of the limited resources available for the study including funding and time. Thus, the study had to be focussed on a population that would not only be manageable but also provide adequate data that would be reliable in addressing the research questions. Although the views of students in both primary and secondary schools were not sought, the data collected from students enrolled in TVET courses included their experiences at the school level, thus to some extent bridged this gap. Besides, it should be understood that some of the Heads of Departments were professional engineers and to some extent represented the views of this group. In addition, their experiences in teaching coupled with their responsibility in admitting students gave them an advantage of a wide knowledge about influences on student careers choices. Moreover, the very high return rates of the two questionnaires that is, 64 Heads of Departments (100 %) and 999 students (91%) provided a sound data base that adequately represented a wide range of opinions of the targeted population.

A second limitation of the study was its cross-sectional nature in that it could not consider what happens after the student participants' graduate and seek employment. It would be of interest to analyse the performance of this group in employment both in general and by gender with a view of determining any differences. Such an evaluation requires a longitudinal study which would entail relatively more time compared with this study.

10.8. Recommendations to key stakeholders

Based on the conclusions from this study, every stakeholder must have a role to play if enrolment challenge in general and by gender is to be addressed. Therefore, the following recommendations have been made requiring contributions by the key stakeholders including the government, technical training institutions, schools, and industry towards addressing the skills shortage as well as gender parity in technology and engineering enrolments.

1) Gender parity in TVET may be enhanced if the government boosts its investment in science, technology and engineering with a view to improving the quality of teaching science and mathematics subjects at both primary and secondary school levels and technology and engineering courses at TVET level. Ensuring that this investment takes into account equity in geographical distribution of training institutions may ease access to the programmes by a majority of the citizens.

2) If the government continue implementing the bursary award scheme currently in force and also mobilise more funds for awarding scholarships for needy students and for females to increase their proportions of enrolments in technology and engineering courses, then gender parity in engineering courses at TVET level may be improved.
3) Gender parity in engineering courses at TVET level may also be improved if technical training institutions develop and implement short,

pre-entry courses to upgrade students, especially girls with lower grades in science and mathematics subjects, but with interests in enrolment in engineering courses.

4) Attraction and retention of female students in STEM programmes may be enhanced if both training institutions and schools ensure that the training environment in science, mathematics in schools and technology and engineering courses at TVET level are conducive for both genders.

5) Gender parity in engineering enrolment at TVET level may be improved if the government formulates and enforces policies that would require schools to implement programmes aimed at changing the culture and knowledge base of careers advice to broaden interest in engineering courses and careers, including knowledge of options for females.

6) Gender parity in engineering at TVET level may be improved by joint efforts of technical training institutions, schools and industry in popularizing engineering courses. Reaching out to aspiring students may be enhanced by laying emphases on use of popular media in the country for relaying careers information.

7) Partnerships of schools and industry with the goal of designing and implementing programmes that would create confidence in school students, especially girls, in engineering as future careers options may improve gender parity in engineering at TVET level. Including in these programmes long term measures aimed at building students', especially girls', confidence and liking for subjects such as mathematics and science, at the primary school level, reinforcing the choice of relevant science subjects at secondary school level and laying emphasis on the importance of mathematics may also enhance gender parity in technology and engineering at TVET level.

8) Government exploration of other measures not covered in this study but which have the potential to raise female student interests in science, technology, engineering and mathematics may improve gender parity in TVET enrolment. For example, in Australia use of outreach programmes has not only been recommended for raising interests of school students

in STEM subjects and courses at both international and regional levels, but has been successfully implemented (Husher, 2010).

9) Gender parity in TVET courses may be enhanced if the government enact legal frameworks that will not only actualise the gender requirements of the current constitution on employment but also address cultural discriminations.

10.9. Recommendations for further studies

In view of the results obtained and the limitations in scope of this study, the following future research that may contribute to the knowledge base is recommended.

1) Since the sample of the present study was limited to students enrolled in the two courses and their respective Heads of Departments, a further study that will increase the range of respondents to other key stakeholders including students enrolled in schools and other TVET courses, their parents, teachers, career advisors and professionals in both engineering and business fields may enhance better understanding of TVET enrolments generally, and by gender specifically.
2) Important information on influences on gender enrolment in TVET may be availed by undertaking longitudinal studies of TVET graduates with a view to evaluating their performance in general and by gender in engineering employments.
3) A further study on how young people perceive engineering jobs, concepts and programmes may disclose the information that is important to understand engineering enrolment challenge.

10.10. Concluding remarks

Achieving equity in TVET programmes especially those related to engineering fields is a challenge across the globe requiring a better solution. However, since the importance of the role played by Technical and Vocational Education in building capacities for both national and individuals' economic and social development cannot be overemphasised for Kenya, there is an urgent need to find a solution to address the enrolment gaps both in general and by gender. An example from what happens in the construction industry may give some insights on how this solution could be found.

It is generally known that construction of a house is complex and thus requires undertaking an investigation into the specific soils it would be built on with a view of finding out the type of soil, its major weaknesses and strength to aid in designing an appropriate foundation. Besides, the house must be built following a systematic plan describing a series of actions that must be undertaken within a given time frame specifying the time frame each action must be accomplished before the house is ready for use. In the same way, factors influencing enrolments in engineering courses generally and by gender are complex and differ by national contexts and their relative importance. Thus, increasing enrolments as well as assuring gender equity in these courses may require not only an investigation to understand the underlying factors in a given national context, but also their strength as well as implementing a specific plan of action describing what can be done and by whom, in the short term, medium term and long term to achieve a more effective solution.

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APPENDICES

APPENDIX A: SUMMARY OF REPORTS THAT FOCUS ON INFLUENCES ON ENROLMENTS

The most significant recent reports on enrolment are summarised in the following table specifying their scope, approach used and findings.

Report Title	Origin	Scope	Approach	Findings
Amelink , T. C., and Creamer, G. E. Gender Differences in Elements of the Undergraduate Experience that Influence Satisfaction with the Engineering Major and the Intent to Pursue Engineering as a Career.	USA 2010	The study identified gender differences on indicators of the undergraduate experience including faculty-related and student-related variables as well as measures of satisfaction with the institutional environment that are related to satisfaction with the engineering major and intent to pursue a career in engineering in ten-year time.	Used mixed methods involving nine institutions with engineering undergraduate degree programmes. An online questionnaire was administered to undergraduate students enrolled in engineering. Qualitative data was collected through focus group interviews with students at each of the nine participating institutions distributed throughout the United States.	Findings reveal that satisfaction with the engineering major does not translate directly to pursuing a career in engineering, particularly among women. In terms of elements of the undergraduate experience, some types of interactions with faculty and peers have both short- and long-term impacts on interest in engineering as a major and as a career. There were no significant differences by gender in agreeing that they were satisfied with their decision to pursue engineering as a major. Males were more likely to believe that they would work in engineering fields.
Bloom, D., Canning, D. and Chan, K. Higher Education and Economic Development in Africa.	World Bank 2005	The paper challenged the long-held belief in the international development community that tertiary education has little role in promoting economic growth in Africa.	Analysis of policy, documents and statistical data from UNESCO, World Bank.	Status of enrolment in Africa was the lowest worldwide. Expanding tertiary education may promote faster technological catch-up and improve a country's ability to maximize its economic output. Sub-Saharan Africa's current production level was about 23 per cent below its production possibility frontier. Thus, given this shortfall, increasing the stock of tertiary education by one year could maximize the rate of technological catch-up at a rate of 0.63 percentage points a year, or 3.2 percentage points over five years.
Brown B. L. Women and Minorities in High-Tech Careers.	USA 2001	Presented ways that schools and teachers could use to attract women and minorities to high-tech careers and prepare them for work.	An analysis of studies.	Studies demonstrate that barriers to science, mathematics, engineering, and technology careers may be overcome by effective school practices. These include teaching and learning practices, early intervention programmes, and mentoring. Social and educational factors that have created barriers to high-tech careers can help educators to move new generations of female and minority students into the high-tech careers in which they have been underrepresented.

Report Title	Origin	Scope	Approach	Findings
Bunyi G. W. Negotiating the Interface Between Upper Secondary and Higher Education in Sub-Saharan Africa: the Gender Dimensions.	France 2008	Exposed the nature and extent of the gender inequities in the transition from upper secondary and participation in higher education in sub-Saharan Africa; Underlined the barriers of female participation in higher education; synthesized various policy interventions that had been implemented, and provided case studies of promising interventions.	Analyzing ministries of education documents programmes and project documents including brochures and newsletters, monitoring and evaluation reports and studies.	Transition from upper secondary to higher education was very low for both boys and girls but especially for girls. Gender disparities were particularly wide in transition to higher education SMT courses and also in the particular case of women from socio-economically marginalized groups. Factors emanating from the feeder school system, the interface between upper secondary and higher education, the higher education system and factors that cut across education levels which include economic, socio-cultural and contextual factors such as HIV and AIDS influenced gender disparities in higher education. Implemented interventions to enhance gender parity in sub-African countries were in small proportions hence did not have significant impact.
Bunyi G. W. Interventions that Increase Enrolment of Women in African Tertiary Institutions. A case study prepared for a Regional Training Conference on Improving Tertiary Education in Sub-Saharan Africa: Things That Work!	Kenya 2003	Analysed interventions put in place to increase female enrolments in tertiary education in Africa.	Analyses of educational policies and literature review	Interventions to address gender disparities at university level that were being implemented in Africa and elsewhere were: Affirmative action (remedial courses and cut off points for girls' admission in universities programmes), engendering tertiary institutions, gender sensitization, outreach programmes, expansion of tertiary places, and addressing relevance of university programmes. However, the implementation varied with countries and in small proportions.
Cohen, C.C. and Deterding, N. Widening the net: National estimates of gender disparities in engineering.	2009 USA	Explored the causes behind the severe under-representation of women in engineering.	Quantitative research, analysing enrolment and degree data covering academic years 1999–2000 through 2004–2005compiled from the American Society for Engineering Education (ASEE), the Engineering Workforce Commission (EWC), Engineering Trends; and integrated Education Data System at the National Center for Education Statistics and the National Science Foundation.	Contrary to widespread beliefs, the study found that overall and in most disciplines there was no differential attrition by gender. Instead, results suggest that gender disparities in engineering were largely driven by inadequate enrolment of women. Recommended need for outreach within institutions of higher education, across institutions and into K-12 curricular reform to address the recruitment as the main problem.

Report Title	Origin	Scope	Approach	Findings
Colclough, C. Global gender goals and the construction of equality: conceptual dilemmas and policy practice.	UK 2007	Examined the processes by which the achievement of gender equality in education, and of women's empowerment more generally, came to be included amongst the Millennium Development Goals (MDGs). Attempted to disentangle the meanings, and the theoretical underpinning of their various formulations. Assessed the feasibility of their attainment and the actual/potential roles of the international community in this process.	Review of literature on implementation of EFA and MDGs. Relied on UNESCO monitoring reports.	Argued that the revised education for all targets to 2015 was more practicable than earlier goals. However, improvement of rates of progress needed enhanced financial support. The paper concluded that gender equality in education was not easy to monitor as an outcome of policy change. The failure to meet gender policy change had serious implications for the possibility of achieving the MDGs – amongst aid donors as they were amongst developing-country governments themselves.
Darling-Hammond, L. The flat earth and education: How America's commitment to equity will determine our future.	USA 2007	Provided an outline of disparities in educational access and illustrate relationships between race, resources, and achievement.	Analysed USA education enrolment statistics and government policies.	Students interests in science and mathematics was related to quality of teaching of the subjects. Recommended need for advancement in balancing resources with attention to disparities at all levels—between states, among schools, and among students differentially placed in classrooms.
Engineering and Technology Board ETB, Factors Influencing Year 9 Career Choices	UK. 2005	Determined how year 9 students could be better supported with advice and background information (Role models etc.) relating to career opportunities in the SET sector.	Questionnaires (1,011 returned) sent out to a representative sample of schools.	Mathematics and science were regarded as more challenging than English, and science was the least likely to be classified as an easy subject. High achievers were most likely to study science compared with other subjects. Science subjects were more popular to boys than girls. Science was much less likely than Mathematics or English to be considered necessary for a good job. The main reasons for student choice of subjects were that they were interested in them and believed the subject to be important for a future job or career and they perceived themselves to be good at a subject. Males and students from higher social-economic backgrounds were more likely to be interested in science and technology careers. Student mostly received career information from websites.
Forum for African Women Educationalist [FAWE]. Re-entry for Adolescent School Girl Mothers, Zambia. Best Practices in Girls' Education in Africa.	Zambia 2004	Examined and recommended re-entry policies for adolescent girl mothers in schools.	Four case studies; Review of literature.	Recommended need to put in place policy environment that was committed to removal of all barriers to access to girls education. Ownership of the policies through participation in formulation and implementation was important. Policies formulation needed be based on information. Sensitization of key stakeholders about re-entry policy and reincorporate re-entry into the ministry structure was important.

Report Title	Origin	Scope	Approach	Findings
Franzway S., Sharp R., Mills J.E., and Gill J. "Engineering Ignorance: The Problem of Gender Equity in Engineering." Frontiers:	Australia 2009	Investigation of engineering as a resilient male-dominated occupation and industry.	Analysed quantitative survey of Australian women engineers (together with a matched sub-sample of men) undertaken by the National Women in Engineering Committee of the professional association, the Institution of Engineers, in 2000. Qualitative study of semi-structured interviews with 51 engineers (41 women and 10 men) who were drawn from the national survey, with a further four interviews of women engineers via email across regional, remote, and metropolitan centres of Australia	Women engineers were significantly more dissatisfied with the prevailing conditions and attitudes in their workplaces than were their male counterparts. However, there was little information to suggest solutions that could increase the small number of women studying or working in the field, in spite of growing demands from the engineering industry.
Fullarton S.,Walker, M., Ainley, J and Hillman, K. Patterns of Participation in Year 12, Longitudinal Surveys of Australian Youth:	Australian 2003	Studied the participation in the final year of school in Australia.	Longitudinal survey. Included cohorts, which were doing Year 9 from 1995 to 1998. The total number of students surveyed exceeds 30,000	Participation rate in Year 12 depended on gender, social economic and cultural backgrounds and earlier school achievement and school sector. Females, students from higher socio-economic backgrounds, non-English speaking groups, earlier school achievers, were more likely to participate in year 12 compared with others.
Griffin, A.M. Educational Pathways in East Africa: Scaling a Difficult Terrain.	Uganda 2007	Undertook in-depth investigations into gender-related access and retention issues within selected universities in three countries of East Africa: Uganda, Tanzania and Kenya. It documented the obstacles faced by females in accessing university education and underlined possible interventions.	Qualitative and quantitative methods of data collection and analysis. Case studies, focus group discussions, interviews, survey questionnaires and literature review. Sources of information were secondary schools, universities, training Institutes	Although the proportion of female students enrolled at university was increasing, those in science based courses remained low. Lowering the university entry points for females, had not achieved gender parity in science-based programmes. Barriers to female enrolments at university level included cultural mindsets which devalued the importance of education for females as compared with males, the demands of the household on females, sexual harassment and sexual maturation issues, practice of female circumcision; unfavourable training environments, lack of female mentors and role models especial for science courses, lack of gender sensitization for teachers and administrators which contributed to poor performance of girls; financial demands of university education and lack the disconnect between feeder schools and universities in terms of information sharing and preparation for new students.
Hannum, E. and C. Buchmann The Consequences of Global Education Expansion: Social Science Perspectives, American Academy of Arts and Sciences,	USA 2003	Research on the presumed consequences of primary and secondary education.	Literature review and analysis of policies.	Expansion of different levels of education seems to have different consequences. Increased primary and secondary education is associated with improved health, greater economic opportunity, and lower population growth. However, tertiary enrolments, in particular, appear to be significantly linked to democratization and technological change. But controversy surrounds the proposition that investment in education results in measurable increments to growth in gross domestic product.

Report Title	Origin	Scope	Approach	Findings
Huggins, A. and Randell, S. Gender Equality in Education in Rwanda: What is Happening to Our Girls? Paper presented at the South African Association of Women Graduates Conference on "Drop-outs from School and Tertiary Studies: What is happening to our Girls?	South Africa 2007	Analysed the status of female participation in schools and university education in Rwanda	Review of literature and statics from other studies	Girl students lagged behind in educational achievement and access, particularly at the secondary and tertiary levels. Girls were under-represented in government schools, and were instead more likely to attend more expensive and lower quality private schools and universities. Despite an enabling policy environment, a number of social and institutional barriers continue to prevent girls and young women from attending schools and universities and from performing equally to their male classmates. The prioritization of science and technology within the educational and development policies of the country may act to further exclude female students unless additional actions were taken to promote women's participation in these fields. Addressing gender equality in the education system, with a focus on improving girls' educational performance and outcomes, is crucial to meeting Rwanda's development goals.
Johnson, W. C. and Jones, R. C. Declining Interest in Engineering Studies at a Time of Increased Business	USA 2006	To identify reasons leading to low enrolments in engineering programmes at tertiary education level.	Documentary review focussing on general conclusions on NSF reports and statistics.	The decline in enrolment in engineering is caused by unattractive projected employment paths caused by off- shoring of engineering graduates; alternative and attractive pathways to good technical jobs; and difficult curriculum.
Jacobs J. E., Chhin, C. S and Bleeker, M. M. Enduring links: Parents' expectations and their young adult children's gender –typed occupational choices.	USA 2006	Examination of long relations between parent's gender-typed occupational expectations and their children's' expectations and occupational choices.	Longitudinal survey on children's and parents' achievements at adolescence and adulthood. Sample comprised 80% of children of 143 sixth grade math classrooms in 12 districts aged 15 years and 60% of their parents. Children were later surveyed at age 17 and 28.	Gender influenced choice of occupations and that parent gender typed expectations continued to be fulfilled as young people began their adult roles and made career choices.
Kerka, S. (2000). Parenting and Career Development.	USA 2000	Looked at the ways in which parenting styles, family functioning, and parent-child interaction influence career development.	Analyses of past studies and review of literature.	Parenting behaviour and family functioning had strong influence on career development. Suggested that career counsellors and career educators should (1) shift the focus from the individual to the family system; (2) develop a new and richer view of parent involvement in schools; (3) help families become more proactive; and (4) consider ways of duplicating helpful types of family functioning in schools, especially for children whose families are not proactive.

