PERCEPTIONS AND ATTITUDES OF FEMALE STUDENTS TOWARDS SCIENCE, TECHNOLOGY, ENGINEERING AND MATHEMATICS (STEM) COURSES AT THE UNIVERSITY OF NAIROBI'S MAIN CAMPUS

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DECLARATION

This Project is my original work and has not been presented for award of a degree in any other University or Institution.

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This Project has been submitted for the award of the degree of Master of Arts in Gender and Development studies with my approval as the University Supervisor.

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DEDICATION

I dedicate this work to my loving family; first to my late mother Hellen Ojwang who stood by me and gave her endless support, without whose inspiration and tireless sacrifices I could not have made it this far and late brother Daniel Wilson who I lost during my course work whose light is forever shining within me with great hope for the future. Secondly to my dear sisters Deckillah Shitandi, Esther Nekesa and Meggy Kweyu who have been my greatest anchor and pillar of strength throughout my rigorous research. I sincerely thank you all for your incredible contribution for shaping me to take on life and pursue my academic endeavors.

TABLE OF CONTENTS

DECLARATION ii
DEDICATION iii
LIST OF TABLES vii
LIST OF FIGURES viii
ACKNOWLEDGEMENTS ix
ABSTRACT x
LIST OF ABBREVIATIONS AND ACRONYMNS xi
CHAPTER ONE 1
1.0 Background to the Study 1
1.1 Introduction 1
1.2 Problem Statement 2
1.3 Objectives of the Study 4
1.3.1 General Objective 4
1.3.2 Specific Objectives 5
1.4 Assumption of the Study 5
1.5 Justification of the Study 5
1.6 Scope and Limitations of the Study 5
1.7 Definition of Key Terms 6
CHAPTER TWO 8
2.0 LITERATURE REVIEW 8
2.1 Introduction 8
2.2 The shortage of women in STEM 8
2.3 Stereotypes about women in STEM 10
2.4 Theoretical Framework 13
2.4.1 Career Construction theory 13
2.5 Relevance of the Theory to the Study 14

CHAPTER THREE **16**
3.0 METHODOLOGY 16
3.1 Introduction 16
3.2 Research Site 16
3.3 Research Design 16
3.4 Study Population and Unit of Analysis 16
3.5 Sampling Procedure 17
3.6 Data Collection Methods 17
3.6.1 Semi-structured Interview 17
3.6.2 Key Informant Interviews 17
3.6.3 Case Narratives 18
3.7 Data Processing and Analysis 18
3.8 Ethical Considerations 18
CHAPTER FOUR **20**
PERCEPTIONS AND ATTITUDES OF FEMALE STUDENTS TOWARDS STEM COURSES AT THE UNIVERSITY OF NAIROBI 20
4.1 Introduction 20
4.1.1 Response Rate 20
4.2.2 Distribution of respondents by age 21
4.2.3 Marital status of the respondents 22
4.2.4 Year of Study at the university 23
4.2.5 Religious affiliations of the respondents 24
4.2.6 Number of STEM subjects pursued in secondary school 25
4.3 Disaggregation of male/female teachers who taught the respondents STEM subjects in secondary school 28
4.3.1 Disaggregated data on whether or not the respondents attended a mixed secondary school 31
4.3.2 JAB or Self-sponsored students 32
4.3.3 Employment status of the respondents 33
4.3.4 Data on respondents having dependents or not 35
4.4 Perceptions of non-STEM female students towards STEM 35

4.5 Attitudes of female students towards STEM 38
CHAPTER FIVE: SUMMARY OF FINDINGS, CONCLUSION AND RECOMMENDATIONS 39
5.1 Introduction 39
5.2 Discussion 39
5.2.1 Perceptions of female students towards STEM 39
5.2.2 Attitudes of female students towards STEM 40
5.3 Summary and discussions of the findings 41
5.4 Conclusions 42
5.5 Recommendations 43
5.5.1 Recommendations for policy formulation 43
5.5.2 Recommendations for further research 43
REFERENCES 45
APPENDICES 48
APPENDIX 1: CONSENT FORM 48
APPENDIX 2: SEMI-STRUCTURED QUSTIONNAIRE 49
APPENDIX 3: KEY INFORMANT INTERVIEW GUIDE 52
APPENDIX 4: CASE NARRATIVE GUIDE 53

LIST OF TABLES

Table 1.1 Gender distribution in the field of engineering in Kenya 4
Table 4.1 Marital Status of the Respondents 23
Table 4.2: Year of study at the University 24
Table 4.3 Number of STEM subjects pursued in secondary school 25
Table 4.4: Parent's occupation 27
Table 4.5: Employment status of the respondent 33
Table 4.6: Perceptions of the female students towards STEM 36
Table 4.7: Whether their attitudes towards STEM has been shaped by socialization 38

LIST OF FIGURES

Fig 2.1 Conceptual Framework..... 15
Figure 4.1: Distribution of respondents by colleges 21
Figure 4.2: Distribution of Respondents by Age 22
Figure 4.3: Religious beliefs/affiliation 25
Figure 4.4: Gender of the Respondent's STEM Tutors in Secondary Schools 29
Figure 4.5: Disaggregate on whether the Respondents attended Girls/Mixed schools..... 31
Figure 4.6: JAB or Self sponsored students..... 32
Figure 5.1 General variation of males and females in STEM studies worldwide 40
Figure 5.2 Weak uptake in STEM studies worldwide for males and females..... 41

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ABSTRACT

The study was on perceptions and attitudes of female students towards Science, Technology, Engineering and Mathematics courses at the University of Nairobi. Its objectives were to identify the perceptions of non-STEM female students towards STEM courses at the University of Nairobi and to describe the attitudes of non-STEM female students towards STEM courses at the University of Nairobi.

The study adopted cross-sectional and exploratory research design using both qualitative and quantitative data collection methods. Purposive sampling was used to identify 50 respondents for semi-structured questionnaires and case narratives. At the same time key informant interviews was carried out to gather more data on this study. The theoretical framework used for the study was career construction theory. The relevance of this particular theory was based on the premise that people choose their careers based on how they have been socialized in life, how their worldview was shaped and also on how they believe their roles are ascribed to them based on their abilities, skills, competencies and aptitude.

The study findings indicate that females at times feel unwanted in STEM studies because of male dominance and lack of role models in STEM fields. It also highlighted that a lot of stereotypes about female students regarding STEM are negative in nature. Culture played a key role in this study since it shapes how females view themselves and establish a relationship with STEM. It is also paramount to acknowledge that the females in this study came from a background where STEM was not given top priority in their lives. They grew up believing that it is a reserve for males and their contribution towards it was overlooked.

The study concluded that gender inequalities were present in STEM and it is evident from a young stage of females where they are molded to take other routes that ‘suit’ their gender expectations according to the society.

The study recommended that there is need to incorporate gender sensitivity in our curriculum especially in our text books through the use of illustrations that allows both boys and girls to feel included and identify. The curriculum could also be revised and updated to make STEM more relatable for students where it can be less abstract. It also noted that Kenyan schools should have career programs from an early stage that allows students to ask questions and open up their world. Trainees who give career talks should have a practical approach that is involving and hands-on for the students. STEM subjects in schools should go beyond laboratory experiments and involve school trips to actual locations where students can physically see how STEM is handled practically in the outside world. The schools can even have holiday programs where the students can be placed in companies that practice STEM and involve students at an early stage where they can write reports about what they learnt during the program.

LIST OF ABBREVIATIONS AND ACRONYMNS

CUE Commission for University Education

GBV Gender-Based Violence

GBSV Gender-Based and Sexual Violence

KCSE Kenya Certificate of Secondary Education

KII Key Informant Interview

KNEC Kenya National Examination Council

HRW Human Rights Watch

SDG Sustainable Development Goals

SPSS Statistical Package for the Social Sciences

STEM Science, Technology, Engineering and Mathematics

UN United Nations

UNFPA United Nations Population Fund

UNESCO United Nations Educational, Scientific and Cultural Organization

UoN The University of Nairobi

CHAPTER ONE

1.0 Background to the Study

1.1 Introduction

There is a great disparity along gender lines in science, technology, engineering and mathematics (STEM) subjects. Female students pursuing non-STEM courses in institutions of higher learning are rapidly increasing. This imbalance calls for action to question the gap between the two sexes and find out the perceptions of non-STEM female students towards STEM and its endeavours. It is not by accident that most scientific, technological and mathematical inventions in the prestigious Nobel Prize awards are attributed to males. The STEM arena is overwhelmingly represented by men and shows a great deficiency of women. When women fail to enter STEM fields, society misses out on their contributions and younger women are denied important role models (Kennerly, 2017).

Across the developing world, 25% fewer women have access to technological advancement. The gender gap in this statistic stretches to 45% in sub-Saharan Africa. Nearly 35% fewer women than men in South Asia, the Middle East and North Africa have technology access and close to 30% in parts of Europe and across central Asia (Broadband Commission, 2013). The average percentage of African women in scientific research is 34.5%. In Africa to date, there is still a staggering level of illiteracy and major world donors are pumping in money to eradicate this problem. Many organizations are also hell bent on improving the status of the girl child by empowering her through education (Okello, 2015). The World Bank has contributed KES 20 billion to Kenya's STEM initiative which was set to be rolled out in secondary schools starting in January 2018 (KNEC, 2016).

In Kenya, affirmative action has been brought forth to balance the ratio between boys and girls in education and ensure that they both reap the full benefits of education. The ministry of education has put measures in place to secure a place for the girl child in the classroom. This move promises a smooth transition for the girls from secondary schools to institutions of higher learning (KUCPS, 2013). According to the Kenya National Examinations Council (KNEC) and the Commission for University Education (CUE, 2016), there is an

alarming sharp decline as more students are failing in mathematics and sciences. Their records show that performance in the two subjects has been on the decline for the last three years (KNEC, 2016).

In STEM subjects 18% of the candidates sat the Biology exam and attained at least grade C in 2014, a drop of more than half, compared to 2015 when 40% of the candidates attained the grade (KNEC, 2016). Physics had a mean grade of C- and was the best recorded science subject in 2016. Chemistry had a mean grade of D plain which was also worse than the previous two years. Nine in ten candidates scored below grade C plain in chemistry in 2015. The records here indicate dwindling results in the sciences (KNEC, 2016).

The worrying performance presented here is indicative of the low intake of STEM students in institutions of higher learning and more so for female students. The bar set does not meet the required threshold for science related courses which in turn will culminate in too few STEM students in Universities and eventually the job market. When all these data are put together they show that female students are in the minority in Kenyan universities especially in STEM studies. Gender issues are diverse especially in STEM and have not been researched widely. Institutions have noted that female students who qualify for STEM courses change their courses to arts-based programmes once they get to the institutions hence having fewer female students in STEM subjects (Kerre, 2009).

