



AN ABSTRACT OF THE DISSERTATION OF

Daphne Wambui Kagume for the degree of Doctor of Philosophy in Counseling  
presented on March 3, 2010.

Title: A Multiple Case Study of Social Cognitive Influences on Career Choice in Science,  
Mathematics and Technology among Kenyan Women

Abstract approved \_\_\_\_\_

Deborah J. Rubel

Kenyan women exhibit a pattern of unequal access and participation to education, particularly Science, Mathematics and Technology (SMT) subjects and careers. This is the result of documented challenges that include cultural attitudes that overburden girls with chores to the detriment of their school work, and a preference by parents to educate boys instead of girls when faced with financial difficulties. Other challenges include unequal funding of schools by the government that has resulted in fewer resources such as Science laboratories in girls' schools and subsequent poor performance in Science subjects in the national examinations. Pervasive gender stereotypes abound in Kenyan schools and many students make subject and major choices based on these stereotypes as opposed to using interest and ability to determine career choice. This stereotyping is exacerbated by the lack of career guidance in Kenyan schools meaning students do not have accurate sources of information about careers. This multiple case study was carried out to determine the individual and social factors that help Kenyan women make an SMT career choice. Women ages 20-30 were interviewed together with a parent/mentor using semi-structured questions to investigate their perceptions of themselves and their environments and how that influenced them to go into SMT careers. Results revealed high self-efficacy in Science and Mathematics, strong environmental support and coping

efficacy all helped these women make a congruent career choice in SMT. This study contributes to the knowledge base on how counselors can help more Kenyan girls and women choose Science careers if that is really where their interests lie.

©Copyright by Daphne Wambui Kagume  
March 3, 2010  
All Rights Reserved

A Multiple Case Study of Social Cognitive Influences on Career Choice in Science,  
Mathematics and Technology among Kenyan Women

by  
Daphne Wambui Kagume

A DISSERTATION

Submitted to  
Oregon State University

in partial fulfillment of  
the requirements for the  
degree of

Doctor of Philosophy

Presented March 3, 2010  
Commencement June 2010

Doctor of Philosophy dissertation of Daphne Wambui Kagume presented on March 3, 2010.

APPROVED:

---

Major Professor, representing Counseling

---

Dean of the College of Education

---

Dean of the Graduate School

I understand that my dissertation will become part of the permanent collection of Oregon State University libraries. My signature below authorizes release of my dissertation to any reader upon request.

---

Daphne Wambui Kagume, Author

## ACKNOWLEDGEMENTS

I would like to express my deep gratitude to my Major Professor, Dr. Deborah Rubel for her unwavering support and encouragement every throughout the dissertation process. I am also grateful to the members of my committee, Dr. Vivian Amantana, Dr. SueAnn Bottoms, Dr. Cass Dykeman and the Graduate Council Representative Dr. Chris Mundt. To my parents Johaan and Lucy Kagume, I will forever be grateful for your love and commitment to my education. Thank you for giving me the freedom to pursue my dreams and for having high educational aspirations for me, long before I had any of my own. My special thanks go to my sisters, brothers and extended family for their encouragement and support as I pursued my educational goals. I particularly appreciate the efforts of my aunt, Alice Gichu in helping me secure bursary funding for my education. I am also grateful to all my friends who supported me by providing free babysitting, preparing meals for us, offering a listening ear, and numerous other ways. I cherish each and every one of you.

My deep appreciation goes to Wilma Hull for supporting my education and for helping make this research and doctorate a reality. I am also grateful to all the Kenyan women and parents/mentors who shared their stories: thank you for giving voice to the educational struggles of Kenyan women and families.

Finally to my son Kyle Njoroge-Kagume, your easy-going and gentle spirit went a long way in helping me complete this journey in one piece. I love you more than words could ever express.

## TABLE OF CONTENTS

CHAPTER 1: Introduction .....	1
CHAPTER 2: Literature Review .....	8
Gender, Culture and Education in Kenya.....	8
Women in the Education System .....	10
Women in the Labor Market .....	15
Career Decision-making in Kenyan Schools .....	17
Career and Educational Interventions in Kenya.....	21
Career Choice Theory .....	23
SMT Interventions in the United States .....	28
CHAPTER 3: Methodology.....	32
Researcher’s Self-disclosure .....	32
Research Design.....	35
CHAPTER 4: Results: Individual Case Analysis .....	45
Participant V.....	47
Participant W.....	68
Participant X.....	88
Participant Y.....	109
Participant Z.....	130
CHAPTER 5: Results: Cross-case Synthesis .....	153
Parent’s Empowerment .....	153
How Parental Empowerment Is Passed On To their Children .....	161
Effects Of This Empowerment on the Women .....	168

## TABLE OF CONTENTS (Continued)

CHAPTER 6: Discussions and Conclusions .....	178
Summary of Methods and Research Questions.....	178
Summary of Results .....	179
Theoretical Implications of the Study .....	184
Implications for Guidance Programs.....	185
Limitations of the Study .....	187
Implications for Future Research .....	188
References .....	190
APPENDICES .....	196

LIST OF APPENDICES

<u>Appendix</u>	<u>Page</u>
A: Interview Survey .....	197
B: Interview Questions .....	199
C: Parent/mentor Questions .....	201
D: Informed Consent for Participants .....	202
E: Informed Consent for Mentors/family members .....	205
F: Glossary of Terms .....	208

## LIST OF TABLES

<u>Table</u>	<u>Page</u>
1: Demographic information .....	45
2: University choices .....	47

## DEDICATION

Dedicated to Johaan and Lucy Kagume, George and Rahab Gichu, Edmund and Charity  
Mengo, Wilma Hull and Kyle Njoroge-Kagume

# A Multiple Case Study of Social Cognitive Influences on Career Choice in Science, Mathematics and Technology among Kenyan Women

## CHAPTER 1

### Introduction

The inability of Kenyan women to equitably participate in the education system as well as the labor market is increasingly becoming a topic of concern for researchers and educators. Research has identified several cultural, social, political and policy factors that serve as obstacles to pursuit of educational and career opportunities for Kenyan women.

Women in Kenya generally have lower status than men in educational, cultural economic and traditional institutions (Kiluva-Ndunda, 2001). The current cultural climate is the result of an interaction of pre-colonial, colonial and postcolonial factors. Pre-colonial gender based division of labor combined with Victorian and Christian views of males as superior have created a position of women as inferior in the current socio-cultural climate (Wambua, 2007).

In colonial times, gender determined who had access to education (Sifuna, 2006). This was the result of the existing strongly engendered cultural practices, the wish by African patriarchy to maintain the little power they could after colonization as well as colonialists and missionaries with Victorian ideologies on gender roles. Postcolonial educational policies left women out of most careers especially those requiring Mathematics and Science mastery (Kiluva-Ndunda, 2001).

Today girls tend to enroll in school later in order to provide child labor and when in school they are overburdened by household chores to the detriment of their academic work (Kiluva-Ndunda, 2001; Shabaya & Konadu-Agyemang, 2004). Added to this

problem is the cultural preference of sending sons to school instead of daughters when faced with economic constraints (Agesa & Agesa, 2002; Kiluva-Ndunda, 2001; Lindsay, 1980). High school fees, traditional practices of child brides, nomadic lifestyles and poverty further constrain girls' education leading to a 35% primary completion rate (Kiluva-Ndunda, 2001).

The Kenyan education system known as 8-4-4 is highly examination oriented and seems to further disadvantage women. Students sit for national examinations at the end of primary school and secondary school and the grades attained at the primary level (KCPE) determine the type of secondary school attended with higher grades leading to better funded and better equipped schools.

Female students tend to have a higher likelihood of attending poorly equipped schools thus it is no surprise that they perform worse than male students in all Science and Math subjects in these examinations, limiting their chances of pursuing SMT careers. This may be attributed to the fact that poorly funded schools lack resources such as Science laboratories and employ poorly trained teachers leading to biased instruction methods in secondary schools (FAWE, 2002). Inferior instruction methods impact grades attained at the KCSE examination and the likelihood of pursuing higher education.

University enrollment figures reveal underrepresentation of women in higher education. In 2005/2006 only 36% of all students in public and private universities were female (Agesa & Agesa, 2002). In 2004/2005 women constituted only 35% of students enrolled in national polytechnics and only 5% of these women were in Science/engineering programs (Republic of Kenya, 2005; UNESCO, 2006). As many as

64% of these female students in college are from middle class or higher socioeconomic backgrounds (Hughes & Mwiria, 1989).

There appears to be a trend in the Kenyan education system that limits female participation in all careers but more so Science, Math and Technology (SMT) careers. This trend can also be seen in the labor market where only 30% of employees in the formal sector are women (Republic of Kenya, 2007b) and they are mainly found in non-SMT careers. An example at the university level is Nairobi University where only 19% of Science faculty are women (Kanake, 1997).

Even when employed, women tend to be promoted at slower rates than men and are less likely to be found in the highest ranks of employment (Hughes & Mwiria, 1989). For example women make up only 19.1% of all public university faculty, only 14% of department heads and a mere 7% of full professors (Kamau, 2004; UNESCO, 2006).

Given the prevailing social, cultural and educational climate, it is not surprising that students' perceptions of careers show pervasive gender stereotypes (Kithyo & Petrina, 2002; Osoro, Amundson & Borgen, 2000; Arap Maritim, 1986). Gender remains the most pervasive influence on career choice, even more so than guidance and labor market practices. Many Kenyan women perceive competitive professional careers (particularly those in the Science, Mathematics and Technology fields) as male domain and shy away from them (Kithyo & Petrina, 2002). Women continue to choose careers that offer low pay, very limited benefits and few opportunities for upward mobility (Kiluva-Ndunda, 2001).

Studies also show that female students of all ages choose significantly less variety of careers than boys of similar age (Arap Maritim, 1984; Lindsay, 1980; Kithyo &

Petrina, 2002). Unlike their male counterparts female students' career aspirations do not broaden as they advance in school. This gender typing of careers is exacerbated by the lack of career guidance at all levels (Kithyo & Petrina, 2002; Osoro et al, 2000). This is a major concern because students choose university majors while still in high school and these choices are not easily changed.

In an effort to remedy this situation, the Ministry of Education published the "Careers Guide Book for Schools", a guidance book to help students make better subject and career choices (Republic of Kenya, 2007a). The ministry is also collaborating with the Forum for African Women Educationalists (FAWE) to create programs to encourage more participation of women in SMT careers (FAWE, 2007). Other suggested interventions include adopting teaching styles and school management practices that instill mathematics and Science self-efficacy in female students (Sifuna, 2006).

The Kenyan government has also recognized that gender plays a key role in educational attainment, hence the need to articulate a gender policy in education in an effort to promote gender equity and equality in education (Republic of Kenya, 2007b). This gender parity is seen as an important contributor to the sustainable economic development of Kenya. One of its provisions is to enhance participation of females in Science, Math and Technology (SMT) based courses.

Increased participation in SMT careers is crucial given that the Kenyan government has declared an urgent need for a critical mass of Science and technology professionals to give the country a much-needed economic boost and promote sustainable development of Kenya (Republic of Kenya, 2005). This will be accomplished sooner if there is a deliberate effort to include women who comprise half the potential labor force,

in SMT. More inclusion leads to the question of what makes women choose these careers.

There is a need for research evidence that aids in the understanding of the psychological and environmental factors that encourage Kenyan women to pursue SMT careers. Some research has pointed to the obstacles that women face in their pursuit of higher education, perceptions of careers at various educational levels and girls' general school experiences. None of the research has specifically addressed SMT career choices.

In order to provide a theoretical basis for understanding Kenyan women's SMT career choices, the Social Cognitive Career Theory (SCCT) was chosen because its constructs have been studied in the context of Math and Science careers (Lent et al., 2001; Lent et al., 2003). The theory also acknowledges the key role played by environmental factors in encouraging or impeding congruent career choices through their effect on self-efficacy beliefs.

According to SCCT career choice is influenced by three key variables that have a triadic causality pattern (Lent, Brown, & Hackett, 1994) (Lent & Brown, 1996). These are self-efficacy beliefs, outcome expectations and personal goals. The theory posits that people engage in activities they believe they are competent in (high self-efficacy) and that are believed to produce desired consequences (positive outcome expectations). Self-efficacy and outcome expectations determine the goals people choose in terms of careers.

SCCT acknowledges that there is an interaction between social constructs (such as gender and ethnicity), environmental barriers, and self-efficacy, outcome expectations and goals (Lent & Brown, 1996). This is as a result of the differential reactions they evoke from the environment as well as differential opportunities they afford for learning

that lead to self-efficacy. The data from the study will provide evidence whether these constructs are applicable in their entirety or if they need modification to better suit the Kenyan social, cultural and educational context.

The purpose of this study was to investigate the factors that help Kenyan women choose and succeed in their educational and career goals, in particular in fields related to Science, math, and technology. In spite of the challenges discussed above, many Kenyan women have succeeded in attaining higher education and employment in these fields. Learning from their success stories is an important first step in the design and implementation of effective career guidance aimed at increasing the number of women choosing SMT careers.

Qualitative methodology was chosen because it is congruent with the researcher's constructivist views as well as a personal and cultural preference of storying as a way of learning. The case study method was chosen because of its appropriateness in explaining social constructs (Gall, Gall & Borg, 2005). This study aimed at explaining how Kenyan women choose SMT careers. The multiple case format was deemed appropriate for the purpose of providing replication logic based upon theoretical constructs of the Social Cognitive Career Theory.

This study investigated three research questions:

1. How do Kenyan women choose careers in Science, Mathematics and Technology?
2. What helps Kenyan women overcome the cultural, social and policy barriers posed by study in these areas?

3. What are the perceived future consequences of choosing to pursue higher education and employment in Science, Math, and Technology?

Participants in this study were Kenyan women between 20 and 30 years of age who have chosen to pursue careers in Science, mathematics and technology. Sociological and psychological life history interviews were conducted with the study participants to get their emic perspective of their educational experiences including the barriers they encountered and the supports they received. An etic perspective guided by theoretical constructs was also included. The design was open and flexible to allow for emergent themes not covered in the review of theory and empirical evidence.

Interpretational data analysis was utilized for this study (Gall et al, 2005). Two analytic strategies were used, one using theoretical propositions of SCCT as a starting point and the other one using rival explanations for the phenomena being studied (Yin, 2003). The analytical technique of pattern matching was utilized to link data to theoretical propositions. Finally, cross-case synthesis was performed to determine if similarities exist across the individual cases.

The findings from the study will inform our understanding of the influences that facilitate women's choices of SMT careers. Understanding women's self-efficacy perceptions, sources of efficacy building experiences and the social supports that lead to a choice to pursue SMT education will form the basis for developing career counseling programs for girls and women. Such programs would be aimed at building their self-efficacy in the Science and Mathematics domains, helping them develop positive outcome expectations of pursuing related careers and finally supporting them in the

career decision making process so that this confidence is translated into SMT career choices.

## CHAPTER 2

### Literature Review

In this section I will review literature on educational and career opportunities for women in Kenya as well as current career and academic interventions. Included in the discussion are cultural, historical and policy factors, their development and current influences on women's participation in society. This will provide the contextual backdrop of studying women's career decision making. Career theory as well as guidance and educational interventions in the US and Kenya will also be discussed to begin building a theoretical understanding of the kind of support that would help Kenyan women participate more in SMT careers. Finally, the implications for education, career counseling and advocacy will be reviewed.

#### *Gender, Culture, and Education in Kenya*

The unique history and culture of Kenya affect the educational and labor opportunities for women. Kenya is located in East Africa right on the equator and occupies an area of 582,650 square kilometers. The population of Kenya as per the last census is 36 million, with a literacy rate of about 85% (CIA, 2007). Kenya is the most industrialized country in East Africa and is considered the economic hub of East and Central Africa (Munene, 2002). It is the only developing nation that hosts headquarters of United Nations agencies, namely, United Nations Environment Programme (UNEP) and the United Nations Center for Human Settlements (UNCHS-Habitat).

Kenya was a British colony and gained independence from colonial rule in 1963. Western formal education was first introduced in Kenya by Christian missionaries in the middle of the nineteenth century. These missionaries brought with them Victorian ideals

regarding gender roles (Sifuna, 2006; Kiluva-Ndunda, 2001). The colonial government subsequently developed education and employment systems based on race and gender, with African women at the bottom of the hierarchy (Kiluva-Ndunda, 2001). The first classes offered for female African students were in areas such as laundry, food preparation, clothing production and food preservation whereas male students were trained in technical areas such as wagon-making and masonry (Sifuna, 2006). In colonial times, female students were not expected to take Math/Science classes (Kithyo & Petrina, 2002).

Postcolonial policy makers also used gender as a criterion to provide or limit academic opportunities leading to further segregation of careers along gender lines. In 1968 the ministry of education published a career information booklet titled “Helping you choose a career” that listed employment opportunities in the public and private sector. Out of 150 careers, two were listed as “girls only” (these were secretarial and nursing) while 112 were listed as “boys only” (these required physics and mathematics).

The current education scenario has not improved much. Today girls tend to enroll in school later when child labor is needed and when they do they are overburdened by household chores such as fetching water and firewood to the detriment of their academic work (Kiluva-Ndunda, 2001; Shabaya & Konadu-Agyemang, 2004). This is especially so in rural areas where traditional gender roles strongly prevail. Also, when faced with economic constraints, parents will choose to send their sons to school instead of daughters (Kiluva-Ndunda, 2001; Lindsay, 1980).

Even when they enroll in school female students have high drop-out rates (35% completion rate in primary schools) due to pregnancy, high school fees, cultural

expectations of women as reproducers and men as producers, traditional practices of child brides, nomadic lifestyles and poverty leading to child labor (Kiluva-Ndunda, 2001).

Enrollment at the university level suggests that the effects of these disadvantages have long term educational implications. In 2003/2004 only 34.7% of students enrolled were women and most of them are in non-SMT careers: only 4% of engineering students are women (Sifuna, 2006).

The combination of factors discussed above factors has led to unequal opportunities and participation for women in the major educational and economic institutions of Kenya. In a nutshell, the effect of modernization of the Kenyan economy is that women have been stripped of their traditional autonomy and economic power. In pre-colonial times women had economic and political authority through their elder organizations as well as natal and marital lineages (Kiluva-Ndunda, 2001). The capitalist economy imposed on indigenous Africa economies dismantled cultural values that supported social systems within which women could exercise direct and indirect decision making power. This restructuring and the subsequent loss of power have implications for the current status of women in the education system.

#### *Women in the Education System*

Kenya's educational system structure appears to disadvantage women. There are three levels of educational institutions: primary, secondary and postsecondary (institutions of higher education). Kenya has five types of higher education institutions; university, college, institute, teacher's college and polytechnic.

The education system consists of eight years of primary education, four years secondary and four years post-secondary education (8-4-4) (Republic of Kenya, 2007c). After 8 years of primary education, students sit for the Kenya Certificate of Primary Education (KCPE) which determines whether they continue on to high school or not; less than half of all KCPE candidates gaining admission to secondary schools (Tumuti, 1985). After four years of high school, students sit for the Kenya Certificate of Secondary Education (KCSE), an exam that determines entry into higher education and major chosen/assigned. At this level again, less than half the students proceed to higher education (Osoro et al., 2000).

This exam-oriented education system puts a lot of pressure on students, parents and teachers alike. Students feel intense pressure from parents and teachers to do well in the national exam in order to gain admission in government-sponsored schools or universities (Tumuti, 1986; Kithyo & Petrina, 2006). The problem with this is that only about 35% of students are admitted to secondary schools and only 12% of secondary graduates gain admittance to universities (Republic of Kenya, 2005). It is therefore not surprising that students experience intense anxiety in the educational arena. Studies of Kenyan students at the primary, secondary and tertiary institutions found that they reported feeling confused, anxious and fearful about the exams and career selection process (Tumuti, 1985).