Report Title	Origin	Scope	Approach	Findings
Kuenzi, J., Mathews C., at al. (2006). Science, Technology, Engineering and Mathematics (STEM) Education Issues and Legislative Options. Congressional Research Service.	USA 2006	Provided a useful context for legislative proposals to address economic competitiveness that support STEM education	Drew data from 6 reports released in 2005-06 in the USA.	This report first presents data on the state of STEM education and then examines the federal role in promoting STEM education. The report concluded with a discussion of selected legislative options currently being considered to improve STEM education. It was designed by the Congressional Research Service (CRS) for USA Congress
Male, S. A., Bush, M. B. and Murray, K. (2009). Think engineer, think male?.	Australi a2009	Investigated the possibility that the perceived importance of competencies is subconsciously influenced by gendered assumptions, and as a consequence, this lowers the status given to stereotypically feminine competencies. It investigated *gender* typing of engineering jobs.	Quantitative research using two surveys including sample of 300 engineers, who had completed bachelor of engineering degrees from 1985 to 2001 at Australian universities with 245 being males. Second survey targeted 250 senior engineers, 246 of whom were male all with experienced in managing, supervising, or directing engineering teams that had included established engineers.	Stereotypically feminine competencies, such as communication, were found to be important. Stereotyping of engineering jobs was present among the senior male engineers and this weakened the status of feminine competencies including communication, self-management, flexibility, and interacting with people from diverse cultures and backgrounds.
Mau, W. -C., Factors that influence persistence in science and engineering career aspirations.	USA 2003	Investigated student's persistence regarding career aspirations in science and engineering as a function of race and sex.	Data was collected from a three-year longitudinal survey. The survey comprised sample of over 20,000 students selected from 1,052 middle schools in the USA	Concluded that acidic proficiency and math self-efficacy were two main factors influencing persistence in participation in Science and Technology studies. Men were more likely to continue than women in STEM careers. None of the family variables had a significant impact on persistence in STEM career aspirations.
Miralles J (2004). A fair go- Factors impacting on vocational education and training participation and completion in selected ethnic communities.	Australi a 2004	Examined key factors, which influenced participation and completion rates in vocational education and training (VET) for six ethnic communities. The main objective of the research was to explore the factors that led to the lower representation of students born in countries where the first language was not English in the higher credentialed VET programmes designed to lead to employment.	Sample size comprised 200 working-age adults from the following language groups: Arabic, Bosnian, Cantonese, Spanish, Turkish and Vietnamese. Qualitative and quantitative research approaches used.	The factors identified as key to affecting participation in and completion of vocational education and training could be categorised into three: *1.* ***System-wide issues:*** understanding of demands, range and portability of VET programs and multiplicity of purposes for training; ***2. Training issues:*** provision of clear pathway into employment and language support; acknowledgement and addressing cultural; trainers showing understanding of issues they faced; acknowledgement of their existing vocational skills and work experience ***3. Settlement issues:*** including cost**,** proximity to home and ease of access via public transport, availability of childcare.
National Science Board. Science and Engineering Indicators 2008	USA 2008	Provided indicators that could reasonably be thought to provide summary information bearing on the scope, quality, and vitality of science and engineering enterprise in the USA and overseas.	Statistical data derived from a variety of national, international and private sources.	Although Americans expressed strong support for science and technology, most of them were not very well informed about these subjects. The public's lack knowledge, about basic scientific facts and the scientific process could have far reaching implications.

Report Title	Origin	Scope	Approach	Findings
National Science Board Science and Engineering Indicators 2006.	USA 2006	Provide indicators that might reasonably be thought to provide summary information bearing on the scope, quality, and vitality of science and engineering enterprise in the USA and overseas.	Statistical data derived from a variety of national, international and private sources.	Most adults found information about engineering careers on TV and that in 2004 internet was the second most popular channel in relying information.
Onsongo J. K. Promoting gender equity in higher education in selected public universities in Kenya.	Ethiopia. 2011	Examined sustainable gender equity interventions in selected universities. Study focussed on interventions related to access to university education by women, curriculum transformation, university environment and staff promotion and development.	Descriptive survey and case study using both quantitative and qualitative methods. Sample comprised 22 university managers, 52 senior academic staff and 261 students drawn from 4 public universities. Used questionnaires and semi structured interview guides and observations to collect data.	Found that implementation of gender interventions were hampered by a number of barriers including in adequate funding qualified academic staff to teach and manage gender related courses and centres, lack of gender awareness among students, staff and university manager; and negative attitudes towards gender issues and lack of a clear gender policy guidelines. Where policies were in place, they lacked monitoring and evaluation of their implementation. There were no female staff in senior management positions of the universities and females were underrepresented in academic staff. Universities had put in place affirmative action in admission of female students by lowering their admission points. However, this was not effective since it did not address their poor performance at secondary school level and financial inabilities of those from poor households.
Onsongo J. K. Affirmative action, gender equity and university admissions – Kenya, Uganda and Tanzania,	UK 2009	Examined the outcomes of affirmative action policies aimed at improving access for women students to university education in Kenya, Uganda and Tanzania.	Literature review on the different experiences in the three countries of the East African region, on their approach to affirmative action to support gender equality in higher education.	Found different interpretations of affirmative action in the three countries. These included lowering entry scores, remedial pre-university programmes and financial assistance. There were limitations and weaknesses inherent in the piecemeal strategies that focused only on lowering admission scores to university without considering other factors. Thus affirmative action as was applied did not enhance access and gender equity in university education.
Pimpa N. Reference groups and choices of vocational education; Case of Thailand.	Australia 2007	Identify factors influencing Thai students' choices of vocational education.	Quantitative approach using questionnaire to a sample of 412 first year students enrolled in TVET institutions.	Influences on TVET enrolments are: personal attitude, curriculum, potential employment, and attractiveness of campus, tuition fees, parents, and school teachers.

Report Title	Origin	Scope	Approach	Findings
Prieto E., Holbrook, A., Bourke S., O'Connorc J., Page A.,and Husher K. Influences on engineering enrolments. A synthesis of the findings of recent reports.	Australia 2009	The study undertook the task of drawing together reports directed specifically at engineering enrolments to identify the main influences that resulted in enrolments or worked against enrolments.	Methodology based on searches using education, engineering and government databases. Examination and analysis of 30 pieces of academic work on the subject was performed.	Major influences contributing to poor enrolments in engineering degrees, were national investment (Government and private sector), sources of information (parents, teachers, career advisors, media and industry), education (teachers, curriculum and effectiveness of outreach) and perceptions of the profession (Nature of engineering, personal characteristics of engineers and financial rewards).
Prieto E., Holbrook, A., Bourke S., O'Connor J., Page A.,and Husher K. Engineering Choices, engineering futures: "Identification and Development of Strategies for Increasing Engineering Enrolments":	Australia 2011	The study undertook the task of identifying directly what will capture and build young people's interest in engineering and to unlock what is necessary for an effective communication strategy to stimulate enrolments in university engineering programs.	A randomised, cross-sectional sampling design using survey instruments. Returned surveys were 555 primary school pupils from 20 schools, 493 secondary school students from 22 schools; 1517 university students from 6 universities, school teachers 30, 24 counsellors and 153 engineers	13% of primary school participants indicated that they would like to become engineers when they grow up. Primary and secondary school students were generally satisfied with school and school subjects, although slightly less satisfied with science and mathematics. Primary school students had higher satisfaction in computing compared with those at higher levels of education. Students at schooling level had favourable attitudes towards engineering. University engineering students differed by discipline for interest in and importance of science, mathematics, computing, perceptions of engineering and liking for engineering activities, with mechatronics students generally being the most positive and computer/software students being the lowest. Students recognised the need to address gender differences in enrolment in engineering. Recommended the need for enriching the primary school experience, enthusing secondary school students, and encouraging intending tertiary students to enrol in engineering degree programmes.
Rodgers Y. M. and Boyer T. Gender and Racial differences in Vocational Education; an International Perspective.	USA 2006	An examination of the extent to which education systems around the world embraced vocational schooling and the degree to which exposure to vocational schooling differed by gender and race.	Distributional analysis applied to cross-country data from UNESCO to examine shares of secondary school students enrolled in the vocational track, by gender. Descriptive statistics based on USA Department of Education data used to examine fields of study within the vocational track.	The emphasis on vocational education and access to different types of training across demographic groups varied around the world with European countries having relatively high vocational school shares in secondary school. Almost 30 countries in the sample, most of them low-income, had vocational school shares below 4 percent. In the majority of countries, a higher proportion of male secondary school students enrol led in the vocational track compared with female students. In the USA, male students cluster in trade and industrial courses, while female students cluster in business preparation courses.

Report Title	Origin	Scope	Approach	Findings
Ruto, S. J., Ongwenyi, Z. N. and Mugo, J. K. Educational marginalisation in Northern Kenya. Background paper for EFA Global Monitoring Report 2010.	Kenya 2009	Explore the extents of educational marginalization in arid districts in Kenya.	Reviewed of government policy documents, study reports and statistics.	Found that barriers to enrolments in schools located in semi-arid areas were non-flexible curriculum that was not responsive to nomadic way of life, adherence to retrogressive practices like female genital mutilation, early marriage and gender stereotype of girls education; unemployment, language of education and political isolation. The government intervention was through bursary wards.
Smith, L. B. The Socialization of Females with Regard to a Technology-Related Career.	2000	Investigated the experiences of 12 women who had taken career paths into traditionally male dominated STEM areas, and who had excelled in their respective fields.	Quantitative design including in-depth interviews.	The study reinforced prior research, which indicated that role models, scaffolding, and collaborative, hands-on, reality-based assignments facilitated girls' interest in STEM. It revealed that fathers, male peers, or male siblings played a strong part in motivating the participants to engage in tinkering activities, and provided scaffolding. It recommends the need for girls to be encouraged to ask questions and to take risks, even if they were only moderate ones.
The United Nation Economic Commission for Africa. Five Years after Beijing- What efforts in favour of African women? Assessing women and education.	Ethiopia 2001	This report assessed the progress made in the implementation of the Dakar Platform for Action and the Beijing Programme of Action with regard to women's education, five years after the conferences. It dealt specifically with women's inadequate access to education, training and science and technology in Africa.	Relied on statistical data, documents, particularly country reports; and interviews, including with officials of governments, regional and subregional intergovernmental bodies and non-governmental organizations (NGOs).	Emphasized the process, rate and level of implementation of the national plans of action prepared in response to the Dakar and the Beijing recommendations. Found that some progress had been made in the education of girls, especially in basic education, which featured prominently in the recommendations of the Jomtien and Ouagadougou conferences. The poor economic and scientific development of Africa was partly attributable to the educational systems in Africa. African countries were at different levels of promotion of women education.
Trumper, R. Factors affecting junior high school students' interest in physics.	Israel 2006	Student interests in Physics at the end of their compulsory schooling in Israel.	A survey was carried out involving a sample of 635 students (338 females and 297 males) representing the population of all Israeli 9th-grade secular Jew students was randomly sampled in clusters (25 schools, one class at each school).	Students overall interests in Physics was neutral (neither positive nor negative) with boys showing a high interest than girls. There was a strong correlation between student neutral interests in Physics and their negative opinions about science classes. Thus raising serious questions about implementation of changes made in the Israel's science curriculum in primary, junior high school in regard to preparation of young generation in a scientific- technological era.
Watt, H. Exploring adolescent motivations for pursuing maths-related careers	USA/ Australia 2005	Explore adolescents' motivations and perceived influences on their plans to either pursue, or not pursue, maths-related careers	Interviews with a sample of 60 adolescents from grade 9 in Sydney Australia	Self- and values perceptions were posited to be the most immediate influences on students' plans for mathematics coursework participation. The analysis extended this proposition to maths-related career participation, which has clear social relevance. Males were more likely than females to pursue STEM related courses irrespective of past performance in math.

Report Title	Origin	Scope	Approach	Findings
West Midlands Education and Training Department. A survey into the perceptions and attitudes of year 7, 8 and 9 students towards careers in engineering.	UK 2004	Address issues concerning the poor image of engineering and the difficulty of attracting sufficient talented young people to the engineering and manufacturing sector.	Questionnaires (2,500 returned) sent out secondary schools to pupils in year 7, 8 and 9.	Perceptions of students about engineering were generally quite good. Engineering and manufacturing was the second most preferred career choice for males. Pupils were four times more likely to be influenced by their parents for career choice. There was a correlation between visiting a factory and developing an interest in engineering as a career.
Wonacott M. E. Myths and Realities: Equity in Career and Technical Education..	USA 2002	To find out whether Title IX policy was achieved or still a dream. Title IX required that all educational programs receiving federal financial assistance to provide equal opportunities to women and girls, reflected the belief that females could enjoy the same educational opportunities as males if compliance with strict equity requirements were mandated and enforced.	Analysis of literature review.	It was difficult to draw conclusions, as there seem to be two positions. In the first instance, there was persuasive evidence that gender bias, gender segregation, and gender discrimination still existed and still had a baneful effect on access. On the other hand, there was movement toward greater gender balance in some CTE programme enrolments, hence more equitable access to CTE programmes. However, those data were partial, reflecting programme enrolments in only certain states and could not reflect the situation in other states.

APPENDIX B: ENROLMENT DATA OF TECHNICAL TRAINING INSTITUTIONS BY GENDER BY COURSE OF STUDY

Institution	Gender	Enrolment in Diploma Engineering courses per year							Enrolment in Diploma Business courses per year						
		2004	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**
Masai (Rural)	M	11	13	23	29	39	39	39	14	17	34	52	60	47	47
	F	0	0	0	2	5	5	5	11	17	42	58	78	65	65
Mathenge (Rural)	M	3	6	3	7	8	13	12	1	1	0	7	24	43	36
	F	0	0	0	0	0	0	0	1	1	0	6	27	47	41
Rift valley (Town)	M	53	84	155	203	207	245	241	13	15	14	17	11	21	21
	F	1	4	5	6	6	45	51	15	25	32	38	31	41	18
Kinyanjui (City)	M	18	9	14	23	43	75	110	4	5	1	6	30	33	53
	F	0	1	0	0	3	12	13	2	2	5	11	43	60	64
Kabete (City)	M	605	653	627	569	483	478	468	233	236	269	313	332	330	277
	F	296	292	286	248	240	203	175	197	227	302	369	410	437	418
Kaiboi (Rural)	M	75	115	151	179	205	230	239	12	29	47	42	46	53	74
	F	6	7	8	12	19	24	38	10	24	40	49	61	73	93
Kitale (Town)	M	288	270	345	285	286	280	399	146	104	128	151	176	177	172
	F	34	46	73	79	70	61	113	150	87	110	136	170	193	180
Ol'lesso s (Rural)	M	19	48	49	76	76	87	91	6	24	36	58	56	80	102
	F	1	4	3	7	7	10	13	17	33	39	78	95	108	78

Source Ministry of Education, Science and Technology enrolment documents

APPENDIX C: UNIVERSITY OF NEWCASTLE HUMAN RESEARCH ETHICS COMMITTEE APPROVAL CERTIFICATE

HUMAN RESEARCH ETHICS COMMITTEE

THE UNIVERSITY OF NEWCASTLE AUSTRALIA

Notification of Expedited Approval

To Chief Investigator or Project Supervisor:	**Professor Sidney Bourke**
Cc Co-investigators / Research Students:	**Mr Meshack Opwora** **Doctor Donald Adams**
Re Protocol:	**Factors influencing gender enrolment in Technical and Vocational Education and Training (TVET) programmes in Kenya**
Date:	**07-Jan-2011**
Reference No:	**H-2010-1306**
Date of Initial Approval:	**06-Jan-2011**

Thank you for your **Initial Application** submission to the Human Research Ethics Committee (HREC) seeking approval in relation to the above protocol.

Your submission was considered under **L2 Low Risk Research Expedited** review by the HREC Panel.

I am pleased to advise that the decision on your submission is **Approved** effective **06-Jan-2011**.

For noting:

1. Application Questions

a. Please ensure that the school principals are aware that the that their appointed institution officer (who will be asked to distribute the Information Statements and Questionnaires), should not hold a position of power over the potential participants (ie will not be their lecturer / direct manager etc)

2. Participant Information Statement

a. In line with the information provided in the application at E7, you may wish to include the information that a summary of the results will be available on the University of Newcastle website.

b. If you anticipate that you may wish to use the collected data beyond the 5 year storage period, then consider changing the final sentence within the privacy paragraph to '...data will be kept for a minimum of 5 years'.

3. Questionnaire / Survey

a. Add a cover sheet to the questionnaire, including the University of Newcastle logo, the title of the research, and the names of the Chief Investigator and student researcher.

b. The wording and range of options at (Part 1) Q7 regarding parental lifestyle may need review to improve clarity and quality of data obtained.

Please provide HREC with final copies of any amended documents resulting from the above comments.

In approving this protocol, the Human Research Ethics Committee (HREC) is of the opinion that the project complies with the provisions contained in the National Statement on Ethical Conduct in Human Research, 2007, and the requirements within this University relating to human research.

Approval will remain valid subject to the submission, and satisfactory assessment, of annual progress reports. *If the approval of an External HREC has been "noted" the approval period is as determined by that HREC.*

The full Committee will be asked to ratify this decision at its next scheduled meeting. A formal *Certificate of Approval* will be available upon request. Your approval number is **H-2010-1306**.

If the research requires the use of an Information Statement, ensure this number is inserted at the relevant point in the Complaints paragraph prior to distribution to potential participants You may then proceed with the research.

Conditions of Approval

This approval has been granted subject to you complying with the requirements for *Monitoring of Progress*, *Reporting of Adverse Events*, and *Variations to the Approved Protocol* as detailed below.

PLEASE NOTE:
In the case where the HREC has "noted" the approval of an External HREC, progress reports and reports of adverse events are to be submitted to the External HREC only. In the case of Variations to the approved protocol, or a Renewal of approval, you will apply to the External HREC for approval in the first instance and then Register that approval with the University's HREC.

- ***Monitoring of Progress***

Other than above, the University is obliged to monitor the progress of research projects involving human participants to ensure that they are conducted according to the protocol as approved by the HREC. A progress report is required on an annual basis. Continuation of your HREC approval for this project is conditional upon receipt, and satisfactory assessment, of annual progress reports. You will be advised when a report is due.

- ***Reporting of Adverse Events***

1. It is the responsibility of the person **first named on this Approval Advice** to report adverse events.

2. Adverse events, however minor, must be recorded by the investigator as observed by the investigator or as volunteered by a participant in the research. Full details are to be documented, whether or not the investigator, or his/her deputies, consider the event to be related to the research substance or procedure.
3. Serious or unforeseen adverse events that occur during the research or within six (6) months of completion of the research, must be reported by the person first named on the Approval Advice to the (HREC) by way of the Adverse Event Report form within 72 hours of the occurrence of the event or the investigator receiving advice of the event.
4. Serious adverse events are defined as:
   - Causing death, life threatening or serious disability.
   - Causing or prolonging hospitalisation.
   - Overdoses, cancers, congenital abnormalities, tissue damage, whether or not they are judged to be caused by the investigational agent or procedure.
   - Causing psycho-social and/or financial harm. This covers everything from perceived invasion of privacy, breach of confidentiality, or the diminution of social reputation, to the creation of psychological fears and trauma.
   - Any other event which might affect the continued ethical acceptability of the project.
5. Reports of adverse events must include:
   - Participant's study identification number;
   - date of birth;
   - date of entry into the study;
   - treatment arm (if applicable);
   - date of event;
   - details of event;
   - the investigator's opinion as to whether the event is related to the research procedures; and
   - action taken in response to the event.
6. Adverse events which do not fall within the definition of serious or unexpected, including those reported from other sites involved in the research, are to be reported in detail at the time of the annual progress report to the HREC

- ***Variations to approved protocol***

If you wish to change, or deviate from, the approved protocol, you will need to submit an *Application for Variation to Approved Human Research*. Variations may include, but are not limited to, changes or additions to investigators, study design, study population, number of participants, methods of recruitment, or participant information/consent documentation. **Variations must be approved by the (HREC) before they are implemented** except when Registering an approval of a variation from an external HREC which has been designated the lead HREC, in which case you may proceed as soon as you receive an acknowledgement of your Registration.