1.2 Problem Statement

Although there are many universities, the Kenyan education system has been characterized by gender disparities at the national level and between various regions in favour of males. A study done in Africa about twenty years ago indicates that there is a low representation of women in science subjects (FAWE, 1997). The African girl child to date is pushed to pursue 'soft' study subjects which restrict her aspiration to excel in STEM studies that are perceived to be for the males (Ramani, 2004). There is a gender gap in STEM with women tailing behind men in this field. This research is out to find out why female students in non-STEM programmes at the University of Nairobi avoid STEM studies. Women account for the minority of science researchers in the world (UNESCO, 2012). Female students are

known to avoid tedious science subjects that they find complex with numerous mathematical calculations and deriving theories that are demanding (Murithi, 1996).

The deficiency of women in this area calls for a boost and questions why women shy away from STEM. Statistics show that between 2007 and 2011, around 207,000 women joined institutions of higher learning. It is estimated that about 67% of the female students joined arts degree programmes. Only 33% were admitted to STEM subjects (CHE, 2011). The World Bank has heavily funded these disciplines and offer support especially in Sub-Saharan Africa but unfortunately females still do not find it attractive enough to pursue them in the long run (World Bank, 2007). Women shun STEM studies mostly because of their gender and not because of their aptitude and capabilities towards STEM (Kimani and Muikamba, 2010).

Gender inequality is problematic in STEM courses. On a larger scale developed countries tend to do better when it comes to gender equality compared to the developing countries. For the longest time there has been a gross underrepresentation of women in the fields of STEM. A wide array of reasons explains the barriers that female students have towards STEM enrollment. They include gender insensitive curriculum, lack of gender inclusive policies to accommodate females in STEM, lack of female role models in STEM careers, gender imbalance in the teaching fraternity, obsolete teaching materials, negative culture, attitude and perceptions of females towards STEM (UNESCO, 2011). Globally, there is a pre-existing misconception that STEM is entirely a male domain that leaves no room for women to participate, engage and thrive at the same level as men. This study seeks to explore the loopholes in gender issues when it comes to STEM studies (HRW, 2005).

The University of Nairobi has fewer female students in STEM courses. The ratio of female students to males in STEM is 1:5. In arts subjects the female students are more than their male counterparts. A lot of female students at the University of Nairobi are academically inclined towards non-STEM subjects as their preferred choice of study. This trend ultimately creates a gender gap in STEM studies at this University. This study then intends to question why there are few female students in STEM courses at the University of

Nairobi. The study seeks to question non-STEM female students about their attitudes and perceptions towards STEM courses.

Table 1.1 below shows the gender distribution in the field of engineering in Kenya according to Akirachix organization in Kenya which deals with women in technology.

Table 1.1 Gender distribution in the field of engineering in Kenya

CATEGORY	MALE	FEMALE	AGGREGATE
Registered Consulting Engineers	272 (98.2%)	5 (1.8%)	277
Registered Engineers	1,298 (96.8%)	43 (3.2%)	1,341
Registered Graduate Engineers	4,972 (92.3%)	413 (7.7%)	5,387
Graduate Technicians	1,128 (98.5%)	17 (1.5%)	1,145

Source: Engineering Board of Kenya (2012)

1. What are the perceptions of non-STEM female students towards STEM courses at the University of Nairobi?

2. What are the attitudes of non-STEM female students towards STEM courses at the University of Nairobi?

1.3 Objectives of the Study

1.3.1 General Objective

To explore the perceptions and attitudes of non-STEM female students towards STEM at the University of Nairobi.

1.3.2 Specific Objectives

1. To identify the perceptions of non-STEM female students towards STEM courses at the University of Nairobi.

2. To describe the attitudes of non-STEM female student's towards STEM courses at the University of Nairobi.

1.4 Assumption of the Study

1. Non-STEM female students at the University of Nairobi think STEM courses are for the males.

2. Non-STEM female students at the University of Nairobi assume STEM courses are tasking.

1.5 Justification of the Study

This study shall stimulate other research areas in the STEM field. A closer and more critical look at this approach will inform and facilitate better and broader research into this area. Of great importance is information on how to best target and enable female students shape their perceptions of STEM. This study will contribute to the body of knowledge within this area of study. It will add on what has been previously researched regarding this area. It will contribute towards filling up knowledge gaps in STEM.

1.6 Scope and Limitations of the Study

The study was carried out at The University of Nairobi's Main Campus and will focus only on non-STEM female students. Furthermore, the research was concerned with the worldview that non-STEM female students have with respect to STEM. The research examined their thoughts, views and opinions regarding STEM. The research design used was cross-sectional and exploratory which is descriptive in nature. The study was guided by career construction theory. The study was only limited to the University of Nairobi's main campus and it will involve the non-STEM female students at the campus who are

pursuing their undergraduate studies. It did not look at other universities to pick their perception regarding this study.

1.7 Definition of Key Terms

Barrier: A demerit or hindrance that deters other things to happen and works to one's disadvantage.

Engender: The process of ensuring that planning and programming is appropriate for and takes into account the female and male differences and concerns.

Engineering: Application of mathematics, science and empirical evidence to innovate, design, build research and improve structural machines.

Gender: The social differences amongst females and males that are learned. It determines power, relations, roles, responsibilities and entitlements for men and women. It is found in every culture and may vary over time.

Gender equality: The equal treatment of men and women so that they enjoy the benefits of development including equal access to and control over opportunities.

Gender mainstreaming: A strategy and approach to achieve equality, equity and advocacy to ensure that programs and projects have planned action, including legislation in all areas and levels to benefit both genders equally.

Mathematics: The study of numbers to calculate and solve equations.

Science: Knowledge based on testing hypothesis to understand and describe natural phenomena.

SGBV: Sexual and gender based violence. It is harm that is perpetrated on a person due to gender power inequalities that exist among males and females.

STEM: Science, Technology, Engineering and Mathematics.

Stereotype: A preconceived notion about a place, people or movement that is based on unsubstantiated generalities.

Patriarchy: 'Rule of father'. It refers to male dominated social relations ownership and control of power at many levels in society. It is thought to be the root cause of the existing system of gender discrimination.

Perception: A belief or formed opinion which is upheld to be true as an awareness of something based on one's senses and experience.

Technology: Application and practicalities embedded in apparatus and machines based on and derived from the knowledge and understanding of science.

CHAPTER TWO

2.0 LITERATURE REVIEW

2.1 Introduction

The literature review in this section focuses on the attitudes and perceptions that non-STEM female students have towards STEM courses. It also covers a broader scope on how the society and key players like parents, teachers, mentors, institutions and communities affect how female students view STEM courses. The section ends with a discussion of the theory that will guide the study and a conceptual framework that explains the study.

2.2 The shortage of women in STEM

A study done in the US in 2009 by the Department of Commerce under the North Central University found that women constituted 48% of the entire national workforce but unfortunately only 24% were in the STEM field. Another research done in the US by The National Girls' Collaborative Project showed a slight improvement in the statistics. Their research indicated that women in America constitute 50% of college educated work force but 29% of them were in STEM fields and out of that only 11% of women pursue engineering courses at university. It indicates that males are six times more likely to pursue STEM studies, only 18% of bachelors degrees are given to girls annually and only 30% of the engineering workforce is made up of females.

According to the National Science Board in Kenya (2014) women feel isolated in STEM. When they look around they do not see a sizeable number of women in this area of study. On a larger scale this locks them out when they try to interact with other women outside STEM since their schedules do not match. Women outside STEM view their female colleagues in STEM as being aloof and always busy with their studies giving them little time to socialize and are well equipped to keep abreast with their fellow women on other social issues.

There is a shortage of trained female STEM scholars. This causes female students to feel left out. They lack the motivation to pursue STEM because they do not envision a future

where they can thrive in this field. Leaders in STEM tend to be males hence reinforcing the expectation that this is a male domain. While studying gender and mathematics, female students internalize failure while the males do the opposite. Female students are discouraged by their grades and as a result they steer clear of STEM. On the contrary, males perceive failure as a challenge and motivation to work harder to boost their performance. This disparity catapults the male students to a different wavelength setting them up for success in STEM. Females lack confidence in themselves to articulate the hurdles they face in STEM-related courses. Consequently, they abhor the outcome and eventually drop out because of the discouragement they face (UNESCO, 2012).

Women fail to see their replica at the top in STEM fields. There is an acute shortage of female leaders in this field. Women lack of inspiration and aspiration to get to the top in this arena. There are no females to lead the way and guide the amateurs on how to survive in the STEM field. All that women see are males who are ruling fiercely in this realm. This pattern reinforces that this field is highly dominated by the males and has no room for women who are interested in venturing into it in the long-term. Women who qualify for STEM opt out and go for courses that they believe are in line with their future prospects. They tend to pick courses that will augur well with their inherent nurturing abilities that will directly impact their immediate life (Bunyi, 2006).

Most women quit STEM studies and careers after having children because of time constraints and career demands. This is because STEM keeps women away from the household sphere for long periods due to the nature of its assignments and this affects their domestic, child care duties and also home keeping. STEM calls for working long hours and irregular shifts. STEM should integrate child care as a new gender aware pathway. (Rustico & Sperotti, 2012).

The World Bank (2007) argues that continual exclusion of women from education causes a loss of productivity and eventually reduces economic development. The merit of women's education raises a country's GDP. Educated women tend to be healthier, have fewer children, educate their offspring and have better income. STEM allows the girl child to enjoy such privileges. Sending girls to school in some African communities seems to be

a tall order since it takes them away from the domestic chores. Science and technology is a major driver of economy. It creates numerous job opportunities (Oxfam, 2005).

2.3 Stereotypes about women in STEM

Stereotypical segregation based on gender has a powerful impact on females. This applies to their studies and ultimately career choice. STEM in its inherent nature is highly '*masculinized'* causing it to be 'harsh' on women who have interest in it. The structural make up of STEM subjects easily favours the boy child and ignores the girl. STEM is fashioned in such a way that girls shy away from it whereas boys from an early stage of development are attracted to it. Consequently, STEM robs females of their femininity and assimilates them into 'manly' attitudes as it is seen to be an apparent requirement for success in this field of study. This disparity causes STEM to be gender blind with outright favour to boys and sheer dismissal to the girl child (Marsh and Scalas, 2011).

In most schools, it is assumed that being feminine indicates inaptitude for mathematics. Teachers think it is not important for girls to be good at mathematics. The gender bias affiliated to STEM studies is ingrained early when young boys and girls are navigating through life in their formative stages as they seek answers to how things work. Many females in the world believe that a STEM career is for the males. This stereotype holds them back from fulfilling their true potential. The females feel inferior when competing with the males in class and based on this belief they tend to shy away from STEM courses (Nosek, 2009).

Parents play a major role when it comes to shaping the worldview of their daughters with respect to STEM. Parents academically profile their children. Unfortunately, parents tend to perceive their daughters as less talented when it comes to 'hard' sciences and mathematics. Both parents and teachers see the boys as naturally capable of tackling the sciences and mathematics and assume that girls will struggle in STEM. A girl's interest in STEM is tightly tied to her faith in herself that she can do well in STEM studies. With great confidence, her interest improves. Then, parents and teachers must demonstratively encourage girls to pursue STEM studies (Dresel, 2007).