Students who do well in KCPE attend government maintained or aided schools whereas the rest have to attend either private or “harambee” (unaided) schools. The budgets of the latter two are fully funded by tuition/fees from students, making them less desirable (Tumuti, 1985). Consequently there is intense pressure to perform well in the

national examinations. In his study of 5<sup>th</sup> and 7<sup>th</sup> graders in rural, semi-urban and urban schools Tumuti (1985) found that 95% of students reported feeling pressured to pass the primary school examination, 77% reported fear of failing, 73% reported confusion/fear regarding making career choices and 64% reported they lacked career guidance/information regarding employment opportunities.

The Kenyan school system puts female students at a disadvantage in terms of access to quality education because female students' performance is worse than male students' in the major examinations (Agesa & Agesa, 2002). Boys perform better than girls in all KCPE subjects as well as in all Science courses at the KCSE level. There are several reasons suggested for this including biased instruction methods, more domestic chores for girls and harassment in the school system (Kiluva-Ndunda, 2001). Examples of biased instruction include the documented practice of teachers in mixed schools asking the male students to perform Science experiments and the female students to record results and clean up afterwards as well as learning materials based on gender stereotyped roles (FAWE, 2007).

Poor examination performance in Science and Mathematics limits girls' opportunities to pursue higher education because students' academic performance and career choices at the primary and secondary level have lifetime ramifications in terms of employment opportunities (Tumuti, 1986; Osoro et. al, 2000). Performance in KCPE determines which rank of secondary school a student will attend. This in turn affects their likelihood of attending universities and other tertiary institutions.

There are also gender disparities in government funding of schools (Sifuna, 2006). These originated from colonial times and continue to affect current performance

of students (Wambua, 2007). Female students are more likely attend non-funded schools compared to their male counterparts (Sifuna, 2006). These schools usually have fewer resources such as Science laboratories, employ less qualified teachers and are limited in the scope of courses they offer, putting their students at a disadvantage when competing for university entry (Kiluva-Ndunda, 2001; Sifuna, 2006; Wambua, 2007). This further limits women's chances for pursuing higher education, particularly in the areas of Science, Math, and Technology.

Gender disparities in higher education institutions are apparent. In 2005/2006 women comprised 36% of all 89,491 students enrolled in both public and private universities (UNESCO, 2006). It is interesting to note that women constitute 34.5% of total enrollment in public universities and 53.3% in private universities (Agesa & Agesa, 2002). This may be due to the fact that the highest proportion of courses offered in public universities is Science based whereas private universities almost exclusively offer Arts, Humanities and Social Sciences. Both Medical schools, all Engineering and Science faculties are found in the seven public universities.

For example, Jomo Kenyatta University of Agriculture and Technology, a university that offers only Science and Engineering courses, has the lowest enrollment of female students at 20% whereas Kenyatta University has 40% female enrollment and has the largest faculty of Education (Agesa & Agesa, 2002). The number of women decreases further at the graduate level. In 1989/90 of the 227 students enrolled in graduate programs in Kenyatta University, one of the large public universities, only 4.2% were women. One of the explanations is the underrepresentation of women among the top

students (first class and upper second class honors) (Hughes & Mwiria, 1989). Academic performance is a top criterion in admission to graduate programs.

The same trend is seen in tertiary institutions. Of the 18,116 students enrolled in national polytechnics in 2004/2005, only 35% were women and only 5% of them were enrolled in Science/engineering programs (Ministry of Education, 2005; UNESCO, 2006). The numbers are reversed in youth polytechnics, the lowest cadre of technical and vocational training institutions offering short term courses. In the same year 62% of students enrolled in these youth polytechnics were women.

University enrollment reveals significant differences in socioeconomic backgrounds of female and male students. Women from higher socioeconomic backgrounds have a higher likelihood to pursue higher education than women from farming/unskilled labor families (Lindsay, 1980). A study of 295 graduates from University of Nairobi showed that 64.2% of the female students came from middle and higher socioeconomic/income families compared to only 37.7% of male students (Hughes & Mwiria, 1989). One of the reasons for this economic disparity may be the cultural preference of educating boys as opposed to girls when faced with financial constraints – when finances are not a constraint parents will send their daughters to school (Hughes & Mwiria, 1989; Kiluva-Ndunda, 2001; Lindsay, 1980).

In summary, the literature reveals disadvantages for women in the Kenyan education system. There has been unequal funding by the government leading to unequal distribution of resources and cultural preferences for educating boys instead of girls especially in lower socioeconomic families. All these factors lead to poor performance by girls in the national examinations and unequal participation in the higher education

institutions, especially in Mathematics and Science, hindering women's equitable participation in the labor market.

The government has acknowledged the gender inequalities at the university level and especially in SMT programs. In the Kenya Sessional Paper No. 1 of 2005, the Ministry of Education has stated as its goal to increase female enrollment at the university level to 50% and to at least 33% of all students enrolled in SMT courses at the university by 2010 (Republic of Kenya, 2005). While this is a worthy goal, the question of what factors in the educational experiences of women, help them to choose and be successful in Science, Mathematics and Technology training programs and careers, still remains.

#### *Women in the Labor Market*

Analysis of participation rates in the labor market reveals that gender disparities in education are carried over into the labor market. According to the Kenya Economic Survey of 2007 women constitute only 30% of those employed in the formal sector. Most women are in the labor intensive informal sector dealing with crafts, agricultural products and other low paying commercial products (Kiluva-Ndunda, 2001). The formal sector that employs the majority of men is capital intensive, highly organized and characterized by high remuneration.

Compounding the problem of low participation in the formal sector is the underrepresentation of women in Science and Engineering careers, in particular in teaching positions at institutions of higher learning. For example, a study at the University of Nairobi, the first and largest Kenyan University, found that women

comprised only 2.3% of Engineering faculty, 10.2% of Veterinary Medicine faculty, 11.1% of Pharmacy faculty and 12.1% Science faculty (Kanake, 1997).

Although women have comparable income and employment experiences upon graduation from university, they are limited in how far up the employment ladder they can go, the so-called glass ceiling effect (Hughes & Mwiria, 1989). One analysis of employment patterns in three private organizations with more than 7000 employees found that only 10% of those occupying the role of supervisor and above were women. In addition, women comprise less than 10% of the highest salary categories.

The situation is similar in institutions of higher learning. For instance, in 2002 out of the 243 department heads in the six public universities in Kenya, only 35 were women (Kamau, 2004). In addition those same universities had a total of 2356 academics and only 19.1% were women, with 86% of them found in the lower ranks. Only 7% of associate and full professors are women (Kamau, 2004; UNESCO, 2006). Women in other sectors seem to experience similar lack of upward mobility. In 1985, out of 170 senior government officials (deputy secretary, undersecretary and senior assistant secretary) only 8 were women (Hughes & Mwiria, 1989).

One of the reasons for this lack of advancement may be the domination of informal informational and mentoring networks by men. A study of women academics in Kenyan universities found that they were treated differently from their male colleagues (Kamau, 2004). Some of the challenges they faced include being left out of informal networks, being promoted at a slower rate than men, having their abilities and accomplishments minimized and not being able to influence university policy. They were also disadvantaged in getting external funding for their research further lowering their

chances of advancement (Kamau, 2004). These findings give credibility to the belief by students that employees discriminate against women in their hiring practices (Kithyo & Petrina, 2002). Anticipated discrimination against women has been identified as a contributing factor to high female school dropout rates (Shabaya & Konadu-Agyemang, 2004).

One result of this paucity of high ranking women professionals is that young women lack role models thus making it difficult for them to aspire for better paying Science and other professional careers (Agesa & Agesa, 2002). They are also deprived of mentors whose influence is critical in career development.

The literature on women in the labor market reveals low participation in the formal sector and low progression up the ranks of employment in public and private sectors, a trend that has been referred to as “glass ceilings and sticky floors” (Fassinger & Assay, 2006). Women are also excluded from the informal informational networks that are so crucial to professional advancement, thus limiting their earning potential and consequently their economic and social status.

This paucity of women in management especially in higher institutions of learning has been recognized as problematic by the Kenyan government which now has as its goal to increase the percentage of women in teaching, administrative and research positions at all levels in higher education. This leads again to the question of how to help women be successful in higher ranks of employment, especially in SMT careers. Having this knowledge and insight will better inform all stakeholders on how best to support women in their career advancement.

Students going through the Kenyan education system choose their college majors while still in high school. They also make choices of high school subjects to be examined on in the 9<sup>th</sup> or 10<sup>th</sup> grade and these subjects then determine the career choices available to them upon high school completion. Several factors that have been identified as having the most influence on career decision making are location (rural vs. urban), gender, family and academic achievements, school environment, home/family, social and cultural norms, labor market and workplace factors (Kithyo & Petrina, 2002; Osoro et al., 2000).

Gender remains the most pervasive factor influencing career choice (Kithyo & Petrina, 2002). A study of 3<sup>rd</sup>, 5<sup>th</sup>, 7<sup>th</sup> grade students from the Kipsigis ethnic group found that the girls chose significantly less variety of careers than boys of similar age (Arap-Maritim, 1984). Other studies of students in secondary and higher education institutions found similar stereotypes (Kithyo & Petrina, 2002; Lindsay, 1980). In addition female students perceived themselves as less competent in professional roles and not competent academically. Not surprisingly boys exhibited broadening of career aspirations with increasing age whereas girls did not.

Another problem with the current education system is that students make choices based on inaccurate information, a fact that has been acknowledged by the Ministry of Education in its guide book on careers (Ministry of Education, 2007). For instance one study of students in a tertiary institution found that they chose technical school majors based on vocational courses they took in high school although these are not prerequisites for admission (Kithyo & Petrina, 2002). This means that students may be eliminating many potential careers that they qualify for because they lack accurate information. Thus the effects of poor career guidance may have lifetime implications.

Parental influence is an important influence at all levels of the education system. A study of female engineering students in several polytechnics in Kenya found that 50% of them made the decision due to influence from their fathers (Wambua, 2007). Female students in the non-engineering programs reported influence from their mothers. Influence from family can also be negative with some studies having found parents to put pressure on their kids to pursue certain courses, especially low socioeconomic status parents (Kithyo & Petrina, 2002). Although most parents felt competent enough to offer career advice, those who lack formal education were not perceived as capable of offering information on careers by their children. These students consequently refrained from talking to their parents about careers and turned to other sources of information such as their career teachers.

A factor affecting career choice related to parental influence is socioeconomic background. Women who come from lower socioeconomic backgrounds are not exposed to a variety of careers, possibly due to lack of many female role models (Arap Maritim, 1986). This can be seen in the fact that female students from professional backgrounds (their parents have some formal education and have a professional job as opposed to farming or unskilled labor) and consequently higher socioeconomic backgrounds usually chose a wider variety of careers compared to students whose parents were farmers or unskilled laborers (Lindsay, 1980). Women from higher socioeconomic backgrounds also have a higher likelihood to pursue higher education than women whose parents are employed in farming/unskilled labor.

As discussed previously, students in Kenya choose their college majors while still in high school. Faced with this daunting task, some students especially in the rural areas

turn to their schools' career departments for help. A study of the decision making process of Kenyan High School students found that a majority of rural students sought help from their career departments whereas a majority of urban students did not (Osoro et al., 2000). This may be due to the fact that rural students do not have access to TV, computer services and professional role models.

The reality in Kenyan schools is that the career departments/teachers are not equipped to offer appropriate career guidance to assist students in making these decisions (Kithyo & Petrina, 2002; Osoro et al., 2000). Career masters are usually teachers with no training and have neither the time nor the facilities to provide career counseling to students. This is because they head the so called career departments in addition to their regular teaching load and do not have career guidance resources. In addition these teachers assume all students should end up in a university despite the fact that only 12% of high school graduates make it to the university (Republic of Kenya, 2005). Limited career information is provided by churches, non-governmental organizations, individual professionals who volunteer their time and resources. (Osoro et al., 2000; Tumuti, 1985).

Simply put, career departments exist in name only. This lack of guidance results in students choosing careers based on gender stereotypes, parental pressure and misinformation regarding career requirements. At the high school stage most of these students do not know the long term implications of their academic and career choices. In fact the Ministry of Education has acknowledged that there is insufficient career guidance and students make choices "out of ignorance" (Republic of Kenya, 2007a). The Ministry also acknowledges that students do not get information that helps them relate subjects chosen to specific careers. All these factors exacerbate the cultural, social and policy

barriers discussed earlier especially for female students, potentially contributing to their exclusion from many rewarding careers.

Kenyan students face many challenges in choosing careers, the main ones being inadequate information and lack of career guidance. Gender has been identified as the most pervasive factor in career choice. This gender typing of careers puts female students at a disadvantage because careers that are competitive and well-paying are perceived as male domain. This is especially true for SMT careers which many female students avoid because they don't believe they can succeed in them.

Despite these significant obstacles, some women have found a way to pursue higher education and subsequently, careers in SMT. In order to create effective career guidance programs for female students, it is important to understand why these women are able to make the choices they did and how they have achieved success.

#### *Career and Educational Interventions in Kenya*

Empirical evidence available suggests that career interventions are very limited or non-existent in the Kenyan schools. In an effort to remedy the dire situation, the Ministry of Education published a career guidance book in 2007 titled "Careers Guide Book for Schools" with the aim of providing occupational information to students as they choose college majors (Republic of Kenya, 2007a). In the book the Ministry acknowledges gender disparities in career selection with women choosing more Arts careers and men choosing more Science careers.

The information contained in this book mainly consists of various university majors and their admission requirements, that is, the subjects one needs to take and pass in secondary school in order to gain admission. The book also contains a brief summary

of personal and academic attributes required for different degree and technical training programs. There is no evidence regarding the extent to which this publication is being used in the schools.

The Ministry of Education has also recognized that gender is a key determinant of educational attainment, hence the need to articulate a gender policy in education. In 2007 the government made provisions in its Gender in Education Policy to ensure women participate equally in education (Republic of Kenya, 2007d). The overarching goal of the policy is “to promote gender equity and equality in education, training and research, to contribute to the economic growth and sustainable development of Kenya.” (p. 16)

Some of its provisions include; a) Enhancing educational outcomes for girls and boys, women and men; b) Provide mechanisms to enhance participation of females in Science, Math and Technology (SMT) based courses; d) Provide policy guidelines and a legal framework to ensure gender-responsive management and administration of universities and equity in university education.

In a limited effort to implement the gender policy in education, the Ministry of Education has started collaborating with the Forum for African Women Educationalists (FAWE) to create replicable programs in schools that encourage women to get into SMT careers (FAWE, 2007). These have included training of teachers to be competent in gender responsive teaching methods and using gender-sensitive teaching and learning materials. Although these programs have been successful, they exist in a handful of schools.

Some researchers and educators have also suggested possible areas of career intervention. Sifuna (2006) suggests school-related areas that need interventions

including; a) challenging gender stereotypes, b) curriculum choice interventions (encouraging female students to choose Science, Math and Technology courses and c) teaching styles and school management practices that instill Mathematics and Science self-efficacy. These are levels at which career counselors can intervene using individual and system advocacy skills to enhance equitable educational opportunities.

While counseling is an appropriate way to intervene in the above recommended areas, there is no theoretical or empirical evidence to guide counselors and educators in this mission of ensuring gender equity in education, particularly SMT education. More research is needed to understand the factors that lead to successful careers in the non-traditional fields of Science, Mathematics and Technology.

While western career interventions may not be entirely suitable for Kenyan girls and women, career theories may give insight into some ways in which career counseling may be helpful to them. Some theories may be more suitable for this context. Social Cognitive Career Theory (SCCT) is one such theory with elements that may make it more suitable for understanding the career needs of Kenyan girls and women and may assist in creating interventions to increase participation in SMT careers.

#### *Career Choice Theory*

SCCT may be uniquely helpful in understanding the career needs of Kenyan girls and women and in formulating career interventions to increase their participation in SMT's due to its attention to environmental supports and barriers as well as its demonstrated applicability to Math and Science efficacy and career choice in the US (Lent et al., 2001; Lent et al., 2003; Nauta & Epperson, 2003; Nauta, Epperson, & Kahn, 1998).

Social cognitive career theory (SCCT) is derived from Albert Bandura's Social Cognitive Theory and is based on three key variables that influence career choice namely self-efficacy, outcome expectations and personal goals (Lent & Brown, 1996). According to SCCT people engage in activities they believe they are competent in and that are believed to produce desired outcome expectations. This process is mediated by many factors that include skill practice and feedback from parents, teachers and other significant others.

Self-efficacy refers to people's judgment of their ability to organize and carry out certain actions in order to achieve goals (Bandura, 1977). Outcome expectations refer to beliefs about consequences of choosing to pursue certain courses of action. Personal goals refer to intention to pursue an activity to bring about a specific outcome. According to Social Cognitive Theory, there is a triadic causal influence between the three variables that is multidirectional (Lent et al., 1994). Goals are influenced by both self-efficacy and outcome expectations and self-efficacy is believed to have the most influence on behavior.

Self-efficacy is influenced by several factors; (a) performance accomplishments, (b) vicarious learning, (c) social persuasion and (d) physiological states and reactions (Lent, Brown & Hackett, 1994). Past successes tend to raise self-efficacy beliefs whereas failures have the opposite effect. People may not pursue some careers within their competence if do not perceive themselves as capable of being successful in them, i.e. they possess faulty self-efficacy beliefs. Empirical evidence suggests that occupational interests are influenced more by perceived capabilities than objective capabilities (Barak, 1981).

This difference between perceived capabilities and objective capabilities appears to be the one of the reasons that Kenyan women do not choose SMT careers. Empirical evidence from Western countries has shown no significant difference between women's and men's abilities in Science and Mathematics (Holmgren & Basch, 2005). The objective capabilities of Kenyan women in the Science and Mathematics may be assumed to be comparable to those of men because there is no evidence suggesting otherwise. However their perceived capabilities are significantly different from their male counterparts leading to their choice of non-Science majors that they perceive themselves competent in (Kithyo & Petrina, 2002).

Social persuasion also seems to be operative in the educational and career choice process through indirect feedback such as gender-biased instruction methods (FAWE, 2007). Female students also seem to have few vicarious learning experiences as a result of not being exposed to high achieving female role models (Osoro et al., 2000). The low numbers of women in the formal sector and especially in leadership positions in the Science, Mathematics and Technology careers deny young women critical learning experiences regarding women's abilities and achievements.

Individuals may also exclude potentially rewarding careers because they perceive negative consequences (outcome expectations) of pursuing those careers. The consequences may be rewards (financial, personal satisfaction) or they may be in the form of perceived barriers. Many theorists concur that perceptions of barriers can deter individuals from finding and entering occupations that are congruent with their abilities, values and interests (Holland, 1985; Krumboltz, 1996).

Empirical evidence in career choice behavior of Kenyan women seems to support the influence of outcome expectations on the pursuit or exclusion of certain careers. Kithyo and Petrina (2002) found that anticipated discrimination from employers was cited by women in tertiary institutions as the reason they did not choose careers they perceived as male domain. The negative outcome expectation of discrimination thus leads to elimination of many potential careers for these women.

Environmental influences such as social, cultural and economic factors are believed to have a profound effect on career development and are important in SCCT through the influence they have on self-efficacy, outcome expectations and personal goals (Chartrand & Rose, 1996). These include economic need, dictates of the family, discriminatory institutional and social practice as well as educational considerations (Fitzgerald & Betz, 1991; Lent & Brown, 1996). People may develop narrowed career interests as a result of being in an environment that does not expose them to a broad range of experiences or one that communicates low self-efficacy or negative outcome expectations (Brown & Lent, 1996; Hackett & Byars, 1996).