Linkage of ethics approval to a new Grant

HREC approvals cannot be assigned to a new grant or award (ie those that were not identified on the application for ethics approval) without confirmation of the approval from the Human Research Ethics Officer on behalf of the HREC.

Best wishes for a successful project.

Professor Alison Ferguson
Chair, Human Research Ethics Committee
For communications and enquiries:
Human Research Ethics Administration
Research Services
Research Office
The University of Newcastle
Callaghan NSW 2308
T +61 2 492 18999
F +61 2 492 17164 Human-Ethics@newcastle.edu.au

Linked University of Newcastle administered funding:

Funding body	Funding project title	First named investigator	Grant Ref

APPENDIX D: RESEARCH AUTHORIZATION BY THE REPUBLIC OF KENYA

REPUBLIC OF KENYA

NATIONAL COUNCIL FOR SCIENCE AND TECHNOLOGY

Telegrams:"SCIENCETECH", Nairobi
Telephone: 254-020-241349, 2213102
254-020-310571, 2213123.
Fax: 254-020-2213215, 318245, 318249
When replying please quote

P.O. Box 30623-00100
NAIROBI-KENYA
Website: www.ncst.go.ke

Our Ref: **NCST/RRI/12/1/SS-011/96/4**

Date: **7th February 2011**

Meshack Chuma Opwora
The University of Newcastle
AUSTRALIA

RE: RESEARCH AUTHORIZATION

Following your application for authority to carry out research on ***"Factors influencing gender enrolment in technical and vocational education and training programmes in Kenya"*** I am pleased to inform you that you have been authorized to undertake research **in Nairobi, Rift Valley, Central, Eastern, Coast and Western Provinces** for a period ending ***31st January 2014.***

You are advised to report to **the Provincial Technical Training Officers in the selected Provinces and the Principals of the selected Technical Training Institutes** before embarking on the research project.

On completion of the research, you are expected to submit **one hard copy and one soft copy** of the research report/thesis to our office.

P. N. NYAKUNDI
FOR: SECRETARY/CEO

Copy to:

The Provincial Technical Training Officers
Selected Provinces

The Principals
Technical Training Institutes

APPENDIX E: STUDENTS' QUESTIONNAIRE

Introduction

The purpose of this study is to identify the factors influencing enrolment in technological and engineering courses offered in technical training institutes in Kenya. The study will also determine the relative importance of the factors and examine the significance of government bursary scheme targeting gender parity in the programmes. The purpose of this questionnaire is to seek your opinion on the factors affecting enrolment in technical institutions in general and enrolment in engineering, technology and business courses in particular.

Before you make a decision to complete this questionnaire, please read the information statement enclosed. If you choose to complete this questionnaire, please be accurate and honest. Please note that **THERE IS NO RIGHT OR WRONG ANSWER.** Your views and opinions are very important and will be highly appreciated and respected.

About the Questionnaire

The questionnaire is divided into two parts: **1 and 2.**

Part 1 is designed to seek some background information about you to enable the researcher to categorize the findings;

Part 2 essentially seeks views regarding various factors that influence enrolment in technology, engineering and business courses generally and by gender in technical training institutes. It also seeks to rank the factors in accordance with their relative importance.

PART 1: Background information and descriptive of the student

Please respond to questions 1 to 8 which have been designed to assist the researcher to categorise your responses. Please tick the appropriate answer.

1. What is your gender?

(a) Male ( )
(b) Female ( )

2. Which of the following is your age bracket?

(a) 18 to 25 years ( )

(b) 26 to 30 years ( )

(c) 31 to 40 years ( )

(d) 41 and above ( )

3. Please indicate the area of programme you are enrolled in.

(a) Technological or engineering ( )

(b) Business ( )

4. What year are you enrolled in?

(a) First year ( )

(b) Third year ( )

5. Which of the following best describes the geographical location of your home?

(a) City (Nairobi, Kisumu or Mombasa) ( )

(b) It is in any of the two largest towns in my province(Exclude Nairobi, Kisumu and Mombasa)

( )

(c) Rural area ( )

6. Which of the following best describes the geographical location of your institution?

(a) City (Nairobi, Kisumu or Mombasa) ( )

(b) It is in the two largest towns in my province(Exclude Nairobi, Kisumu and Mombasa) ( )

(c) Rural ( )

7. Which of the following best describes the life style of your parents? (Please circle)

a) High Class ( )

b) Middle Class ( )

c) Low Class ( )

PART 2:- Factors Affecting Enrolment in TVET Programmes and their relative rank

(A) What attracts students to TVET programmes?

8. Attitudes and interests towards science, mathematics and business

(a). Read carefully each statement on the following table and tick any one of the alternatives that best represents your experiences about science, mathematics and business in secondary school. The alternatives are weighted as follows:

Strongly agree (SA) = 4, Agree (A) = 3, Disagree (D) = 2 and Strongly Disagree (SD) = 1

		Strongly Agree	Agree	Disagree	Strongly Disagree
A	**Experience in Science**				
		SA	**A**	**D**	**SD**
1	I enjoyed science subjects in secondary school	☐	☐	☐	☐
2	I felt good when it came to working on science assignments in secondary school	☐	☐	☐	☐
3	I think science is exciting	☐	☐	☐	☐
4	I found science to be more interesting than other subjects in secondary school	☐	☐	☐	☐
5	I liked working on science problems during my spare time in secondary school.	☐	☐	☐	☐
6	I wanted to learn all about science in secondary school	☐	☐	☐	☐
B	**Experience in Mathematics**				
		SA	**A**	**D**	**SD**
1	I enjoyed doing mathematics at secondary school	☐	☐	☐	☐
2	I felt good when it came to working on mathematics assignments in secondary school	☐	☐	☐	☐

		SA	A	D	SD
3	I think mathematics is exciting	☐	☐	☐	☐
4	I found mathematics to be more interesting than other subjects in secondary school	☐	☐	☐	☐
5	I liked working on mathematics problems during my spare time in secondary school.	☐	☐	☐	☐
6	I wanted to learn all about mathematics in secondary school	☐	☐	☐	☐

		Strongly Agree	Agree	Disagree	Strongly Disagree
C	**Experience in Computing**				
		SA	**A**	**D**	**SD**
1	I enjoyed computing at secondary school	☐	☐	☐	☐
2	I felt good when it came to working on computing assignments in secondary school	☐	☐	☐	☐
3	I think computing is exciting	☐	☐	☐	☐
4	I found computing to be more interesting than other subjects in secondary school	☐	☐	☐	☐
5	I liked working on computing problems during my spare time in secondary school.	☐	☐	☐	☐
6	I wanted to learn all about computing in secondary school	☐	☐	☐	☐

D	**Experience in Accounting**				
		SA	**A**	**D**	**SD**
1	I enjoyed accounting at secondary school	☐	☐	☐	☐
2	I felt good when it came to working on accounting assignments in secondary school	☐	☐	☐	☐
3	I think accounting is exciting	☐	☐	☐	☐
4	I found accounting to be more interesting than other subjects in secondary school	☐	☐	☐	☐
5	I liked working on accounting problems during my spare time	☐	☐	☐	☐

		SA	A	D	SD
	in secondary school.				
6	I wanted to learn all about accounting in secondary school	☐	☐	☐	☐

E	**Experience in Business education**				
		SA	**A**	**D**	**SD**
1	I enjoyed business education at secondary school	☐	☐	☐	☐
2	I felt good when it came to working on business education assignments in secondary school	☐	☐	☐	☐
3	I think business education is exciting	☐	☐	☐	☐
4	I found business education to be more interesting than other subjects in secondary school	☐	☐	☐	☐
5	I liked working on business education problems during my spare time in secondary school.	☐	☐	☐	☐
6	I wanted to learn all about business education in secondary school	☐	☐	☐	☐

(b). From the following list of secondary school subjects please indicate by ticking the three you liked most and the three you liked least; the three most difficult and three least difficult.

SUBJECT	MOST LIKED (TICK 3)	LEAST LIKED (TICK 3)	MOST DIFFICULT (TICK 3)	LEAST DIFFIC ULT (TICK 3)
English	☐	☐	☐	☐
Kiswahili	☐	☐	☐	☐
Mathematics	☐	☐	☐	☐
Biology	☐	☐	☐	☐
Chemistry	☐	☐	☐	☐
Physics	☐	☐	☐	☐
History	☐	☐	☐	☐

Religious education	☐	☐	☐	☐
Geography	☐	☐	☐	☐
Business Education	☐	☐	☐	☐
Accounting	☐	☐	☐	☐
Technical and industrial education	☐	☐	☐	☐

(c). Read carefully each statement and tick appropriate alternative that best represents your opinion about the usefulness of science, mathematics, technology, engineering and business. The alternatives are weighted as follows: Strongly agree (SA) = 4, Agree (A) = 3, Disagree (D) = 2 and Strongly Disagree (SD) = 1

		Strongly Agree	Agree	Disagree	Strongly Disagree
A	**Usefulness of Science**				
Having an understanding of science is important for:		**SA**	**A**	**D**	**SD**
1	my future career	☐	☐	☐	☐
2	my personal development	☐	☐	☐	☐
3	my employment	☐	☐	☐	☐
4	social development	☐	☐	☐	☐
5	national economic development	☐	☐	☐	☐

		Strongly Agree	Agree	Disagree	Strongly Disagree
B	**Usefulness of Mathematics**				
Having an understanding of mathematics is important for:		**SA**	**A**	**D**	**SD**
1	my future career	☐	☐	☐	☐
2	my personal development	☐	☐	☐	☐
3	my employment	☐	☐	☐	☐
4	social development	☐	☐	☐	☐
5	national economic development	☐	☐	☐	☐

C Usefulness of Technology/computing					
Having an understanding of technology/computing is important for:		SA	A	D	SD
1	my future career	☐	☐	☐	☐
2	my personal development	☐	☐	☐	☐
3	my employment	☐	☐	☐	☐
4	social development	☐	☐	☐	☐
5	national economic development	☐	☐	☐	☐

D Usefulness of Engineering					
Having an understanding of engineering is important for:		SA	A	D	SD
1	my future career	☐	☐	☐	☐
2	my personal development	☐	☐	☐	☐
3	my employment	☐	☐	☐	☐
4	social development	☐	☐	☐	☐
5	national economic development	☐	☐	☐	☐

		Strongly Agree	Agree	Disagree	Strongly Disagree
E Usefulness of Business					
Having an understanding of business is important for:		SA	A	D	SD
1	my future career	☐	☐	☐	☐
2	my personal development	☐	☐	☐	☐
3	my employment	☐	☐	☐	☐
4	social development	☐	☐	☐	☐
5	national economic development	☐	☐	☐	☐

9. Interests in technology, engineering and business

The following are statements describing interests in technology, engineering, and business-related areas. Indicate by ticking any of the alternatives that best describes your interest. The values assigned to the alternatives are: Strongly Agree (SA) = 4; Agree (A) = 3; Disagree (D) = 2; and Strongly Disagree (SD) = 1.

		Strongly Agree	Agree	Disagree	Strongly Disagree
	Interests in technology, engineering and business				
I like doing the following:		**SA**	**A**	**D**	**SD**
1	Designing things	☐	☐	☐	☐
2	Working as part of a team	☐	☐	☐	☐
3	Creating and constructing things	☐	☐	☐	☐
4	Testing and modeling my ideas	☐	☐	☐	☐
5	Experimenting	☐	☐	☐	☐
6	Venturing into new projects	☐	☐	☐	☐
7	Marketing products and services	☐	☐	☐	☐
8	Keeping accounting records	☐	☐	☐	☐
9	Managing people	☐	☐	☐	☐
10	Solving problems	☐	☐	☐	☐

10. Employment interests

From the list of jobs below, please indicate by numbering up to three you would like to do with 1 being the foremost, 2 the second most, and 3 the third most preferred.

1	Shop work/retails, wholesale, hardware	☐
2	Office work	☐
3	Healthcare / medicine / nursing	☐
4	Services (e.g. police, fire service, transport, national youth service)	☐
5	Armed forces (army, navy, air force,)	☐
6	Information technology	☐
7	Agriculture (farming, gardening)	☐
8	Hotels / catering	☐
9	Technology/engineering	☐
10	Banker, or financial institutions	☐
11	Manufacturing	☐
12	Teaching	☐
13	Music / drama / media / art	☐
14	Accountant	☐
15	Businessman/ Entrepreneur	☐
16	Tourist industry	☐
17	A manager	☐
18	Others; specify	

11. Influence from people, media and internet

What was the level of influence from the following sources towards your choice of the course you are undertaking? Please indicate on the following table by ticking the box that best represents your rating. (The rating scale for level of influence is 4 Very High (VH); 3 High (H); 2 Low (L); and 1 None (N)).

		Very High	High	Low	None
A	**Influence from family and other people on your choice of course**				
		VH	**H**	**L**	**N**
1	Your dad	☐	☐	☐	☐
2	Your mum	☐	☐	☐	☐
3	Your brother	☐	☐	☐	☐
4	Your sister	☐	☐	☐	☐
5	Your other male relative	☐	☐	☐	☐
6	Your other female relative	☐	☐	☐	☐
7	Your close friends	☐	☐	☐	☐
8	Your science teacher	☐	☐	☐	☐
9	Your mathematics teacher	☐	☐	☐	☐
10	Your business education teacher	☐	☐	☐	☐
11	A careers advisor	☐	☐	☐	☐
B	**Influence from media and internet**				
		VH	**H**	**L**	**N**
1	TV or the internet	☐	☐	☐	☐
2	Newspapers	☐	☐	☐	☐

12. Students objectives for doing the course

How important were the following objectives in influencing your enrolment in the current course? Rank them from most important (1) to least important (4).

	OBJECTIVE	**RANK**
1	For advancement to higher education	☐
2	To acquire a desired skill	☐
3	To get employed	☐
4	To get better salary	☐

13. Influence of Technical and Vocational Education and Training system and policies on your decision to enrol in this course.

Indicate by ticking the appropriate alternative on whether the following have had any influence on your decision to enrol in your current course. The ratings are; Very High (VH) influence 4; High (H) influence 3; Low (L) influence 2; and No (N) influence 1.

		Very High	High	Low	No
	Influence from TVET system and policies on your decision to enrol in this course				
		VH	**H**	**L**	**N**
1	Availability of Government TVET bursaries	☐	☐	☐	☐
2	Flexibility of TVET curriculum	☐	☐	☐	☐
3	Quality of training	☐	☐	☐	☐
4	Conducive learning environment	☐	☐	☐	☐
5	Geographical location of the institution I am enrolled in	☐	☐	☐	☐
6	Cost of the course	☐	☐	☐	☐

14. (a) If you had a second chance to choose your career, would you pursue the same course? (i) YES ( ) (ii) NO ( )

(b) If your answer in 7 (a) above is 'NO', please indicate the broad area of the course you would choose.

(i) Business ( )

(ii) Technology and engineering ( )

(iii) Other areas ( )

(Please specify) ____

15. What is the reason for your answer in 7 above? …… … ………………..

<u>(B). Factors affecting gender parity in engineering and technological courses</u>

16. There is more gender parity in business courses than in technology and engineering courses. The following statements describe possible factors that may influence gender parity in Technical and Vocational Education and Training programmes. Indicate by ticking the alternative that best represents your opinion of each statement. The rating scale is as follows:

Strongly Disagree (SD) = 1; Disagree (D) = 2; Agree (A) = 3; Strongly Agree (SA) = 4

	FACTORS THAT HINDER EQUAL ENROLMENT OF MALE AND FEMALE STUDENTS IN TECHNOLOGICAL ENGINEERING COURSES	Strongly Disagree	Disagree	Agree	Strongly Agree
A	***Attitudes and interests towards the courses***				
		SD	***D***	**A**	***SA***
1	Females lack personal interests in technology and engineering courses compared with males	☐	☐	☐	☐
2	Females don't enjoy studying technology and engineering courses compared with males	☐	☐	☐	☐
3	Females don't like technology and engineering courses compared with males	☐	☐	☐	☐
B	***Cultural influence***				
		SD	***D***	**A**	***SA***
1	Technology and engineering courses are more suited to males than females	☐	☐	☐	☐
2	Technology and engineering jobs are meant for males but not for females	☐	☐	☐	☐
3	Employment opportunities in technological and engineering are limited for females than for males	☐	☐	☐	☐
4	Technological and engineering jobs are too dirty for females than for males	☐	☐	☐	☐
5	Technological and engineering jobs are more difficult for females than for males	☐	☐	☐	☐
6	Technological and engineering jobs are more dangerous for females than for males	☐	☐	☐	☐
C	***Employment interests***				
		SD	***D***	**A**	***SA***
1	Technological and engineering related jobs are more important for males than females	☐	☐	☐	☐
2	Males are more interested in technological and engineering jobs than females	☐	☐	☐	☐
3	Males become more excellent technologists and engineers than females	☐	☐	☐	☐
4	Females are more interested in business jobs than males are	☐	☐	☐	☐
D	***Interest in science, and maths***	**Strongly Agree**	**Agree**	**Disagree**	**Strongly Disagree**
		SD	***D***	**A**	***SA***
1	Females are less interested in science and mathematics	☐	☐	☐	☐

	compared with males.				
2	Females perform poorer compared with males in mathematics and science at secondary school level	☐	☐	☐	☐
E	***Effects of influence from family and other people***				
	The following people have more influence on females choice of courses compared with males	***SD***	***D***	**A**	***SA***
1	secondary school teachers	☐	☐	☐	☐
2	parents	☐	☐	☐	☐
3	brothers and sisters	☐	☐	☐	☐
4	relatives	☐	☐	☐	☐
5	peers	☐	☐	☐	☐
6	Occupational role models	☐	☐	☐	☐
F	***Media and internet have more influence on males enrolment compared with females in technological and engineering courses***	☐	☐	☐	☐
G	***TVET Systems and policies***				
		SD	***D***	**A**	***SA***
1	Institutional TVET policies favour males more than females	☐	☐	☐	☐
2	There is inadequate provision of TVET bursaries for females compared with males	☐	☐	☐	☐
3	Institutional environment, facilities and equipment favour males more than females	☐	☐	☐	☐
4	Curriculum for technology and engineering favour males more than females	☐	☐	☐	☐
5	Geographical location of training institutions favour males more than females	☐	☐	☐	☐
H	***Individual's objectives in doing the course***				
		SD	***D***	**A**	***SA***
1	Objectives to get employed have more influence on males' choice of technology and engineering courses compared with females.	☐	☐	☐	☐
2	Objectives for advancement to higher education have more influence on males choice of technological and engineering courses compared with females	☐	☐	☐	☐
3	Objectives to get better salary have more influence on female students' choice of business courses compared with males	☐	☐	☐	☐

17. Please add any other information that you think is important to this study.

END

THANK YOU FOR YOUR CO-OPERATION!