Parents are responsible for encouraging their children's academic excellence with regard to STEM. At the early stages of development boys are allowed to explore, imagine, question and innovate in their own world without restrictions from their parents. However, teachers are prone to unconsciously perpetuating gender discrimination by under-rating girls' ability in mathematics and over-rate the boys. On the other hand, girls are confined and held closely with a lot of caution. The girls are confined to the home and are warned from exploration. STEM by its very nature, calls for immense practicalities and trials to yield results. This phenomenon will favour the boys and discredit the girls due to the gender bias that they face when growing up. At a later stage when girls independently choose to pursue STEM, they are frowned upon and are told especially by their parents that they could do better in other fields that suit them as well as 'match' with their gender (UNESCO, 2012).

The problem with stereotypes is not that they are untrue, but they are incomplete and most times they rob people of their full capabilities. Stereotypes are learned and internalized to mean something. They hold water and eventually put a specific group of people in an imaginary box where they are expected to exist and conform according to how the society labels them. Women conform to fit into social stereotypes placed upon them. Gender stereotypes have a great impact in choice of STEM studies. Girls are made to believe that they are cut out to pursue certain courses that go hand-in-hand with their upbringing that has nurturing characteristics (Owens and Massey, 2011).

On the other hand, females who believe to be good enough in STEM still suffer from the stereotype that they are not well equipped to pursue it. This stereotype burdens them as they try to look for pathways to pursue and excel in STEM. They feel the need to work extra hard to prove their worth in STEM studies and compete with the males in the field. The internalization of this stereotype at times can reflect on their academic performance. Consequently, they doubt their abilities to excel in STEM and eventually it becomes a self-fulfilling prophecy that reinforces the idea that girls are not built for STEM (Macher, 2015).

Stereotypes corrupt self image. STEM subjects, particularly those that record a low enrollment and retention of women, are perceived to be demanding of high intelligence,

good grades and unique talent. Students with good grades need a lot of support to pursue such STEM studies and girls too with good grades can be encouraged to enroll in them and succeed just as much as the boys (Ziegler, 2002).

Kenya is still a patriarchal society. Property and title are inherited by the male lineage. Bias is still evident in schools, families and workplace against female students in STEM. Patriarchal structures in our society have hampered women from realizing their full potential. Family, marriage and culture also influence women's experiences as scientists. A number of African communities and cultures do not have a tradition of professional women. There is a strong expectation that women must conform to the traditional roles of wife and mother (IPOL, 2015).

Culture is a limiting factor for women when it comes to STEM studies. Culture produces the pattern of few women in STEM. Women have faced gross injustice due to past retrogressive culture through customs, laws and attitudes especially in Sub-Saharan African countries. When we change how we address women and girls, we ultimately change the way they think about themselves. Women's gender roles in the past have contributed to their exclusion in higher education. Women lack access to education because of customs that give outright preference and allocation of economic resources to the boy child causing high level dependency syndrome. The culture of encouraging boys to go to school causes them upward mobility and ultimately they have greater numbers in STEM. In the end STEM will have a homogenous group that thinks alike. The result of this is lack of diversity and creativity which ultimately affects the job market in STEM. A diverse group opens up creativity and will be perceived as exciting (DFID, 2005).

Women are constantly attached to care giving duties. Double work load limits women to domestic realms whereas the males are liberated to find their passion outside the home. For most married women, when their husbands are given job transfers in STEM, they are forced to follow their spouses and relocate to a new region. On the contrary, when a married woman in STEM is given a transfer to a better job in a different location, she either goes alone or resigns from her job. This disparity still manifests itself for women working in STEM fields (Masanja, 2010).

In our societal upbringing, from a young age females are raised and moulded culturally to aspire to marry and raise families. Women are praised when they demonstrate good home making skills and are always sacrificing every other venture to put their families first. On the other hand, STEM from its very onset calls for perpetual concentration and commitment to succeed and get to the management level. These two parallel issues cause a conflict. In the long run, women are compelled to quit and take care of their families at the expense of their studies and careers (Fouad and Singh, 2011).

Many African communities believe that educating a girl to higher levels will impede her prospects for marriage and at the same time increase her bride wealth to exorbitant heights putting a strain on the girl's parents and causing a financial burden to them. When girls at an early age are away from home it cuts back on the needed house chores. Such communities prefer to have the boy child in school for them to find paid work and bring financial success to the family (ILO, 2002).

It is also noted with great concern that in family setup women have insecurities in their marriages whenever they consider STEM courses and careers. They are highly likely to face challenges in their marriages and are worried of the social ridicule if they earn more than their husbands. Consequently, women who make the cut off points to study STEM often opt to pursue other courses that allow them enough time to be 'proper' wives and mothers (Hawks, 1998).

2.4 Theoretical Framework

2.4.1 Career Construction theory

This study was guided by the career construction theory. The theory was brought forth by a scholar named Savickas in 1996 and has been revised ever since by other contributing scholars over time. It explains how an individual's social environment with respect to their socialization, education, peers, culture and family necessitate their need to aspire towards certain careers and job markets to shape their life's satisfaction. This phenomenon sets a foundation for their career targets. A person's social network ultimately streamlines their

future career. The relationship between socialization and education comes to full circle when career prospects are looked into (Hogan, 2003).

It is contended that the entry point into one's career pathway is heavily dependent on their earlier interactions and perceptions in life that are tied to education and early childhood encouragements of the chores that they picked up to pursue. This notion has a gender angle to it on how boys and girls are socialized in their formative years. A person's navigation in education and career is tied to their internal perceptions and goals. This theory supports future aspirations as a strategy that comes to pass due to a person's well being with regards to their mental and psychological makeup (Guichard, 2005).

Further research on this theory posits that capabilities, interests and talents shape one's career choice for long-term prospects. It argues that people are well aligned to their careers in relation to what they do with ease. It shows that an individual's personality will inherently affect their job transitions and negotiations (Savickas, 2012). This is conceptualized as shown in fig 2.1.

2.5 Relevance of the Theory to the Study

The career construction theory shows that the relationship between perceptions, education, socialization, experiences, beliefs and networks ultimately affects an individual's career path in life. The assortment of all the things a person goes through will manifest in their career choice. The theory explains why and how education shapes people's worldview and out of it they create a perception of their goals in life and contribution to society. The theory argues that career is constructed over a long period of time. The theory is significant in the context of this study. The extent to which the career construction theory is relevant to this study is principally guided by why there are few women in STEM courses in institutions of higher learning.

There is a perception that STEM is a preserve for males. This is carried on by its long history of being a male domain. Due to this it shapes the perception that females are not welcomed in STEM studies. The career construction theory shapes the world view that certain careers are molded by how people perceive things and see their best fit when

pursuing studies. This perception is brought forth in STEM studies in relation to gender beliefs in society. Females are care-givers and nurturers. This opinion is viewed to be contrary to how STEM studies are packaged. STEM calls for rigorous training, practice and thorough reading. The upheld perception in society is that females are best matched with non STEM studies that allows them time to maintain their feminine composure.

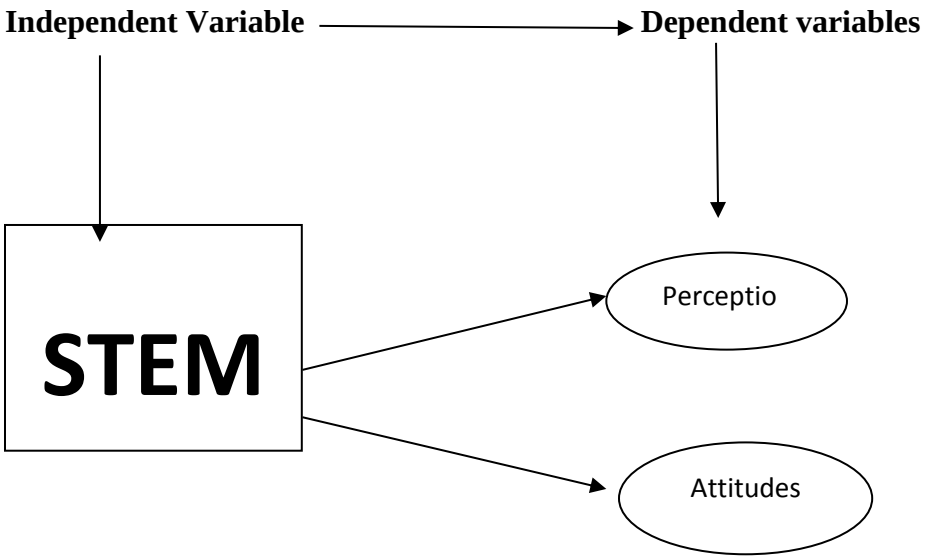


Fig 2.1 Conceptual Framework

The conceptual framework shows the relationship between my variables (Dependent and independent). In this study, STEM is the independent variable whereas Perceptions and attitudes of non-STEM female students is the dependent variable.

The conceptual framework shows how the perception of non-STEM female students affects their attitude towards STEM subjects. Other factors may come into play that will eventually affect their attitudes and perceptions as explained in the literature review. These are issues such as gender, culture, educational background, age, worldview, career choice and societal expectations of the girl child that feed into their various perceptions and attitudes.

The conceptual frameworks shows that perceptions and attitudes can be altered based on the environment in which the students are part of.

CHAPTER THREE

3.0 METHODOLOGY

3.1 Introduction

This section describes the methodology that was used in this study. It covers the research study, research design, study population and unit of analysis, sampling procedure, data collection methods, data processing analysis and ends with the ethical considerations that guided the study.

3.2 Research Site

The study was undertaken at the University of Nairobi's Main Campus adjacent to the central business district (CBD). It lies on latitude at 1. 16' 47" S and its longitude at 36 49' 00" E. It is located along University Way in Nairobi. The Main Campus is the host campus to the College of Humanities and Social Sciences and the College of Architecture and Engineering.

3.3 Research Design

This study adopted a cross-sectional and exploratory research design. A cross-sectional design is descriptive in nature. It is time related and gives a snapshot of the phenomenon under study. A cross-sectional design establishes patterns. It utilized qualitative methods of data collection so as to guide the exploration of data perceived attitudes and perceptions faced by non-STEM female students regarding STEM courses at the University of Nairobi.

3.4 Study Population and Unit of Analysis

The study population targeted non-STEM female students at the University of Nairobi Main Campus. The unit of analysis was the individual non-STEM female student.

3.5 Sampling Procedure

The sample size estimated that 50 respondents were adequate for the analysis based on the survey to be undertaken. Thus, the respondents for the data were picked in line with the data collection methods. The study used purposive sampling method to pick the respondents.

3.6 Data Collection Methods

3.6.1 Semi-structured Interview

The study used a semi-structured questionnaire (Appendix 2) to collect demographic information from the respondents as well as their views and perceptions towards STEM. This was used to explain the variables in the study. The respondents in the interview were examined on their perceptions, thoughts, feelings and attitudes to give qualitative feedback. This measured data quantitatively by checking on numeric data through frequencies, percentages and statistics.