Educational, cultural and policy barriers seem to be pervasive in the Kenyan education system, affecting self-efficacy beliefs, perceived consequences and finally personal goals of Kenyan women. Gender biased instruction methods, differential funding of male versus female schools and parental biases in educating their children based on gender are just a few of the environmental obstacles that seem to limit efficacy-building experiences for Kenyan women for future SMT careers (Lindsay, 1980; Sifuna, 2006).

Social constructs like gender are important in SCCT because they influence self-efficacy and outcome expectations through the reactions they evoke from the environment and also the opportunity structures related to them (Lent & Brown, 1996). Differential reactions and opportunities based on gender and other factors provide learning experiences through which individuals develop judgments of their own competence as well as likely environmental responses to particular actions. Gender role socialization in particular biases the information available to boys and girls in developing self-efficacy beliefs leading to development of abilities in tasks that are considered gender appropriate in a particular culture (Hackett & Betz, 1981).

Gender appears to be a major determinant of the availability of efficacy-building experiences in Kenya. Female students have a lower likelihood of succeeding in Science and Mathematics, a prerequisite for SMT careers (Agesa & Agesa, 2002). This is the result of unsupportive school and social environments discussed above. By attending schools that are not equipped to teach them Science and Mathematics, Kenyan girls do not get learning experiences through which Science and Math self-efficacy can be build. This in turn precludes them from related majors at the universities and other tertiary institutions.

Contextual affordances and influences impact learning experiences, beliefs, interest formation, goals performance and attainment. In the Kenyan context contextual factors such as cultural influences, socioeconomic status and educational policies interact with gender to produce low self-efficacy in SMT and negative outcome expectations of pursuing careers perceived to be male domain. Women's career goals and choices then become narrower than those of men in the same context. Social Cognitive Career Theory

thus seems especially suited to explaining career choices among Kenyan women, specifically their failure to pursue SMT career options in rates comparable to those of Kenyan men.

Based on the theory the most appropriate interventions seem to be those ones that offer women diverse efficacy-building experiences, promote positive outcome expectations and reopen foreclosed career options in SMT fields. In order to begin to understand what types of supports might encourage Kenyan women to pursue SMT careers, interventions that have been recommended to increase the number of women in the same careers in the US will be reviewed. Although these may not be entirely appropriate for Kenyan women, they can be a starting point in developing career counseling programs that meet the unique needs of Kenyan women.

#### *SMT Intervention in the United States*

Several SCCT-based interventions have been suggested to promote women's participation in Science and math related careers (Nauta & Epperson, 2003). These authors propose early academic intervention with girls who show low Math and Science achievement. This is based on their research findings that academic ability is associated with Science, Math and Engineering efficacy in high school and college.

These authors also suggest identification of talented girls through interest inventories and subsequent intervention using Science interest-enhancing activities. This is based on the research evidence suggesting that low Science interest may increase the risk of early attrition from Science and related careers. Lastly, because women are more likely to pursue careers they perceive as helping people and the society in general, the

authors propose highlighting the ways in which pursuing leadership positions in SME can promote the welfare of others.

While these are appropriate interventions at the individual level, more changes are needed at the systemic level. The National Science Foundation has suggested that universities and industry employers alike appoint women to influential committees and positions so that junior faculty, graduate students and researchers can have mentors and role models to encourage them early in their Science career (Holmgren & Basch, 2005). This is important because research has shown that lack of mentoring is one of the major obstacles women in SMT careers face (Fassinger & Assay, 2006).

The Carnegie Foundation for the Advancement of Teaching (2005) suggests providing opportunities for cooperative hands-on Science learning beginning at the elementary school level. Because girls and women tend to lean towards Health, Environmental Science and Arts careers, cross-disciplinary studies linking these areas of interests to Science and Technology may be helpful in getting more girls interested in Science careers. Quality instruction, the advancement of Science pedagogy and parental encouragement have also been suggested as ways to advance women's careers in SMT.

While this research and resulting recommendations are valuable, the fact that it was undertaken in the US affects its applicability to Kenyan women. Investigation specific to Kenyan women's career choices, particularly for SMT careers is needed.

#### *Summary and Conclusion*

The literature on Kenya reveals significant barriers to women in their pursuit of educational and employment opportunities. These barriers are social, cultural, institutional in nature and pervade educational and employment institutions. Differential

gender socialization in particular seems pervasive Kenyan society and is seen to have negative effects of career aspirations of female students. Some of the negative outcome expectations that girls and women exhibit regarding SMT careers can be attributed to these very real and significant barriers.

Exclusion of the majority of Kenyan women from these careers is a significant concern for individual women and for the country as a whole. As a developing country Kenya needs to build a critical mass of highly qualified Science and Technology workers in order to develop and compete at the global level. The growth rate of this workforce will be significantly retarded if the current pattern of excluding half the potential employees continues.

Women's equitable participation in SMT careers is therefore a national economic development concern. In order to begin to build a conceptual base of factors that might promote this equity, theory on career decision making has been reviewed to shed some light on the process of making occupational choices, the factors that influence the process and the interventions that might prove helpful in alleviating the said gender inequalities. In particular Social Cognitive Career Theory has been discussed with its concepts of self-efficacy beliefs, outcome expectations and personal goals which are seen as key influences in the development of vocational interests.

It appears that the decision making process of Kenyan female students is heavily influenced by faulty self-efficacy beliefs and negative outcome expectations stemming from socialization processes at home as well as in school and employment settings. Environmental barriers seem evident stemming from cultural, social and policy

influences. All these factors lead to limited career goals for women, especially in SMT careers.

Whereas there is a plethora of literature outlining the barriers women face in Kenya, there is a dearth of research on what brings about success in this social and cultural context. Some women still succeed in school and end up pursuing SMT careers even continue to graduate work in spite of the daunting challenges. Investigating Kenyan women's success stories to identify motivation, supportive elements, and consequences is a crucial aspect of developing future career counseling interventions,

## CHAPTER 3

### Methodology

Women in Kenya face many identified challenges that affect the extent to which they choose SMT careers. Understanding the factors that influence their choice in SMT careers and ability to overcome challenges in this process is critical. The purpose of this study was to investigate Kenyan women's experiences in choosing these careers, including their perceptions of their abilities, environmental supports and barriers.

This chapter includes researcher's self-disclosure of experiences and beliefs that have shaped the research process. Also included is a rationale for choosing a multiple case study research design as well as the technical aspects of the research including sampling techniques, methods of data collection and analysis and a brief summary of the theoretical foundation of the study.

#### *Researcher's Self-disclosure*

The decision to do qualitative research was influenced by both my cultural and personal preference of storying as a way of learning as well as the theoretical perspective of constructivism. In conducting research I see myself as a co-constructor of reality with the participants, bringing in my own convictions, biases and experiences into the process.

Throughout the research process I continued to reflect on my experiences and possible biases as they relate to my research. This self-revealing stance is congruent with the feminist perspective of a researcher becoming vulnerable in the process of research just as the participants do when they talk about their experiences with the researcher. This helps to shrink the power differential between the researcher and participants. Also influential is my humanistic and radical philosophies of scholarship,

viewing learning, teaching and investigating as ways of bringing about social change. It was, and still is my intention to use my research to bring about change at the individual and systemic level that will benefit the women of Kenya and the society as a whole.

I believe in the constructivist assertion that reality is a social construction of the mind and that there are as many constructions as there are individuals (Guba & Lincoln, 1989). This view emphasizes subjective interrelationships between researcher and participant and the co-construction of meaning between the researcher and the participants which appeals to me because I do not want to assume the expert role. So I started the data collection process with the goal of facilitating the process of participants voicing their perspectives on the issue being investigated and encouraging them to use their experiences to empower others.

My natural curiosity regarding the “why” and “how” of many human phenomena led me to case study research. Yin (2003) suggests several attributes necessary for successful case study research which include ability to ask good questions, listen, be flexible and adaptive as well as having a good grasp of the issues being addressed. I believe my questioning stance, my experiences in the Kenyan education system and having reviewed the literature available will serve me well in this research.

My experiences as a student in Kenya are similar to what is revealed in the literature. Despite attending one of the top high schools in the country for girls, I received minimal career guidance in the process of choosing university majors, which I did during my last year of high school prior to taking the national Kenya Certificate of Secondary Education (KCSE) exam. The guidance included the class teacher handing out scantron forms and a booklet listing all the majors from the public universities accompanied with a

brief lecture on what subjects (and expected performance) would open doors to particular careers.

We were then asked to choose four majors and rank them in order of preference, the last one being one with minimal entry requirements to maximize our chances of going to the university. Prior to this, we had a day when individuals, most of whom were parents in the school, talked to us about what they did for a living. To my recollection, their careers were mostly in Engineering, Medicine and Law. That was all the career guidance we received, which is more than many students get.

When I started the research process I assumed experiences are similar to those of other women in Kenya in terms of career guidance. I also come from a middle class background which is typical of female university students in Kenya – almost two thirds of them are from middle class or higher backgrounds compared to about a third of male students. In terms of the university admission process I was assigned a major that I had ranked third in order of preference which is common practice in our admission process. My experiences turned out to be similar to those of the study.

However I am aware that may have had privileges that many women don't have, for example the fact that both my parents and most of my extended family are college educated. I also attended a high quality secondary school with all the educational resources we needed to succeed academically. These advantages may have provided me with more information about college than many of my fellow students had. As I proceeded with my research I continued to reflect on my experiences and beliefs and how they influenced my work.

### *Research Design*

I used multiple case study research methodology for this study with five units of analysis (Yin, 2003). Case study methodology has been defined as

. . . an empirical inquiry that investigates a contemporary phenomenon within its real- life context, especially when the boundaries between phenomenon and context are not clearly evident. The inquiry copes with the technically distinctive situation in which there will be many more variables of interest than data points and . . . relies on multiple sources of evidence, with data needing to converge in a triangulating fashion and . . . benefits from the prior development of theoretical propositions to guide data collection and analysis.” (p.13)

Case study methodology is appropriate for the purpose of describing, explaining or evaluating social constructs (Gall et al, 2005). This methodology was selected for this particular study because the research questions aimed at explaining why and how Kenyan women choose non-traditional career choices as well as generating data to inform the development of counseling interventions for Kenyan women. Also to be investigated was the context within which educational and occupational decisions are made as well as the motivations behind such choices.

The multiple case study format was selected in order to make the research findings more compelling. Collecting evidence from more than one case is considered as one way to make case study research more robust (Yin, 2003). The purpose of multiple cases is to allow for replication of findings, literal or theoretical. This study followed the theoretical replication logic based on the constructs of Social Cognitive Career Theory as a starting point.

The case study was both sociological and psychological, utilizing semi-structured educational history interviews to explain SMT career choices and generate new interventions for women in Kenya (Krathwohl & Smith, 2005; Yin, 2003). The educational history interview was chosen as the method of data collection because of its appropriateness in answering “why” and “how” questions.

*Unit of analysis.* The unit of analysis defines what the “case” is (individual, event, organization, etc.) (Yin, 2009). Given that major choices are made individually, the unit of analysis was individual Kenyan women who have chosen SMT careers. Although environmental influences are influential, how these women perceive themselves and their environment determines the choices they make ultimately.

*Questions, hypotheses and propositions.* The questions for investigation were:

1. Why do Kenyan women choose careers in Science, Mathematics and Technology?
2. What helps Kenyan women overcome the cultural, social and policy barriers to studying and working in the fields of in Science, Mathematics and Technology?
3. What are the perceived consequences of choosing to pursue higher education?

In particular, I investigated the role of family, educational and other social support in the career decisions of these families. Because I was interested in the women’s emic perspective, I focused on their perceptions of their educational and employment experiences. This included their views and beliefs of their internal experiences and external barriers and supports.

Using the social cognitive theoretical framework, I expected that the women who transcend the environmental barriers have positive self-efficacy beliefs and outcome expectations and have set specific performance goals for their futures. I also proposed that they would exhibit high coping efficacy and barrier coping skills. Also, Kenya is a collectivist culture and individual success is synonymous with that of the family/larger society, I expected that these women would have strong social support networks that offered encouragement. However, the structure of the interviews and analysis was left sufficiently flexible to allow the emergence of other significant constructs that differ from these assumptions (Yin, 2009).

*Theoretical framework.* Theory development prior to data collection is one of the characteristics that distinguish case studies from other methods such as ethnography (Yin, 2009). The purpose of theory in case study research is to facilitate data collection as well as to guide analysis of findings in order to keep the research focused and rigorous. More specifically, developing a theory beforehand provides an analytic template to which data can be compared to for generalization.

For this study Social Cognitive Career Theory was chosen as the starting point for theory development for several reasons the first one being its focus on self-efficacy and its influence on career choice. From the literature women in Kenya appear to have different learning experiences from men leading to different self-efficacy beliefs in the Math and Science domains. These different experiences include feedback from teachers, policy influences on education and cultural attitudes towards women's education.

The second reason is that SCCT addresses environmental factors that may influence career decisions (Lent, Brown & Hackett, 1994). The theory addresses issues of

environmental barriers that individuals may encounter and also takes into account how gender and other social constructs impact opportunities and learning experiences available. This theory seems appropriate in the Kenyan situation where women seem to face numerous environmental barriers such as gender biased educational policies and practices, cultural values that favor boys' education over girls and inadequate resources. All these factors seem to contribute to low math and Science self-efficacy.

The third rationale for choosing SCCT is that there is considerable research done in the area of Math and Science efficacy and their translation into career choices. This background seems appropriate given that the subject of this research is Science and Math related careers.

Whereas this theory has many constructs that appear to fit the Kenyan situation well, it has some shortcomings. Despite its acknowledgment of barriers that hinder congruent occupational choices, it does not go into detail regarding what those barriers are and how people overcome them. In addition, the barriers faced by Kenyan women may be different from those faced by women in the US, the context within which this theory was developed. With this in mind, the data collected was analyzed to provide new insights as to how women in Kenya navigate the education and career arenas. From the literature, it seems that interventions may be more effective if they focus more on the environmental factors that indirectly affect self-efficacy, outcome expectations and goals. Results from the study had implications on the appropriateness of SCCT constructs in understanding Kenyan women's SMT choices.

*Criteria for Judging Credibility and Trustworthiness.* Several tests were used to enhance the validity and reliability of the study.

The first set of tests relate to the construct validity of the research design. These include developing a theory (SCCT) prior to data collection, using multiple sources of information and member checking.

Development of a theoretical framework before carrying out the research is crucial in conducting sound case study research as Yin (2003) explains, “[Case study research] benefits from the prior development of theoretical propositions to guide data collection and analysis.” Research findings were analyzed from a Social Cognitive Career Theory framework. Given that this theory was applied to a context different from the one in which it was developed, it was expected that modifications would be necessary to make it more applicable to Kenyan women.

Data triangulation was used to ensure credibility and trustworthiness of research findings (Yin, 2003). Multiple (two) sources of primary data were used; interviews with the primary participants and at least one identified mentor. Reports from the interviews were sent to the participants for verification to ensure that the researcher has accurately represented the participants’ emic perspective (Gall et al, 2005).

The second set of tests relate to the internal validity of the study. Because this is an explanatory case study it was crucial to ensure that the inferences made were indeed correct. Yin (2009) suggests the use of theoretical propositions in order to build a strong case for causality. In particular, pattern matching was used to determine if predicted patterns match the actual findings of the study. In addition rival explanations were explored to rule out other plausible explanations of the results.

External validity measures were built into the research design to ensure that analytical generalizations of the study results can be made (Yin, 2009). The first one was

developing a theoretical framework prior to data collection that was then used as a template for interpreting results. The second one was using multiple cases for replication logic. Yin (2009) recommends using multiple cases to make findings more compelling. From the study findings a thick description was developed to determine cases to which generalizations can be made.

Reliability was enhanced in this study by following a case study protocol so that the same procedure is followed for each case (Yin, 2003). A protocol is good practice in case study research and is considered essential when conducting multiple case studies to keep the researcher focused on the topic of study (Yin, 2009). The same procedure was followed for each interview; a first session was scheduled with the participants to explain the study to them and to have them become comfortable with the researcher. This was followed by the actual interview during which the informed consent was first read, followed by a short survey and finally the semi-structured interview was conducted. A final follow up interview was carried out over the phone.

### *Sampling*

*Phenomenon.* The phenomenon of interest was the decision making process of Kenyan women in non-traditional careers in Science, Mathematics and Technology therefore individual women were selected from the larger population of women in these careers. In addition to investigating their internal process (self-efficacy, outcome expectations and goals), external factors such as family support, educational supports and policy factors were also studied. Finally, the women's barrier coping strategies and supports were studied. These are the primary constructs of interest from a Social Cognitive Career Theory perspective that guided the initial data collection.

*Sampling procedures.* Cases to be studied were selected to represent the typical decision making process for theoretical (not literal) replication logic (Yin, 2003). The average Kenyan female student is from a middle class professional background hence the women to be interviewed were screened using this criterion. The emergent sampling strategy of snowballing (Gall et al, 2005) was utilized to gain access to participants by making contact with key informants in the professional organizations and asking for referrals to individuals who met the study criteria.

*Sampling units.* Individual cases were selected for the purpose of this study. Individual case histories are especially suited for studying “. . . antecedents, contextual factors, perceptions and attitudes preceding a known outcome.” (Hakim, 2000). In this study, the known outcome is choosing a non-traditional career in Science, Math or Technology. Individual cases were also chosen to give the researcher an opportunity to conduct an in-depth exploration of participants’ perceptions of their experiences.

The criteria for selecting participants were age, choice of career and socioeconomic background. Specifically, women in the age range of 20-30 were selected. These women are relatively new in the profession therefore information gathered from them will be more relevant to future career interventions as opposed to those who made career decisions many years ago when contextual factors were different. In addition, these are women who went through the 8-4-4 education system that is radically different from the earlier British system of education (7-4-2-3).

*Methods of Data Collection*

*Data collection procedures.* Data was collected from the emic perspective to gain an understanding of how the participants view their educational and career paths. Several methods were used in the process and are discussed later in this section.

Participants were selected through community referrals. For each case study two sources of data were used; the woman and at least one significant person in the participant's lives such as mentors and family members.

*Data collection instruments.* A short survey was utilized to gather demographic information (see Appendix A). Open-ended questions (Appendix B) were used to conduct in-depth interviews.

#### *Methods of Data Analysis*

The first step in data analysis was to transcribe the interviews and enter this information into computer files using numbers and codes to keep track of participants. The data was then analyzed for recurring constructs, themes and patterns using the Social Cognitive Career Theory. This process was guided by several strategies and techniques.

Analytic strategies are the foundation of data analysis in case studies. Yin (2009) has identified four general strategies for synthesizing case study evidence and these are: (a) relying on theoretical propositions, (b) developing a case description, (c) using qualitative and quantitative data, and (d) examining rival explanations. The two analytic strategies of relying on theoretical propositions and using rival explanations for the phenomena being studied were identified for use in this study. The first strategy was chosen because it has been identified as the most preferred strategy case analysis strategy because theory provides a strong guiding structure to looking at case evidence. The

second strategy was used because it is important to rule out other plausible explanations in explanatory case studies.

The theoretical constructs proposed in Social Cognitive Career Theory were the starting point in determining if the data collected match the expected pattern. In addition rival explanations were developed and examined so as to increase the construct validity of this study. Ruling out other plausible explanations for the outcome being studied made it more probable that the career choices under study are indeed influenced by the theoretical constructs proposed by SCCT and the other additional themes that emerged during analysis.

After strategies were defined, the next step was to choose data analysis techniques that were the more specific guidelines for looking at case evidence (Yin, 2009). Five analytic techniques have been identified a suitable for case study analysis. These are pattern matching, explanation building, logic models, time series analysis, and cross case synthesis. Two methods were selected for use in this investigations; pattern matching of the individual cases and cross-case synthesis.