APPENDIX F: QUESTIONNAIRE FOR HEADS OF DEPARTMENTS

Introduction

The purpose of this study is to identify the factors influencing enrolment in technological and engineering courses offered in technical training institutes in Kenya. The study will also rank the factors and examine the significance of government bursary scheme targeting gender parity in the programmes. The purpose of this questionnaire is to seek your opinion on the factors affecting enrolment in technical institutions in general and enrolment in engineering, technology and business courses in particular.

Before you make a decision to complete this questionnaire, please read the information statement enclosed. If you choose to complete this questionnaire, please be accurate and honest. Please note that **THERE IS NO RIGHT OR WRONG ANSWER.** Your views and opinions are very important and will be highly appreciated and respected.

About the Questionnaire

The questionnaire is divided into two parts: **1 and 2.**

Part 1 seeks some background information and descriptive about you to enable the researcher to categorise the findings.

Part 2 essentially seeks views regarding various factors that contribute to gender disparities in technological, engineering and business courses in technical training institutes and the interventions you think can enhance gender balance in enrolments in the courses.

PART 1: HOD's Background Information.

Please respond to question 1 to 4 to assist the researcher to categorise your responses.

1. Please indicate your gender by ticking in the brackets.

(a) Male ( ) (b) Female ( )

2. Please indicate your age bracket by ticking the appropriate option below.

(a) Up to 30 years ( )

(b) 31 to 40 years ( )

(c) 41 years and above ( )

3. Please indicate the category of the department that you head by ticking the appropriate option.

(a) Engineering and technological ( )

(b) Business ( )

4. Please indicate the geographical location of your institution.

(a) City ( )

(b) Town ( )

(c) Rural ( )

PART: 2 Your Views on Factors Affecting Enrolment in TVET Programmes

(A). Factors affecting gender parity in technological and engineering courses

5. The following statements describe possible factors that may influence gender parity in Technical and Vocational Education and Training programmes. Indicate by ticking the alternative that best represents your opinion of each statement. The rating scale is as follows:

Strongly Disagree (SD) = 1; Disagree (D) = 2; Agree (A) = 3; Strongly Agree (SA) = 4

FACTORS THAT HINDER EQUAL ENROLMENT OF MALE AND FEMALE STUDENTS IN TECHNOLOGICAL ENGINEERING COURSES	Strongly Disagree	Disagree	Agree	Strongly Agree
A Students' attitudes and interests towards the courses				

		SD	D	A	SA
1	Females lack personal interests in technology and engineering courses compared with males	☐	☐	☐	☐
2	Females don't enjoy studying technology and engineering courses compared with males	☐	☐	☐	☐
3	Females don't like technology and engineering courses compared with males	☐	☐	☐	☐
4	Males lack personal interests in business and accounting courses compared with females	☐	☐	☐	☐
5	Males don't enjoy studying business and accounting courses compared with females	☐	☐	☐	☐
6	Males don't like business and accounting courses compared with females	☐	☐	☐	☐

B	***Students' employment interests***	**Strongly Disagree**	**Disagree**	**Agree**	**Strongly Agree**
		SD	***D***	**A**	***SA***
1	Technological and engineering related jobs are more important for males than for females	☐	☐	☐	☐
2	Males are more interested in technological and engineering jobs compared with females	☐	☐	☐	☐
3	Males become better technologists and engineers compared with females	☐	☐	☐	☐
4	Females are more interested in business and accounting jobs compared with males	☐	☐	☐	☐
5	Females become better at business and accounting compared with males	☐	☐	☐	☐
C	***Students' interests in science, and maths***				
		SD	***D***	**A**	***SA***
1	Females are less interested in science and mathematics compared with males.	☐	☐	☐	☐
2	Females perform wolrse compared with males in mathematics and science at secondary school level	☐	☐	☐	☐
D	***TVET Systems and policies***				
		SD	***D***	**A**	***SA***
1	Institutional TVET policies favour males more than females	☐	☐	☐	☐
2	There is inadequate provision of TVET bursaries for females compared with males	☐	☐	☐	☐
3	Institutional environment, facilities and equipment favour	☐	☐	☐	☐

	males more than females				
4	Curriculum for technology and engineering favour males more than females	☐	☐	☐	☐
5	Geographical location of training institutions favour males more than females	☐	☐	☐	☐
E	***Effects of influence from family and other people***				
The following people have more influence on females choice of courses compared with males		***SD***	***D***	**A**	***SA***
1	secondary school teachers	☐	☐	☐	☐
2	parents	☐	☐	☐	☐
3	brothers and sisters	☐	☐	☐	☐
4	relatives	☐	☐	☐	☐
5	peers	☐	☐	☐	☐
6	Occupational role models	☐	☐	☐	☐
F	***Cultural influence***	**Strongly Disagree**	**Disagree**	**Agree**	**Strongly Agree**
		SD	***D***	**A**	***SA***
1	Technology and engineering courses are more suited to males than to females.	☐	☐	☐	☐
2	Technology and engineering jobs are meant for males but not for females	☐	☐	☐	☐
3	Employment opportunities in technological and engineering are more limited for females than for males	☐	☐	☐	☐
4	Technological and engineering jobs are too dirty for females	☐	☐	☐	☐
5	Technological and engineering jobs are more difficult for females than for males	☐	☐	☐	☐
6	Technological and engineering jobs are more dangerous for females than for males	☐	☐	☐	☐
7	Business and accounting courses are more suited to females than to males	☐	☐	☐	☐
8	Business and accounting jobs are more suited to females than to males.	☐	☐	☐	☐
G	***Media and internet have more influence on males enrolment compared with females in technological and engineering courses***	☐	☐	☐	☐
H	***Individual's objectives in doing the course***				

	The following are the main reasons why individuals do your courses	***SD***	***D***	**A**	***SA***
1	To become professionals	☐	☐	☐	☐
2	For advancement to higher education	☐	☐	☐	☐
3	To set up businesses	☐	☐	☐	☐
4	To get employed	☐	☐	☐	☐
5	For self actualization	☐	☐	☐	☐
6	To get better salary	☐	☐	☐	☐

(B). ISSUES CONCERNING GENDER PARITY IN TVET

6. Given below are statements about enrolment and training of students in diploma courses in the technological, engineering and business programs in Technical Training Institutes. Circle one of the given choices on a four-point scale that best describes your opinion. The scale is interpreted as follows:

S.A –Strongly Agree; A - Agree; D-Disagree and SD- Strongly Disagree

1. The dropout rate of females who enroll in technological and engineering courses is more than that of their male counterparts.

SA A D SD

2. Females who enroll for technological and engineering courses cannot work independently as compared with their male counterparts.

SA A D SD

3. The dropout rate of males who enrol in business and accounting courses is more than that of their female counterparts.

SA A D SD

4. Males who enroll for business and accounting courses cannot work independently as compared with their female counterparts.

SA A D SD

(C). Measures to ensure gender parity in TVET

7. Which of the following are the five most important measures you think will achieve better gender parity in your courses? Please indicate by assigning appropriate number 1, 2, 3, 4 or 5 (Where 1 represents most important measure and 5 represents the least important measure).

(a) Enhance training institutions' collaborations with careers guidance and counselling departments in schools. ☐

(b) Make curriculum flexible and suitable for both genders ☐

(c) Undertake promotional activities to popularise TVET programmes ☐
(d) Increase award of bursaries and scholarships to improve gender equity. ☐
(e) Use of role models to encourage enrolment in the programmes ☐
(f) Development and implementation of institutional gender policies ☐

(g) Improve the training environment, facilities and equipment to attract both genders ☐
(h) Use of affirmative action in admission ☐

(i) Any other (please specify) ....

END
THANK YOU FOR YOUR CO-OPERATION!

APPENDIX G 1: DIRECTOR OF TECHNICAL EDUCATION INFORMATION STATEMENT

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Director of Technical Education Information Statement for the Research Project:

RESEARCH PROJECT: Factors Influencing Gender Enrolment in Technical and Vocational Education and Training (TVET) in Kenya
dated 15/11/2010

You are requested to give your consent for your institutions to participate in the research project identified above which is being conducted by Prof. Sid Bourke (Principal supervisor), Dr. Donald Adams (Co supervisor) and Mr. Meshack Chuma Opwora (Student Researcher) from the School of Education at the University of Newcastle. The research is part of Meshack Chuma Opwora's Doctoral studies at the University of Newcastle.

Why is the research being done?

Kenya has identified science, engineering and technology as one of the major platforms for spearheading the achievement of its vision for becoming industrious and prosperous country by the year 2030. Even though, there are low enrolment rates of female students in science, technology and engineering in technical training institutions. This is despite government's efforts to address the disparities. This will not only undermine the achievement of the vision of the Nation, but also hinder females' empowerment and social inclusion.
There has been no national study done in this area to inform policy decisions. The purposes of the research therefore are: (1) to identify the factors influencing

gender enrolment in engineering and technological courses at diploma level in technical training institutes;

(2) rank them in accordance to their relative importance; and (3) examine the significance of the government's bursary scheme targeting gender parity. A further purpose is: (4) to identify any differences in influences between business and engineering and technological courses.

The research findings will be important to the stakeholders and government of Kenya, who will focus the limited resources available to major areas which have a great impact on gender enrolment in TVET. The policy makers will use the information to review policies in TVET and make informed decisions that will guide the growth of the sub-sector. In addition, the curriculum developers will use the finding to review and design a curriculum that is attractive and relevant for both genders to equally participate in the national development. This will go in a long way in building an equitable national human capital with relevant skills for achievement of the national development goals

Who can participate in the research?

We are targeting first and third year students enrolled in diploma courses in engineering, technology, and business fields offered in technical training institutes. In addition, Heads of Departments of technology, engineering and business in technical training institutes are also sought.

What choice do the participants have?

Participation in this research is entirely by choice. Whether or not the participants decide to participate, their decision will not disadvantage them. The information to be collected will be treated confidentially and therefore they will not be required to write the names of their institutions, their names or any of their identification on the questionnaires. Since the questionnaires are anonymous, it will not be possible to link their responses to themselves or their institution.

They may:

- Decide not to continue answering questions at any time without giving a reason.
- Choose not to answer some of the questions
- Decide not to submit the answered questionnaire
- Answer and submit the questionnaire

What would they be asked to do?

If they agree to participate, they will be asked to complete a questionnaire which is designed to find out your opinion on factors that influence gender enrolment in the engineering, technological and business courses. In addition, the questionnaire seeks to find out what attracts students (generally and by gender) to enrol in engineering, technology and business programmes.

How much time will it take?

The questionnaire will take 30 minutes to be completed.

What are the risks and benefits of participating?

While there may be no direct benefit to the participants, indirect benefits may be experienced through the outcomes of the research. In addition, there are no risks anticipated by participating in this research.

How will their privacy be protected?

It is emphasised that the questionnaire is anonymous and therefore not possible to identify them with the responses. They are further assured that the only people who will access to the information collected will be the two supervisors and student researcher. The completed questionnaires will be kept confidentially under lock and key in the primary supervisor's office; will only be accessible to the supervisors and the student researcher. Upon completion of the analysis of data the analysed data will be kept on a computer which will be protected by a password. As required by the university, data will be kept for five years.

How will the information collected be used?

The final study report will be contained in a thesis which will be submitted for the Doctor of Philosophy degree in Education for Mr. Meshack Chuma Opwora. The executive summary of the study will be made available to participating Institutions and the Directorate of Technical Education. If you wish to obtain a summary of the results, which will not be available until the end of 2013, please contact via email the student researcher. The results may also be published in appropriate journals and presented at conferences.

***What do they need to do to participate*?**

They are required to read this Information Statement and be sure they understand its contents before they consent to participate. If there is anything they do not understand, or they have questions, they should contact the researcher. If they would like to participate, they can complete and return the attached anonymous questionnaire in the reply paid envelope provided. This will be taken as their informed consent to participate.
If you consent to the study please complete the Director of Technical Education's consent form and return to the either the principal supervisor or the researcher.

Further information

If you would like further information please contact Meshack Opwora on +254721591138 or e-mail meshack.opwora@studentmail.newcastle.edu.au or mopwora@gmail.com. or Attention to Meshack Opwora , Ministry of Higher Education, Science and Technology, P.O Box 60209 00200 Nairobi, Kenya.

Thank you for considering this invitation.

Signed:

Meshack C. Opwora	**Prof. Sid. F. Bourke**
Student Researcher	**Principal Supervisor**

Complaints about this research

This project has been approved by the University's Human Research Ethics Committee, Approval No. .... **H-2010-1306**..

Should you have concerns about your rights as a participant in this research, or you have a complaint about the manner in which the research is conducted, it may be given to Meshack Opwora ,e-mail meshack.opwora@studentmail.newcastle.edu.au or mopwora@gmail.com, Ministry of Higher Education, Science and Technology, P.O Box 60209 00200 Nairobi, Kenya. or, if an independent person is preferred, to the Human Research Ethics Officer, Research Office, The Chancellery, The University of Newcastle, University Drive, Callaghan NSW 2308, Australia, telephone (02) 49216333, email Human-Ethics@newcastle.edu.au.

APPENDIX G.2: PRINCIPALS' INFORMATION STATEMENT

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THE UNIVERSITY OF
NEWCASTLE
AUSTRALIA

Prof. Sid Bourke (Supervisor)
School of Education / Faculty of Education and Arts
University of Newcastle, NSW, 2308 Australia
Telephone +61249215901
Email Sid.Bourke@newcastle.edu.au

<u>Principals Information Statement for the Research Project:</u>

RESEARCH PROJECT: Factors Influencing Gender Enrolment in Technical and Vocational Education and Training (TVET) in Kenya
Document Version 1; dated 15/11/2010

You are invited to consent and appoint an officer from your institution who will undertake the distribution of packages of questionnaires to your institution for the the research project identified above which is being conducted by Prof. Sid Bourke (Principal supervisor), Dr. Donald Adams (Co supervisor) and Mr. Meshack Chuma Opwora (Student Researcher) from the School of Education at the University of Newcastle. The research is part of Meshack Chuma Opwora's Doctoral studies at the University of Newcastle.

Why is the research being done?

Kenya has identified science, engineering and technology as one of the major platforms for spearheading the achievement of its vision for becoming industrious and prosperous country by the year 2030. Even though, there are low enrolment rates of female students in science, technology and engineering in technical training institutions. This is despite government's efforts to address the disparities. This will not only undermine the achievement of the vision of the Nation, but also hinder females' empowerment and social inclusion.

There has been no national study done in this area to inform policy decisions. The purposes of the research therefore are: (1) to identify the factors influencing gender enrolment in engineering and technological courses at diploma level in technical training institutes; (2) rank them in accordance to their relative importance; and (3) examine the significance of the government's bursary scheme targeting gender parity.

A further purpose is: (4) to identify any differences in influences between business and engineering and technological courses.

The research findings will be important to the stakeholders and government of Kenya, who will focus the limited resources available to major areas which have a great impact on gender enrolment in TVET. The policy makers will use the information to review policies in TVET and make informed decisions that will guide the growth of the sub-sector. In addition, the curriculum developers will use the finding to review and design a curriculum that is attractive and relevant for both genders to equally participate in the national development. This will go in a long way in building an equitable national human capital with relevant skills for achievement of the national development goals

Who can participate in the research?

We are targeting first and third year students enrolled in diploma courses in engineering, technology, and business fields offered in technical training institutes. In addition, Heads of Departments of technology, engineering and business in technical training institutes are also sought.

What choice do the participants have?

Participation in this research is entirely by choice. Whether or not the participants decide to participate, their decision will not disadvantage them. The information to be collected will be treated confidentially and therefore they will not be required to write the names of their institutions, their names or any of their identification on the questionnaires. Since the questionnaires are anonymous, it will not be possible to link their responses to themselves or their institution.

They may:

1) Decide not to continue answering questions at any time without giving a reason.
2) Choose not to answer some of the questions
3) Decide not to submit the answered questionnaire
4) Answer and submit the questionnaire

What would they be asked to do?

If they agree to participate, they will be asked to complete a questionnaire which is designed to find out your opinion on factors that influence gender enrolment in the engineering, technological and business courses. In addition, the questionnaire seeks to find out what attracts students (generally and by gender) to enrol in engineering, technology and business programmes.

How much time will it take?

The questionnaire will take 30 minutes to be completed.

What are the risks and benefits of participating?

While there may be no direct benefit to the participants, indirect benefits may be experienced through the outcomes of the research. In addition, there are no risks anticipated by participating in this research.

How will their privacy be protected?

It is emphasised that the questionnaire is anonymous and therefore not possible to identify them with the responses. They are further assured that the only people who will access to the information collected will be the two supervisors and student researcher. The completed questionnaires will be kept confidentially under lock and key in the primary supervisor's office; will only be accessible to the supervisors and the student researcher. Upon completion of the analysis of data the analysed data will be kept on a computer which will be protected by a password. As required by the university, data will be kept for five years.

How will the information collected be used?

The final study report will be contained in a thesis, which will be submitted for the Doctor of Philosophy degree in Education for Mr. Meshack Chuma Opwora. The executive summary of the study will be made available to participating Institutions and the Directorate of Technical Education. If you wish to obtain a summary of the results, which will not be available until the end of 2013, please contact via email the student researcher. The results may also be published in appropriate journals and presented at conferences.

***What do they need to do to participate*?**

They are required to read this Information Statement and be sure they understand its contents before they consent to participate. If there is anything they do not understand, or they have questions, they should contact the researcher. If they would like to participate, they can complete and return the attached anonymous questionnaire in the reply paid envelope provided. This will be taken as their informed consent to participate.

If you consent to this study, then you will be required to:

1. Appoint an institution officer (who will be asked to distribute the Information Statements and Questionnaires to the respondents). The officer should not hold a position of power over the potential participants (ie will not be their lecturer / direct manager etc).
2. Complete the Principal's consent form and return to either the principal supervisor or the student researcher.

Further information

If you would like further information please contact Meshack Opwora on +254721591138 or e-mail meshack.opwora@studentmail.newcastle.edu.au or mopwora@gmail.com. or Attention to Meshack Opwora , Ministry of Higher Education, Science and Technology, P.O Box 60209 00200 Nairobi, Kenya.

Thank you for considering this invitation.

Signed:

Meshack C. Opwora	**Prof. Sid. F. Bourke**
Student Researcher	**Principal Supervisor**

Complaints about this research

This project has been approved by the University's Human Research Ethics Committee, Approval No. H-2010-1306..