3.6.2 Key Informant Interviews

The key informants were picked to provide data on attitudes and perceptions of women towards STEM especially in institutions of higher learning. This was done with the help of Key informant interview guide.

The KII will be the following personnel

I. The Dean faculty of Arts at The University of Nairobi
II. Dean faculty of engineering at The University of Nairobi
III. The Dean college of health sciences at the University of Nairobi
IV. The director of African women in science
V. Chairperson association of women scientists in engineering
VI. Director of women in STEM program for university internships at Safaricom

3.6.3 Case Narratives

The narrators gave their own accounts regarding their attitudes and perception towards STEM courses. They gave their educational background with respect to their encounters with STEM studies throughout their previous years of schooling.

3.7 Data Processing and Analysis

The qualitative data from the Key informants, semi-structured interviews and case narratives was transcribed, coded and analyzed thematically. Quantitative data was derived from semi-structured interviews. All tape recorded work was transcribed and translated to prose form. Verbatim quotes from case narratives was used accurately from case narratives hand-in-hand with the general description of the data to project the respondents stand point.

3.8 Ethical Considerations

The main rationale for ethics in research methodology is to ensure that no respondent is harmed or suffers adverse ramifications from the research undertakings (Cooper and Schindler, 2010). To obtain the informed consent of the respondents, the researcher explained the purpose, duration and potential use of the research results from the field beyond academic purposes and any other research related information as might be of interest to the respondents was duly clarified before any data collection. To ensure data security, the researcher ensured that all recorded data and documents are kept safe. The researcher took various measures to protect the rights of the respondents as explained below:

The respondents in this study had all the details of the research prior to their participation. They decided at their own discretion whether or not they wanted to be part of the study. An informed consent was sought from the relevant authorities of the selected sample institutions and the respondents before the commencement of the research. The respondents on their part, were able to make informed decisions about their participation in the research as such all respondents were informed the reason and purpose of the research.

The research respected privacy and anonymity of the respondents.

At any one point if a respondent wanted to pull out of the research, they were free to do so. Respondents were also informed of their right to terminate their participation at any given point of the research. Voluntary participation was upheld by ensuring that the respondents were selected and asked to participate without compulsion. Participants of this study freely choose to share their sentiments at their own volition.

CHAPTER FOUR

PERCEPTIONS AND ATTITUDES OF FEMALE STUDENTS TOWARDS STEM COURSES AT THE UNIVERSITY OF NAIROBI

4.1 Introduction

This chapter presents findings on the data collected. It focuses on attitudes and perceptions of non-STEM female students towards STEM courses. The socio-demographic characteristics of the respondents are also presented. The chapter presents empirical results and findings of the application of variables using descriptive qualitative and quantitative methods.

4.1.1 Response Rate

The sample size of 50 respondents was the aim of the study. All (50) semi-structured questionnaire was completed and submitted making a full response rate (100%). This percentage was enough to capture the sample size as a representation of the target population.

4.2 Socio-demographic characteristics of the study sample

4.2.1 Distribution of the respondents by colleges

The study showed that students were from different colleges in the university. The distribution was from colleges such as: College of humanities and social sciences (CHHS), College of Architecture and engineering (CAE), College of biological and physical sciences (CBPS) as well as college of health sciences (CHS). This study majorly focused on students from CHHS and a small section of them from CAE. Results are presented on figure 4.1 below.

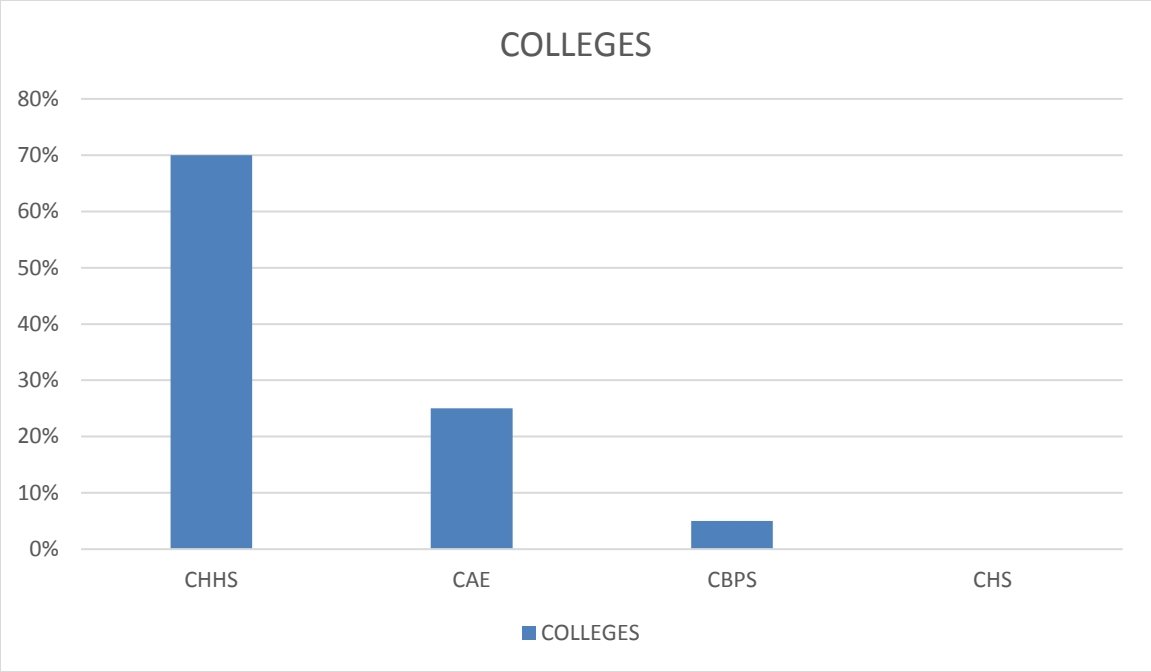


Figure 4.1: Distribution of respondents by colleges

Results obtained show that 70% of the respondents were from CHHS and 30% were from CAE. These colleges are the main ones that have non-STEM female students at the university. Most of the respondents were from CHHS because majority of non-STEM female students are found in this cluster.

4.2.2 Distribution of respondents by age

The data collected was keen on the respondents' age. Different age groups have diverse opinions on this study. The study mostly focused on respondents between the ages of 18-27 years as they are likely to be undergraduate students. There is likelihood that older persons could be pursuing their undergraduate studies. Results are presented in figure 4.2 below.

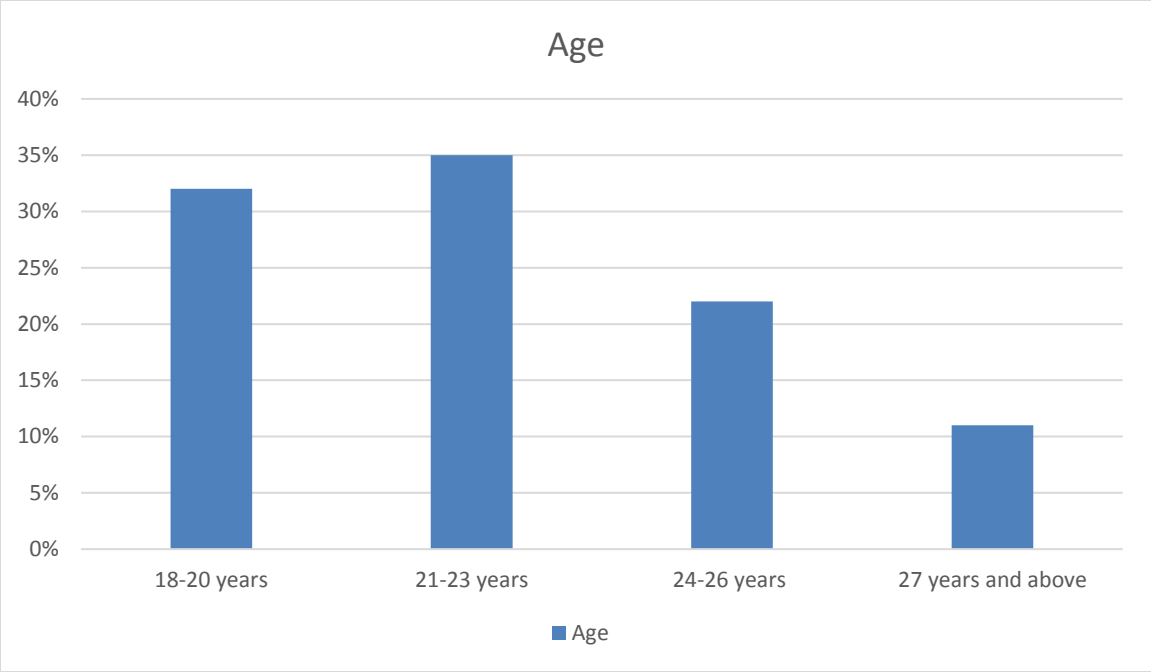


Figure 4.2: Distribution of Respondents by Age

Results obtained show that most of the participants are between the ages of 21-23 years. The least group of respondents are 27 years and above.

The study established that 32% of the respondents were between the ages of 18-20 years. 35% of the respondents were 21-23 years old. 22% of the respondents were between the ages of 24-26 years and 11% were 27 years and above.

4.2.3 Marital status of the respondents

The study sought to determine the marital status of the respondents which was established to be important in this study so as to gauge the respondents' attitudes and perceptions. Results are presented in table 4.1 below.

Table 4.1 Marital Status of the Respondents

Status	Frequency	Percentages
Single	33	66
Married	8	16
Separated	5	10
Divorced	3	6
Widowed	1	2
Polygamous	0	0
Total	50	100%

The study found that 66% of the respondents were single while 16% were married. It also showed that 6% were divorced, 10% separated, 2% widowed and none of them was in a polygamous arrangement. This shows that majority of the respondents in this study were single people, very few were widowed and none of them was practicing polygamy. This data was important to establish how marital status affects their attitudes and perceptions towards STEM studies.

4.2.4 Year of Study at the university

The study also looked into the year of study for the respondents to see how far they have gone in their academic endeavor. This also helped to analyze how their attitudes and perceptions change as they transition from one year to the next. Respondents were requested to indicate their year of study in the research. Results are presented in table 4.2 below.

Table 4.2: Year of study at the University

Year of study	Frequency	Percentages
1st year	10	20
2nd year	12	24
3rd year	15	30
4th year	13	26
5th year	0	0
Total	50	100%

Results obtained show that 20% of the respondents were in 1st year of their studies while 24% were in 2nd year at the university. It also indicated that 30% were in 3rd year of their studies and 26% were in their final year. It is also important to note that some courses in the university go up to 5th and 6th year but the target respondents were mostly completing their studies in 4th year unless there was the need to repeat or other isolated cases of deferment and exam failure. This in turn shows no recording of any respondents in 5th and 6th year of study.

4.2.5 Religious affiliations of the respondents

The Research probed the respondents on their religious beliefs and the findings are presented on figure 4.3 below.

Most of the respondents practiced the Christian faith. They were the leading at 80% followed by Muslims at 15%. Very few were practicing traditional African beliefs at 3% and the least was atheism at 2%.