The analytical technique of pattern matching was used to link the data to theoretical propositions and rival explanations to make the inferences made from predicted and actual patterns more compelling. According to Yin (2009) pattern matching in an explanatory case study can be done either by relating patterns to the independent and/or dependent variables in the study or by using rival explanations as patterns to explain the findings.

For pattern matching in this study, the outcome under investigation was the choice to pursue a career in the fields of Science, Mathematics and Technology. The

factors whose influence on the outcome was being studied included self-efficacy, outcome expectations and personal goals. After data was analyzed using SCCT open coding was done to look for concepts that were not sufficiently addressed by the theory. Several cultural issues were identified through this process and are discussed in the results section.

Finally cross-case synthesis was performed to aggregate the findings from the individual cases (Yin, 2009). A uniform set of themes were extracted from the data and tabulated then individual cases were analyzed according to this framework. This process was guided by theoretical constructs from feminist literature that propose how empowerment occurs with a focus in women (Corey, 2001).

## CHAPTER 4

### Results: Individual Case Analysis

In previous chapters I have described the rationale, based on a review of available literature, of conducting this study as well as the methodology that was followed. Kenyan women face many obstacles in their pursuit of higher education especially in the Sciences, more so than Kenyan men. This study was designed to investigate the factors that help Kenyan women choose careers in Science, Math and Technology. Case history interviews were conducted to capture the experiences of these women at various stages of their education.

As stated in previous chapters Social Cognitive Career Theory was chosen to provide a theoretical framework within which to analyze the data. In this chapter I will describe each individual case using this theory, progressing from early stages of education to the later ones. Finally I will describe other themes that emerged during the data collection and analysis process that may not fall under the SCCT theory.

Participants in the study were five women at various levels on the continuum of professional development. One woman had just finished a Masters in Physics, two were in the fourth year of their Bachelor's degree programs, one had finished the previous year and was in her first job and the last one was doing her internship after completing her degree in Pharmacy. Table 1 and Table 2 summarize their characteristics.

Table 1

Demographic Information

<b>Participant</b>	Z	Y	X	W	V
<b>Degree</b>	MS	BSC	BPharm	BSC	BSC
<b>Major</b>	Physics	Actuarial Science	Pharmacy	Biochemistry	Geospatial Engineering
<b>Primary school</b>	Public Day	Private Day	Public Day	Private Day/Boardin g	Private Boarding
<b>Secondary school</b>	Public National	Public Provincial	Public Provincial	Public Provincial	Public Provincial
<b>University</b>	Public Regular	Public Parallel	Public Regular	Public Regular	Public Regular
<b>Residence</b>	Urban	Semi-urban	Semi-urban	Semi-urban	Semi-urban
<b>Mother's occupation</b>	Teacher	Teacher	Teacher	Radiographer	Homemaker
<b>Father's occupation</b>	Industrial Trainer/Engi neer	Doctor	Engineer	Teacher	Teacher
<b>Siblings</b>	5	4	3	3	2
<b>Career status</b>	Private employment	Private employment	Public employment	Fourth year	Fifth year

Table 2

## University choices

Participant	Choice 1	Choice 2	Choice 3	Choice 4
Z	BA Architecture	BSc Engineering	BEd	BSc General
Y	BCom	BSc Computer Science	BA Survey	BSc Math
X	BPharm	BSc Computer Science	BCom	BSc Chemistry
W	BMed	Dental Surgery	BSc Biology and Chemistry	BEd
V	BSc Geospatial Engineering	Law	BCom	BSc Math

In the following sections of this chapter, the cases are presented in alphabetical order by participant code. Each case begins with a narrative, followed by an analysis of Social Cognitive Career Theory constructs. Finally gender and cultural issues pertaining to the case are discussed.

*Participant V*

*Case Story*

Participant V was born and raised in a small town in central Kenya as the second born of three children, two boys and one girl. Her father was a Mathematics teacher and her mother a homemaker who also did some farming and small business work. Her parents believed strongly in education and made the choice to take their daughter to a

private girls' primary school so as to provide her with a solid academic foundation and increase her chances of performing well in KCPE. This school is one of the best in the district, with a reputation of producing high achieving students, and top grades in Mathematics.

Beginning from standard four, V's father was her Mathematics teacher in school. She credits him with giving her a strong foundation in the subject that has enabled her to achieve as she has. Her father says he worked very hard to instill in his students a liking for Math, realizing that his female students were conforming to a gender-typed dislike for Math from an early age. He consistently pointed out the practicality of the subject in everyday life, whether one became a doctor or was only doing simple budgeting for the home.

This teacher also spent a lot of time, above and beyond what the school scheduled for him, in class helping the students with any difficulty they had in Math. It was not uncommon for him to come to school at 6 am and leave at 5 pm, and also spend his lunch time teaching and grading assignments. This effort paid off: his daughter and the other students he taught earned excellent grades in Mathematics, with 60 out of 70 students in the class achieving A's in KCPE, an exceptional feat in Mathematics education where the mean, median, and mode grade in the national examinations is below average.

From an early age V showed high aptitude in Math, and according to her father she would talk about pursuing a Math career in the future, although she did not specifically cite a major. Her role models in childhood were women who had the courage to do something different: her Science teacher who was the only female Science teacher in the school; her aunt who was an attorney and always spoke her mind; and, according to

her father, a woman in the neighborhood who was an engineer. V recalls that her aunt was the first role model she identified and liked the fact that as a lawyer she defended other people and always spoke her mind, regardless of what other people thought. This inspired her to always speak for herself and air her opinions even though they went against other people's belief systems.

V's father recalled that his daughter used to admire a woman in the neighborhood who was an engineer. V said she remembers this woman as someone who was strong and also kind and generous, and she realized later in life that she was striving to be like this woman: "She impressed me in a way; it was something I could not see then, but I realized later that I was working towards becoming like her. She was one of these people you call successful-- not that she had a lot of money or anything-- but that her family was good. I thought she knew how to relate with almost everyone." The fact that this woman did not isolate herself from the rest of the community, including people from lower socioeconomic groups, was even more impressive and V found herself wanting to make a difference in the society in the same way.

V's Science teacher in primary school was another great inspiration, not only because she was the only woman teaching Science in the school, but also because she cared about the students and was always there to offer general guidance with regard to issues they were facing, including some normal developmental challenges. This teacher identified V's academic potential particularly in the Math and Science subjects and encouraged her to keep working hard because her ability would take her far. V says this support, in addition to her parents', was very important and gave her the confidence she needed to dream big, to think about the possibility of pursuing a career in the Sciences,

and to buck the prevailing gender stereotypes. This confidence was reflected in her attitude towards her examinations and she says although she was a little apprehensive, she looked forward to the examinations because “I was prepared and knew I had to do well.”

Math and Science were V’s favorite subjects in primary school. Speaking of her experience with Mathematics, she says, “Math is the easiest subject in school. You just have to know the formula and everything revolves around it, unlike theory subjects.” According to V studying for Math is quick and easy because it does not take that long to learn the basic concepts and formulas. Science was fascinating to her because of its practicality, aiding in the understanding of everyday activities like cooking, which, according to V, makes Science so exciting.

The one subject that V hated the most was CRE (Christian Religious Education). She was quick to point out that she upholds the Bible as an infallible moral guide and that was the reason she did not like the approach of the teacher who taught it “just as a subject” and “preached water and drank wine.” The disconnect between V’s strong spiritual values and her perception of the teacher’s approach to CRE made it difficult for her to be in class, with her negative attitude hindering her learning. She says, “Even the simplest concept that even a nursery school child can understand, I could not because of my negative attitude.” English was the next least favorite subject; V did not find the concepts interesting in any way.

When she took her KCPE examination, V attained good grades and was admitted to a provincial girls’ school in central Kenya. Here she excelled in academics, or according to her father, “she did wonders,” despite facing a few challenges during form

two and three. During these two years, her parents were experiencing some financial difficulties and at times were not able to pay her tuition in time. This meant being sent home, sometimes for two or three weeks at a time, resulting in her falling behind at school. Upon returning, she faced discouragement because of the amount of work needed to catch up with the rest of the class in order to continue doing well in the tests. V always made a point to talk to the teachers when she returned to school, to find out from them what she needed to do to catch up, and to ask them for help.

This was not an easy time, but V knew that the problem was temporary, unavoidable, that her parents were trying their level best to educate her. She therefore took it upon herself to “help myself and my parents” by talking to the school principal and explaining her parents’ financial situation. She “begged” the principal not to send her home again because this was affecting her performance. The principal agreed and promised not to send her home again while her parents worked out a solution to their financial challenges. The principal would also award her any bursary funding that was available.

In addition to advocating for herself, V turned to her strong spiritual upbringing to help her cope with these challenges and would constantly “pray about it.” This was an effective coping tool during this time when she knew that her parents’ resources were stretched to the limit. Believing in a higher power who could accomplish what her parents could not was comforting.

In the meantime V and her friends formed a study group so as to pool their knowledge and encourage each other when the academic material became challenging. Being in a group made it easier to work through hard problems; V would be encouraged

and motivated to find a solution, knowing she was not the only student finding the subjects difficult at times. In addition, the group would approach the teachers if they were unable to find a solution and the teachers would provide additional study material upon request. This helped this group of students stay ahead of their peers in academics.

V's favorite subjects in high school were Mathematics, Physics and Chemistry, and again the ease with which she understood the concepts and the practicality of the subjects appealed to her. In class she would be thinking about how to apply the concepts and "invent something of my own." She gave an example of learning about energy and conservation methods in Physics and when she went home that holiday she made an energy conservation charcoal stove using an old stove, cow dung and a chemical compound she got from the laboratory. She calls this practicality "the better part of Science" and knew that she wanted to pursue a degree that would give her opportunity to practice the fascinating concepts of Science.

In an effort to provide the students with information about potential careers, the school would organize career days, inviting various professionals to talk to the students about their careers. V at this point knew she wanted to be an engineer, and the only part of the career day that made sense to her was the speech from the guest speaker who was an engineer. At this point she was considering doing Civil Engineering, although she did not know much about other engineering options.

When it came time to choose university majors, V chose Engineering, Law, BCom and BSc Mathematics in that order. She cited several reasons for choosing Engineering, the first one being that she knew from research that Engineering entailed applying the subjects she loved and had an interest in (Math, Biology, Physics and

Chemistry) to solving real life problems. Secondly, she knew that there was a ready market for the degree and she would not “tarmac” looking for a job. V also knew that a career in engineering would provide an attractive remuneration package.

Thirdly, pursuing Engineering would offer her an opportunity to influence other young women to follow suit, having observed that many of her classmates in primary and secondary school had a negative attitude towards Mathematics and Science. She hoped that pursuing education in that area would give her credibility in influencing young women to pursue SMT subjects and careers. The only reservation that she had in choosing Engineering was that she knew most of the students were male, a fact that worried her, after attending girls’ only schools her entire life and not knowing how she would relate to the male students. This was confirmed when she started the program and found that the male: female ratio was 20:1, which took some time to adjust to.

Although her first choice was to pursue a career in Math and Science, V knew that the Kenyan education system is not very student-centered and students sometimes get assigned majors that are not their first choice. With this in mind she had to consider other careers that she would not mind pursuing, and one came to mind: Law. This came about because her childhood admiration of lawyers, in particular her aunt who was an attorney, stayed with her. According to V’s father, through family discussions he learned that his daughter was willing to settle for Law, her second choice, if she did not get her first choice.

The KCSE exam was something that V eagerly anticipated because she felt well prepared and was confident her performance would be good. She got all A’s in the

Sciences and Mathematics and was admitted to pursue Engineering at the oldest and largest public university in Kenya.

After finishing high school, students in Kenya have to wait two years before they join the public universities, and V used this time to find out more about different careers. She asked her father to help her get employment in a building surveying firm near her home town and he did. She did computations work for them and realized that she really wanted to pursue this as a career as opposed to designing and building structures in Civil Engineering. She ended up choosing Geospatial Engineering because it combined surveying work with various integrated technologies.

V found college to be a challenging experience in some ways, the first being that few women in the program, a ratio of 1:20. Although a difficult learning atmosphere for her because she had attended all girls' schools since standard four, eventually she was able to adjust. The academic content has been challenging, too, and V says that the professors were not available to the students outside of class. She said of this experience, "For them it is more like they just come to class and teach and have nothing to do with you after class. Sometimes I think they are too busy; for some of them it is just books and nothing more." Despite this, V has found the work to be manageable with the support of friends who formed study groups to help each other.

V's parents were always there to support and encourage her. Her mother encouraged her to work hard in school and offered guidance regarding how to handle life issues. Her father recalls that his wife laid a strong spiritual foundation for their children and would initiate discussions with the children regarding life issues. These spiritual values are what V turned to when she faced challenges during her schooling years,

especially when her parents were having difficulty paying her tuition. Her spirituality has also provided a moral standard to abide by during college and helped her stay focused on her goal. V also recognizes that a positive attitude and determination “will take you wherever you want to go” and says this was true for her.

#### *SCCT Constructs*

*Self-efficacy.* V exhibited great self-efficacy not only in Science and Math but in school generally. She says Math is the easiest subject for her because “you just need to know the formula and think and apply it.” Science was an easy and practical subject, too, and V said it was easy for her to understand the principles because she could see them in real life situations, for instance, boiling/cooking which operate under the rules of Physics. She repeatedly referred to this ease of understanding and practicality as “the better part of Science.”

This self-efficacy surfaced as she talked about her anticipation for the often dreaded national exam, KCSE. V says, “I was longing for KCSE and it was good . . . because I knew I had to pass. In fact I was the best student in the school that year, and third in the district.” This attitude of looking forward to the examination is rare among Kenyan students because often strong pressure to succeed makes students anxious. V believed in her ability firmly enough to know that she would do well in the examination and succeed.

In addition to high Math and Science efficacy, V’s self-evaluation with respect to Science, and the objective capabilities seen in the examination results are clearly congruent, and this led her to choose an equally congruent career, engineering. Her father proudly talked about his daughter’s accomplishments in the educational arena and said

that V got A's in all the Science subjects and in Mathematics in KCSE, a confirmation of her abilities in Math and Science.

*Outcome expectations.* V cited various outcomes she expected would follow her choice to pursue Geospatial Engineering. Based on her research by talking to people in the field, V knew that the work involved application of the principles of Science to real life problems. This appealed to her because of the many possibilities of application she could envision. This practical aspect is what had drawn V to the subject in the first place during her early schooling years.

V also knew that a degree in a Science/Technology field would give her the credibility and opportunity to encourage other girls to pursue Engineering/Science. She noted that many of her high school classmates disliked Science subjects, unfortunate in V's view, because she knew girls/women can do well in Science/Math just like in other subjects. She wanted to be able to change the stereotypes associated with Science and Math, and since joining the university has visited local girls' schools that she perceives as not having access to professionals, to talk about Science careers. She encourages the girls to work hard in Science subjects, to ignore gender stereotypes and to choose SMT careers if that is where their interests lie.

A third expected consequence of choosing engineering was available employment soon after graduating without lengthy searching. This was an important consideration because college graduates in Kenya generally spend months job-hunting, which can be discouraging.

The one aspect V did not relish was the vastly male-dominated nature of the Engineering programs. She knew it would be hard to adjust to a classroom full of men

because she had attended girls' only schools since primary school. The actual male to female ratio in V's first year class was 20:1 and it took time to get used to this.

*Environmental supports.* V had strong social supports during her education, starting with her father who was her Math teacher. V says of her primary school experience with Mathematics, “. . . my dad was my Math teacher and this gave me all the courage to do well in school. I can say he gave me a good foundation for Mathematics and Sciences, too.” V's father said he recognized that most of his students harbored a negative attitude towards Math, so his approach to teaching them was to demonstrate the practicality of the subject in everyday situations. He says of his students, “You know they don't like Math. I had to teach very hard, coming to school at 6 am and leaving at 5 pm. I had to show them that Math is not hard, that Math is needed everywhere you go.”

V's parents also made the decision early in her education to take her to a private school where the quality of education would be good. It was at this school that V had the first of numerous experiences that would draw her towards Science. She recalls that her teacher was the only female Science teacher, and she took the time to talk to her students not only about Science but also about life in general, and provided guidance to them about how to handle many developmental concerns. V says of her teacher, “She identified the potential in me. She would call me and tell me I have potential and could do well.” This helped V become more confident in her academic ability in both Science and Mathematics.

V's parents also tried their level best to pay the school fees in time although they had a few challenges along the way, especially in secondary school when they had difficulty meeting the school deadlines. During this time V talked to the principal who

was understanding of the situation, agreed not to send V home, and also awarded her any bursary that was available. V was also able to form a study group with her fellow classmates to give each other support and work through difficult assignments together. The teachers were impressed with the efforts the students in the groups were putting into their academics and would offer assistance when the students requested it.

After V took her KCSE exam, she wanted to get some work experience to be sure she had chosen the right career. Her father talked to some surveyors who had an office in town, and was able to secure her an internship. It was while working there that she realized she was more interested in doing the ground work before construction than in designing and building structures. She therefore made up her mind to change from Civil to Geospatial Engineering.

V's mother offered much encouragement and spiritual guidance to her children, which helped V surmount challenges along the way. She said when she would be sent home for non-payment of tuition she would pray about it and this gave her peace and confidence to keep going in the face of discouragement.

V's father also recalled that his daughter used to admire a woman in the neighborhood who was an engineer. This was where her interest in the profession began because V was able to see another woman in a Science career (in addition to her primary school teacher). According to V, not only was this role model successful professionally, but she also was well aware of the needs of poor people in her neighborhood and took steps to help them, even though she was not wealthy by any means. V said she found this well-rounded quality admirable and strove to be like her, even though it was years later before V realized she was emulating her role model.

*Environmental barriers.* V experienced several challenges in her quest to get a good education, the biggest being the financial commitment required of parents in Kenya. The education system in Kenya is based on a cost-sharing model and the parents must pay significant tuition and fees to educate their children. This creates financial difficulty for many families as they struggle to pay in time so their children are not sent home from school. V found herself confronted with this policy obstacle in form two and three when her parents had some financial challenges that prevented them from meeting their tuition obligations. V would be sent away from school sometimes for as long as three weeks, and began to fall behind; her school work and her exam performance declined. Knowing her capabilities made this extra discouraging to V.

In college the first challenge V faced was the very small number of women in the program. This was made worse by some men in the program who had the opinion that the women in class were “tough” and did not deserve to be treated any differently from the men. V cited an example of some men who would take her seat and expect her to fight them for it like the men did among themselves. She found this annoying and wished they would realize she would still like to be respected even though she is pursuing a “hard” Science.

Another challenge that V has experienced recently in her fifth year in college is the perception among some professors that the female students are not tough enough to be involved in some of the difficult internship projects; hence they choose to have only male students participate in these internships. V is disappointed that the women’s choices are limited as a result of this attitude, which also proves disadvantageous to them when it comes to being competitive in the labor market.

*Coping efficacy.* Coping efficacy refers to a self-evaluation of coping ability. V rates her ability to overcome challenges as a six or seven, depending on the challenge, and says sometimes she does get very discouraged. She talks about the process of feeling disappointed, then being able to find a solution and keep going. “Things sometimes become so hard for me and I am like, ‘Oh, God, I can’t continue anymore.’ I feel like giving up and leaving everything. But finally I get a way out.”

V says she is able to find solutions to her problems and keep going even when no solution seems viable, because of her strong spiritual grounding. This belief in God and prayer was important during her most challenging times, such as when she was sent home for non-payment of fees. In answer to the question of how she was able to overcome the frustration and hopelessness that she felt at times, V simply said, “I used to pray about it.” This faith was instilled in her very early in her childhood and she has clung to it ever since. She reflected on this coping strategy, “I think the thing that has been helping me is that I was taught to believe in God when I was so, so small. My childhood upbringing made me have the faith that I have in God.” This faith led her to believe that any challenge she faced could be solved with time: “It is just the belief I have in God that everything is possible, that he can provide a way out; when things are beyond me that God can help me out.”