Should you have concerns about your rights as a participant in this research, or you have a complaint about the manner in which the research is conducted, it may be given to Meshack Opwora ,e-mail meshack.opwora@studentmail.newcastle.edu.au or mopwora@gmail.com, Ministry of Higher Education, Science and Technology, P.O Box 60209 00200 Nairobi, Kenya. or, if an independent person is preferred, to the Human Research Ethics Officer, Research Office, The Chancellery, The University of Newcastle, University Drive, Callaghan NSW 2308, Australia, telephone (02) 49216333, email Human-Ethics@newcastle.edu.au.

APPENDIX G.3: PARTICIPANTS' INFORMATION STATEMENT

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THE UNIVERSITY OF NEWCASTLE AUSTRALIA

Participant Information Statement for the Research Project:

RESEARCH PROJECT: Factors Influencing Gender Enrolment in Technical and Vocational Education and Training (TVET) in Kenya
Document Version 1; dated 15/11/2010

You are invited to participate in the research project identified above which is being conducted by Mr. Meshack Chuma Opwora

Why is the research being done?

Kenya has identified science, engineering and technology as one of the major platforms for spearheading the achievement of its vision for becoming industrious and prosperous country by the year 2030. Even though, there are low enrolment rates of female students in science, technology and engineering in technical training institutions. This is despite government's efforts to address the disparities. This will not only undermine the achievement of the vision of the Nation, but also hinder females' empowerment and social inclusion.

There has been no national study done in this area to inform policy decisions. The purposes of the research therefore are: (1) to identify the factors influencing gender enrolment in engineering and technological courses at diploma level in technical training institutes;

(2) Rank them in accordance to their relative importance; and (3) examine the significance of the government's bursary scheme targeting gender parity. A further purpose is: (4) to identify any differences in influences between business and engineering and technological courses.

The research findings will be important to the stakeholders and government of Kenya, who will focus the limited resources available to major areas, which have a great impact on gender enrolment in TVET. The policy makers will use the information to review policies in TVET and make informed decisions that will guide the growth of the sub-sector. In addition, the curriculum developers will use the finding to review and design a curriculum that is attractive and relevant for both genders to equally participate in the national development. This will go in a long way in building an equitable national human capital with relevant skills for achievement of the national development goals

Who can participate in the research?

We are targeting first and third year students enrolled in diploma courses in engineering, technology, and business fields offered in technical training institutes. In addition, Heads of Departments of technology, engineering and business in technical training institutes are also sought.

What would you be asked to do?

You are required to complete a questionnaire which is designed to find out your opinion on factors that influence gender enrolment in the engineering, technological and business courses. In addition, the questionnaire seeks to find out what attracts students (generally and by gender) to enrol in engineering, technology and business programmes.
The information to be collected will be treated confidentially and therefore you will not be required to write your names or any of your identification on the questionnaires. Since the questionnaires are anonymous, it will not be possible to link your responses to yourself.

How much time will it take?

The questionnaire will take 30 minutes to be completed.

What are the risks and benefits of participating?

While there may be no direct benefit to the participants, indirect benefits may be experienced through the outcomes of the research.. In addition, there are no risks anticipated by participating in this research.

How will your privacy be protected?

It is emphasised that the questionnaire is anonymous and therefore not possible to identify you with the responses. You are further assured that the only people who will access to the information collected will be the two supervisors and student researcher. The completed questionnaires will be kept confidentially under lock and key .

How will the information collected be used?

The final study report will be contained in a thesis which will be submitted for the Doctor of Philosophy degree in Education for Mr. Meshack Chuma Opwora. The executive summary of the study will be made available to participating Institutions and the Directorate of Technical Education. If you wish to obtain a summary of the results, which will not be available until the end of 2013, please contact via email the student researcher. The results may also be published in appropriate journals and presented at conferences.

Further information

If you would like further information please contact Meshack Opwora on +254721591138 or e-mail meshack.opwora@studentmail.newcastle.edu.au or mopwora@gmail.com. or Attention to Meshack Opwora , Ministry of Higher Education, Science and Technology, P.O Box 60209 00200 Nairobi, Kenya.

Thank you for considering this invitation.

Signed:

Meshack C. Opwora	**Prof. Sid. F. Bourke**
Student Researcher	**Principal Supervisor**

Complaints about this research

This project has been approved by the University's Human Research Ethics Committee, Approval No. .... **H-2010-1306**..

Should you have concerns about your rights as a participant in this research, or you have a complaint about the manner in which the research is conducted, it may be given to Meshack Opwora ,e-mail meshack.opwora@studentmail.newcastle.edu.au or mopwora@gmail.com, Ministry of Higher Education, Science and Technology, P.O Box 60209 00200 Nairobi, Kenya. or, if an independent person is preferred, to the Human Research Ethics Officer, Research Office, The Chancellery, The University of Newcastle, University Drive, Callaghan NSW 2308, Australia, telephone (02) 49216333, email Human-Ethics@newcastle.edu.au.

APPENDIX H.1: SAMPLE OF THE DIRECTOR OF TECHNICAL EDUCATION, CONSENT FORM

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Prof. Sid Bourke (Supervisor)
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University of Newcastle, NSW, 2308 Australia
Telephone +61249215901
Email Sid.Bourke@newcastle.edu.au

The Director of Technical Education, Consent Form For the Research Project

TITLE: *Factors influencing gender enrolment in Technical and Vocational Education and Training in Kenya (by Meshack Chuma Opwora - student researcher)*

I have considered your request for my consent to the above research project to be conducted in technical training institutions and wish to state as follows:

1. I understand that the project will be conducted as described in the Information Statement, a copy of which I have retained.
2. I have read the Participant Information Statement and questionnaires.
3. I consent to the survey being distributed to Technical Training Institutes for Heads of Departments and students in 3rd and 1st year Diploma programmes in technological, engineering and business departments to participate.
4. I understand that the study participants and colleges will be confidential.
5. I understand that the study is voluntary and presents no risks to the participants.

Print: Name____

Signature__________________________

Date____________________________

APPENDIX H.2: SAMPLE OF THE PRINCIPAL'S CONSENT FORM

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Prof. Sid Bourke (Supervisor)
School of Education / Faculty of Education and Arts
University of Newcastle, NSW, 2308 Australia
Telephone +61249215901
Email Sid.Bourke@newcastle.edu.au

<u>Principal's Consent Form For the Research Project</u>

TITLE: *Factors influencing gender enrolment in Technical and Vocational Education and Training in Kenya (by Meshack Chuma Opwora, student researcher).*

I have considered your request for my consent to the above research project and appointment of an officer to distribute the questionnaires. I wish to state as follows:

1. I understand that the project will be conducted as described in the Information Statement, a copy of which I have retained.
2. I have read the Participant Information Statement and both questionnaires.
3. I consent to a survey being distributed to Heads of Departments and students in 3rd and 1st year Diploma programmes in technological, engineering and business departments.
4. I understand that the study participants and training institutions will be confidential.
5. I understand that the study is voluntary and presents no risks to the participants.
6. I have appointed Mr/Ms .... who has no power over the participants to distribute the questionnaires.

Print: Name____

Signature__________________________ **Date**___________________

APPENDIX I. INFLUENCES ON TVET ENROLMENT BY AGE, SOCIAL CLASS, HOME LOCATION AND INSTITUTIONAL LOCATION.

Table 10.0. Analyses of on influences on student enrolments on TVET Courses by age, social class, home location, and institutional location

	Factors		Mean	SD.	F	df	Sig
Influences by Age	Family and other people influence	18 to 25 years	2.56	.76	1.61	3	.19
		26 to 30 years	2.53	.78			
		31 to 40 years	2.62	.80			
		41 and above	1.61	.90			
	Media and internet	18 to 25 years	3.04	.87	.44	3	.72
		26 to 30 years	3.02	.96			
		31 to 40 years	3.24	.81			
		41 and above	2.75	1.19			
	Student objective	18 to 25 years	2.88	.63	.88	3	.45
		26 to 30 years	2.86	.69			
		31 to 40 years	2.65	.63			
		41 and above	3.06	.38			
	TVET system and policy	18 to 25 years	2.79	.62	.62	3	.60
		26 to 30 years	2.77	.66			
		31 to 40 years	2.91	.46			
		41 and above	2.46	.32			
Influences by Home location	Family and other people influence	City	2.52	.81	.56	2	.57
		Town	2.51	.80			
		Rural Area	2.58	.76			
	Media and internet	City	3.13	.90	1.05	2	.35
		Town	2.96	.93			
		Rural Area	3.04	.86			
	Student objective	City	2.96	.64	2.01	2	.13
		Town	2.79	.60			
		Rural Area	2.88	.64			
	TVET system and policy	City	2.75	.65	.83	2	.44
		Town	2.76	.62			
		Rural Area	2.81	.60			
Influences by institutional location	Family and other people influence	City	2.53	.76	.40	2	.67
		Town	2.54	.77			
		Rural Area	2.58	.78			
	Media and internet	City	3.03	.89	.04	2	.96
		Town	3.05	.85			
		Rural Area	3.05	.89			
	Student objective	City	2.90	.66	1.45	2	.23
		Town	2.81	.58			
		Rural Area	2.91	.65			
	TVET system and policy	City	2.79	.64	.21	2	.81
		Town	2.82	.61			
		Rural Area	2.78	.61			
Influences by social class	Family and other people influence	High Class	2.46	.89	.08	2	.92
		Middle Class	2.55	.77			
		Low Class	2.55	.76			
	Media and internet	High Class	2.59	1.09	1.54	2	.22
		Middle Class	3.05	.86			
		Low Class	3.03	.89			
	Student objective	High Class	2.81	.87	.11	2	.89
		Middle Class	2.88	.64			
		Low Class	2.87	.62			
	TVET system and policy	High Class	2.90	.80			
		Middle Class	2.78	.61	.39	2	.67
		Low Class	2.81	.62			

APPENDIX J. SUMMARY OF INFLUENCES ON TVET ENROLMENT

Table.10.1. Summary of significant and non-significant relationships in influences on student enrolment in TVET courses

		Significant relationships =(Y) and Non-Significant = (N)		
Factor	**Student gender by course**	**Both genders in business & engineering**	**Engineering by gender**	**Business by gender**
Student background influence	Student age influence	Y	N	N
	Year of study influence	N	N	N
	Home location influence	N	N	N
	Institution location influence	Y	Y	N
	Social class influence	Y	N	N
Experience in secondary school subjects (difficulty)	English difficulty experience	Y	Y	N
	Kiswahili difficulty experience	N	N	N
	mathematics difficulty experience	Y	Y	N
	Biology difficulty experience	N	N	N
	Chemistry Difficulty experience	Y	N	N
	Physics Difficulty experience	Y	Y	Y
	History Difficulty experience	N	N	N
	Religious education difficulty experience	Y	Y	N
	Geography Difficulty experience	Y	N	N
	Business Education Difficulty experience	Y	N	N
	Accounting difficult experience	Y	Y	N
	Technical education difficulty	N	N	N
Experience in secondary school subjects (Liking)	English liking experience	Y	Y	N
	Kiswahili liking experience	Y	Y	Y
	Math liking experience.	Y	Y	N
	Biology liking experience	Y	Y	N
	Chemistry liking experience	Y	N	N
	Physics liking experience	Y	Y	Y
	History liking experience	N	N	N
	Religious education liking experience	Y	Y	N
	Geography liking experience	Y	N	N
	Business liking experience	Y	N	N
	Accounting liking experience	Y	N	N
	Technical education liking experience	N	N	Y
Experience in secondary school subjects (enjoyment)	Enjoyment of secondary school science	Y	N	N
	Enjoyment of secondary school Mathematics	Y	N	N
	Enjoyment of secondary school Computing	Y	Y	N
	Enjoyment of secondary school Accounting	Y	N	Y
	Enjoyment of secondary school Business	Y	N	N
Usefulness of subjects	Usefulness of science	Y	N	N
	Usefulness of mathematics	Y	N	N
	Usefulness of technology/computing	Y	N	Y
	Usefulness of engineering	Y	Y	Y
	Usefulness of business	Y	N	N

		Significant relationships =(Y) and NON-Sig = (N)		
Factor	**Student gender by course**	**Both genders in business & engineering**	**Engineering by gender**	**Business by gender**
Interests in areas	Interest in engineering area	Y	Y	N
	Interest business area	Y	N	N
	Interest general area	N	N	N
Employment interests	Interests in shop , wholesale, hardware	N	N	N
	Office work	Y	Y	N
	Interest in health care (nurse)	Y	Y	N
	Interests in service (police) employment	N	N	N
	Interests in armed forces employment	Y	Y	Y
	Interests in Information Technology employment	N	Y	N
	Interests in agricultural employment	N	Y	N
	Interests in Hotels and catering	Y	Y	N
	Interests in technology engineering employment	Y	Y	N
	Interests in Banking and finance employment	Y	Y	N
	Interests in manufacturing employment	Y	N	N
	Interests in teaching employment	N	N	N
	Interests in music, drama, media employment	N	N	N
	Interests in accounting employment	Y	Y	N
	Interests in business entrepreneur employment	Y	N	N
	Interests in tourist industry employment	Y	N	N
	Interests in management employment	Y	N	N
Family and other people	Father influence	N	N	N
	Mother influence	N	Y	N
	Brother influence	N	N	N
	Sister influence	Y	Y	N
	Male relative influence	N	N	N
	Female relative influence	Y	Y	N
	Friends influence	Y	N	N
	Science teacher influence	Y	N	Y
	Mathematics teacher influence	Y	N	N
	Business teacher influence	Y	Y	N
	Career advisor influence	Y	Y	N
Media and internet	TV or internet influence	N	N	N
	Newspaper influence	N	N	N
Student objective to do the course	Objective to advance to higher education influence	Y	N	Y
	Objective to acquire desired skill influence	Y	N	N
	Objective to get employed influence	N	N	N
	Objective to get better salary influence	N	N	N
Government system and policies	Availability of government bursary influence	Y	N	N
	TVET curriculum flexibility influence	N	N	N
	Quality training influence	N	N	N
	Conducive learning environment influence	Y	N	N

	Location of institution influence	N	N	N
	Cost of course influence	N	N	N

Appendices K, L and M present the detailed results of analyses of influences on student enrolment in TVET courses.

APPENDIX K. DETAILED ANALYSES OF INFLUENCES ON STUDENT ENROLMENTS IN TVET COURSES

Table 10.2. Student backgrounds by gender enrolment in TVET courses

Background	Student gender by course	18 to 25 years %	26 to 30 years %	31 to 40 years %	41 and above	χ^2	df	Sig
Student age influence	Female in Engineering	92.4	3.8	3.8		18.76	9	.03
	Males in Engineering	86.6	10.1	2.4	.9			
	Females in Business	94.2	4.9	.8				
	Males in Business	90.5	7.5	2.0				
		First Year	**Third Year**					
Year of study influence	Female in Engineering	49.6	50.4			2.41	3	.49
	Males in Engineering	50.7	49.3					
	Females in Business	44.7	55.3					
	Males in Business	46.7	53.3					
		City	**Town**	**Rural**				
Home location influence	Female in Engineering	18.8	11.7	69.5		2.46	6	.87
	Males in Engineering	18.1	10.0	71.9				
	Females in Business	18.0	11.3	70.7				
	Males in Business	16.4	14.2	69.4				
		City	**Town**	**Rural**				
Institution location influence	Female in Engineering	25.8	33.9	40.3		14.23	6	.03
	Males in Engineering	35.3	22.5	42.2				
	Females in Business	30.1	28.2	41.6				
	Males in Business	26.8	21.9	51.4				
		Higher	**Middle**	**Lower**				
Social class influence	Female in Engineering	2.3	62.8	34.9		18.42	6	.01
	Males in Engineering	1.4	57.4	41.2				
	Females in Business	1.7	71.9	26.4				
	Males in Business	1.5	69.7	28.7				

Table 10.3. Student attitudes and interests in secondary school subjects by TVET courses by gender

Secondary school subject	Student gender by course	Least Difficult%	Moderately difficult%	Most Difficult%	χ^2	df	Sig
English difficulty experience	Female in Engineering	6.9	89.7	3.4	18.70	6	.01
	Males in Engineering	12.4	76.9	10.7			
	Females in Business	9.1	87.2	3.7			
	Males in Business	8.6	84.5	6.9			
Kiswahili difficulty experience	Female in Engineering	11.9	78.8	9.3	8.09	6	.23
	Males in Engineering	14.3	73.6	12.1			
	Females in Business	10.6	82.5	6.9			
	Males in Business	15.0	77.2	7.8			
mathematics difficulty experience	Female in Engineering	5.8	70.2	24.0	52.54	6	.00
	Males in Engineering	6.4	76.6	17.0			
	Females in Business	6.0	51.4	42.6			
	Males in Business	8.0	58.9	33.1			
Biology difficulty experience	Female in Engineering	7.8	76.5	15.7	11.04	6	.09
	Males in Engineering	12.4	70.7	16.9			
	Females in Business	8.7	81.6	9.7			
	Males in Business	13.7	73.2	13.1			
Chemistry Difficulty experience	Female in Engineering	15.8	60.5	23.7	23.10	6	.00
	Males in Engineering	8.4	63.8	27.8			
	Females in Business	10.6	47.8	41.5			
	Males in Business	9.3	53.5	37.2			
Physics Difficulty experience	Female in Engineering	8.5	61.5	29.9	112.34	6	.00
	Males in Engineering	8.4	72.2	19.4			
	Females in Business	10.4	31.1	58.5			
	Males in Business	9.9	43.9	46.2			
History Difficulty experience	Female in Engineering	23.6	65.5	10.9	5.84	6	.44
	Males in Engineering	19.9	67.5	12.6			
	Females in Business	22.8	68.0	9.1			
	Males in Business	20.0	73.3	6.7			
Religious education difficulty experience	Female in Engineering	32.1	61.5	6.4	23.81	6	.00
	Males in Engineering	39.6	44.8	15.7			
	Females in Business	25.0	68.2	6.8			
	Males in Business	31.7	56.9	11.4			
Geography Difficulty experience	Female in Engineering	17.8	66.3	15.8	21.19	6	.00
	Males in Engineering	16.3	60.9	22.8			
	Females in Business	28.9	58.3	12.8			
	Males in Business	19.0	68.0	12.9			
Business Education Difficulty experience	Female in Engineering	24.0	56.0	20.0	44.75	6	.00
	Males in Engineering	20.7	63.4	15.9			
	Females in Business	12.1	81.6	6.3			
	Males in Business	11.5	83.0	5.5			
Accounting difficult experience	Female in Engineering	17.4	32.6	50.0	31.79	6	.00
	Males in Engineering	27.1	44.6	28.3			
	Females in Business	27.6	50.0	22.4			
	Males in Business	25.4	57.1	17.5			
Technical education difficulty	Female in Engineering	31.1	42.6	26.2	5.18	6	.52
	Males in Engineering	28.4	47.0	24.6			
	Females in Business	33.0	34.8	32.1			
	Males in Business	32.6	44.6	22.8			
English liking experience	Female in Engineering	24.2	18.8	57.0	32.30	6	.00
	Males in Engineering	30.5	31.2	38.3			
	Females in Business	22.3	19.7	58.0			
	Males in Business	22.1	24.6	53.3			