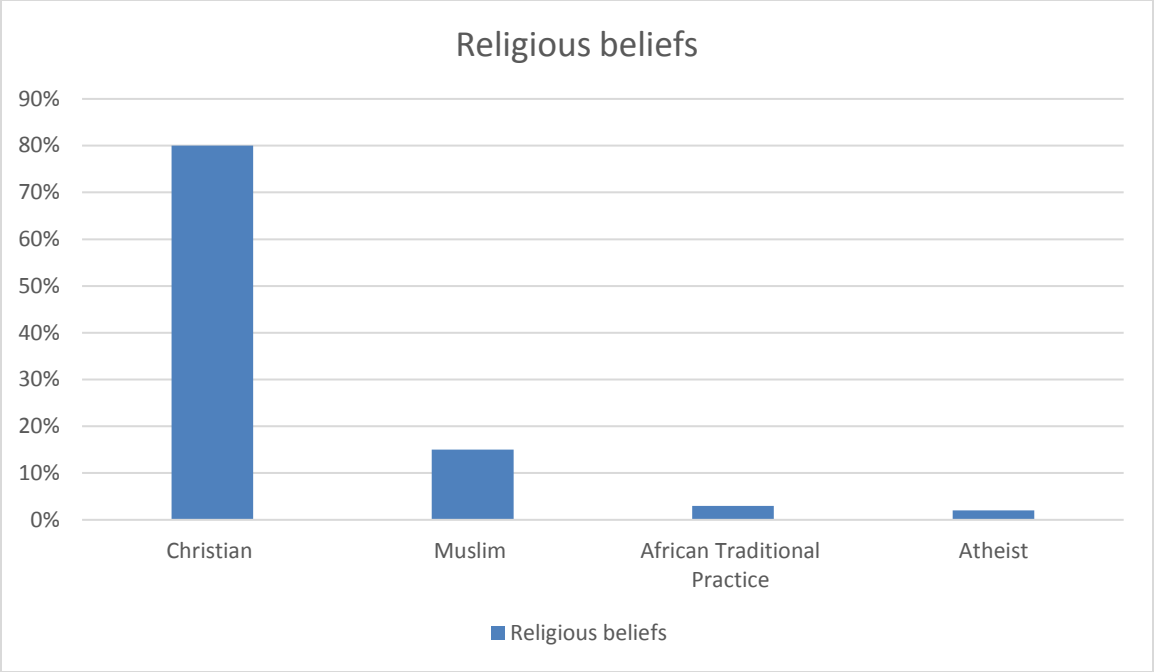


Figure 4.3: Religious beliefs/affiliation

4.2.6 Number of STEM subjects pursued in secondary school

Table 4.3 Number of STEM subjects pursued in secondary school

Subjects	Frequency	Percentages
Mathematics	50	100
Chemistry	35	70
Biology	40	80
Physics	10	20
Electrical and power mechanics	0	0
Aviation	0	0
Total	50	100%

80% of the respondents were Christians, 15% were Muslims while 3% represented the African traditional practice and only 2% were atheists.

One respondent had the following to say:

"I only pursued STEM studies in secondary school because some of them were compulsory. If it was up to me I wouldn't bother with them. They caused me sleepless nights trying to get the concepts. I endured STEM classes despite my poor performance. I simply had no other choice but to go with the flow that was already set out for me in the 8-4-4 curriculum system that I was expected to put up with. If I had the choice I would only stick to non-STEM courses and give them my all to ensure I succeed in them. I liked Arts from the beginning. I was discouraged by the laboratory sessions we had in our secondary school. I particularly didn't like chemistry and physics that introduced me to foreign concepts and chemicals in the lab that were strange to me. I preferred non-STEM subjects because they were familiar and a bit friendly. I could easily relate to the topics taught in non-STEM subjects because unlike STEM subjects they (non-STEM) phenomena I could easily identify and warm up to without wondering about its meanings and trying to decipher them for long periods." Sheila* 2nd year non-STEM student.

The study found out that 100% of the respondents did mathematics all through their 4 years of secondary school. It indicated that mathematics was a compulsory subject in the 8-4-4 curriculum studies. The other STEM subjects were optional and the respondents were free to pick or drop their subject of choice based on preference, careers prospects and skill set. The 8-4-4 system in Kenya, especially in secondary school gives the option of studying Chemistry, Biology, and Physics as the core subjects. Other subjects that fall within the STEM realm are aviation, Electronics and power mechanics which are not so common in many schools. The findings are presented in table 4.3 below.

Table 4.4: Parent's occupation

Parents occupation	Frequency	Percentages
STEM careers	5	10
Non-STEM	18	36
Informal	7	14
Unemployed	5	10
Self-employed	15	30
Total	50	100%

The study found out that 100% of the respondents did mathematics studies in secondary school. This response was statistically sufficient to analyze the population for the study as it captured all the respondents picked for the study. 70% of the respondents did chemistry studies in secondary school while 80% pursued biology studies and only 20% pursued physics as a subject. None of the respondents did Electronics and power mechanics or aviation studies. The study also found out that the Kenyan 8-4-4 system, no girls school had registered for an aviation studies. All aviation studies in Kenya at secondary level is only offered in boy schools. This gender disparity was alarming.

Some key informants pointed out that a parent's occupation largely determines where their children will end up. They opine that parents shape the destiny of their children. When children grow up seeing their parents go into careers that are fruitful, the children then in turn start to shape their worldview around that specific career. Children start to internalize early how careers are the pillars of self improvement and provision at home. With time they start to see themselves admiring what their parents do.

The study established that parents are great role models to their children in their formative years. Parents who are educated are likely to take their children to school unlike parents

who did not have an opportunity to be educated. Educated parents who have enjoyed the benefits of a good education will strive to give their children the same opportunities if not better.

The major Key informants highlighted that educated parents follow up on their children's welfare while they are in school. Educated parents are more invested in their children's academic affairs and always strive to provide the best educational facilities for them.

"It is paramount that parents go into careers or at least expose their children to careers that will make their daughters want to take up challenges. With few parents in STEM careers these girls lack role models to look up to when picking up courses in universities. Most of the parents for students especially in JAB programs are in the informal sector and this leaves the students with limited choices when picking up courses to pursue. Students from rural settings lack the exposure and most of what they know is agriculture and teaching courses which are prestigious in their upbringing. Some of them have to be taken through career talks and allow them to interact with other people so that they can broaden their career prospects. Parent's occupation greatly influences the students to work hard and go into promising careers." (KII)

4.3 Disaggregation of male/female teachers who taught the respondents STEM subjects in secondary school

The respondents reported that 35% of their teachers in secondary school were female and 65% were male. The role models and mentors were not female teachers. The gender disparity in this segment was not in favor of female teachers as STEM tutors. The results are presented in figure 4.4 below.

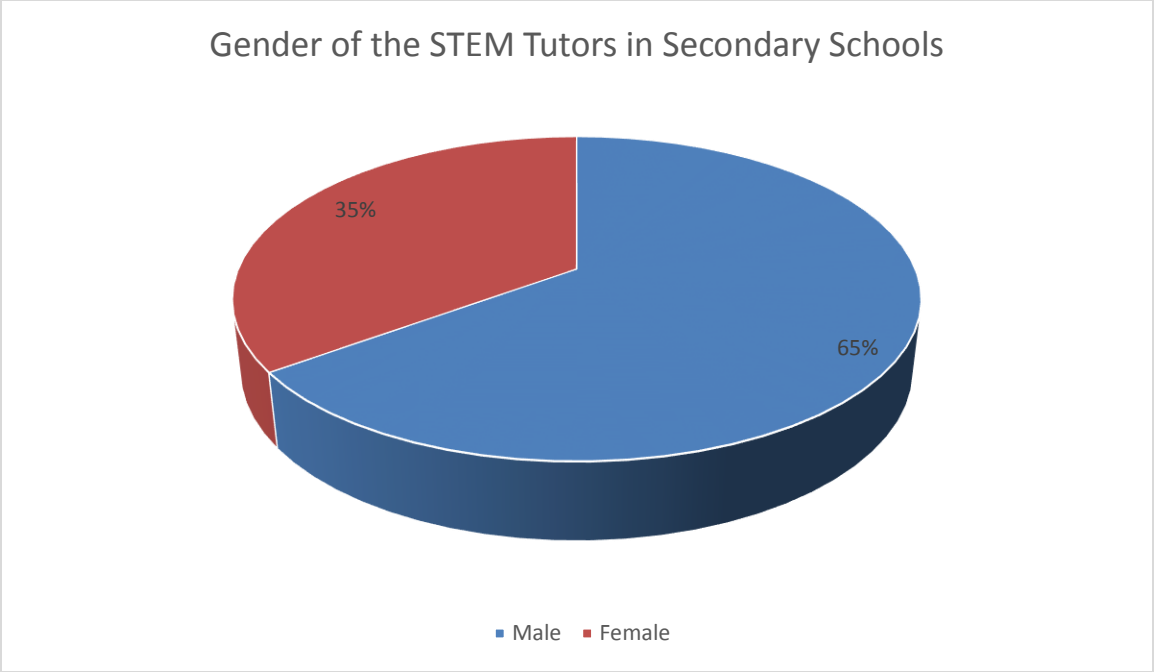


Figure 4.4: Gender of the Respondent's STEM Tutors in Secondary Schools

Most of the respondents said that they were mostly taught by male tutors in STEM subjects in their respective secondary schools. They indicated that from their interaction with STEM studies they have majorly encountered male STEM tutors.

One respondent articulated the following:

"*Throughout my high school studies I was taught by male teachers in all my STEM subjects. It seemed to be something that they (male teachers) understood with ease. The female teachers were mainly found in languages and humanities. I wanted to pursue the STEM subjects but unfortunately I did not see my own gender being at the forefront in STEM studies. I was more inclined to the languages because it was left to the female teachers that I truly admired. They inspired me to write stories and poems that I could relate to. I had difficulties approaching the male teachers in STEM who I found a bit cold. Most of them could not comprehend why I could not figure out certain concepts and formulas that they taught in class. I was put off and I stopped trying my luck with STEM subjects. One of the male STEM tutors in my school once told us of how the boys in his previous school were performing better than us in STEM studies and that he does not understand why we are not at par with the boys in STEM performance. That comment*

embedded in me that STEM was easier for the boys and it pushed further the notion that my male STEM tutor preferred teaching the boys than us girls. I assumed he found us girls to be slow in understanding STEM concepts and that we should be confined to languages and humanities studies that 'suits' our gender better". 3rd year non-STEM student

Another respondent echoed her sentiments by saying the following:

"Myself, I wanted to excel in mathematics but it is unfortunate that the odds were not in my favor. I wanted to be an engineer. My mathematics teacher was male in secondary school. I was the class prefect and I noticed as we moved up in our classes our mathematics grade was getting worse. I thought of engaging our mathematics teacher so that he can chip in and help us better our grades. One time as a class in secondary school we asked him to give us remedial class and he resisted saying that sarcastically that 'women who fail mathematics belong to the market', his comment was disheartening. I lost motivation. His remarks made me believe that our failure as a class was because of our gender. I wished at that moment I could exchange him with a female teacher who was more caring, sensitive and understanding to our needs but that decision was beyond me. I feared reporting the matter to our school principal for fear of being scolded. After joining university I pursued Economics which I greatly enjoy and I trust it will make a great impact in my life." 4th year Economics student.