The spiritual grounding gave V a lot of faith in herself that she could get through the challenges she faced: “It was more of believing myself, believing I can make it. It was that positive attitude that I can make it.” This in turn gave her the confidence to advocate for herself when confronted with system challenges/environmental barriers. For example, when she realized her continued absences from school were affecting her performance,

she talked to the principal and “begged and pleaded with her not to send me home again and she agreed. If there was bursary money I would get it.”

V felt compelled to help herself and her parents because she felt they had exhausted all possibilities where finances were concerned. She explained that her ability to speak for herself was a result of watching and admiring her aunt, an attorney, as well as other attorneys on television. She said of the influence, “The whole idea of being bold, saying anything even if it offends other people, gave me the courage to always share my views.” After long absences from school V knew that she could not catch up all by herself, and this threatened to affect her academic performance. She was able to talk to her teachers upon return and ask for their assistance in catching up with the school work so she did not have to rely solely on her peers, who already had enough to do.

Another coping resource that V relies on when faced with challenges is her parents and friends in college. Her mother was always there to encourage her when she was young and V reflected on her support, “My mom used to encourage me to go to school and work hard.” V’s father also commented on the role his wife played in their children’s education: “She has played a big role in talking to our children. If they messed somewhere she would talk to them and pray for them.”

In boarding primary school, secondary school and college when her family was not near to encourage her, V surrounded herself with friends who shared the same spiritual and educational values, and they were able to help each other through challenges. In secondary school V had a study group that helped her catch up with school work missed during her long absences: “I got support from some of my friends in high

school. We used to form groups and study. I really concentrated on that and it helped me a lot . . . you don't feel alone."

In college where the academic and social aspects were even more challenging, friends were an important source of encouragement. V expressed how they helped her face difficulties: "Having good friend who support me, so far that has played a big, big role in my life because you know there is positive peer influence. That one I work on with my friends; I make sure that I get the good from them."

*Goals.* V's goals started becoming clear around the time she was in upper primary (standard five, six, seven) and she realized she like the Sciences and wanted a related career. By the time she was in form two she knew she wanted to be an engineer a decision which remained constant throughout school. She says that during the career day in form two, the only part she really paid attention to was the keynote speech by an engineer, because she was sure this was the career for her.

#### *Gender and Cultural Issues*

*Gender and cultural influences in the family.* V's family was instrumental in the development of her self-efficacy and values regarding education. Because her father is a teacher, he made it a point to talk to the children, especially V, the only daughter, about their academics and to encourage them that they could excel in whatever field they chose to pursue. V felt she got special treatment at home by virtue of being the only girl. Because she attended boarding school in standard four, V only spent a few weeks a year at home, a phenomenon that is common in many Kenyan families. "For me it was fun now that I was the only girl in my family, but I have not spent much time at home with my family because I went to boarding school when I was in class four. I was at home

only a few weeks in a year, but it was fun because I was the only girl, mommy's favorite daughter. But I had not had much experience with family life until I finished form four."

Despite the long absences from home, V still found her parents' encouragement to be invaluable as she worked hard to succeed in school. She feels fortunate that her parents did not adhere to cultural views of women and education, and gave her the same opportunities as her brothers. V believes this stems from her parent's personalities, which she felt was unlike most others she knew: "I think it is more of the character in them, I found them that way. I think their character . . . it is different from other parents. When I became older and interacted with other adults I realized that some of them can be helpful but there are others you don't want to be like." V says she was thankful of her parents' values and that she did not hear any negative messages from them regarding her abilities.

In V's family all the children were encouraged to pursue what they excelled at, and they all ended up in technical or Math related fields: her older brother studied Mechanics at a polytechnic and her younger brother who finished form four in 2008 plans to go into Accounting.

*Gender and cultural influences in the school.* V's schooling experience was crucial in the development of her career aspirations in SMT, and one of the most significant aspects of this was her father, who was also her Math teacher from standard four onwards. He recognized the gender stereotypes that pervade Math and Science education and set out to change this mind set in his students. He taught at an all girls' school and said he had to work diligently to counteract these stereotypes. He did this by showing his students that Math is a practical subject and useful in everyday life, and helped them realize they could all perform better with practice.

Boarding schools in Kenya are quite common and most people attend boarding high school. Primary boarding schools are also common, but to a lesser degree. Children who go to boarding school do not have any contact with their parents for weeks or even months. Because there are no counselors in schools and most teachers are only interested in doing the teaching part, these young children end up figuring out life issues on their own during the crucial years of growing up.

Having a teacher to guide students about life in general is not a common occurrence, but V had this support and guidance from her Science teacher whom she says was not just interested in teaching Science. She was also available to students for non-academic concerns and to offer encouragement. This teacher's supportive influence was even more significant because her specialty was Science, providing V not only a role model of excellence in Science, but in personal caring for the overall welfare and adjustment of her students, which especially encouraged and inspired V.

During her schooling years V was well aware that most of her classmates did not like Math, which she saw as a loss to girls and women because she believes SMT careers have potential to be enjoyable and well-paying, too. She perceived her choice in Engineering as a way not only to follow her dreams but also to mentor young girls into similar careers. This goal she has accomplished by going to local girls' schools and talking about the many possibilities available to those students who choose SMT. She chooses to go to the local girls' schools that have fewer resources and are more likely to have teachers/students who adhere to gender typing of Mathematics and Science subjects, with the hope of providing an alternative lens of looking at their abilities.

The dearth of females in SMT education programs was apparent to V when she joined the university engineering program, where she found the ratio of men to women to be 20:1. Although she expected this gender disparity, it still challenged V to be in this kind of academic environment, feeling she lacked experience interacting with male students, having attended all female schools since primary school. With time, however, she was able to adjust and relate to her colleagues in the classroom.

The adjustment process is an ongoing one because V finds that her male classmates get so used to her presence in the class that they treat her and the other female students roughly, like “one of the guys.” She talks about this treatment: “Of course, now that we are going to fifth year we have become like, they don’t take me like a woman. The way they treat me sometimes especially in fourth year/fifth year, it is just like you are like them, sometimes too crude on you. Like someone comes to class and takes my seat and refuses to move. They expect me to start fighting with them the way they fight with the other jamaas (guys). A point reaches and they think you are like them, they don’t realize you are a girl and they don’t realize you don’t like that.” V dislikes this treatment and tells her classmates that the fact that she is pursuing the same degree as them does not negate the fact that she is a woman and would like to be respected. “I want them to treat me like a woman.”

Although V gets some of this treatment in her class, she points out that other men in the class respect her, for which she is thankful, feeling this gives her a break from having to defend and stand up for herself: “But there are others who are gentlemen who are just good. There are those who still have the gentleman heart in them and they treat

you like a woman; you never realize the difference.” V would like to see more of this kind of treatment and believes it is only a matter of time before things change.

Another aspect of the engineering program that V has found discouraging is some professors’ attitudes regarding the tenacity of their female students. V’s experience is that some of them do not believe the women are as capable of doing some projects as the men: “Sometimes we feel like they favor guys over us in Engineering, others treat you like everyone else. Our coursework gets more technical after the fifth year; sometimes they get a project and prefer to work with the guys and won’t take the girls. They think we can’t endure the hard work and harsh conditions and I know I can do it but they prefer to take the guys because the conditions are so harsh, so they prefer to work with the hard men. And it has happened especially this year.”

V thinks this perception is unfortunate, especially coming from the professors who in essence have the power to provide or deny learning opportunities to the students. She says all the students are in the program because they are capable, and the professors should let the female students decide for themselves if they want to be involved in a particular project. This differential treatment has been discouraging especially coming so close to graduation, when V feels the female students especially need some practical learning opportunities to be competitive in the labor market.

*Gender and cultural influences in the society.* V’s values and perceptions of women professionals was partly shaped by interactions with people outside her family and school settings. V recalls in particular one engineer she admired during her childhood years: “There are these people you admire in life. She was one of those focused people. She had a big heart for many people, she was a family woman, you see everything in her

life is just smooth so you just have to admire and say ‘One day I have to be like her’.” Through her interactions with this woman, V was slowly beginning to see that women can break free from the traditional gender roles and pursue highly competitive professions.

In addition, V became aware of societal needs/issues that needed to be addressed by those having awareness and resources. V’s role model, involved in charity work, impressed V even more: “She used to help the needy people. In our place there are those poor people who do not have anyone to help them, and not that she had too much; she was just generous. She was such a nice person.” To V the fact that this woman was not wealthy and yet was doing so much to help the needy in her village gave her the resolve not only to pursue an Engineering career but also to do something to contribute to the welfare of those around her, especially those with limited resources.

V reflected on the consequences of being a female engineer: “One thing is maybe that people respect you, and some fear you. The people in the village, you know how people here live, they see you are so learned and fear to talk to you. They view you like a proud person.” V finds that people respect her for her accomplishments, but sometimes the perception is that she is not really one of them. “They see like you can’t relate to them because you are a bit higher than them in terms of education, but generally people respect you.”

V feels this evaluation is unfair because she sees herself as someone who understands the needs of those around her, and does not view herself as having special accomplishments or deserving special attention. She defends herself, “It is not like I am proud...” but she also finds that she sometimes doubts herself and wonders if she really is

acting in a manner that comes across as proud. “For me, I have to feel like maybe I am the one who gives the impression, or maybe I am the one who makes them feel like I am proud.” This questioning has sometimes led V to isolate herself because she does not want to be judged harshly by her peers and others around her. She says, “I am not sure sometimes how they will react if I go talk to them, and I feel like staying by myself sometimes.”

The decision to pursue a career she loves has had the unanticipated social consequence of limiting her social circles, which has sometimes led to feelings of loneliness, something V had not anticipated. However, she sees this as a small price to pay for accomplishing her dreams and for having the opportunity to inspire other young women to pursue their dreams in SMT. V hopes such negative societal perceptions of women in professional careers will change sooner rather than later. In the meantime she will continue to do what she is doing; going to girls’ schools that have less resources and exposure, to be a role model for these students, proving to them that women are indeed capable of succeeding in male-dominated careers if that is where their strongest interests lie.

### *Participant W*

#### *Case Story*

Participant W was born and raised in a semi-urban town in the Central province of Kenya in a family of four children, two girls and two boys. Her mother, a radiographer, and her father, a teacher, both strongly believed in the value of education as a way of ensuring long term financial security for their children. They recognized that the traditional economy was changing and the corresponding currency, namely land, no

longer guaranteed financial security compared to the skills gained from a modern formal education. They saw education as a way of providing their children with independence and competence in the emerging formal labor market and sought to educate all their children regardless of gender. They saw all their children, two daughters and two sons, as a blessing, and sought to equip them with life skills to the best of their ability.

W went to a private girls' primary school that also offered boarding facilities, and became a boarding student in the standard seven. Learning was excellent at this school, with teachers setting very high standards for the students and following up with consequences when the students did not invest as much effort as was required. W's perception of her teachers was that they were devoted to their work and to helping the students excel. The teachers were also encouraging and offered numerous assessments to provide students with feedback regarding their performance.

W identified Science as her favorite subject in primary school because of its ability to explain everyday occurrences in terms of physical laws, a quality that held great appeal to W's inquisitive mind. She was constantly intrigued by the mechanisms behind the workings of the human body, plants, and with the different chemical compositions of objects around her. She also was fascinated with her teachers' wealth of information, and ability to answer her many questions about why and how things happen.

Her love of, and fascination with, Science did not go unnoticed by her family, who encouraged her right from the beginning to pursue a Science career if that was where her heart was. They provided everything she needed for school, even when finances were tight, to ensure she worked towards her dream. They made sure her tuition was paid in time so she was never sent home in the middle of the term as are many students in high

school. In addition, they provided a study room for her at home and assigned her minimal chores to ensure she had plenty of time to devote to her studies.

Since her early childhood years W recalls she always wanted to be a doctor because of the opportunity this would give her to give to society. She also thought a career in medicine would give her a solid financial future and respect in society. Becoming a doctor was core to her and she says of the dream, “It was just in me to become a doctor.” Her parents recall this strong drive in their daughter to become a doctor and her father says part of it was because she wanted to have a position of high responsibility in society.

W took the KCPE examination after eight years of primary school, and although she admits having some “butterflies” in her stomach, she was not really worried about her performance, knowing she was well prepared. When the results came out she was called to join a provincial girls’ secondary school in the Rift Valley province. Learning was “excellent” here, especially after form two, when the school got a new, more student-centered principal who implemented changes that “bridged the gap” between teachers and students, thus making the teachers more accessible and enhancing the learning environment.

Although W looked forward to going back to school, she says the opening day of school was a nightmare because the school was far from home and roads were nearly impassable. This meant getting all her suitcases to school was a difficult undertaking, leaving her exhausted at the end of the day. The school is located in the highland region of Rift Valley province, one of the coldest regions in Kenya, and W found the cold

unbearable at times. As she began to adjust to it, she was able to focus on the academics and did well.

Biology and Chemistry were W's favorite subjects in high school, again because of how well they answered her questions about living things and the world in general. She won a few prizes for being the best student in these subjects, and describes her Science ability as excellent. W loved Biology, finding it easy to understand and practical in that it related to "real" things she could see and touch: people, plants and animals. Chemistry was another fascinating subject in both its quantitative and qualitative aspects; how mixing different chemicals in various proportions created new chemicals with different qualities, balancing chemical equations, etc. The practical side of Chemistry, conducting experiments, mixing chemicals and creating new interesting ones, appealed to W the most.

To W, Biology and Chemistry were not about just reading for the sake of doing well in the examination; it was about discovering and she was always anxious to find out more. This excitement and fascination with Science was a confirmation that her dream was congruent with her interests and abilities and she had no doubt she wanted to do this kind of work for a career. Math and History were difficult for her, and although she was doing well in Math, she found that she disliked the way the problems would be twisted and she could not always apply the formula smoothly unlike in Chemistry or Biology where she felt the concepts were quite straightforward. W shuddered when she talked about History, recounting the experience of memorizing all the dates and names and events associated with the major world religions. She said "that just did it for me."

The high school W attended organized career days for students in form four and would invite students from the University of Nairobi to come and spend a weekend with the students, providing them with information about different majors available at the universities, the pros and cons of pursuing each career, employment opportunities available for each major and the subject combinations one would need to be admitted into the various degree programs. W noted that all the information they received was about white collar jobs, even though not everyone ends up in those careers. In addition, a career teacher in the school provided information regarding majors and prerequisite subjects for them to any student who approached him with career questions.

When the time to make career choices came, W chose Medicine, Dentistry, BSc and BEd, in that order. After KCSE results were released and the university admissions process was completed, she was disappointed to find out she had not been assigned her first choice, Medicine, or her second choice, Dentistry. This was especially disappointing because W felt well- prepared for the KCSE exams and expected to do well in the examination. When the semester began and students were given a chance to do interfaculty transfers during the first week of the term, she again tried to get into the Dentistry program, but unsuccessfully. She had to settle for the BSc option and was very discouraged and says “I was here [in college] just for the sake of being here.”

W’s family’s support was important during this time and they continued to encourage her not to give up on her dream of being in the medical field. W’s aunt who is a professor at the Dental School told her about the option of doing Biochemistry, instead of the general Science degree that offered less specialization and is perceived as less marketable. At that time Biochemistry was a relatively new major at the university and

students were told that it would offer less competition, good remuneration and opportunities to be on the cutting edge of research in Kenya. The only thing that gave W some doubt about her new major was that at that time it was a relatively new degree and she worried that some employers would not recognize it, making it difficult to secure employment. This concern was minor and W went ahead with her plans.

Even at the university level W did not like Math and wanted to avoid it at all costs, so she chose Botany, Zoology and Chemistry (other options were Double Math, Chemistry; Math, Chemistry, Botany; Math, Chemistry, Zoology; Botany, Math). After getting her BotZooChem option she felt settled and once again began to enjoy being in Science and discovering what lies beneath the everyday occurrences of the world around. Her experience differed from what she expected because she had been told that Biochemistry was a very difficult major, but she has found it not that difficult. In addition, it provided another avenue for W to pursue her dream of being in a health-related field. She intends to get into pharmaceutical research and eventually pursue Masters and PhD degrees.

Throughout her education process W has felt well supported by her parents, especially important when she was dealing with the disappointment of not getting into Medicine or Dental Surgery. They encouraged her to see that not as the end of the road but as a different route towards her dreams. Their continued emotional and financial support has been valuable, and the main reason W feels she can still hope to pursue her dream career in health care.

The family has strong spiritual beliefs and this has served as a way to cope with disappointments and find hope in the midst of difficulty. W has embraced this spiritual

aspect of her upbringing to cope with the challenges that life in college brings, and to stay focused on her goals. Her parents noted her firmness of character and ability not to be swayed by peer pressure and other external influences, describing their daughter as “very principled.” According to her mother, W set very high performance standards for herself especially in high school and would at times get discouraged if she did not meet her goals. She wanted to be sure she got high points to make it to the public university because she did not want her parents to have the financial burden of taking her to a parallel program or a private university.

W’s parents would reassure her that they would be able to educate her regardless of the circumstances life brought, encouraging her to focus on her studies and let them worry about how to finance her education. According to W’s mother, they were so determined to provide a good education for their children that they would consider selling their property (land) if that was the only way to finance higher education. They also believed in encouraging their children to have high aspirations, rather than just settling for what they thought was good enough.

W was inspired to do well by her parents’ commitment to her education, and says her mother was the person she admired the most from the time she was a young child. She was fascinated by her ability to figure things out from X-rays, the way she put together information and always seemed to come up with a solution that worked, even though she was not a medical doctor. This fascination with her mother’s career and ability further increased her curiosity about Science and especially the underlying workings of the human body, slowly influencing her towards a career in medicine.

*SCCT Constructs*

*Self-efficacy.* Self-efficacy is one of the important determinants of career choice in Social Cognitive Career Theory and there is a direct correlation between self-efficacy and goals. High self-efficacy in a subject is more likely to lead to goals to pursue a career in that field. W found Science easy and exciting and says she won a few prizes in school competitions. She talked about her performance in Science: “Science-wise I was excellent, I know. I even have a few prizes to show for it. In Math I used to perform well but it was just something in me; I did not like it.” She described her performance as excellent and said she looked forward to the exams because she felt ready for them. W’s self-efficacy was apparent when she talked about how much she enjoyed the numerous exams she had to take during primary school, “. . . it was good, excellent, being pushed to read, but we had very dedicated teachers, encouraging, many exams. It was good.”

W felt very well prepared for the national examinations and says of both KCPE and KCSE, “Of course I had butterflies in my stomach, but I was not worried because I was prepared and I knew it.” Her confidence in her Science ability was also evident when she recalled assuming Biochemistry would be difficult because of what students ahead of her had told her, but finding it was not; in fact, she found the course quite manageable, and said after she got in she felt very settled there. To W, what other students found challenging was a way for her to work towards realizing her greatest potential as a scientist, an opportunity that she embraced enthusiastically.

*Outcome expectations.* The term “outcome expectations” refers to the positive or negative consequences one anticipates when making a career choice according to SCCT theory. These determine whether a career path is pursued or not, depending on how the negative compare with the positive in the decision maker’s subjective analysis. W had

several reasons for choosing Medicine and Dental Surgery during form four, the first being that she knew this career would assure her of financial stability, an important consideration for her after seeing how her parents struggled to put her and her siblings through school. W said, “I thought doctors were respected in society and were doing well financially, socially.” She wanted to be able to provide for herself, and also to help her parents as a way of showing her gratitude for all their sacrifices in seeking to provide the best education possible to W and her siblings.