Secondary school subjects	Student gender by course	Least Difficult%	Moderately difficult%	Most Difficult%	χ^2	df	Sig
Kiswahili liking experience	Female in Engineering	30.5	27.3	42.2	28.59	6	.00
	Males in Engineering	37.3	34.4	28.3			
	Females in Business	27.3	24.8	47.9			
	Males in Business	28.7	33.8	37.4			
Math liking experience.	Female in Engineering	23.4	33.6	43.0	95.28	6	.00
	Males in Engineering	22.1	26.8	51.1			
	Females in Business	26.5	53.4	20.2			
	Males in Business	32.3	47.2	20.5			
Biology liking experience	Female in Engineering	19.5	31.3	49.2	8.80	6	.19
	Males in Engineering	26.8	35.4	37.8			
	Females in Business	27.3	29.4	43.3			
	Males in Business	25.6	36.9	37.4			
Chemistry liking experience	Female in Engineering	23.4	46.1	30.5	46.15	6	.00
	Males in Engineering	31.0	42.0	27.0			
	Females in Business	32.8	58.4	8.8			
	Males in Business	32.8	52.8	14.4			
Physics liking experience	Female in Engineering	25.8	43.8	30.5	170.54	6	.00
	Males in Engineering	16.2	34.2	49.6			
	Females in Business	21.8	72.3	5.9			
	Males in Business	23.1	61.5	15.4			
History liking experience	Female in Engineering	34.4	43.8	21.9	15.03	6	.02
	Males in Engineering	26.0	43.2	30.7			
	Females in Business	26.1	43.7	30.3			
	Males in Business	21.5	37.9	40.5			
Religious education liking experience	Female in Engineering	22.7	39.8	37.5	24.60	6	.00
	Males in Engineering	23.6	51.1	25.3			
	Females in Business	18.9	38.7	42.4			
	Males in Business	16.9	47.2	35.9			
Geography liking experience	Female in Engineering	29.7	47.7	22.7	12.76	6	.05
	Males in Engineering	22.9	49.4	27.8			
	Females in Business	29.4	54.2	16.4			
	Males in Business	26.2	48.7	25.1			
Business liking experience	Female in Engineering	22.7	56.3	21.1	114.30	6	.00
	Males in Engineering	25.6	51.1	23.3			
	Females in Business	14.7	29.4	55.9			
	Males in Business	13.8	29.7	56.4			
Accounting liking experience	Female in Engineering	18.8	78.1	3.1	29.64	6	.00
	Males in Engineering	22.1	70.5	7.4			
	Females in Business	16.8	68.1	15.1			
	Males in Business	19.0	63.1	17.9			
Technical education liking experience	Female in Engineering	10.2	79.7	10.2	9.51	6	.15
	Males in Engineering	11.1	78.9	10.1			
	Females in Business	12.6	83.6	3.8			
	Males in Business	10.8	79.0	10.3			

Table 10.4. Student interests and attitude scales by gender by course

Subject	Gender by course	Mean	Std. Deviation	F	df	Sig
Experience, Enjoyment of secondary school science	Female Engineering	2.99	.56	55.49	3	.00
	Males in Engineering	3.08	.53			
	Females in Business	2.55	.69			
	Males in Business	2.60	.64			
	Total	2.85	.65			
Experience, enjoyment of secondary school Mathematics	Female Engineering	2.93	.72	29.47	3	.00
	Males in Engineering	2.95	.63			
	Females in Business	2.52	.82			
	Males in Business	2.51	.75			
	Total	2.76	.74			
Experience, enjoyment of secondary school Computing	Female Engineering	2.83	.72	5.63	3	.00
	Males in Engineering	2.62	.81			
	Females in Business	2.86	.73			
	Males in Business	2.81	.76			
	Total	2.74	.78			
Experience, enjoyment of secondary school Accounting	Female engineering	2.33	.73	24.09	3	.00
	Males in Engineering	2.31	.80			
	Females in Business	2.70	.84			
	Males in Business	2.88	.85			
	Total	2.53	.85			
Experience, enjoyment of secondary school Business	Female engineering	2.74	.75	76.25	3	.00
	Males in Engineering	2.68	.80			
	Females in Business	3.42	.64			
	Males in Business	3.39	.60			
	Total	3.02	.80			
Usefulness of science	Female engineering	3.32	.53	52.47	3	.00
	Males in Engineering	3.41	.50			
	Females in Business	2.89	.66			
	Males in Business	2.93	.63			
	Total	3.18	.62			
Usefulness of mathematics	Female engineering	3.18	.67	4.11	3	.01
	Males in Engineering	3.26	.60			
	Females in Business	3.17	.64			
	Males in Business	3.07	.65			
	Total	3.19	.63			
Usefulness of technology/computing	Female engineering	3.43	.59	2.58	3	.05
	Males in Engineering	3.34	.58			
	Females in Business	3.42	.57			
	Males in Business	3.28	.62			
	Total	3.36	.59			
Usefulness of engineering	Female engineering	3.14	.83	167.94	3	.00
	Males in Engineering	3.56	.58			
	Females in Business	2.39	.72			
	Males in Business	2.57	.77			
	Total	3.04	.86			
Usefulness of business	Female engineering	3.17	.71	99.44	3	.00
	Males in Engineering	3.11	.61			
	Females in Business	3.74	.44			
	Males in Business	3.76	.33			
	Total	3.41	.62			
Interest in engineering area	Female engineering	3.22	.70	54.34	3	.00
	Males in Engineering	3.43	.51			
	Females in Business	2.87	.61			
	Males in Business	2.95	.65			
	Total	3.18	.63			

Subject	Gender by course	Mean	Std. Deviation	F	df	Sig
	Males in Engineering	2.92	.68			
	Females in Business	3.43	.57			
	Males in Business	3.38	.63			
	Total	3.14	.68			
Interest general area	Female engineering	3.36	.62	.55	3	.65
	Males in Engineering	3.42	.50			
	Females in Business	3.43	.47			
	Males in Business	3.40	.52			
	Total	3.41	.52			

Table 10.5. Employment interests by gender by course of study

Employment interests	Student gender by course	Not preferred %	Third most preferred%	Second most preferred %	First most preferred %	χ^2	df	Sig
Interests in shop , wholesale, hardware	Female in Engineering	63.4	9.9	13. 0	13.7	9.32	9	.41
	Males in Engineering	54.4	14.1	15.1	16.5			
	Females in Business	58.8	9.1	13.6	18.5			
	Males in Business	56.0	15.0	15.5	13.5			
Office work	Female in Engineering	55.7	19.8	16.8	7.6	62.87	9	.00
	Males in Engineering	55.8	11.3	17.2	15.8			
	Females in Business	43.2	35.0	12.3	9.5			
	Males in Business	45.5	28.0	16.0	10.5			
Interest in health care (nurse)	Female engineering	60.3	16.8	9.9	13.0	24.63	9	.00
	Males in Engineering	60.7	5.9	9.2	24.2			
	Females in Business	59.0	5.5	9.0	26.5			
	Males in Business	60.9	8.6	9.5	21.0			
Interests in service (police) employment	Female engineering	62.6	8.4	11.5	17.6	8.16	9	.52
	Males in Engineering	60.0	9.9	12.7	17.4			
	Females in Business	63.0	6.6	8.6	21.8			
	Males in Business	61.0	6.0	13.0	20.0			
Interests in armed forces employment	Female engineering	57.3	12.2	12.2	18.3	54.38	9	.00
	Males in Engineering	41.9	25.4	18.1	14.6			
	Females in Business	58.4	9.5	9.1	23.0			
	Males in Business	51.5	21.5	15.0	12.0			
Interests in Information Technology employment	Female engineering	56.5	18.3	16.8	8.4	9.74	9	.37
	Males in Engineering	55.3	15.3	14.1	15.3			
	Females in Business	60.1	13.2	15.6	11.1			
	Males in Business	60.0	13.0	17.0	10.0			
Interests in agricultural employment	Female engineering	62.6	6.1	13.7	17.6	9.05	9	.43
	Males in Engineering	57.6	8.7	16.0	17.6			
	Females in Business	60.9	5.8	12.3	21.0			
	Males in Business	61.0	10.5	14.5	14.0			
Interests in Hotels and catering	Female engineering	62.6	7.6	8.4	21.4	24.34	9	.00
	Males in Engineering	60.9	4.2	4.9	29.9			
	Females in Business	61.3	4.5	13.2	21.0			
	Males in Business	60.0	7.5	10.0	22.5			
Interests in technology engineering employment	Female engineering	45.0	9.9	9.2	35.9	230.01	9	.00
	Males in Engineering	25.2	8.5	15.5	50.8			
	Females in Business	60.5	23.5	9.1	7.0			
	Males in Business	55.5	20.0	15.5	9.0			
Interests in Banking and finance employment	Female engineering	61.1	8.4	19.8	10.7	128.07	9	.00
	Males in Engineering	60.7	6.6	13.4	19.3			
	Females in Business	40.3	32.5	18.5	8.6			
	Males in Business	40.0	33.0	15.0	12.0			
Interests in manufacturing employment	Female engineering	54.2	15.3	15.3	15.3	18.12	9	.03
	Males in Engineering	50.8	21.6	14.6	12.9			
	Females in Business	60.9	11.9	18.1	9.1			
	Males in Business	59.5	16.0	13.0	11.5			

Employment interests	Student gender by course	Not preferred %	Third most preferred%	Second most preferred %	First most preferred %	χ^2	df	Sig
Interests in teaching employment	Female engineering	55.7	12.2	13.7	18.3	14.19	9	.12
	Males in Engineering	50.4	8.7	14.8	26.1			
	Females in Business	58.0	10.3	11.5	20.2			
	Males in Business	55.5	5.5	18.0	21.0			
Interests in music, drama, media employment	Female engineering	60.3	6.9	12.2	20.6	8.96	9	.44
	Males in Engineering	58.6	8.0	9.9	23.5			
	Females in Business	61.7	9.9	13.2	15.2			
	Males in Business	59.0	9.5	9.5	22.0			
Interests in accounting employment	Female engineering	64.1	3.1	19.1	13.7	93.24	9	.00
	Males in Engineering	60.2	5.4	11.8	22.6			
	Females in Business	48.6	22.2	15.6	13.6			
	Males in Business	43.5	24.5	18.5	13.5			
Interests in business entrepreneur employment	Female engineering	53.4	16.8	16.0	13.7	85.94	9	.00
	Males in Engineering	47.5	18.6	18.4	15.5			
	Females in Business	34.2	45.3	7.8	12.8			
	Males in Business	34.0	43.0	11.0	12.0			
Interests in tourist industry employment	Female engineering	53.4	16.8	13.0	16.8	28.76	9	.00
	Males in Engineering	56.5	9.9	13.4	20.2			
	Females in Business	55.1	17.3	17.7	9.9			
	Males in Business	50.0	19.0	19.0	12.0			
Interests in management employment	Female engineering	54.2	24.4	12.2	9.2	73.40	9	.00
	Males in Engineering	50.1	23.1	13.6	13.2			
	Females in Business	34.6	49.8	8.2	7.4			
	Males in Business	38.5	46.5	10.0	5.0			

Table 10.6. Influences to student enrolments in TVET courses by gender by course

Factor	Variables	Student gender by course	None%	Low%	High%	Very high%	χ^2	df	Sig
People influences	Father influence	Female in Engineering	22.3	9.9	27.3	40.5	4.80	9	.85
		Males in Engineering	26.8	10.1	26.3	36.9			
		Females in Business	32.2	9.4	23.6	34.8			
		Males in Business	27.1	10.6	27.1	35.1			
	Mother influence	Female in Engineering	13.2	13.2	30.6	43.0	14.87	9	.10
		Males in Engineering	23.1	12.3	34.2	30.5			
		Females in Business	26.2	12.4	26.6	34.8			
		Males in Business	23.4	13.3	26.6	36.7			
	Brother influence	Female in Engineering	21.5	14.9	35.5	28.1	14.34	9	.11
		Males in Engineering	33.4	13.3	28.7	24.6			
		Females in Business	30.0	13.7	32.2	24.0			
		Males in Business	26.1	21.3	27.1	25.5			
	Sister influence	Female in Engineering	24.8	13.2	29.8	32.2	17.16	9	.05
		Males in Engineering	37.1	15.2	28.0	19.7			
		Females in Business	33.9	15.5	30.5	20.2			
		Males in Business	29.3	21.3	26.6	22.9			
	Male relative influence	Female in Engineering	22.3	23.1	32.2	22.3	14.85	9	.10
		Males in Engineering	31.7	20.6	27.3	20.4			
		Females in Business	35.2	13.3	27.9	23.6			
		Males in Business	31.9	22.3	29.8	16.0			
	Female relative influence	Female in Engineering	28.1	26.4	27.3	18.2	24.73	9	.00
		Males in Engineering	43.2	22.6	22.9	11.3			
		Females in Business	37.8	14.2	28.3	19.7			
		Males in Business	37.8	17.6	28.2	16.5			
	Friends influence	Female in Engineering	16.5	22.3	33.9	27.3	19.99	9	.02
		Males in Engineering	25.3	18.9	33.4	22.4			
		Females in Business	34.3	12.9	30.0	22.7			
		Males in Business	29.3	21.8	26.1	22.9			
	Science teacher influence	Female in Engineering	21.5	14.9	30.6	33.1	149.12	9	.00
		Males in Engineering	23.6	11.1	30.7	34.6			
		Females in Business	57.5	21.9	11.6	9.0			
		Males in Business	45.2	19.7	20.2	14.9			
	Mathematics teacher influence	Female in Engineering	29.8	16.5	22.3	31.4	51.20	9	.00
		Males in Engineering	26.8	15.5	27.3	30.5			
		Females in Business	51.5	15.5	16.3	16.7			
		Males in Business	41.5	16.5	22.3	19.7			
	Business teacher influence	Female in Engineering	31.4	25.6	20.7	22.3	126.86	9	.00
		Males in Engineering	46.4	25.1	17.4	11.1			
		Females in Business	37.8	6.0	18.5	37.8			
		Males in Business	29.3	6.9	28.2	35.6			
	Career advisor influence	Female in Engineering	12.4	11.6	23.1	52.9	20.53	9	.02
		Males in Engineering	31.2	6.6	20.6	41.5			
		Females in Business	28.3	6.9	17.2	47.6			
		Males in Business	27.1	6.9	21.8	44.1			

Factor	Variables	Student gender by course	Non %	Low%	High %	Very high%	χ^2	df	Sig
Other sources (information channels)	TV or internet influence	Female in Engineering	13.3	8.8	30.1	47.8	11.45	9	.25
		Males in Engineering	11.5	15.8	33.6	39.1			
		Females in Business	17.3	14.8	33.7	34.2			
		Males in Business	15.1	17.5	31.9	35.5			
	Newspaper influence	Female in Engineering	8.9	7.1	33.0	50.9	4.24	9	.90
		Males in Engineering	9.5	10.9	34.8	44.8			
		Females in Business	11.4	9.5	33.3	45.8			
		Males in Business	8.0	12.5	33.5	46.0			
Student objective to do the course	Objective to advance to higher education influence	Female in Engineering	12.6	13.6	28.2	45.6	17.43	9	.04
		Males in Engineering	17.6	9.5	25.4	47.6			
		Females in Business	15.4	13.3	30.3	41.0			
		Males in Business	21.7	7.8	16.9	53.6			
	Objective to acquire desired skill influence	Female in Engineering	3.9	7.8	21.4	67.0	21.80	9	.01
		Males in Engineering	4.8	7.9	17.5	69.9			
		Females in Business	8.7	10.7	17.9	62.8			
		Males in Business	9.1	13.3	26.7	50.9			
	Objective to get employed influence	Female in Engineering	17.5	33.0	22.3	27.2	9.60	9	.38
		Males in Engineering	14.0	26.2	28.5	31.3			
		Females in Business	10.4	32.6	21.8	35.2			
		Males in Business	12.0	30.1	27.1	30.7			
	Objective to get better salary influence	Female in Engineering	48.5	15.5	6.8	29.1	11.90	9	.22
		Males in Engineering	35.9	19.4	11.4	33.3			
		Females in Business	45.1	18.1	13.0	23.8			
		Males in Business	38.8	18.8	13.3	29.1			
TVET system and policies	Availability of government. bursary influence	Female in Engineering	24.8	23.9	29.2	22.1	16.28	9	.05
		Males in Engineering	32.9	26.2	18.5	22.4			
		Females in Business	41.3	24.9	18.4	15.4			
		Males in Business	35.5	27.3	16.9	20.3			
	TVET curriculum flexibility influence	Female in Engineering	15.2	25.0	41.1	18.8	9.68	9	.38
		Males in Engineering	14.8	31.1	36.8	17.4			
		Females in Business	22.3	25.9	38.6	13.2			
		Males in Business	18.1	25.9	41.0	15.1			
	Quality training influence	Female in Engineering	3.6	8.1	41.4	46.8	8.28	9	.51
		Males in Engineering	4.4	11.9	45.9	37.9			
		Females in Business	6.3	8.3	44.9	40.5			
		Males in Business	7.1	12.9	41.8	38.2			
	Conducive learning environment influence	Female in Engineering	6.8	17.7	45.3	30.2	17.71	9	.04
		Males in Engineering	6.1	11.4	42.1	40.4			
		Females in Business	5.9	8.4	45.0	40.6			
		Males in Business	8.4	10.8	41.3	39.5			
	Location of institution influence	Female in Engineering	8.9	19.6	37.5	33.9	8.58	9	.48
		Males in Engineering	13.1	20.1	41.0	25.8			
		Females in Business	14.4	16.9	35.3	33.3			
		Males in Business	13.2	16.2	37.1	33.5			
	Cost of course influence	Female in Engineering	14.3	20.5	36.6	28.6	11.30	9	.26
		Males in Engineering	14.9	17.7	33.7	33.7			
		Females in Business	12.4	10.4	41.8	35.3			
		Males in Business	11.2	18.9	36.7	33.1			

APPENDIX L. DETAILED ANALYSES OF INFLUENCES ON TECHNOLOGY AND ENGINEERING ENROLMENTS

Table 10.7. Influences from student backgrounds on enrolment in technology and engineering courses by gender