4.3.1 Disaggregated data on whether or not the respondents attended a mixed secondary school

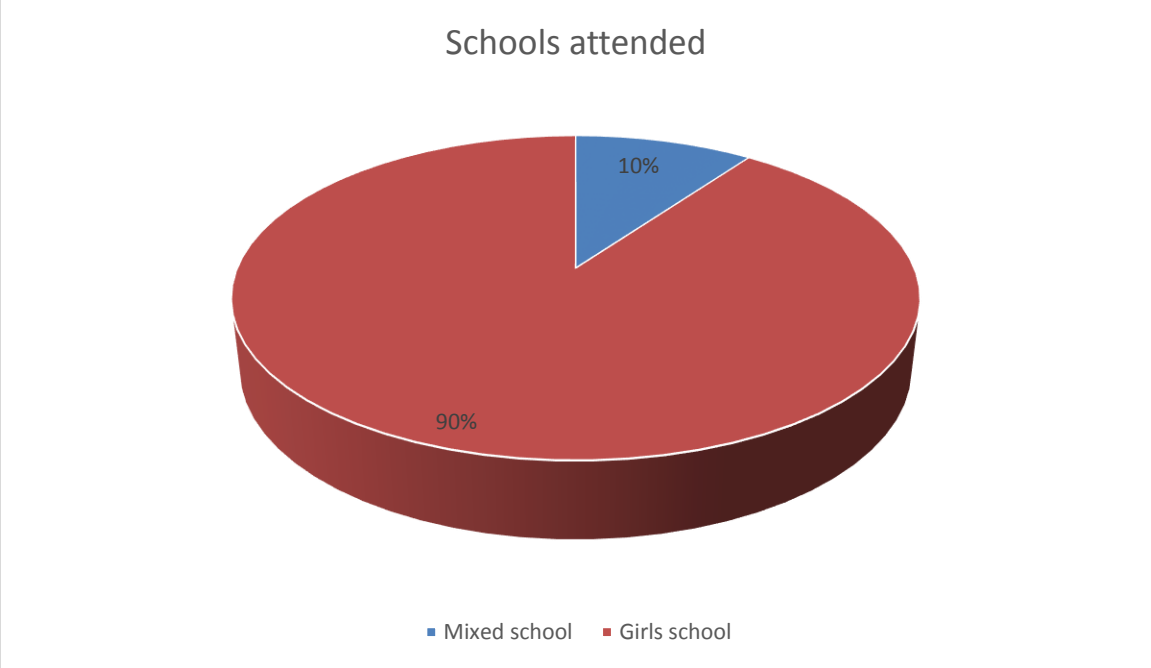


Figure 4.5: Disaggregate on whether the Respondents attended Girls/Mixed schools

Most of the respondents attended girls' school while only 10% went to a mixed school. Most respondents said their parents preferred to take them to girl's school which was invariably a boarding school that allowed them maximum concentration on their studies and avoid distraction. They opine that at this stage in their schooling they were undergoing puberty and the adolescence period required them to be separated from their male counterparts to safeguard against wayward behavior that could interfere with their studies.

On the other hand the other female students who attended a mixed school reported that most mixed secondary schools in the country tend to be boarding schools. A few were boarding and in that scenario they were totally separated and not allowed any room for interaction.

"*Some girls schools out rightly do not have physics as a subject because it is deemed to be a 'boys' subject. In some cases other girl schools will go for two semesters without a physics teacher present to train them. This at times is done to reduce cost and that also in many schools physics is an optional subject. This principle already discourages girls who*

have an interest in this particular subject and denies them an opportunity to pursue a great array of careers that requires physics as a fundamental subject. It is unfortunate that their fate has already been decided for them without even giving them a chance to try it out. This is a terrible gender bias in education that misses out on women's contribution in science subjects. The notion that girls cannot do well in certain subjects merely because of their gender is detrimental to their career choice and plans to shape their future prospects" Director African women in science (KII)

4.3.2 JAB or Self-sponsored students

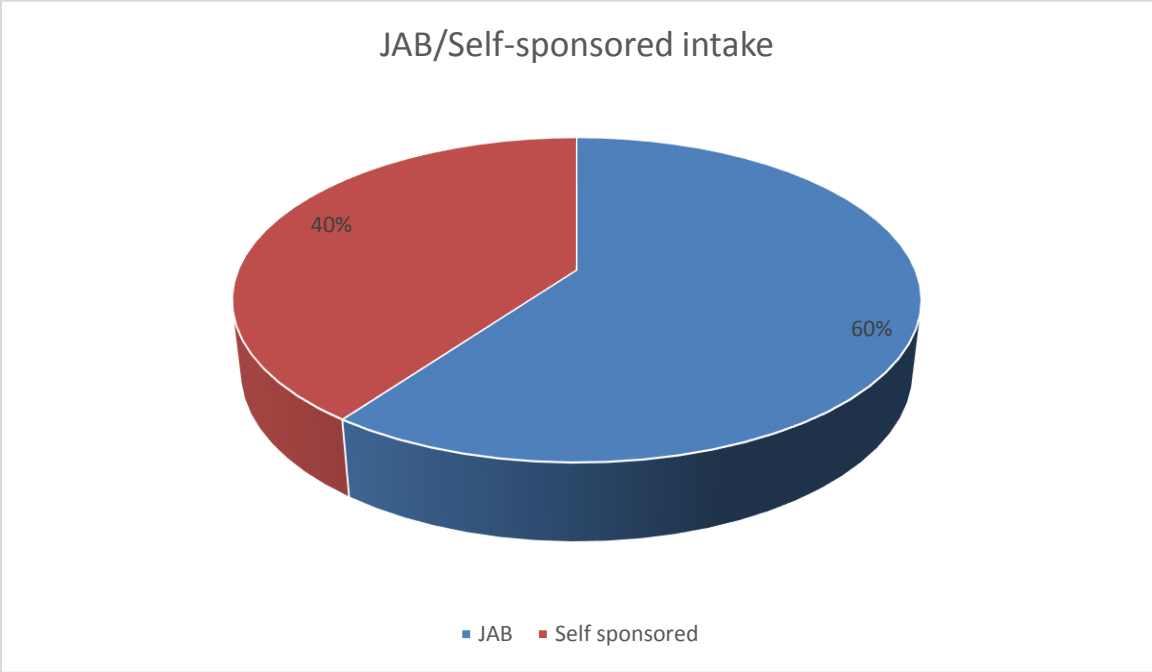


Figure 4.6: JAB or Self sponsored students

60% of the respondents were government sponsored students while 40% were self sponsored students. The students under the government program mostly reported to have no other choice than to accept the courses that they were admitted to. Some were limited because of their cut-off points while others wanted to change the course to their preferred choice but unfortunately they could not afford to pay from their pockets.

One of the K.I.I informants had this to say:

"*We get a lot of bright students admitted to the university with great potential to succeed in STEM fields but unfortunately the cut-off points from one year to another keep shifting causing them to settle for whatever they have been allocated. Others would like to venture into the STEM field but they are not able to afford the tuition fees as self-sponsored students. We receive letters regarding such cases asking for transfers to STEM courses but then fee becomes a stumbling block for many of them especially the JAB students from low income families and sometimes single-parent homes. These students try their best to get financial assistance from HELB offices but the money allocated is not enough to see them through their studies as self-sponsored students. In the long run they miss out on chances to pursue their dream courses that catapult them to their preferred careers. They are forced to settle for what they find unfulfilling all in the name of getting a university degree that will at least help them stay afloat in the ever changing and competitive job market. Some get these degrees just to satisfy their parents and peers and put up a brave faced that shows that they did not give up on their studies but deep down they were targeting to pursue something else totally different from what they were set out to do."* K.I.I Informant

4.3.3 Employment status of the respondents

Table 4.5: Employment status of the respondent

Employment status	Frequency	Percentages
Employed	6	12
Internship /attachment	17	34
Part-time	12	24
Self-employed	9	18
Unemployed	6	12
Total	50	100%

The study findings revealed that some of the respondents were working so as to sustain themselves and hence could not afford the time to be in class all day as is the requirement of most STEM courses. Engineering and medicine courses are run the whole day and backed up with a series of practical. These courses are very demanding and do not give one a chance to concentrate on other things. It is especially hard to juggle a job and STEM studies at the same time.

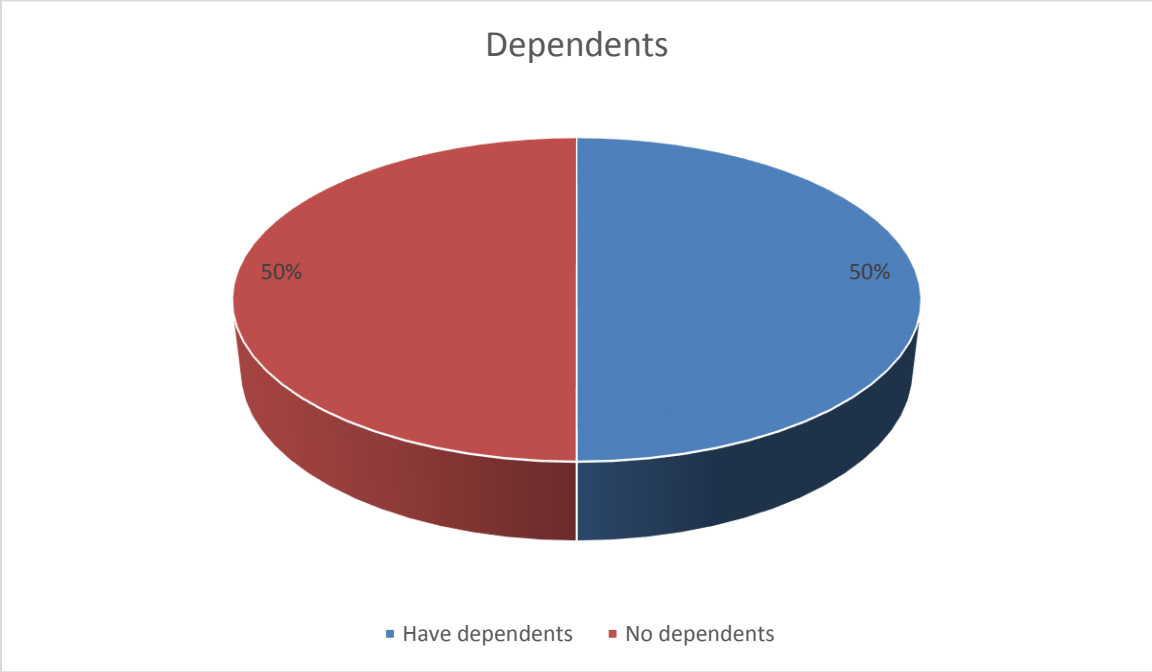
Many case narratives revealed that the student life at the university needed some money for upkeep. Some students reported that they were from low-income families and once their tuition fee was paid they were not left with much money to survive daily demands. This led them to look for jobs that could sustain them as they pursue their studies.