As a child, W noted that doctors were regarded highly in society, and had a high degree of responsibility, which drew her towards the idea of pursuing Medicine as a career. W’s father noted that his daughter has good leadership qualities and was even a school captain in high school, a confirmation that W was regarded highly by her peers and seniors alike. It was this leadership streak in W that motivated her to want to become a doctor and use that position to make a difference in people’s lives, a motivation that both parents noted in their daughter from a young age and one that is still evident to them.

W’s outcome expectations of pursuing an SMT career did not change even when W was forced to make another choice of major after missing admission to Medicine and Dental surgery. Her SMT career orientation was again evident when she chose Biochemistry, partly because it was a relatively new major that had minimal competition in the labor market. The information available to the students at that time also suggested that the remuneration associated with this profession was very attractive, another important consideration for W. Finally, W knew that this would reopen the doors to

medical careers which had been slammed shut by what she saw as an unfair and inflexible university admission system.

Whereas the positive consequences W anticipated were many, she was also aware from informal information channels that Biochemistry would come with one major challenge: highly rigorous course content. W had heard that the Biochemistry program was very difficult and she expected to struggle through it. Her experience was different, though, and she found it rigorous but manageable.

*Environmental supports.* SCCT theory identifies environmental supports as those factors in a person's life, whether family, school or other, that contribute to high self-efficacy and/or help reduce the impact of environmental barriers. For W, a good student right from the beginning of her schooling, her teachers both in primary and secondary school provided important support by being an inspiration to pursue an SMT field of study. They did this first by being knowledgeable about Science and eliciting enthusiasm about the subject from their students. W was amazed at the knowledge base her teachers had; their ability to answer questions about everyday happenings in scientific terms sparked her interest.

Another form of support from the school system and teachers came in the form of provision of information about university admission requirements, particularly the necessary subject combinations students would need to acquire. W's school did this by having career days where current university students would be invited to talk with high school students about their experience. This helped W get some clarity about how to allocate her study time in order to improve her chances of being accepted into Medical or

Dental School. With this information W was able to stay focused on her goals to pursue a Science career.

W's parents have been her greatest and most unwavering source of support and inspiration. Not only did they provide all her material needs for school, they also provided for her in many practical ways that helped her excel in school. A significant example of this is the study room they gave W. They also allowed her plenty of time to study by assigning her minimal chores during exam periods and when she needed extra time to complete her assignments. They also offered consistent encouragement to do well and to pursue her dream of being a doctor. Their support was unwavering even after W's failure to be admitted to the Schools of Medicine/Dental Surgery. W's parents urged her not to give up on her dream, helping her view the situation as a temporary setback in the attainment of her goal.

W's aunt in the School of Dentistry also played a key role by providing her with information about the Biochemistry option, a piece of information that proved crucial to W's planning for her future career. Biochemistry was a more appealing option than BSc General because it offered a specialization, was considered a professional degree, and would also help her towards her goal of possibly pursuing an advanced degree in the medical field, perhaps in pharmaceutical research. Having this option helped her deal with the disappointment she felt at missing her first two choices.

At the university, W reached out to other students to develop a support network in this learning environment, where interaction with professors was limited to class time, and students have to find other ways of coping with the challenges of not only academics, but also about university life in general. W sees the support of friends as one of the major

reasons she is able to deal with the challenges facing her. This group of friends continues to encourage each other as challenges come so that they can accomplish their academic and career goals in SMT.

*Environmental barriers.* Environmental barriers in SCCT theory are external factors that stand in the way of pursuit of goals, sometimes through limited efficacy-building experiences. W experienced some challenges in her education and career pursuits, the most significant of which was the Kenyan examination system/university admission process. W expressed frustration at this unpredictable, inflexible system which is not student-friendly, in her opinion, illustrated by the fact that she got A's in all her Science subjects, yet still was not admitted to Medical or Dental Surgery school because of a B+ in English. Although she felt very well prepared for the KCSE exam and was surprised at her English grade, W was still convinced she would make it into her first two university choices.

Prior to college, W did not perceive any challenges that threatened her career aspirations. The obstacles she identified were more like inconveniences that made her schooling somewhat uncomfortable but still manageable. W identified logistical problems both in her primary and secondary schooling years; both the primary and secondary schools she attended were located in very cold areas and the local infrastructure was lacking, so getting to school was "a nightmare". Students in boarding schools have to carry all they will need in school at the beginning of the term; books, clothes, toiletries and imperishable food for snacking. This usually means the typical student has several bags to carry to school on the first day of school. For students attending schools near

good transportation infrastructure this is usually a manageable fete, but for students in W's situation, this process can be extremely physically tiring and mentally stressful.

The location of the schools in the cold highland regions posed another challenge for W. Boarding schools do not provide hot water to students, and in these areas where temperatures can drop to as low as five degrees Celsius, a cold shower can be an excruciating experience. The cold classrooms proved intolerable at times, making concentration on academics nearly impossible. With time, W got somehow used to these inconveniences and still described learning at these schools as excellent.

*Coping efficacy.* A person's perception of her ability to overcome challenges is referred to as coping efficacy in SCCT theory and is a key determinant of persistence with career goals. Spirituality was the most important coping tool for W, a value instilled in her from early childhood. W was brought up in a Christian family and her faith in God formed the foundation of how she views challenging circumstances. Focusing on the positive, reframing situations and being future oriented are all strategies that helped W deal with major disappointments. She says believing in a higher power allows her to do this because she knows there is a grand plan that is good, one that she may not be able to see clearly now. She says of her faith "it is from there I get the attitude of everything happens for a reason and God has better plans for everything."

This faith helps her find the positive aspects of any situation she finds herself in. In her own words she said "I have adopted a positive attitude as my way of life" to describe how she tries to make the best of every situation including her disappointment at not getting into Medicine. She said although it takes time to get to a positive outlook when dealing with a major disappointment, she believes that all things happen for a good

reason and this helps her embrace whatever life brings. Time for spiritual activities is part of her schedule, and in fact the research interview was scheduled around class time and church time.

W held on to her faith during her time of disappointment and reached the conclusion that Biochemistry still offered her an opportunity to pursue Science as a career in an academically challenging environment. She took this opportunity still relying on her faith to understand her career destiny and said of the experience, “I realized I was meant to work hard and I realized there is something better for me in Biochemistry.” This faith coupled with her ability to take in relevant information and incorporate it into her planning process enabled her to view her new major as a different route to her original goal.

Utilizing existing social networks and creating new ones when necessary provided a strong coping tool. W’s parents’ financial and emotional support during her schooling continues to date. They are still paying her tuition and fees and providing her with all the supplies she needs. W’s mother stated that they still believe their daughter will achieve her dream of pursuing Medicine, and she makes a point of reminding W of this on a regular basis. W also said that she formed close friendships in college whose support encouraged her to keep going when the discouragement ran high. She says of this support: “My friends support me and we encourage each other. They tell me it is not the end of life and this helps me get through disappointment.”

*Goals.* Goals refer to intentions to pursue a certain career path, and are influenced by self-efficacy and outcome expectations. Goal persistence usually results from high

self-efficacy and positive outcome expectations and will eventually translate into goal behavior such as actually pursuing a certain major.

From a young age W had the unwavering desire to become a doctor and worked very intentionally to accomplish this goal in school. The aspiration to be in the medical field was influenced partly by the fact that her mother worked in a hospital. W knew much about the medical profession, what it takes to get in as well as the conditions and expectations of the work environment. Her interest in Chemistry and Biology were also congruent with this professional goal and she sought to excel in those subjects because she knew they held the key to her dream career. She said this goal was simply out of the interest she had in Science and the fact that she knew she was good in the subject and therefore would not struggle with the course content.

W exhibits strong goal persistence; even after the disappointment of not being admitted for Medicine or Dental Surgery, W still embraces the same goals, considering the possibility of going into pharmaceutical research first, then working her way to graduate school to pursue a medical career.

#### *Gender and Cultural Issues*

The data analysis process revealed several pertinent issues that relate specifically to the Kenyan culture and how that affects women's access to and participation in education. The analysis was done at three levels starting from the first and perhaps the most influential social institution, the family and proceeded to look at the same issues in the school systems and in the larger society.

*Gender and cultural influences in the family.* Families are the first socialization experiences and arguably the most influential when it comes to acquisition of values, in

this case values about women's roles and abilities and how they fit in with the larger societal needs and expectations. W's parents set out right from the beginning to bring up their four children in a way that did not discriminate against female children, quite contrary to many parents in Kenya. They said they loved all their children (two daughters and two sons) equally, and provided them with the same opportunities with regard to education.

Recognizing that Kenyan society is changing from its pre-colonial agricultural economy to one primarily driven by formal education, W's parents saw investing in their children's education as the way to ensure independence in later years. In particular they were aware of changing gender roles and the fact that women in modern Kenya need to have skills that will provide economic and social independence. Years ago a woman's way of ensuring economic security for herself and her children was through marriage because most of the resources (land, animals) were owned by men. W's parents noted that with changing times many women are opting to stay single, and having an education will provide financial and social security for the modern woman.

Awareness of other barriers that hinder girls' and women's access to and success in education, particularly in the Sciences, helped them find strategies to help their daughters, to succeed. One such factor identified by literature is the fact that many girls are overburdened by chores, meaning they lack sufficient time to devote to the more demanding SMT subjects. To counteract this, W's parents made sure they assigned her minimal chores and allowed plenty of time for study. This was important for W's success in Science subjects requiring considerably more time and effort to master.

W's parents were also aware that space for concentration on study was important, and to this end they also provided a study room separated from the household distractions. W said her siblings recall wondering why she was receiving such preferential treatment, a fact they were not too happy about then. They came to appreciate it when they reached a point in their schooling when they needed--and received--the same support.

Most people think about the kind of legacy/inheritance they want to leave their children and future generations. In many Kenyan cultures, this historically was property, mostly land and livestock. In modern Kenya it is still important to many parents to leave something tangible to their children to help them become independent, productive adults. W's parents want their legacy to be one of equal opportunity for their male and female children, and an ability to be independent even in old age. Both parents stated how especially important it is to be independent in old age, with its inevitable physical frailties, and how important it is for one to be able to provide for physical and social needs in this stage of life. To these parents, education is the key to this provision.

W's parents both are college educated, her mother a radiographer and her father a retired teacher, and W believes that through their education experience they gained a new framework for gauging parenting, education and life issues in general. Being open, flexible people in general played a big role in their ability to integrate the new values into their existing value systems. W believes this exposure formed the basis of her parents' determination to provide the best education for their children that they could afford.

In W's family all the children were offered the same opportunity, and work was divided fairly, thus giving everyone equal access to academic achievement. W described

this fairness in the following simple statement, “What he can do I can do and what I can do he can do” By this she meant that her parents did not have different expectations of their female and male children but rather treated them all fairly based on their abilities.

This provision of equal opportunities has meant the freedom to pursue whatever career one chose and W, the first born, and her sister who follows her, have chosen to be in Science (her younger sister is a first year student in Actuarial Science). According to W’s parents even the younger children who are in standard seven and eight are showing high Science aptitude and interest, and they encourage them to pursue that if it is their dream.

*Gender and cultural influences in school.* Schools provide another important socialization process whose influence is critical in shaping societal and individual values. Students in Kenya spend a lot of time in schools, inevitably absorbing the values of the teachers and possibly peers they engage there. The typical day for a Kenyan student in primary school is from 7 am to 5 pm, sometimes extending to 7 pm with extra tutoring. Boarding schools, the norm in secondary school education and quite common in primary education, mean that parental influence is not constant during later childhood and teenage years. Teachers then become the key people shaping the lives of young people; the values they hold regarding gender and education determine the messages they send both consciously and unconsciously to their students.

During her younger schooling years W did not perceive any differential treatment based on her gender, mainly due to her high achievement from a young age, and also due to her attending girls’ boarding schools for a significant portion of her life. In the girls’ boarding primary school the teachers focused on teaching the students, setting high

expectations for all the students, and to W this translated into a feeling that she was perceived as capable of excelling in academics. When she went to secondary school the same pattern of high expectations continued, again based on the fact that she excelled in her Sciences and Math at this level, also, and there was nothing that could stop her from pursuing SMT.

College was a significantly different experience, and W found herself encountering professors and classmates who do not think women should be in a Science major like Biochemistry. She said most of the people she has encountered in her college learning environment have the opinion that the women in the class should not be doing as well as the men. In her words, “Everyone, with few exceptions, believe that a man should perform better than a woman, so there is always this issue of you perform better than a guy and people are like, ‘this woman is doing better than you so you need to perform better.’ It is like we are supposed to be below the men and that pushes us to work harder, so they can see we can be ahead of them. That is very common around here. You wonder why they should think you are lesser than they are.”

To W, this attitude from the professors and classmates pushes her to work even harder to realize the full potential of her Science ability and prove to the men that indeed her stellar performance is no accident: “The men in the class feel bad that a woman is doing better than them, and this motivates me to work harder than ever to prove to them that I really am good at this. It pushes us all to work harder so they can see we can be ahead of them.”

W shared that the other women in the class shared this sentiment and they all believe it is their responsibility to change the perception of women as inferior. She

believes that in so doing, they are making a strong statement to their classmates and to society at large that women can do just as well as men, sometimes even better. To W this attitude is surprising in this day and age, and more so in the Biochemistry program where there are just as many women as men in the class. She believes that change in the perception of women in the Sciences and in society in general is long overdue, and she hopes to make a difference in bringing about this change.

*Gender and cultural influences in the society.* The third level of analysis for the gender and cultural influences on women's education is the broader societal level that encompasses the family and school influences. Being a woman in SMT is an identity that follows W wherever she goes, including informal social settings. W finds that when people realize she is doing Biochemistry, they tend to defer to her and treat her differently. She says although it is not bad treatment, this kind of reverence is not helpful and she feels she should be treated like anybody else. In her own words, "Some people think you are really tough, that you are really bright, and say such things. Some people elevate you high, they overdo it sometimes." W dislikes this kind of attention that she refers to as "too much respect" as it makes her feel uncomfortable. She believes she is just an ordinary person pursuing a career, and would like to be treated that way.

Although deferential treatment is the case most of the time, occasionally W will come across people who openly verbalize that she is a male career and should not be there. "Sometimes you do things and people are like, 'You are not supposed to be doing that--you are a woman.'" She has learned to brush off such comments and continue undeterred with her educational and career goals. To W, her family's unwavering support

of her education is all she needs, and she has resolved not to let other people's opinions dictate the path she follows in her education, career or even socially.

### *Participant X*

#### *Case Story*

Participant X was born and raised in a semi-urban town in central Kenya in a family of four children; two daughters and two sons. Her parents are both in the Sciences, the mother being a Biology and Chemistry teacher and the father an engineer. X's mother reports that from a very young age, as early as preschool, X showed a keen interest in why and how things happened in her surroundings and was constantly asking questions. Her mother noted this awareness of the surroundings and the curiosity that followed, and sought to nurture this in her daughter by answering the questions X posed.

X went to a public primary school with very high academic standards and enjoyed her schooling there. She especially loved Mathematics and Science and says it was evident the Science teacher enjoyed teaching and subsequently made class a lot of fun. He would divide the class into teams and have them compete to answer the most questions for points. This made class and learning fun for the students, X recalls. He also had a way of teaching that was different from the other teachers in X's experience. He would make many diagrams to illustrate the concepts he was teaching and this made it easier to grasp Science. X says her Math and Science performance was excellent, reflecting her ongoing curiosity and about life around her. X says, however, that in primary school she was not in any way linking her schooling with her prospective career, and says any influence then was minimal, perhaps just laying a foundation of positive learning experiences.

X remembers aspiring to be a doctor when she was in primary school, an interest springing from her love of helping and making a difference in people's lives and in society. This dream did not last long after X started hearing stories about medical school that discouraged her from thinking seriously about Medicine. Her mother recalls that some people told X that in medical or pharmacy school the first thing students do is to dissect a cadaver, a thought that turns many potential health workers away from those fields.

In primary school X's parents were very supportive, making sure she got everything she needed for school. They also encouraged her to have some non-academic activities to avoid putting too much pressure on herself to the detriment of her performance. This was quite contrary to what other parents were doing at the time, taking their children to after-school tutoring as well as vacation tutoring, ensuring their children were not getting any break from academics. At the end of primary school X took her KCPE exams and did well, despite feeling somehow nervous at the idea of being examined for eight years' worth of work in just three mornings. In fact, she was among the top ten students in her class and was admitted to a provincial girls' school in central Kenya.

The good performance in Math and Science continued all the way through high school. Her natural abilities and interests were further reinforced by the teachers in high school. X states that her Math teacher was consistently involved and devoted time above and beyond what was required of him by the school. He also was patient with the students and this helped them understand the concepts well without being pushed too hard. Noticing her Math and Chemistry ability, other students sought help from her and X

would find herself devoting substantial amounts of time to helping the students who were struggling with the subjects. After some time and discussions with her school principal X realized she needed to cut down on the amount of time she was devoting to others so as not to affect her own performance, a fact that was not easy for her because she loves helping others.

In high school X's parents made sure they paid her tuition in time so she was never sent home for non-payment of tuition, a regular occurrence in high schools that makes students fall behind in class work. They also gave her guidance regarding non-academic issues and helped her work through developmental concerns of adolescence that sometimes get in the way of academics. X's mother says she gave her daughter permission to talk to other confidants that she trusted about any challenge that she was facing if she did not feel comfortable talking about it with her parents. According to her mother, X was able to forge close relationships with some spiritual mentors, and their support contributed significantly to her ability to face the challenges she faced during her schooling.

One such challenge X faced was a problem she developed with her eye when she was in form two. The lid started drooping, affecting her appearance, her self-confidence and even her performance as she became preoccupied with this condition. Fortunately the problem resolved itself just like the doctor had promised and X was able to focus again on her academic performance. During this time X's parents, especially her mother, would talk to her and reassure her that this was only a temporary condition and this helped her adjust well.

High school classroom experiences in Math and Chemistry were positive, and X realized that she found both fairly easy to understand, needing only to learn the basic concepts/formulas well and to apply them to different situations. She described her ability in these subjects as excellent. This was unlike her experience with the Arts and Humanities, where she found herself spending much time memorizing dates, names and events, a task she found highly unappealing. She also found that although she was good in Biology and Physics, there was more memorization required for these two Sciences and she did not enjoy them as much.

High school was when her parents realized that she had exceptional ability in Math and Science, and encouraged her to pursue a career in related areas. On her part, X did not want to consider doing anything Medicine- related because of the discouraging information she had received from peers about Medicine; instead she was considering choosing a business-related career. She was considering Accounting, Banking Management or general Business Administration.

Seeing her daughter's potential in Math and Science, X's mother worked to counteract earlier misleading information by providing her daughter with more accurate information regarding what to expect if she chose to do Medicine or Pharmacy. She also reminded X that she had great ability in the Math and Science areas and should choose a career that could build on this potential. During high school X also started thinking about her likes and dislikes, as well as her strengths and the needs of the society around her. She realized that she did not possess the qualities to be successful in business, because of her quiet non-competitive nature.

In form four when it was time to make choices regarding majors to pursue at the university, X chose Pharmacy, BCom, Computer Science and BSc. She said the decision to pursue Pharmacy was inspired by a quote she had heard regarding how to choose a career, “Where the world’s greatest needs meet with your heart’s greatest desires.” Although Medicine would have met this criterion of great societal need, and would have been her parents’ preference, X knew that she wanted something that required a little less interaction with patients. Pharmacy still looked like the better choice.

Another influencing factor was the knowledge that with a degree in Pharmacy she would readily find employment after graduation. The other options she was considering would mean more competition in the labor market because private universities also offer Business courses. The final influence to choose Pharmacy was the fact that Math and Chemistry were her favorite subjects and she knew that a degree in Pharmacy entailed a hefty amount of each.