Background	Student gender by course	18 to 25 years %	26 to 30 years %	31 to 40 years%	41 and above%	χ^2	df	Sig
Student age influence	Female in Engineering	92.4	3.8	3.8		7.01	3	.07
	Males in Engineering	86.6	10.1	2.4	.9			
		First Year	**Third Year**					
Year of study influence	Female in Engineering	49.6	50.4			.05	1	.83
	Males in Engineering	50.7	49.3					
		City	**Town**	**Rural**				
Home location influence	Female in Engineering	18.8	11.7	69.5		.38	2	.83
	Males in Engineering	18.1	10.0	71.9				
		City	**Town**	**Rural**				
Institution location influence	Female in Engineering	25.8	33.9	40.3		7.54	2	.02
	Males in Engineering	35.3	22.5	42.2				
		Higher	**Middle**	**Lower**				
Social class influence	Female in Engineering	2.3	62.8	34.9		1.97	2	.37
	Males in Engineering	1.4	57.4	41.2				

Table 10.8 Technology and engineering student attitudes towards and interests in secondary school subjects by gender (Difficulty experiences)

Secondary school subject	Student gender by course	Least Difficult	Moderately difficult	Most Difficult	χ^2	df	Sig
English difficulty experience	Female in Engineering	6.9	89.7	3.4	9.35	2	.01
	Males in Engineering	12.4	76.9	10.7			
	Total	11.0	80.0	9.0			
Kiswahili difficulty experience	Female in Engineering	11.9	78.8	9.3	1.33	2	.51
	Males in Engineering	14.3	73.6	12.1			
	Total	13.7	74.8	11.4			
mathematics difficulty experience	Female in Engineering	5.8	70.2	24.0	2.99	2	.03
	Males in Engineering	6.4	76.6	17.0			
	Total	6.3	75.1	18.6			
Biology difficulty experience	Female in Engineering	7.8	76.5	15.7	2.10	2	.35
	Males in Engineering	12.4	70.7	16.9			
	Total	11.3	72.1	16.6			
Chemistry Difficulty experience	Female in Engineering	15.8	60.5	23.7	5.44	2	.06
	Males in Engineering	8.4	63.8	27.8			
	Total	10.1	63.0	26.9			
Physics Difficulty experience	Female in Engineering	8.5	61.5	29.9	5.94	2	.05
	Males in Engineering	8.4	72.2	19.4			
	Total	8.4	69.7	21.9			
History Difficulty experience	Female in Engineering	23.6	65.5	10.9	.81	2	.67
	Males in Engineering	19.9	67.5	12.6			
	Total	20.8	67.0	12.2			
Religious education difficulty experience	Female in Engineering	32.1	61.5	6.4	7.95	2	.02
	Males in Engineering	39.6	44.8	15.7			
	Total	37.7	49.0	13.3			
Geography Difficulty experience	Female in Engineering	17.8	66.3	15.8	2.24	2	.33
	Males in Engineering	16.3	60.9	22.8			
	Total	16.6	62.2	21.2			
Business Education Difficulty experience	Female in Engineering	24.0	56.0	20.0	1.80	2	.41
	Males in Engineering	20.7	63.4	15.9			
	Total	21.5	61.6	16.9			
Accounting difficult experience	Female in Engineering	27.1	44.6	28.3	13.94	2	.00
	Males in Engineering	17.4	32.6	50.0			
	Total	24.8	41.7	33.5			
Technical education difficulty	Female in Engineering	31.1	42.6	26.2	.36	2	.84
	Males in Engineering	28.4	47.0	24.6			
	Total	29.1	45.9	25.0			

Table 10.9. Technology and engineering student attitudes towards and interests in secondary school subjects by gender (Liking experience)

Secondary school subject	Student gender by course	Least liked%	Moderately liked%	Most liked%	χ^2	df	Sig
English liking experience	Female in Engineering	24.2	18.8	57.0	14.62	2	.00
	Males in Engineering	30.5	31.2	38.3			
	Total	29.0	28.2	42.8			
Kiswahili liking experience	Female in Engineering	30.5	27.3	42.2	8.76	2	.01
	Males in Engineering	37.3	34.4	28.3			
	Total	35.7	32.7	31.6			
Math liking experience.	Female in Engineering	23.4	33.6	43.0	2.98	2	.03
	Males in Engineering	22.1	26.8	51.1			
	Total	22.4	28.4	49.2			
Biology liking experience	Female in Engineering	19.5	31.3	49.2	5.64	2	.05
	Males in Engineering	26.8	35.4	37.8			
	Total	25.0	34.4	40.6			
Chemistry liking experience	Female in Engineering	23.4	46.1	30.5	2.68	2	.26
	Males in Engineering	31.0	42.0	27.0			
	Total	29.2	43.0	27.9			
Physics liking experience	Female in Engineering	25.8	43.8	30.5	15.21	2	.00
	Males in Engineering	16.2	34.2	49.6			
	Total	18.5	36.4	45.0			
History liking experience	Female in Engineering	34.4	43.8	21.9	5.08	2	.06
	Males in Engineering	26.0	43.2	30.7			
	Total	28.0	43.4	28.6			
Religious education liking experience	Female in Engineering	22.7	39.8	37.5	7.71	2	.02
	Males in Engineering	23.6	51.1	25.3			
	Total	23.4	48.4	28.2			
Geography liking experience	Female in Engineering	29.7	47.7	22.7	2.88	2	.24
	Males in Engineering	22.9	49.4	27.8			
	Total	24.5	49.0	26.5			
Business liking experience	Female in Engineering	22.7	56.3	21.1	1.04	2	.60
	Males in Engineering	25.6	51.1	23.3			
	Total	24.9	52.3	22.8			
Accounting liking experience	Female in Engineering	18.8	78.1	3.1	4.06	2	.13
	Males in Engineering	22.1	70.5	7.4			
	Total	21.3	72.3	6.4			
Technical education liking experience	Female in Engineering	10.2	79.7	10.2	.09	2	.96
	Males in Engineering	11.1	78.9	10.1			
	Total	10.8	79.1	10.1			

Table 11. Interests and attitudinal scales for technology and engineering enrolments

Subject	Gender by course	Mean	Std. Deviation	F	df	Sig
Experience, enjoyment of secondary school science	Female Engineering	2.99	.56	2.80	1	.10
	Males in Engineering	3.08	.53			
	Total	3.06	.54			
Experience, enjoyment of secondary school Mathematics	Female Engineering	2.93	.72	.08	1	.78
	Males in Engineering	2.95	.63			
	Total	2.94	.65			
Experience, enjoyment of secondary school Computing	Female Engineering	2.83	.72	6.24	1	.01
	Males in Engineering	2.62	.81			
	Total	2.67	.80			
Experience, enjoyment of secondary school Accounting	Female engineering	2.33	.73	.04	1	.84
	Males in Engineering	2.31	.80			
	Total	2.32	.78			
Experience, enjoyment of secondary school Business	Female engineering	2.74	.75	.60	1	.44
	Males in Engineering	2.68	.80			
	Total	2.69	.79			
Usefulness of science	Female engineering	3.32	.53	3.17	1	.08
	Males in Engineering	3.41	.50			
	Total	3.39	.51			
Usefulness of mathematics	Female engineering	3.18	.67	1.54	1	.21
	Males in Engineering	3.26	.60			
	Total	3.24	.62			
Usefulness of technology/computing	Female engineering	3.43	.59	2.43	1	.12
	Males in Engineering	3.34	.58			
	Total	3.36	.58			
Usefulness of engineering	Female engineering	3.14	.83	39.43	1	.00
	Males in Engineering	3.56	.58			
	Total	3.47	.67			
Usefulness of business	Female engineering	3.17	.71	.27	.69	.41
	Males in Engineering	3.11	.61			
	Total	3.13	.63			
Interest in engineering area	Female engineering	3.22	.70	4.21	13.66	.00
	Males in Engineering	3.43	.51			
	Total	3.38	.56			
Interest business area	Female engineering	2.96	.66	.12	.26	.61
	Males in Engineering	2.92	.68			
	Total	2.93	.68			
Interest general area	Female engineering	3.36	.62	.37	1.31	.25
	Males in Engineering	3.42	.50			
	Total	3.41	.53			

Table 11.1. Employment interests for technology and engineering students

Employment interests	Student gender by course	Not preferred	Third most preferred	Second most preferred	First most preferred	χ^2	df	Sig
Interests in shop, wholesale, hardware	Female in Engineering	63.4	9.9	13. 0	13.7	3.55	3	.31
	Males in Engineering	54.4	14.1	15.1	16.5			
	Total	56.5	13.1	14.6	15.8			
Office work	Female in Engineering	55.8	11.3	17.2	15.8	10.29	3	.02
	Males in Engineering	55.7	19.8	16.8	7.6			
	Total	55.8	13.3	17.1	13.8			
Interest in health care (nurse)	Female engineering	60.7	5.9	9.2	24.2	20.05	3	.00
	Males in Engineering	60.3	16.8	9.9	13.0			
	Total	60.6	8.5	9.4	21.6			
Interests in service (police) employment	Female engineering	62.6	8.4	11.5	17.6	.47	3	.93
	Males in Engineering	60.0	9.9	12.7	17.4			
	Total	60.6	9.5	12.4	17.4			
Interests in armed forces employment	Female engineering	57.3	12.2	12.2	18.3	16.01	3	.00
	Males in Engineering	41.9	25.4	18.1	14.6			
	Total	45.5	22.3	16.7	15.5			
Interests in Information Technology employment	Female engineering	56.5	18.3	16.8	8.4	4.57	3	.21
	Males in Engineering	55.3	15.3	14.1	15.3			
	Total	55.6	16.0	14.7	13.7			
Interests in agricultural employment	Female engineering	62.6	6.1	13.7	17.6	1.58	3	.66
	Males in Engineering	57.6	8.7	16.0	17.6			
	Total	58.8	8.1	15.5	17.6			
Interests in Hotels and catering	Female engineering	60.9	4.2	4.9	29.9	7.02	3	.05
	Males in Engineering	62.6	7.6	8.4	21.4			
	Total	61.3	5.0	5.8	27.9			
Interests in technology engineering employment	Female engineering	45.0	9.9	9.2	35.9	21.10	3	.00
	Males in Engineering	25.2	8.5	15.5	50.8			
	Total	29.9	8.8	14.0	47.3			
Interests in Banking and finance employment	Female engineering	60.7	6.6	13.4	19.3		3	.05
	Males in Engineering	61.1	8.4	19.8	10.7	7.54		
	Total	60.8	7.0	14.9	17.3			
Interests in manufacturing employment	Female engineering	54.2	15.3	15.3	15.3	2.68	3	.44
	Males in Engineering	50.8	21.6	14.6	12.9			
	Total	51.6	20.1	14.7	13.5			
Interests in teaching employment	Female engineering	55.7	12.2	13.7	18.3	4.44	3	.22
	Males in Engineering	50.4	8.7	14.8	26.1			
	Total	51.6	9.5	14.6	24.3			
Interests in music, drama, media employment	Female engineering	60.3	6.9	12.2	20.6	1.11	3	.78
	Males in Engineering	58.6	8.0	9.9	23.5			
	Total	59.0	7.7	10.4	22.8			
Interests in accounting employment	Female engineering	60.2	5.4	11.8	22.6	9.19	3	.03
	Males in Engineering	64.1	3.1	19.1	13.7			
	Total	61.2	4.9	13.5	20.5			
Interests in business entrepreneur employment	Female engineering	53.4	16.8	16.0	13.7	1.41	3	.70
	Males in Engineering	47.5	18.6	18.4	15.5			
	Total	48.9	18.2	17.8	15.1			
Interests in tourist industry employment	Female engineering	53.4	16.8	13.0	16.8	4.95	3	.18
	Males in Engineering	56.5	9.9	13.4	20.2			
	Total	55.8	11.5	13.3	19.4			
Interests in management employment	Female engineering	54.2	24.4	12.2	9.2	1.88	3	.60
	Males in Engineering	50.1	23.1	13.6	13.2			
	Total	51.1	23.4	13.3	12.2			

Table 11.2. Influences on student enrolments in technology and engineering courses by gender

		Student gender by course	None %	Low%	High%	Very high%	χ^2	df	Sig
Family and other people influences	Father influence	Female in Engineering	22.3	9.9	27.3	40.5	1.09	3	.78
		Males in Engineering	26.8	10.1	26.3	36.9			
		Total	25.8	10.0	26.5	37.7			
	Mother influence	Female in Engineering	13.2	13.2	30.6	43.0	9.17	3	.03
		Males in Engineering	23.1	12.3	34.2	30.5			
		Total	20.8	12.5	33.3	33.3			
	Brother influence	Female in Engineering	21.5	14.9	35.5	28.1	6.38	3	.10
		Males in Engineering	33.4	13.3	28.7	24.6			
		Total	30.7	13.6	30.3	25.4			
	Sister influence	Female in Engineering	24.8	13.2	29.8	32.2	11.02	3	.01
		Males in Engineering	37.1	15.2	28.0	19.7			
		Total	34.3	14.8	28.4	22.5			
	Male relative influence	Female in Engineering	22.3	23.1	32.2	22.3	4.03	3	.26
		Males in Engineering	31.7	20.6	27.3	20.4			
		Total	29.5	21.2	28.4	20.8			
	Female relative influence	Female in Engineering	28.1	26.4	27.3	18.2	10.16	3	.02
		Males in Engineering	43.2	22.6	22.9	11.3			
		Total	39.8	23.5	23.9	12.9			
	Friends influence	Female in Engineering	16.5	22.3	33.9	27.3	4.60	3	.20
		Males in Engineering	25.3	18.9	33.4	22.4			
		Total	23.3	19.7	33.5	23.5			
	Science teacher influence	Female in Engineering	21.5	14.9	30.6	33.1	1.39	3	.71
		Males in Engineering	23.6	11.1	30.7	34.6			
		Total	23.1	11.9	30.7	34.3			
	Mathematics teacher influence	Female in Engineering	29.8	16.5	22.3	31.4	1.27	3	.74
		Males in Engineering	26.8	15.5	27.3	30.5			
		Total	27.5	15.7	26.1	30.7			
	Business teacher influence	Female in Engineering	31.4	25.6	20.7	22.3	14.11	3	.00
		Males in Engineering	46.4	25.1	17.4	11.1			
		Total	43.0	25.2	18.2	13.6			
	Career advisor influence	Female in Engineering	12.4	11.6	23.1	52.9	18.20	3	.00
		Males in Engineering	31.2	6.6	20.6	41.5			
		Total	26.9	7.8	21.2	44.1			
Media and internet	TV or internet influence	Female in Engineering	13.3	8.8	30.1	47.8	5.13	3	.16
		Males in Engineering	11.5	15.8	33.6	39.1			
		Total	11.9	14.2	32.8	41.1			
	Newspaper influence	Female in Engineering	8.9	7.1	33.0	50.9	1.98	3	.58
		Males in Engineering	9.5	10.9	34.8	44.8			
		Total	9.4	10.0	34.4	46.3			
Student objective to do the course	Objective to advance to higher education influence	Female in Engineering	12.6	13.6	28.2	45.6	2.76	3	.43
		Males in Engineering	17.6	9.5	25.4	47.6			
		Total	16.4	10.4	26.0	47.1			
	Objective to acquire desired skill influence	Female in Engineering	3.9	7.8	21.4	67.0	.90	3	.83
		Males in Engineering	4.8	7.9	17.5	69.9			
		Total	4.6	7.9	18.3	69.2			
	Objective to get employed influence	Female in Engineering	17.5	33.0	22.3	27.2	3.56	3	.31
		Males in Engineering	14.0	26.2	28.5	31.3			
		Total	14.8	27.8	27.1	30.4			
	Objective to get better salary influence	Female in Engineering	48.5	15.5	6.8	29.1	5.98	3	.11
		Males in Engineering	35.9	19.4	11.4	33.3			
		Total	38.8	18.5	10.4	32.4			

		Student gender by course	None %	Low%	High%	Very high%	χ^2	df	Sig
TVET system and policies	Availability of government. bursary influence	Female in Engineering	24.8	23.9	29.2	22.1	6.84	3	.08
		Males in Engineering	32.9	26.2	18.5	22.4			
		Total	31.1	25.7	20.9	22.3			
	TVET curriculum flexibility influence	Female in Engineering	15.2	25.0	41.1	18.8	1.61	3	.66
		Males in Engineering	14.8	31.1	36.8	17.4			
		Total	14.9	29.7	37.8	17.7			
	Quality training influence	Female in Engineering	3.6	8.1	41.4	46.8	3.34	3	.34
		Males in Engineering	4.4	11.9	45.9	37.9			
		Total	4.2	11.0	44.9	39.9			
	Conducive learning environment influence	Female in Engineering	6.8	17.7	45.3	30.2	5.18	3	.16
		Males in Engineering	6.1	11.4	42.1	40.4			
		Total	6.6	16.3	44.6	32.5			
	Location of institution influence	Female in Engineering	8.9	19.6	37.5	33.9	3.53	3	.32
		Males in Engineering	13.1	20.1	41.0	25.8			
		Total	12.1	20.0	40.2	27.7			
	Cost of course influence	Female in Engineering	14.3	20.5	36.6	28.6	1.31	3	.73
		Males in Engineering	14.9	17.7	33.7	33.7			
		Total	14.8	18.4	34.3	32.5			

APPENDIX M. DETAILED ANALYSES OF INFLUENCES ON STUDENT ENROLMENTS IN BUSINESS COURSES

Table 11.3. Influences from student backgrounds on enrolment in business courses by gender

Background	Student gender by course	18 to 25 years	26 to 30 years	31 to 40 years	41 and above	χ^2	df	Sig
Student age influence	Females in Business	94.2	4.9	.8		2.47	2	.29
	Males in Business	90.5	7.5	2.0				
		First Year	**Third Year**			**Chi**	**df**	**Sig**
Year of study influence	Females in Business	44.7	55.3			.16	1	.69
	Males in Business	46.7	53.3					
		City	**Town**	**Rural**				
Home location influence	Females in Business	18.0	11.3	70.7		.87	2	.65
	Males in Business	16.4	14.2	69.4				
		City	**Town**	**Rural**				
Institution location influence	Females in Business	30.1	28.2	41.6		3.96	2	.14
	Males in Business	26.8	21.9	51.4				
		Higher	**Middle**	**Lower**				
Social class influence	Females in Business	1.7	71.9	26.4		.30	2	.86
	Males in Business	1.5	69.7	28.7				

Table 11.4. Business student attitudes towards and interests in secondary school subjects by gender