Others preferred to look for jobs while they are studying so that they do not have to struggle or stay idle once they graduate. They reported that it was easier to start early even on a volunteer basis so that they have a track record of work history and have better prospects of being absorbed into their respective job positions to ensure that they have a promising income that will keep them afloat.

The ones employed who constituted 12% of the respondents reported that they are paying their own tuition fee and could not afford to pursue STEM courses that are a bit costly and demanding at the same time. Employed respondents said that some of them were looking for promotions at their work place and that was their major reason for being in school. This specific group of employed people confirmed that they needed a degree so that they can negotiate for a pay rise at their place of work.

34% who were doing their internship/attachment at the time of the study reported that they were doing it as a requirement for their respective courses. They noted that an internship was treated as a unit in their course as something that will link them with the corporate world and help them boost their working experience and at the same time apply the skills that they have learnt in class.

4.3.4 Data on respondents having dependents or not



Half of the respondents had dependants under their care e.g. children, siblings and other relatives that they are taking care of. Some dependants were orphans with underage siblings. The other half did not have any dependants and were free from responsibilities.

4.4 Perceptions of non-STEM female students towards STEM

The study findings discovered that most non-STEM female students had a lot of prejudice towards STEM studies. Most of the respondents said that from an early stage in their upbringing they were 'subtracted' from STEM environments and made to believe that they are made for other duties that were in line with their femininity. Most of them realized that in many subtle ways they were groomed to be wives and mothers. One respondent said that she found out that her upbringing shaped her to be a glorified servant/maid who was pushed to always cater to other people's basic needs and she never had an opportunity to really question what she wants in life in terms of career and educational pursuits.

Table 4.6: Perceptions of the female students towards STEM

Opinion	Frequency	Percentages
Positive	28	56
Negative	22	44
Total	50	100%

Key informants reported that most female students in the university always followed through with careers that were modeled by the female members of their society especially their close family members and friends. They said at a young age a girl is likely to ape her mother and aunties by following in their career paths. Out of this behavior girls are forced to conform and assimilate so as to fit in the society. Many girls come from families where women keep them close by telling them what is necessary in their lives. The older women emulate the roles that the younger ones should pick up in their adult stage.

This research also showed that cultural practice plays a big role in shaping women's perceptions about their expectations and roles in society. The respondents were urged to pick out careers that would harmonize with their future wifely and motherly duties. Girls are trained to be less than who they really are. They are trained to be what the culture wants of its young women, not what they themselves want to become. Girls are constantly reminded that whatever they do should always remember that they are expected to start families and devout their time to it and that any other thing, careers included should come second. STEM courses present a challenge in this context in the sense that they take the girls away for too long and this poses a threat to how the girls pursuing STEM will uphold their families. Medicine course at the university takes 6 years to study while engineering goes for up to 5 years of study. The two courses as careers are also very demanding and involving. Women are then reminded that they will be mothers to children who will need care and that these careers will cause them to be swayed from their family duties.

The female students in this study who went to mixed secondary schools reported that subject selection in schools was biased on gender lines. It was revealed that mixed schools were heavily laden with stereotypes about what male and female students can do. Males were encouraged to pursue science subjects while the females were expected to do humanities. Students who did not align themselves to these stereotypes were ridiculed. One respondent who attended a mixed secondary school had this to say:

"Throughout my secondary school the boys always did physics and chemistry as a badge of honor and sign of prestige. They would brag to us about their brain power saying that they were better than us and that they would make good money in the careers that they would go into. Science subjects were synonymous to the boys and humanities were always associated to the girls. Any girl who defied the odds by pursuing science subjects was referred to a 'she-male', a term loosely used to allude to the fact that she wanted to be a man. The boys on other hand stayed away from subjects that had too many females for fear of being mocked. In my school home science class had only girls who would be taught how to cook, clean and knit clothes all day. These girls were called 'house helps' and 'maids' waiting to get husbands. There were a lot of sexist jokes that degraded them for picking up home science class and they were always reminded by the physics students of how they would amount to nothing and that the best they could do is be house wives to husbands who excelled in physics and chemistry. Students who pursued the sciences had a superiority complex and walked around school with their heads high and they treated other students like second class. "

This report shows how perceptions towards STEM are formed in the girls schooling. Their interaction with the males on the same level shows how they are segregated from STEM. Stereotypes burden them by constantly telling them that they do not belong.

The girls who went to an all girl's boarding school had a slightly different story. It was noted that some girls schools did not have STEM subjects such as electronics and power mechanics. Other girl schools did not even have physics as a subject in secondary school.

4.5 Attitudes of female students towards STEM

Table 4.7: Whether their attitudes towards STEM has been shaped by socialization

Opinion	Frequency	Percentages
Yes	37	74
No	13	26
Total	50	100%

The respondents agreed that socialization in some ways shaped their attitudes towards STEM. 74% of them were of the opinion that the environment around them contributed to their attitudes towards STEM. T hey pointed out that the exposure they had throughout their schooling was instrumental in their worldview towards STEM courses. The other section of the group was of the opposite opinion. 26% disagreed that socialization was not a factor that contributed to their attitudes towards STEM. Some said that they lacked interest while others reported that they did not test well in STEM subjects hence their negative attitudes towards it.

"I am a creative person. I enjoy birthing new ideas. I like performing arts. I love song, dance, drama, theatre and poems. Throughout life I have been artistic. I am a good performer on stage and I knew from the onset that performing arts is what I would pursue without a doubt. I had problems convincing my parents that this is the path I want to take. I never developed a positive attitude towards STEM courses. I had a lot of pressure from my family to pursue STEM subjects and I did it in my first year at the university but then I quit. I was in bio-chemistry but I was so bored and I did not look forward to my classes neither did I ever attempt doing my class assignments while there. I hated the laboratory environment when we went in for practical. The chemicals in the lab made me nauseous. I could not wait to finish my classes and go back to my room to write poems, plays and short stories that I was deeply passionate about. I enjoy my creative space. After my first year I had to be honest with my parents and forge ahead with what I truly wanted and I switched my course to literature studies. I am now in my final year and I truly have no regrets." 4th year Literature student.

CHAPTER FIVE: SUMMARY OF FINDINGS, CONCLUSION AND RECOMMENDATIONS

5.1 Introduction

In this chapter, discussion on the findings, summary and conclusion will be tabled. The recommendations are split into areas for further research and policies.

5.2 Discussion

5.2.1 Perceptions of female students towards STEM

The study revealed that perceptions of female students vary from one to another regarding STEM courses. Many gave their reasons as to why they harbor their personal perception towards it. It became increasingly evident that STEM has systemic structures that are invisible but still counts when it comes to female students' choice of uptake. It is also notable that there is an inherent speculation that females generally do not like to be associated with STEM. From the study findings secondary school appears to shape girls choice of uptake in STEM studies and it is at this stage that girls stop to question who they are or what they are and culture shifts them to start thinking how they can please others by shrinking, assimilating and conforming to gender limitations which in the long run also affects how they view STEM studies in school. There is an assumption that females lack skills, competence, aptitude and abilities to take up STEM courses and hence they prefer nurturing careers that are easy on them and suit their preference.

The results obtained call for gender equality in STEM subjects by allowing a level playing field for both boys and girls in their learning process to ensure that they both thrive successfully. The figure below shows general variation between males and females in Stem courses worldwide.

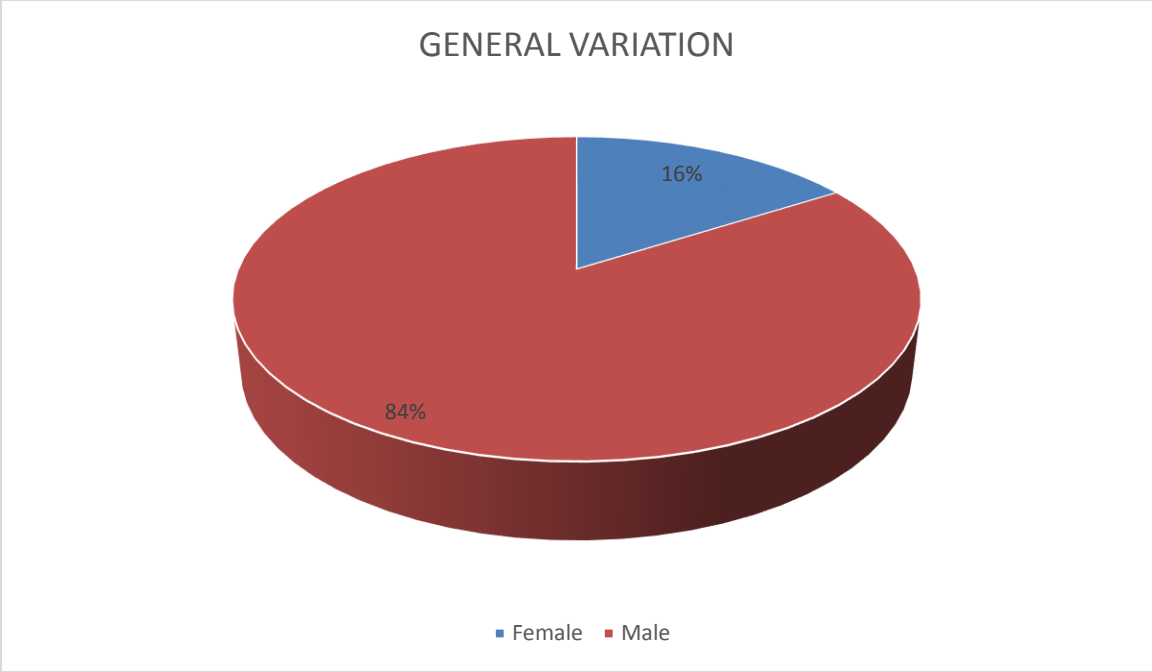


Figure 5.1 General variation of males and females in STEM studies worldwide

5.2.2 Attitudes of female students towards STEM

Many of the attitudes stem from past experiences and interactions with the subjects. Their attitudes were heavily laden with stereotypes that they have come across and being shown that they do not fit in STEM subjects. Some females initially wanted to do STEM subjects but unfortunately looking into the future they were reminded that it leads to very demanding careers that will cause them to negate their societal roles and be seen as misfits. To avoid problems that fall back on 'lighter' courses that allows them the time and comfort to pursue other duties that have been assigned to them.

It also became increasingly apparent that females lacked role models that they would aspire to be and emulate in STEM. Most respondents mentioned that they did not have many women to look up to or even approach for mentorship. Some said that most theories and innovations in STEM were done by men in the field hence questioning the woman's place in STEM. The language used in STEM subjects is non-inclusive for the girls. Leaders are "he" and secretaries are "she". In these books men make history, innovations, wrote books, won wars and created eternal works of art. The books read in school were written by men and about men but ironically they were taught and shared by female teachers who did not

address or even comment about their own exclusion. The male dominance in STEM fields is a great disservice to women who feel that they do not belong and have not had other women before them excel to a place of recognition and contribution in STEM.