X’s performance in KCSE was very good and she got all A’s in Math and the Sciences. At that time the admission process had changed slightly and students were given a chance to revise their major choices after seeing their exam results. Her father suggested that she obtain the forms to change to Medicine or Business, two options he felt were better than Pharmacy. X did not want to change, but took the forms home anyway because she had a week before she had to return them. After discussing this for a week with her parents, they let her keep her first choice as Pharmacy.

College was a challenging, but also rewarding experience, because X was doing exactly what she wanted to do in life; use her Math and Chemistry skills and help meet the society’s needs. The coursework was demanding with classes lasting from morning

till dusk, the workload requiring working in study groups. There was another challenge in the form of a seldom-spoken- about rivalry between Pharmacy and Medicine students, with the latter having the opinion that pharmacists are not really necessary because the doctor is the one who sees the patient and prescribes medication.

To these medical students the pharmacist's work is just to hand out the medicine which they say anyone can do. This prejudice was difficult to face because X loved what she did and knew that pharmacists have training that serves certain needs in healthcare. She said she clung to this understanding when she felt discouraged, and also found that her friends in Medicine, including her sister, would ask her for help with some of the drug-related coursework requiring more Math skills, and this validated what she was doing.

Another challenge that X faced in college came in the form of male colleagues who believed that Pharmacy was not an appropriate major for a woman. Although in the minority, these male students were especially vocal about their opinions. X cited one student in particular who so disliked the idea of having female classmates that he would not sit next to any female student, instead pushing his desk as far from them as possible. This behavior was irritating not only to X and other female members of the class, but also to other male students who saw his behavior as clearly inappropriate. Although this behavior made the learning environment somewhat unfriendly, X was not bothered much by it, perceiving it rather as a personal growth issue of this particular student.

Mentoring was also important as X progressed through her academic program. She reported feeling fortunate to have a friend a year ahead who acted as a mentor by teaching her the ropes and telling her what to expect at each step in her academic career.

X says this mentoring was invaluable to her, and laments that not many students have someone to mentor them through their academic and employment processes. In fact she said that by the time she graduated, most of the pharmacists she knew were her professors and one or two students in the class ahead, meaning most of the students in her class did not have a mentor in the profession.

Throughout her education X's parents provided everything she needed for school, and even more, when they could afford it. They made sure that the initiative to pursue certain educational paths was their children's, and did not push them to study when they needed a break, or to take subjects they did not like. They also instilled in her a strong spiritual grounding that she embraced when faced with difficulties, even through college when parents are not there to guide their children as closely as before.

Because of the societal expectation that girls do not have Math and Science ability to the same extent as boys, X's mother said that she and her husband talked to their children to counteract this, or, to use her words, "get those myths out of them." In addition, their children could see from the fact that both their parents were in the Sciences that Math and Science ability is not related to gender. The parents were very inspiring to X and she says she admired them as professionals. She says her father in particular was her hero and inspired her with his dedication to striving for excellence in whatever he does, as well as for his good leadership and interpersonal skills.

#### *SCCT Constructs*

*Self-efficacy.* Self-efficacy refers to an evaluation of one's abilities and in this case, Math and Science subjects. X exhibited high self-efficacy and described her ability in Math and Chemistry as very good or excellent. In her words, "I was pretty, in fact,

very good in Math and Chemistry. Biology and Physics I was fairly good, more memorization is required for these.” This ability was reflected in her KCPE results where she said she and her twin sister did better than most their classmates in the exam. During high school, X’s exceptional performance in the Sciences saw her being approached by several students for help, particularly in Mathematics and Chemistry. This was further confirmation that she had high ability in those areas.

Her perceived abilities and objective abilities are highly congruent, seen from the fact that X describes her ability as excellent, which was reflected in her performance throughout both primary and secondary school. This ability was confirmed by X’s mother, who reported that her daughter had all A’s in the Science subjects and Math, a feat only a small percentage of students accomplish. This congruence between perceived and objective capabilities in Mathematics and Chemistry made the choice to pursue Pharmacy a relatively easy one for X, since it required in-depth knowledge of both subjects.

The self-evaluation of competence was also evident as X described her education experience at the university. She talked about finding the coursework manageable, not difficult as some students perceive it. She said her Math skills came in handy especially during the classes where they had to do pharmaceutical calculations for various drugs. The medical students who were her friends (her twin sister included) also had to take a similar class, although less advanced, and they would come to X to request help because they knew she excelled at it.

*Outcome expectations.* The term “outcome expectations” in SCCT refers to what one expects to follow a decision to pursue a certain educational or career path, and are a

key determinant of SMT career goals. To X the reasons for pursuing a Science career far outweighed the reasons not to; in fact, the negative outcomes were influenced more by inaccurate information she received from peers.

X cited several reasons for choosing to pursue Pharmacy, the first being that she wanted a career in healthcare. To X, the greatest need in Kenyan society is in healthcare, where access is still a major challenge and many people lack easy access to medical professionals. Knowing she would be able to make a difference in that field, with opportunity to help many people badly in need of medical care, X cited this as one of the most satisfactory aspects of being a pharmacist. To her making a positive contribution to society is the most important thing she can do.

Another reason for pursuing Pharmacy was knowing that with this degree employment would be readily available and she would not have to “tarmac”. In Kenya students in SMT majors such as Medicine and Pharmacy get job placements as part of their academic program and they end up being permanently employed relatively fast, unlike Arts or Humanities graduates who sometimes can remain unemployed for years post-graduation. This was an attractive prospect to X, especially in the Kenyan economy where the official unemployment rate is 49% as reported by the Minister of Labor in May 2009. A related advantage was the relatively attractive remuneration that goes with a degree in Pharmacy.

*Environmental supports.* Environmental supports are external factors that provide efficacy- building experiences and provide a buffer from barriers and other negative environmental influences. X’s parents were the biggest support to her education and career pursuits, and their value of education influenced the decisions they made with

regard to their children's education. They were always there to support their children; first and foremost, by choosing a good primary school having the highest performance standards in the area. This particular school has a few years' waitlist, making admittance harder. Yet, knowing this school would provide a quality academic foundation for their children, they did all that was necessary to ensure their admission. They also made sure that their children, X included, had all the basics they needed for school. Tuition and fees were paid in time so the children never got sent home from school.

Another form of support came from the awareness X's mother had that there may have been some issues her daughter would be uncomfortable talking to her about. With this in mind, she made sure there were good Sunday school teachers that her daughter could talk to and encouraged her to turn to them. She said, "I gave her the freedom to talk to other people she could trust, you know there are fears/problems that girls have and they have no one to tell . . . I know there are some Sunday School teachers she was able to open up to and they have helped her a lot." This added support meant that X was surrounded by people she could confide in whenever difficulties arose, an important advantage, because talking and praying about problems is usually her first response to challenges.

Family support also came in handy during secondary school and career prospects became a topic of discussion. This was when X's mother realized that her daughter had received some discouraging information about careers in healthcare and she set forth to counteract this first by pointing out to her daughter that X had the ability to pursue such a career, and then offered her more accurate information about what to expect in the School of Pharmacy. This information helped, and X began to realize that her fears were largely

unfounded. After further reflection on her personality and strengths, she went ahead and chose Pharmacy.

X's parents were not pushy although they wanted their children to do well. They encouraged their children to take time off school work to relax and pursue extra-curricular activities. X talked about this experience: "In primary school our classmates used to go for after-school tuition and also for holiday tuition, and we used to think they would beat us in the exam. We used to go home in the evening and my mom would say, 'You just relax, do your homework, play, watch some TV and sleep.' She would do the same during school holidays. In the end we did better than all of them." This helped X feel relaxed and balanced, and she believes the reason she was able to do so well in the exams was because she did not feel the kind of intense pressure and stress that her peers did.

Mentoring was also crucial to X during college where X said she had a friend who was one year ahead and he talked to her about what to expect during her four years in Pharmacy School. X learned from him how much she needed to plan for her work, and the fact that groups would come in handy for some of the classes. This knowledge helped her feel prepared and she was not caught by surprise, as were many of her classmates who did not have any mentoring. X said she is grateful to have had this support, and believed that life in college would have been more stressful without it.

*Environmental barriers.* Environmental barriers in SCCT are those challenges that have a negative influence on self-efficacy, outcome expectations and goals. One major challenge that X faced in her quest to choose a career congruent with her abilities and interests was the misleading information that she received from peers about the

coursework in Pharmacy. It is common for students considering a career in the medical fields to be discouraged by peers with “horror stories” about having to dissect a cadaver during the first class. Hearing this, X had decided not to pursue her dream career, and instead considered a business career.

Exacerbating this misinformation was the fact that there was no career guidance from the school to correct this misinformation. X says that the only careers the students heard about from alumni or from visiting colleges and universities were all in Business, and no one talked about Science careers. She said, “Contact with those ahead is lacking and is so important. Like in high school I don’t remember anyone coming to talk to us [about Science]. It was mainly universities that offer business courses.”

X noted the lack of career guidance especially when students were choosing majors in high school: “We never get forums to meet other pharmacists and never get someone to tell you what to expect, which is important especially in high school before you make a career choice so you know what to expect. Most people choose blindly and it has become all about what grade you get determines where you end up, not what you are interested in.” X was talking about the university selection process where students are not guided to discover their interests, but are advised on what major to choose based on their anticipated KCSE grade.

Another potential barrier was the rigid examination system in Kenya, which does not offer continuous assessment of abilities and skills. Although X did very well in the national exams, she felt that it was not a fair assessment of students’ abilities and was nervous when taking both exams. She says taking an exam after eight years of primary school fails to take into account many factors, such as how much a student has learned at

different grades and other environmental influences that are out of the control of the student. The fact that a student's entire future is based on this one exam makes it even more anxiety-provoking. X's parents, especially her mother, stepped in and made sure their daughter had adequate time to relax and pursue activities not related to academics.

X's mother noted that differences in socioeconomic status of parents can sometimes affect students negatively, especially in boarding schools, where students bring with them items that reflect their lifestyle. These inequalities are more evident in national and provincial schools where parents' professions range from diplomats and high-ranking government officials to subsistence farmers. This creates feelings of inequality among the lower SES students and can sometimes lead to distress. X's mother said the school her daughter attended had students from many SES levels and the students from wealthy families would come to school with shopping items that "would fill five boxes."

X's mother says her daughter, and other students, too, would sometimes want to have what their peers had even though it was not financially feasible. X's mother noted that she and her husband would have discussions with their daughter if there was something she wanted and they could not afford to get it for her. X's mother said her daughter was very agreeable and understanding of the fact that her parents could not buy her everything she wanted. She was able to appreciate that they were able to provide her with all the necessities she needed to be successful and comfortable in school.

*Coping efficacy.* Coping efficacy refers to how one rates one's ability to overcome barriers that are education and career related. X believes she has a good ability to cope with challenges and rates this efficacy as above average, a six or seven on a scale

of one to ten. She admits that major challenges in her education and career have at times felt overwhelming because she wants to excel in all she does, and the obstacles are a reminder of the fact that failure is a possibility. X, however, says she is able to overcome obstacles because over time she has developed a repertoire of tools that she uses when difficulties arise, the most important of which is her Christian faith.

X developed this strong faith from being raised in a Christian home and seeing it not only modeled to her in the family, but also in church and in spiritual mentors who taught her and supported her from a young age. This upbringing instilled in her a deep belief in God which has helped her cope with difficulties that have arisen in the pursuit of her education and career goals. She spoke about her spiritual beliefs. “My faith plays a big part in how I deal with issues. I read my Bible and go to church on a regular basis and I believe God has a good plan and a good future for me. He is my creator so I believe he has a purpose for me here and I consult with him on issues.” This spiritual stance was confirmed by X’s mother, who talked about the values they instilled in their children, “We made sure they fear God . . . to know . . . that where mom and dad cannot reach, God will see them through, and I know that has helped them all the way, even through university where life is very, very difficult for girls.”

This faith also gives X the ability, when faced with challenges, to reframe situations in light of the grand picture she believes God has for her, and this helps her see the situation in a less negative and distressing way. An example was when she faced rivalry with the medical students and saw that they needed her help in some coursework. At this point she realized that in fact what she was doing was valuable and there was a

purpose for her, and a need for her chosen profession. She was able to see the rivalry as a pride issue with the medical students.

This reframing strategy was also helpful when X and her friends were confronted with a male classmate who did not like being the same class with women and did not hide his feelings and opinions about it. X was able to see the issue as his problem, something that he needed to deal with, not her, and was able to ignore him for the most part. She said, “I just thought he was shallow-minded and did not let him influence me.”

X also relies on her network of family, spiritual mentors and friends when faced with difficulties, and she goes to them to talk about many challenges she faces. She said that she likes to talk to people she is close to just to get the issues off her chest, but also to use them as a sounding board for ideas she may have about how to cope with the distressing situation. Although X seeks out other people’s opinions on challenges she faces, when she receives advice that is contrary to her [beliefs and values], she is able to take a firm stance on issues she feels strongly about. For instance, when X’s father wanted her to change from Pharmacy to Business because he perceived the labor market to be more favorable towards a business degree, she was able to stand her ground and persuade him to see her point, and eventually she kept the former as her first choice.

*Goals.* A goal refers to the intention to pursue a particular career path, and is largely influenced by one’s perception of abilities as well as anticipated consequences. From a young age X wanted to be a doctor, a career aspiration arising out of a desire to help others and also influenced by the knowledge X had from a young age that she was good in the Sciences and had the academic aptitude to get into medical school.

At some point in X's schooling her goals changed somewhat, not because of her perception of her abilities, but because she was misguided by peers about what to expect in medical school. The information going around was that the very first class involved dissecting a cadaver and X did not think she could go through that at the beginning of her program. She reluctantly began to revise her goals and thought that a career in business would be more manageable on an emotional level. This stance did not last long; as X progressed in school she found that her liking for Science and Math subjects continued to grow. She started to question whether a business career was really what she wanted to do for the rest of her life.

The reasoning behind her earlier goal of medical school started to gain clarity during X's secondary schooling years when she began to think about the needs of society and her preferences for Science. At this point she realized she wanted a healthcare career. This decision was made possible by information from X's mother, who helped her see the congruence between her interests and abilities and a medical career and also gave X accurate information about the coursework in Medical and Pharmacy school. In addition to choosing a career that enabled X to put into practice the subjects she loved in school, namely, Math and Chemistry, she also knew that she wanted to make a positive contribution to society. Pursuing Pharmacy accomplished both goals.

#### *Gender and Culture Issues*

In this section I have included the issues relating to gender and the Kenyan culture in general that arose during the analysis. This was done on three levels starting with the family, perceived to be most influential in forming gender values of education. This was followed by a synthesis of how gender and culture shape the school experience; and

finally an analysis of how societal perceptions of being female and pursuing SMT education have affected the women.

*Gender and cultural influences in the family.* X's family was the most influential to her views on gender, and it was in this social unit that she learned and adopted the perspective that Science is not an academic pursuit for males only. Seeing both her parents pursuing and excelling in Science careers, as well as not being treated differently from her brothers, formed the foundation of X's Science efficacy and SMT career aspirations. In this family all the children were treated the same and given the same opportunities and responsibilities.

As a teacher, X's mother was aware of the stereotypes that Kenyans have regarding women's abilities. Even today she experiences biased comments, citing people who say she looks like she should be teaching Home Economics as opposed to the two Sciences she teaches, Biology and Chemistry. Having this experience and knowledge helped her shape her children's educational aspirations by talking with them about these biases that have led many girls to believe they have inferior abilities in the areas of Science and Mathematics.

X's mother was impartial in her expectations of her children and did not offer differential opportunities or responsibilities based on gender. X says of the experience of growing up, "I can't say we were ever treated differently from our brothers. My mom especially has tried to make things equal between us. She makes sure there is no role for us and a different one for my brothers when it comes to things like doing dishes and other responsibilities like cleaning the house." This was significant because being overwhelmed with household chores is one of the major reasons female students fail in

the Sciences, lacking enough time to devote to their studies. In X's family this burden was shared equally among the male and female siblings, along with hired domestic help, with the result that all the children who have gone to college are in SMT careers; X's twin sister is in her last year of Medical School and her younger brother is doing Architecture.

X's mother strongly believes it is important for parents and teachers of girls to actively counteract stereotypical messages to increase the breadth of career aspirations that accurately reflect their abilities. She also lamented the gross misinformation that students have in general regarding career choice, which compounds the problem of gender-typing of abilities, giving an example of when her daughter was afraid of choosing a health related career because of the information she had heard. All these are challenges she was aware of and actively set out to counteract in the family setting using regular dialogue.

Kenya's education system is highly competitive and achievement oriented, and many parents and teachers push their children too hard, creating extra stress. X's parents were aware of this trend and its harmful consequences on young children, and did not want their children to be subjected to this intense pressure to succeed. They therefore made sure their children had plenty of time to just be children, to play and relax. X credits her good performance in the examinations to this attitude of her parents, enabling her to perform at her optimum level without being pushed beyond her limits as happens with so many children.

X's mother also was aware of developmental concerns girls have especially during their high school years and how lack of guidance and support allows these issues

to get in the way of education. In particular she mentioned how young girls seem to experience challenges to their self-esteem as they grow and develop, and how important it is to have enough support during this time. Aware that her daughter may not always be comfortable telling her everything she was dealing with, X's mother made sure that there was always a trusted friend, sometimes a spiritual mentor, that her daughter could talk to about these issues. She said this was so helpful that her daughter has maintained close friendships with these mentors to this day.

*Gender and cultural influences in the school.* The education experience is an important socialization process and this is more so in Kenya where students spend long hours at school, and especially when they attend boarding schools where peers and teachers are the most influential people for most of the school year.

X's experience of school was one of gender parity for the most part. She went to a prestigious primary school where she did not feel discriminated against, and because she was an excellent student she got even more attention and support from the teachers there. This further reinforced her confidence in her abilities and consequently her career aspirations. Her stellar performance in the KCPE examination saw her admitted to an all girls' provincial secondary school and here again, the experience was positive and X did not feel like she was treated differently because of her gender. Her teachers saw her as a good student who did not need help to improve her academic performance, hence X relied on self-direction and determination during this phase of her studies.

When X joined the School of Pharmacy, she was one of the few women in SMT careers not to be in a male-dominated classroom; there are more women than men in the Pharmacy program. This is due to the fact that Pharmacy, like Medicine, is one of the few

SMT majors that admits at least as many women as men, possibly because these Sciences are seen as more “feminine”. At the university, X did not perceive any differential treatment by her professors based on her gender, and feels fortunate to have had this experience.

Despite the fact that women outnumbered men in the classroom, X found that some male students were uncomfortable with the idea of being in a Pharmacy class with female students. She gave an example of a male student who was very vocal about his disapproval of women pursuing Pharmacy as a profession, and felt he should not have to sit in the same class as a woman. He made a show of putting distance between his desk and that of the nearest female classmate. Although X and the other students were irritated with his behavior, they were able to dismiss his behavior and not let it influence their learning process or how they viewed themselves. She expressed her opinion of his behavior, “In campus sometimes some of our classmates were really shallow; they did not believe they should be in the same class as a woman, but that was a small minority of the men. That did not influence me; I just thought they were shallow minded.”

Whereas gender was not a direct challenge in the academics, other cultural issues relating to perceived power hierarchies in society and specifically in careers, became evident. This was in the form of rivalry from students in the School of Medicine who frequently voiced the opinion that Pharmacy is a redundant career, their reasoning being that doctors prescribe medications and all the pharmacist has to do is to give it to the patient. According to these students, a degree in Pharmacy was not required to perform this task they considered mundane. X found this very disconcerting because she had

chosen a major that she felt excited about and she knew that the health care sector needed professionals in this area.