Secondary school subject	Student gender by course	Least Difficult	Moderately difficult	Most Difficult	χ^2	df	Sig
English difficulty experience	Females in Business	9.1	87.2	3.7	2.12	2	.35
	Males in Business	8.6	84.5	6.9			
	Total	8.9	86.0	5.1			
Kiswahili difficulty experience	Females in Business	10.6	82.5	6.9	1.86	2	.39
	Males in Business	15.0	77.2	7.8			
	Total	12.5	80.2	7.3			
Mathematics difficulty experience	Females in Business	6.0	51.4	42.6	3.79	2	.15
	Males in Business	8.0	58.9	33.1			
	Total	6.9	54.7	38.4			
Biology difficulty experience	Females in Business	8.7	81.6	9.7	3.84	2	.15
	Males in Business	13.7	73.2	13.1			
	Total	11.0	77.8	11.2			
Chemistry Difficulty experience	Females in Business	10.6	47.8	41.5	1.21	2	.55
	Males in Business	9.3	53.5	37.2			
	Total	10.0	50.4	39.6			
Physics Difficulty experience	Females in Business	10.4	31.1	58.5	6.88	2	.03
	Males in Business	9.9	43.9	46.2			
	Total	10.2	36.8	53.0			
History Difficulty experience	Females in Business	22.8	68.0	9.1	1.38	2	.50
	Males in Business	20.0	73.3	6.7			
	Total	21.5	70.4	8.0			
Religious education difficulty experience	Females in Business	25.0	68.2	6.8	4.07	2	.13
	Males in Business	31.7	56.9	11.4			
	Total	28.0	63.1	8.9			
Geography Difficulty experience	Females in Business	28.9	58.3	12.8	4.49	2	.11
	Males in Business	19.0	68.0	12.9			
	Total	24.6	62.6	12.9			
Business Education Difficulty experience	Females in Business	12.1	81.6	6.3	.17	2	.92
	Males in Business	11.5	83.0	5.5			
	Total	11.9	82.2	5.9			
Accounting difficult experience	Females in Business	27.6	50.0	22.4	1.61	2	.45
	Males in Business	25.4	57.1	17.5			
	Total	26.6	53.2	20.1			
Technical education difficulty	Females in Business	33.0	34.8	32.1	2.80	2	.25
	Males in Business	32.6	44.6	22.8			
	Total	32.8	39.2	27.9			
English liking experience	Females in Business	22.3	19.7	58.0	1.57	2	.46
	Males in Business	22.1	24.6	53.3			
	Total	22.2	21.9	55.9			

Secondary school subject	Student gender by course	Least liked	Moderately liked	Most liked	χ^2	df	Sig
Kiswahili liking experience	Females in Business	27.3	24.8	47.9	5.84	2	.05
	Males in Business	28.7	33.8	37.4			
	Total	27.9	28.9	43.2			
Math liking experience.	Females in Business	26.5	53.4	20.2	2.07	2	.36
	Males in Business	32.3	47.2	20.5			
	Total	29.1	50.6	20.3			
Biology liking experience	Females in Business	27.3	29.4	43.3	2.87	2	.24
	Males in Business	25.6	36.9	37.4			
	Total	26.6	32.8	40.6			
Chemistry liking experience	Females in Business	32.8	58.4	8.8	3.50	2	.17
	Males in Business	32.8	52.8	14.4			
	Total	32.8	55.9	11.3			
Physics liking experience	Females in Business	21.8	72.3	5.9	11.43	2	.00
	Males in Business	23.1	61.5	15.4			
	Total	22.4	67.4	10.2			
History liking experience	Females in Business	26.1	43.7	30.3	5.01	2	.08
	Males in Business	21.5	37.9	40.5			
	Total	24.0	41.1	34.9			
Religious education liking experience	Females in Business	18.9	38.7	42.4	3.23	2	.20
	Males in Business	16.9	47.2	35.9			
	Total	18.0	42.5	39.5			
Geography liking experience	Females in Business	29.4	54.2	16.4	5.06	2	.08
	Males in Business	26.2	48.7	25.1			
	Total	27.9	51.7	20.3			
Business liking experience	Females in Business	14.7	29.4	55.9	.07	2	.97
	Males in Business	13.8	29.7	56.4			
	Total	14.3	29.6	56.1			
Accounting liking experience	Females in Business	16.8	68.1	15.1	1.20	2	.55
	Males in Business	19.0	63.1	17.9			
	Total	17.8	65.8	16.4			
Technical education liking experience	Females in Business	12.6	83.6	3.8	7.30	2	.03
	Males in Business	10.8	79.0	10.3			
	Total	11.8	81.5	6.7			

Table 11.5. Business student interests and attitude scales

Subject	Gender by course	Mean	Std. Deviation	F	df	Sig
Experience, enjoyment of secondary school science	Females in Business	2.55	.69	.54	1	.46
	Males in Business	2.60	.64			
	Total	2.57	.67			
Experience, enjoyment of secondary school Mathematics	Females in Business	2.52	.82	.04	1	.84
	Males in Business	2.51	.75			
	Total	2.52	.79			
Experience, enjoyment of secondary school Computing	Females in Business	2.86	.73	.47	1	.49
	Males in Business	2.81	.76			
	Total	2.84	.74			
Experience, enjoyment of secondary school Accounting	Females in Business	2.70	.84	3.99	1	.06
	Males in Business	2.88	.85			
	Total	2.78	.85			
Experience, enjoyment of secondary school Business	Females in Business	3.42	.64	.18	1	.67
	Males in Business	3.39	.60			
	Total	3.41	.62			
Usefulness of science	Females in Business	2.89	.66	.52	1	.47
	Males in Business	2.93	.63			
	Total	2.91	.64			
Usefulness of mathematics	Females in Business	3.17	.64	2.51	1	.11
	Males in Business	3.07	.65			
	Total	3.12	.65			
Usefulness of technology/computing	Females in Business	3.42	.57	5.23	1	.02
	Males in Business	3.28	.62			
	Total	3.36	.60			
Usefulness of engineering	Females in Business	2.39	.72	6.19	1	.01
	Males in Business	2.57	.77			
	Total	2.47	.74			
Usefulness of business	Females in Business	3.74	.44	.25	1	.62
	Males in Business	3.76	.33			
	Total	3.75	.39			
Interest in engineering area	Females in Business	2.87	.61	1.38	1	.24
	Males in Business	2.95	.65			
	Total	2.91	.62			
Interest business area	Females in Business	3.43	.57	.51	1	.48
	Males in Business	3.38	.63			
	Total	3.41	.60			
Interest general area	Females in Business	3.43	.47	.26	1	.61
	Males in Business	3.40	.52			
	Total	3.41	.50			

Table 11.6. Business student employment interests

Employment interests	Student gender by course	Not preferred	Third most preferred	Second most preferred	First most preferred	χ^2	df	Sig
Interests in shop , wholesale, hardware	Females in Business	58.8	9.1	13.6	18.5	5.44	3	.14
	Males in Business	56.0	15.0	15.5	13.5			
Office work	Females in Business	43.2	35.0	12.3	9.5	2.97	3	.40
	Males in Business	45.5	28.0	16.0	10.5			
Interest in health care (nurse)	Females in Business	59.0	5.5	9.0	26.5	3.01	3	.39
	Males in Business	60.9	8.6	9.5	21.0			
Interests in service (police) employment	Females in Business	63.0	6.6	8.6	21.8	2.26	3	.52
	Males in Business	61.0	6.0	13.0	20.0			
Interests in armed forces employment	Females in Business	58.4	9.5	9.1	23.0	22.34	3	.00
	Males in Business	51.5	21.5	15.0	12.0			
Interests in Information Technology employment	Females in Business	60.1	13.2	15.6	11.1	.26	3	.97
	Males in Business	60.0	13.0	17.0	10.0			
Interests in agricultural employment	Females in Business	60.9	5.8	12.3	21.0	6.50	3	.09
	Males in Business	61.0	10.5	14.5	14.0			
Interests in Hotels and catering	Females in Business	61.3	4.5	13.2	21.0	2.74	3	.43
	Males in Business	60.0	7.5	10.0	22.5			
Interests in technology engineering employment	Females in Business	60.5	23.5	9.1	7.0	5.44	3	.14
	Males in Business	55.5	20.0	15.5	9.0			
Interests in Banking and finance employment	Females in Business	40.3	32.5	18.5	8.6	2.03	3	.57
	Males in Business	40.0	33.0	15.0	12.0			
Interests in manufacturing employment	Females in Business	60.9	11.9	18.1	9.1	3.81	3	.28
	Males in Business	59.5	16.0	13.0	11.5			
Interests in teaching employment	Females in Business	58.0	10.3	11.5	20.2	6.44	3	.09
	Males in Business	55.5	5.5	18.0	21.0			
Interests in music, drama, media employment	Females in Business	61.7	9.9	13.2	15.2	4.19	3	.24
	Males in Business	59.0	9.5	9.5	22.0			
Interests in accounting employment	Females in Business	48.6	22.2	15.6	13.6	1.38	3	.71
	Males in Business	43.5	24.5	18.5	13.5			
Interests in business entrepreneur employment	Females in Business	34.2	45.3	7.8	12.8	2.13	3	.80
	Males in Business	34.0	43.0	11.0	12.0			
Interests in tourist industry employment	Females in Business	55.1	17.3	17.7	9.9	1.29	3	.73
	Males in Business	50.0	19.0	19.0	12.0			
Interests in management employment	Females in Business	34.6	49.8	8.2	7.4	2.10	3	.55
	Males in Business	38.5	46.5	10.0	5.0			

Table 11.7.Influences on student enrolments in business courses by gender

Factor		Student gender by course	None %	Low %	High %	Very high%	χ^2	df	Sig
People influences	Father influence	Females in Business	32.2	9.4	23.6	34.8	1.56	3	.67
		Males in Business	27.1	10.6	27.1	35.1			
		Total	29.9	10.0	25.2	34.9			
	Mother influence	Females in Business	26.2	12.4	26.6	34.8	.49	3	.92
		Males in Business	23.4	13.3	26.6	36.7			
		Total	24.9	12.8	26.6	35.6			
	Brother influence	Females in Business	30.0	13.7	32.2	24.0	5.03	3	.17
		Males in Business	26.1	21.3	27.1	25.5			
		Total	28.3	17.1	29.9	24.7			
	Sister influence	Females in Business	33.9	15.5	30.5	20.2	3.56	3	.31
		Males in Business	29.3	21.3	26.6	22.9			
		Total	31.8	18.1	28.7	21.4			
	Male relative influence	Females in Business	35.2	13.3	27.9	23.6	8.37	3	.04
		Males in Business	31.9	22.3	29.8	16.0			
		Total	33.7	17.3	28.7	20.2			
	Female relative influence	Females in Business	37.8	14.2	28.3	19.7	1.37	3	.71
		Males in Business	37.8	17.6	28.2	16.5			
		Total	37.8	15.7	28.3	18.3			
	Friends influence	Females in Business	34.3	12.9	30.0	22.7	6.34	3	.10
		Males in Business	29.3	21.8	26.1	22.9			
		Total	32.1	16.9	28.3	22.8			
	Science teacher influence	Females in Business	57.5	21.9	11.6	9.0	11.37	3	.01
		Males in Business	45.2	19.7	20.2	14.9			
		Total	52.0	20.9	15.4	11.6			
	Mathematics teacher influence	Females in Business	51.5	15.5	16.3	16.7	4.78	3	.19
		Males in Business	41.5	16.5	22.3	19.7			
		Total	47.0	15.9	19.0	18.1			
	Business teacher influence	Females in Business	37.8	6.0	18.5	37.8	6.81	3	.08
		Males in Business	29.3	6.9	28.2	35.6			
		Total	34.0	6.4	22.8	36.8			
	Career advisor influence	Females in Business	28.3	6.9	17.2	47.6	1.49	3	.68
		Males in Business	27.1	6.9	21.8	44.1			
		Total	27.8	6.9	19.2	46.1			
Other sources (information channels)	TV or internet influence	Females in Business	17.3	14.8	33.7	34.2	.82	3	.85
		Males in Business	15.1	17.5	31.9	35.5			
		Total	16.3	16.0	32.9	34.8			
	Newspaper influence	Females in Business	11.4	9.5	33.3	45.8	1.97	3	.58
		Males in Business	8.0	12.5	33.5	46.0			
		Total	9.8	10.9	33.4	45.9			
Student objective to do the course	Objective to advance to higher education influence	Females in Business	15.4	13.3	30.3	41.0	14.17	3	.00
		Males in Business	21.7	7.8	16.9	53.6			
		Total	18.3	10.8	24.1	46.8			
	Objective to acquire desired skill influence	Females in Business	8.7	10.7	17.9	62.8	5.90	3	.12
		Males in Business	9.1	13.3	26.7	50.9			
		Total	8.9	11.9	21.9	57.3			
	Objective to get employed influence	Females in Business	10.4	32.6	21.8	35.2	2.01	3	.57
		Males in Business	12.0	30.1	27.1	30.7			
		Total	11.1	31.5	24.2	33.1			
	Objective to get better salary influence	Females in Business	45.1	18.1	13.0	23.8	1.80	3	.62
		Males in Business	38.8	18.8	13.3	29.1			
		Total	42.2	18.4	13.1	26.3			

Factor		Student gender by course	None %	Low %	High %	Very high%	χ^2	df	Sig
TVET system and policies	Availability of government. bursary influence	Females in Business	41.3	24.9	18.4	15.4	2.43	3	.49
		Males in Business	35.5	27.3	16.9	20.3			
		Total	38.6	26.0	17.7	17.7			
	TVET curriculum flexibility influence	Females in Business	22.3	25.9	38.6	13.2	1.16	3	.76
		Males in Business	18.1	25.9	41.0	15.1			
		Total	20.4	25.9	39.7	14.0			
	Quality training influence	Females in Business	6.3	8.3	44.9	40.5	2.33	3	.51
		Males in Business	7.1	12.9	41.8	38.2			
		Total	6.7	10.4	43.5	39.5			
	Conducive learning environment influence	Females in Business	5.9	8.4	45.0	40.6	1.63	3	.65
		Males in Business	8.4	10.8	41.3	39.5			
		Total	7.0	9.5	43.4	40.1			
	Location of institution influence	Females in Business	14.4	16.9	35.3	33.3	.22	3	.98
		Males in Business	13.2	16.2	37.1	33.5			
		Total	13.9	16.6	36.1	33.4			
	Cost of course influence	Females in Business	12.4	10.4	41.8	35.3	5.46	3	.14
		Males in Business	11.2	18.9	36.7	33.1			
		Total	11.9	14.3	39.5	34.3			

APPENDIX N: PERCEIVED FACTORS INFLUENCING GENDER DISPARITY IN TECHNOLOGICAL AND ENGINEERING COURSES

Table.11.8. Students' opinions on possible factors influencing gender disparity in technological and engineering courses

Factors perceived to influence gender disparities in technology and engineering programmes	Mean	Std. Deviation
Interests and attitudes towards course		
Females lack personal interests in Technology and engineering courses compared with males	2.76	1.14
Females don't enjoy studying Technology and engineering courses compared with males	2.66	1.04
Females don't like Technology and engineering courses compared with males	2.68	1.05
Cultural influence		
Technology and engineering courses are more suited to males than to females.	2.21	1.10
Technology and engineering jobs are meant for males but not for females	1.67	.91
Employment opportunities in technological and engineering are more limited for females than for males	1.92	.99
Technological and engineering jobs are too dirty for females	1.87	1.01
Technological and engineering jobs are more difficult for females than for males	2.07	1.03
Technological and engineering jobs are more dangerous for females than for males	2.01	1.02
Employment interests		
Technological and engineering related jobs are more important for males than for females	1.94	.98
Males are more interested in technological and engineering jobs compared with females	2.87	1.04
Males become better technologists and engineers compared with females	2.32	1.07
Females are more interested in Business and Accounting jobs compared with males	2.70	1.10
Interests in science and Mathematics		
Females are less interested in science and Mathematics compared with males.	2.44	1.01
Females perform worse compared with males in Mathematics and science at secondary school level	2.35	.99
Influence from other people		
Secondary school teachers	2.49	.98
Parents	2.68	.98
Brothers and sisters	2.54	.89
Relatives	2.50	.88
Peers	2.69	1.00
Occupational role models	2.76	1.03
Influence from media and internet	2.39	1.04
Influence from TVET system and policy		
Institutional TVET policies favour males more than females	1.86	.95
There is inadequate provision of TVET bursaries for females compared with males	2.04	1.04
Institutional environment, facilities and equipment favour males more than females	1.93	.96
Curriculum for Technology and engineering favour males more than females	1.98	.97
Geographical location of training institutions favour males more than females	1.88	.96
Individual objectives to do the course		
Objectives to get employed have more influence on males' choice of Technology and engineering courses compared with females.	2.38	1.01
Objectives for advancement to higher education have more influence on males choice of technological and engineering courses compared with females	2.29	.94
Objectives to get better salary have more influence on female students' choice of business courses compared with males	2.34	1.02

Table.11.9. Heads of Departments opinions on causes on gender disparity in technological and engineering programmes

Causes of gender disparity in enrolment in technological and engineering programmes	Mean	Std. Deviation
Interests and attitudes towards course		
Females lack personal interests in Technology and engineering courses compared with males	3.15	.85
Females don't enjoy studying Technology and engineering courses compared with males	2.58	.89
Females don't like Technology and engineering courses compared with males	2.83	.79
Males lack personal interests in Business and Accounting courses compared with females	1.71	.79
Males don't enjoy studying Business and Accounting courses compared with females	1.73	.67
Males don't like Business and Accounting courses compared with females	1.73	.67
Employment interests		
Technological and engineering related jobs are more important for males than for females	2.08	.86
Males are more interested in technological and engineering jobs compared with females	3.14	.69
Males become better technologists and engineers compared with females	2.13	.87
Females are more interested in Business and Accounting jobs compared with males	2.72	.70
Females become better at Business and Accounting compared with males	2.11	.80
Interests in science and Mathematics		
Females are less interested in science and Mathematics compared with males.	2.90	.78
Females perform worse compared with males in Mathematics and science at secondary school level	2.71	.77
Influence from TVET system and policy		
Institutional TVET policies favour males more than females	1.89	.78
There is inadequate provision of TVET bursaries for females compared with males	2.03	.93
Institutional environment, facilities and equipment favour males more than females	2.05	.88
Curriculum for Technology and engineering favour males more than females	1.92	.63
Geographical location of training institutions favour males more than females	1.67	.74
Influence from other people		
Secondary school teachers	2.83	.94
Parents	2.98	.75
Brothers and sisters	2.94	.69
Relatives	2.69	.73
Students interests in science and Mathematics		
Females are less interested in science and Mathematics compared with males.	3.19	.71
Females perform worse compared with males in Mathematics and science at secondary school level	3.23	.79
Cultural influence		
Technology and engineering courses are more suited to males than to females.	2.53	.91
Technology and engineering jobs are meant for males but not for females	1.84	.83
Employment opportunities in technological and engineering are more limited for females than for males	2.24	.93
Technological and engineering jobs are too dirty for females	2.10	.87
Technological and engineering jobs are more difficult for females than for males	2.37	.90
Technological and engineering jobs are more dangerous for females than for males	2.21	.85
Business and Accounting courses are more suited to females than to males	2.17	.83
Business and Accounting jobs are more suited to females than to males.	2.06	.83
Media and internet	**2.19**	**.89**
Individual's objectives in doing the course		
To become professionals	3.14	.56
For advancement to higher education	2.92	.57
To set up businesses	2.59	.64
To get employed	3.42	.69
For self-actualization	2.52	.84
To get better salary	3.27	.70