The figure below shows global areas of weak uptake in the STEM field.

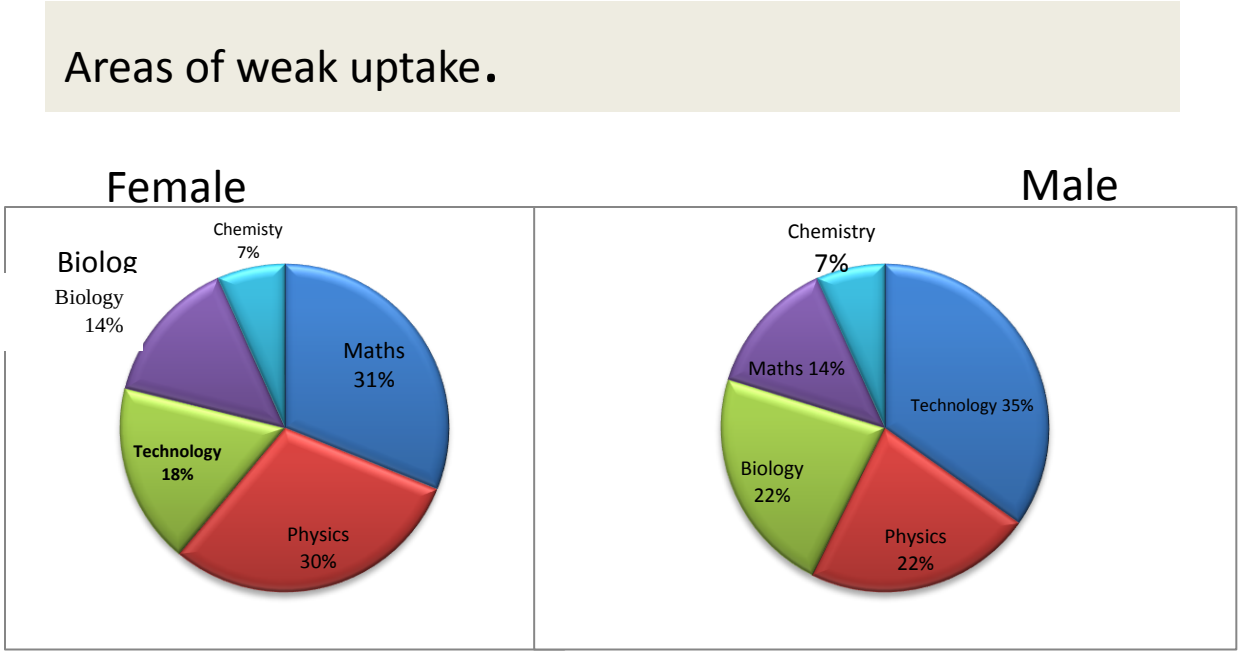


Figure 5.2 Weak uptake in STEM studies worldwide for males and females

5.3 Summary and discussions of the findings

The summary of this research shows that there is a continual subtraction of women from STEM studies. There is a perennial problem in girls' upbringing that consistently reminds them that they are supposed to be trailing behind their male counterparts. Socialization and culture infiltrates women's thinking and how they view themselves as well as how they present themselves to the world. Schools, environment and society at large enforce male power. Men are principals, leaders and ministers while women are left to cater to them as

servants, receptionists and maids. The study established that the language used in STEM does not fit women's experiences and hence they cannot identify or even envision themselves in STEM spaces. Gender issues are trivialized and turned out to be the norm and at times to the detriment of women. STEM is normalized as a male domain that has not opened up to accommodate women by side stepping gender issues that affect it.

5.4 Conclusions

The study concludes that gender is a factor in STEM studies. It is assumed that one gets into STEM studies out of merit without looking into other pre-existing barriers in place that denies others entry based on socialization, stereotypes and retrogressive culture that ties them in shackles leaving them with limited option to choose from. The study found out that most class room activities in STEM are male-centered. Boys tend to be portrayed as clever, brave, creative and resourceful while girls are depicted as kind, dependent and docile. Boys' failure is attributed to external factors and their success is attributed to ability and confidence. It tends to be the direct opposite when it comes to girls because their success is attributed to good luck and hard work whereas their failure is attributed to lack of ability and confidence. These stark comparisons work in subtle ways to stop girls from aspiring to be surgeons, mathematicians, astronauts and scientists. In the long run we see a pattern where girls mysteriously lose interest in STEM subjects.

The study from its findings concluded that when girls fade academically especially in STEM subjects they are reminded by their teachers that perhaps they are not good at it and that they should look at other subjects that they can explore but when boys are in the same predicament they are encouraged to settle down and focus their attention toward STEM by giving it another try so that they can succeed. Girls need to be encouraged to persevere in the face of adversary and believe in themselves. These invisible yet powerful misgivings need to be brought to light through extensive research that deeply looks into how they cause inconsistencies that are discouraging in the STEM field.

5.5 Recommendations

In view of the research findings, the study recommended the following for further research:

5.5.1 Recommendations for policy formulation

- There is need to incorporate gender sensitivity in our curriculum especially in our text books through the use of illustrations that allows both boys and girls to feel included and identify. The curriculum could also be revised and updated to make STEM more relatable for students where it can be less abstract.
- Kenyan schools should have career programs from an early stage that allows students to ask questions and open up their world. Trainees who give career talks should have a practical approach that is involving and hands-on for the students.

- STEM subjects in schools should go beyond laboratory experiments and involve school trips to actual locations where students can physically see how STEM is handled practically in the outside world. The schools can even have holiday programs where the students can be placed in companies that practice STEM and involve students at an early stage where they can write reports about what they learnt during the program.

5.5.2 Recommendations for further research

- Other than perceptions and attitudes of non-STEM female students towards STEM, research can be done further to check what can be done to erase the stereotypes about women and STEM so as to ensure that more females are taking up STEM courses. This research can look into culture and gender responsiveness when teaching STEM from the onset.
- Another area of research will be to examine the challenges that female students in STEM go through. It will be important to check the gender dynamics and see some of the systemic issues that are unique only to female students in STEM and even go further to see how they have overcome the challenges. This will go further to research on the female retention rates in STEM studies and follow through to see if the females enrolled in STEM courses keep up with the courses till completion.

- Also checking on the experiences of women in STEM would be a great area of further research, to follow the lives of female students in STEM to see how they are coping with STEM studies will be an area of great interest. It would be helpful to document what these female students go through while pursuing STEM studies and listen to their sentiments which can give room to certain adjustments that will be gender sensitive and provide mechanisms for better affirmative action.

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APPENDICES

APPENDIX 1: CONSENT FORM

My name is Damaris Nanjira Omukoba. I am a Master's student at the University of Nairobi pursuing Gender and development studies. I am undertaking a study on 'Perceptions and attitudes of female students towards Science, Technology, Engineering and Mathematics (STEM) courses at the University of Nairobi's Main campus.'

You have been purposively selected as an informant in this study by virtue of being a non-STEM female student at the University of Nairobi's main campus. I hereby humbly request your participation in this study. The information obtained from you will be treated with utmost confidentiality and will only be used for academic purposes. To this extent I will not keep a record of your name or address. There is no right or wrong answers.

You have the right to stop the interview at any time or skip any questions that you are not comfortable answering. Your participation is completely voluntary but your experiences could be very helpful. The questions take approximately 30 minutes to complete. Do you agree to be interviewed?

Please sign below consent to participate.

Signature: _____

Date: _____

Thank you for your cooperation

APPENDIX 2: SEMI-STRUCTURED QUSTIONNAIRE

1. Age of the respondent……..

2. Marital status of the respondent

Single () Divorced ()

Widowed () Separated ()

Married ()

3. Secondary school attended……

4. Course studied by the respondent……..

5. Department in which the respondent is in……

6. The year of study…….

7. Why did you choose the course you are currently pursuing?

    a) Cut-off points
    b) Interest
    c) Career objectives
    d) Family influence
    e) Peer influence
    f) Societal expectations
    g) Career talks in High school
    h) Mentors and role models

8. What is your perception towards STEM? .....

9. Do you think STEM courses are attractive to women? ……

10. If yes, why……..

11. At what point in your schooling did you digress from STEM? ……..

12. What are some of the cultural roles of women in your community (Please list)

    i. …….

    ii. ……

    iii. ……

    iv. ……

13. Did your gender affect your choice of study at the University level?

    Yes () No ()

14. Kindly indicate your level of agreement to the statements below relating to female students attitudes and perceptions towards STEM courses at the University of Nairobi's main campus.

    Use a scale of 1-5

    1-strongly agree,

    2-Disagree,

    3- Neutral,

    4-Agree,

    5-Strongly agree

STATEMENTS	1	2	3	4	5
Boys are better than girls in STEM studies and that is the reason girls are few in STEM courses					
The society expects girls to shy away from STEM studies and leave it to the boys					
There are not enough female role models and mentors for girls to look up to in STEM					
STEM careers are overwhelming and girls cannot cope with the career demands in STEM					
STEM studies best suit a masculine demeanor and therefore the females feel they cannot fit in based on their gender					
Female students face so many challenging barriers when they choose to pursue STEM studies as opposed to their male counterparts					
Lowering the cut off points for girls in STEM studies has helped in affirmative action and ultimately more girls have joined the STEM field					
Some cultural beliefs and practices hinder girls from pursuing STEM studies leaving them with few options to choose from					
Girls believe they will do better in nurturing courses and this tendency pushes them away from STEM studies					

15. Did your school grades hinder you from pursuing STEM studies?

    …….

16. If yes, how? ……

17. What hindered you from pursuing STEM studies in university? (Please list)

    i. ……..
    ii. ……
    iii. ……....
    iv. …….

APPENDIX 3: KEY INFORMANT INTERVIEW GUIDE

1. In your opinion is STEM studies gender sensitive?

2. In your years of experience what have you observed as challenges faced by female students when pursuing STEM studies?

3. In your years of practice what stereotypes have you seen projected towards female students regarding STEM studies?

4. Are there measures that can be taken to encourage more females to pursue STEM studies?

5. Are there policies put in place to ensure gender sensitivity in STEM studies?

6. What do you think can be done to encourage more females to pursue STEM courses?

7. Are there enough female role models in STEM at the University of Nairobi?

8. In your opinion what shapes female students perception towards STEM courses?

APPENDIX 4: CASE NARRATIVE GUIDE

1. Describe your overall perception on STEM studies?

2. Describe to me your personal experience with STEM studies in your years of schooling?

3. Throughout your years of study what are some of the challenges you have encountered when pursuing STEM?

4. Do you think STEM is attractive to the female gender?

5. At what point in your studies did you decide to digress from STEM studies?

6. Did you have any female teachers in STEM subjects' in primary and secondary school?

7. As a girl child what were you encouraged to study by your parents when you were growing up?

8. What did you aspire to be professionally while growing up?

9. Are there any female STEM professionals in your family?