X's mother raised another important challenge relating to life at the university from the perspective of female students. In the Kenyan culture male-female relationships are highly imbalanced and female students find themselves at risk of being in relationships that do not honor them as equal partners. Many times this is the result of older working men seeking relationships with college students and many times using their financial resources to create inequality in the relationship. Other times this is the result of men in the more advanced classes approaching the relatively new students unfamiliar with life at the university. X's mother said her daughter was able to avoid these negative influences because of her strong character and religious faith. X was able to surround herself with friends who shared similar values and these friends have supported each other through difficult academic and social times at the university.

*Gender and cultural influences in the society.* X's experience of being a Pharmacy major, and now a Pharmacist, is that people tend to treat her differently, not in a negative way but by elevating her to a position of deference. She expressed the discomfort she feels about this kind of treatment: "They give me more respect than I deserve." X believes she should be treated just like everybody else and not given preferential treatment. Sometimes her professional pursuits have meant that people expect her to give professional advice even in social settings, frequently approaching X with medical and pharmaceutical questions. X speaks of this experience, "It places too much responsibility on me. A lot of times they will expect me to know more than I can say I know and sometimes I am caught off-guard. I don't always have everything at my

fingertips and I feel like I have failed them in a way. Sometimes someone will come and say ‘I am feeling this way’ and I can’t give them an answer immediately and they don’t understand. It’s a lot of pressure.”

X believes that the pressure she faces is different from what a male pharmacist would face, because in her situation, people seem to have underlying assumptions that she is doing something extraordinary and are constantly testing her to see if she really is competent in what she does. For a man in a similar situation there is less pressure because people already assume he is competent; he is not required to prove himself. To X, this double standard just goes to show that although there is equal participation and access for women in the School of Pharmacy, societal expectations still need to change to a point where women do not feel the need to prove themselves in whatever career path they choose to pursue.

### *Participant Y*

#### *Case Story*

Y was born in a semi-urban area located in the highland region of central Kenya. She was the third born of five girls. Y’s father is a doctor and her mother a Biology teacher and both strongly believed in the importance of getting good grades in Math and Science as the way to get more doors to open for their five daughters. They impressed this fact upon their children from a young age and encouraged them to put extra effort in these subjects. Y reports that from a young age she knew that she would have more opportunities if she performed well in Mathematics and Science.

From a very young age, Y’s mother noticed her daughter had an interest in numbers and would observe her categorizing and counting various items she came across

at home, such as fruits. When food was put on the table Y would sort out the various food groups and count how many items were in each category, something her parents noted with interest. As she advanced in school, her mother again noted that she could learn Math concepts with ease, such as her multiplication tables, which she mastered faster than her classmates or even her siblings.

Y went to a private primary school and describes this experience as non-significant to her career choice because “you go to primary because you have come of age, what else do you do? Go to school.” She says she really did not care much about the subjects she did or the grades she got at that level because she was too young to know how the grades would impact her future. Although Y’s experience of primary school was simply going through the motion, she recognizes the significance of her parents foresight in choosing the private school they did, because that meant she got to experience a solid educational foundation, even though she did not realize it at the time.

During her primary school years Y wanted to become a pilot when she grew up. This career interested her because of the challenge of flying an aircraft and the depth and breadth of the knowledge required to master the intricacies of the cockpit. At some point she also considered being an air hostess because she admired how professional they looked in their uniforms, as well as their elegant postures. These career dreams faded because she thought “it was too crazy up there, anything can happen.” So she was back to square one, having to figure out once again what she wanted to be when she grew up. Y’s mother says that at some point her daughter started thinking about pursuing an Accounting or other Business career, as long as it was Math-oriented.

Participant Y's memories of her Math and Science classroom experiences are vague but she remembers she liked Math and won at least one Math contest in primary school. This prize was among the first experiences she had that helped her realize she that not only was she good in the subject, but she also enjoyed it. Business Education was another class that Y enjoyed in primary school and was one of her first inspirations to pursue a career in business. Y says her final grade in KCPE was nothing out of the ordinary, with the exception of Math, in which she got an A. This average grade did not really matter to her at this point as she was too young to know how her school impacted her future.

After primary school Y attended a provincial girls' school in central Kenya and recalls that she did not really know what she wanted to do with her life in terms of careers. She said in form one and two she was still dealing with issues of peer pressure and other developmental issues to give much thought to her future career possibilities. Her mother reports that her daughter's high school Math teacher had low performance expectations of her daughter and would rate her performance as good when her mother actually thought she could do better. To make matters even worse the teacher was not prompt in giving feedback on assignments and this frustrated Y because she had a great desire to improve her grade in the subject. This, coupled with the fact that so many of the girls in the school hated Math and tried to get others to think the same way, further discouraged Y from pursuing her goal of Math excellence.

In form three when the Math classroom situation did not improve, Y and her parents agreed that she needed a private tutor to help her get a different perspective of her ability and performance. Y's mother says that the tutor very actively counteracted gender

stereotypes regarding Math and would frequently tell the students that Math is a practical everyday tool, whether one ended up being a stay-at-home parent, a small business operator or a business executive. She impressed upon the students that both boys and girls could do well in Mathematics, as well as the fact that learning Math was not just about getting a good grade but about acquiring a very important life skill. The tutor also identified the Math aptitude Y had and pointed that out to her frequently and helped build her confidence that she was capable of more than what her regular teacher said. In fact, she credits her exceptional Math grade in KCSE to this tutor.

This inspired Y in several ways, first by helping her gauge her performance based on different standards than she had before when she had to rely on her school teacher, and secondly by the mere fact that this was a female Math teacher who was very good at what she did. Thirdly, the tutor stepped in and provided feedback that the regular school teacher did not. During the school term, Y's parents would go to school every few weeks, collect her assignments for that duration and take them to the tutor to grade, then bring them back. This was not always easy and the parents risked angering the school teacher. They however knew that they had to do everything in their power to help their daughter excel and explained this to the school principal who was very understanding and urged them to continue with their plans.

Y was the best student in the Math class and her school teacher assigned her two girls to tutor to help improve their performance. This served as added validation of her ability in Math. Math was the only subject she looked forward to, doing the others just because they were required and she had no choice. Her love of the subject and the

support she received from her tutor resulted in her getting an A in the KCSE exam, the only A she achieved in that exam.

At some point during high school some alumni of her school got together and came to talk to the students about careers. One of them happened to talk about Actuarial Science. At that time Y had no idea what career she wanted to pursue; the only thing she knew was that she wanted to do something Math-related, so Actuarial Science instantly struck a chord with her. When it came time to choose her university majors in form four, Actuarial was not an option that was available at the public universities back then. At the end of high school Y sat her KCSE exam and the experience was not positive: in her words, “KCSE got me.” She reported not knowing what to expect and the process being stressful with a lot of pressure put on the students to perform well or “become failures.”

When she did not make it to the public university, Y and her family started looking at other higher education options. At one point Y happened to come across an advertisement of a new degree in Actuarial Science at one of the parallel programs at a public university. She remembered how impressed she was during high school when an alumnus talked about the work that she did using her degree. There and then Y made up her mind to apply, noting that they only required good grades in Math and English, in both of which she did well. When she told her parents her plans, they were at first concerned because they thought the program would consider the “cluster” of subjects the regular public programs did, and they knew their daughter would not be accepted if that was the criteria. They supported her fully, however, and encouraged her to move ahead with her plans. The day after seeing the advertisement she travelled to Nairobi and

applied for the program. Pleased to find that indeed the only subjects they considered were Math and English, she went ahead and turned in her application.

Y was accepted, one of the very few female students to join the new program. The program was intense with classes starting at eight in the morning and ending as late as nine at night. Y says, “school became my friend.” The academics were rigorous and difficult, and she thought about quitting many times during the first two years. In Y’s own words, “You do calculus seven and you are thinking, ‘What did I get myself into?’” The only thing that kept her going was the fact that this was her choice and her parents had given her freedom to pursue her dreams with their full support; the thought of disappointing them kept her in the program. In order to survive the difficult classes, Y and the other female students formed study groups and supported each other during the process.

During the difficult times, Y kept her mind focused on the fact that other people had finished the program, including the woman who had come to her school to talk about Actuarial. She also knew that if she persevered and graduated she would be in a position to inspire other girls to consider pursuing Math and Science careers. Y got through the coursework and during her final term found an internship with an insurance company. She did well at the company and was finally offered a job at the same organization two months post-graduation.

Working as an investment advisor has been a journey of challenge and excitement and Y says she is enjoying her work, still intrigued by how much there is to learn about the stock markets, primarily where they invest for clients. She likes the fact that one has

to have real time information to be effective in advising clients where to invest, and this inspires her to keep learning.

Y's parents were very supportive throughout her education and offered emotional support and encouragement to continue even in the face of challenges. She in fact says her father was her hero because he does not follow the masses when making decisions; he does what he believes is right, even when it goes against societal norms. Y's mother says her husband would encourage his daughters to think of themselves not as girls but as human beings who were capable of accomplishing anything they put their minds to. He also vowed to support them in whatever career path they chose. This was important especially during the years after high school when Y was figuring out what higher education options were available to her and during college when the course content was very difficult. Y says her parents would always ask her about school and encourage her, and were concerned at the hours the classes were held, sometimes until 9 pm.

Y's parents were very aware of some of the cultural expectations that sometimes hinder girls' education, according to her mother, and they sought to counteract these negative influences. First, they made sure that they had domestic help all the time so their daughters would not be overburdened by chores and would have enough time to do homework and consult with their peers when they experienced difficulty. The extra help also ensured that the children had time to relax and rejuvenate before going back to their school work, making them more effective in their studies.

The second step they took was to have discussions with their children, finding out where they were facing challenges and encouraging them. For instance Y's mother says she had to have regular discussions with her daughter to discourage her from listening to

her peers at school who were not doing so well in Math and would belittle the improvements Y made during the school holidays. Y's mother would tell her that it did not matter even if her grade improved by one percentage point, it was still an improvement and it was good enough.

The parents also made sure that their daughters were safe by providing transportation when they had to go for tutoring. Y's mother said she and her husband were well aware of some of the factors that cause girls to drop out of school such as teenage pregnancies, many times resulting from unwanted sexual advances. They knew that they had to protect their daughters from this possibility and would take turns dropping and picking up the girls from wherever they needed to be, therefore avoiding the possibility that they would be stranded somewhere late in the evening, waiting for public transportation.

#### *SCCT Constructs*

*Self-efficacy.* In response to the question about how she rated her Math and Science ability, Y stated that she was aware that her Math ability was good and she won at least one Math prize in primary school and several in secondary school. Her teachers were aware of her ability and gave her two students to tutor. She says of her experience with Math in high school, "Secondary school was my highlight because I used to be number one. In fact I used to have two girls I used to coach and I really looked forward to that class because it is the only one I liked." Y's mother noted, too, that her daughter was aware of her abilities and set high standards for herself in Mathematics and would be discouraged when she did not meet her goals. This discouragement did not last long

though because Y was able to find ways to improve her grade and meet her target performance expectations.

It is evident that Y's evaluation of her abilities is quite congruent with objective assessment, such as exams. She demonstrated high Math self-efficacy and this is congruent with her performance in both KCPE and KCSE. In KCPE, Math was the only subject in which she got an A, and during her high school education, she identifies her Math classes as the highlights of her experience. This self-evaluation is backed by her stellar performance in KCSE where yet again she got straight A in Mathematics.

*Outcome expectations.* The nature of expected consequences, whether negative or positive influences career goals, and Y had several considerations when she was making this choice. When Y was choosing Actuarial Science it was a relatively new field in Kenya and she did not know what to expect in terms of academic rigor and career opportunities. But she knew that with that degree she could be a role model for other young women in Kenya hoping to pursue SMT careers. Getting that degree would give her the credibility she needed to persuade others to follow suit. She said this was important to her because she sees how much her mother is passionate about girls' education in Math and Science, and wanted to follow in her footsteps.

She also recalled that she had first heard about Actuarial Science from her high school alumna and she felt the need to do something to make a contribution to girls' SMT education like the alumna in Actuarial Science did. She said no matter how small her contribution was, she knew it would create a ripple effect.

Because Actuarial Science was a relatively new field in Kenya, Y knew that the job market would not be flooded and she could find work easily after graduation. This

was an important consideration with the high unemployment rate in Kenya; the official unemployment statistics by the Ministry of Labor as of May 1, 2009 stood at 49%, a grim reality for college graduates. The flip side of pursuing a relatively unknown major was that she knew many employers would not know what Actuarial Science was all about and it would take some explaining to potential employers before they knew enough to hire her.

Even after failing to be admitted to the public university Y was still confident that a career related to Mathematics would be the most fulfilling route for her to take. She said the disappointing overall results did not affect her career plans because she had known for a while that this is her area of strength.

*Environmental supports.* Throughout her schooling Y had much support and her parents were her strongest allies during her education, providing everything she needed for school. They helped her get a tutor, got her school assignments for the tutor to grade, and were unwavering in their support of whatever career path she chose. Their support gave her plenty of positive learning experiences to build her self-efficacy in Math. It is this support that got her through the challenges she had after high school and during college, partly because she did not want to disappoint her parents after they gave her the freedom to choose her major.

Y's parents were aware of the quality of instruction in various schools and chose a reputable Catholic school for their children, knowing that they would receive a good education foundation there. Although at that time Y considered her schooling insignificant, the high quality of education there helped her gain admittance to a provincial secondary school. The parents were also aware of the gender stereotypes

rampant in the schools and actively counteracted them at home. Y's father encouraged his children to think of themselves as human beings and not think of their abilities in terms of gender. He also let them know that he was there to support them in whatever course they chose and this opened up many doors for Y and her sisters.

Y's mother said she greatly admired and respected her husband for the value he placed on his daughters and said he could not have loved them more if they were boys. This is contrary to the norm in many Kenyan families where female children are viewed as second best compared to boys and many children are aware of the disappointment their parents, especially fathers, feel at not having sons. This was not so in Y's family, and this only helped their self-worth and confidence grow.

The private tutor during high school was instrumental to her success in Math in the KCSE exam. She reinforced the fact that Math ability had nothing to do with gender and emphasized the practicality of Math in everyday life. Her performance expectations were also high and did not conform to gender stereotypes, unlike Y's school teacher's.

The tutor, on Y's parents' request, also provided a list of books to supplement the school list. Y's parents were of the opinion that the more Math models their daughter could find, the higher her chances were at finding something that clicked with her.

The Math competitions acted as another contextual affordance that helped build Y's Math self-efficacy. She was chosen to take part in these contests during primary and secondary school and won many prizes. The fact that her teachers were able to identify her ability and encourage her to participate provided further information to Y that she was skilled in the subject.

*Environmental barriers.* Several challenges confronted Y during her education, the first one being that Y's high school Math teacher had low expectations of her because, according to Y's mother, she was female. The teacher would rate her performance as good even when Y's mother and tutor and even Y herself knew she could do better. This might have gotten in the way of her performance if the family had not decided to hire a private tutor. Y's mother believes this is the result of the Kenyan views of the teaching profession. Many people go into teaching not because they are passionate about it but because they see it as the only option when all other doors close. (It is fairly easy to get into teaching; many students are advised to include teaching as the last option because it has some of the lowest university entry requirements).

Another barrier is related to how assessment is done in Kenyan schools. The examination system in Kenya with its rigid way of assessing ability discouraged Y at times during her pursuit of her goals. She did not qualify to go to the regular public university programs and instead enrolled for the parallel program in Actuarial Science. Y graduated from this program, a feat which only half the incoming freshmen attained. This she did after having been assessed as below average in performance in the KCSE examination. The assessment seemed unfair given that during her degree program Y passed calculus seven courses.

In addition to academic and course work related barriers, Y also experienced some challenges relating to her social life. During college Y's social life was limited to her study groups and this was strenuous. The program was also a three year "crash program" and classes used to run until late at night, making travelling to and from campus tedious/risky. Her parents expressed concern about this but they were also aware

that there was no way around this schedule and offered encouragement when things got tough.

*Coping efficacy.* Strong coping efficacy is related to the ability to surmount environmental barriers that stand in the way of accomplishing goals. Y sees herself as having good coping skills and rated herself as a seven on a scale of one to ten. To her the most important coping resource is her faith which she summed up this way, “Faith is definitely important, in terms of believing in a higher power; my strength comes not from within but from him. You rely on strength from a higher power.” This was comforting to Y because sometimes the challenges she faced seemed too daunting to be overcome by mere human power. Believing in an all-powerful gave her hope that solutions would be found even when she could not see what those would be.

Another skill that Y has found helpful in facing challenges has been her ability to look for solutions to problems, or work around them when solutions are not readily available. She reflected on this process, “I guess I also try to work around the challenges. I try and find solutions to problems such as going to the lecturers (professors) for more information.” Y used the same strategy in secondary school: when she realized that she was not getting much help for her high school Mathematics teacher, she asked her parents to help her find a Math tutor. This tutor had high performance expectations of Y and identified her Math potential and gave her a lot of encouragement.

After KCSE results came out and Y realized she did not qualify for admission to a public university, she started looking at other higher education alternatives that were available to her considering her grades. She would regularly scan advertisements in the daily newspapers looking for academic programs that were related to Math. After doing

this for a while Y finally came across the information about the new Actuarial Science program at Jomo Kenyatta University of Agriculture and Technology (JKUAT). She applied that same day, hand-delivered her application the next day and was accepted into the program.

Another coping tool related to problem solving is the ability to assess available information and see what is relevant to the accomplishment of her goals. When Y's high school alumni came to talk about their careers and one of them mentioned Actuarial Science, Y knew that this was something she could do because it was Math-related. Even though at that time Actuarial Science was not an option at the university, it still sparked an interest in her and she kept this information in the back of her mind and later chose to pursue it as a parallel student.

Social support is another resource that Y turns to when faced with challenges. During her younger years in primary and secondary school this was mostly her family members, "I try to talk about it with my parents, my sisters, basically my family." Y finds that talking to her family prevents her from feeling like she is dealing with her problems alone. Knowing that her family supports her educational goals and will do anything in their power to help her attain this goal makes challenges such as having an uninterested Math teacher or not making it to public university seem manageable. During her college years Y realized that she needed to create a support network for herself because she was away from home. This was especially important when she realized that the academic material was extremely challenging, so Y and her female classmates formed a study group to help with the course work and also to offer mutual emotional support. This

support saw all the members in this group finish the program, which only half the incoming students achieved.

*Goals.* From a young age participant Y realized that she was good in Mathematics and started to consider the possibility of pursuing a career that was Math related; “I knew I wanted to do something Math oriented.” Y’s mother confirmed that her daughter had this dream from a very young age: “She talked about wanting to be a career woman and practice the Science and Math she had been taught in school.” Y’s career aspirations started to gain clarity as she advanced to secondary school and became aware of the different career options that were available to her, “I realized I wanted to do something related to the stock market. In fact at some point I was looking for a job as a stock broker.” Y’s mother again corroborated this and said her daughter “wanted to be in Accounting or Business.”

In form four when it came time to choose university majors, Y’s Math orientation again became evident as she chose BCom, Computer Science, Survey and BSc Math. Although Y was disappointed by the KCSE results disqualifying her from admittance into any of the public universities, she was still certain that she wanted to pursue a major involving mostly Mathematics. She talked about her SMT career goals: “That did not change. I already knew I wanted to do something related to Math.” Her challenge at this point was to find a program that met this criterion either in a private university, or one of the parallel programs offered at public universities. She found this at JKUAT and was finally able to actualize her SMT career goal.

While pursuing her Actuarial Science degree, Y started to think about the work setting which she wanted to work in and at that time she was thinking about being a stock

broker, a career she admired because of the fast-changing work setting: “At some point I was looking for work as a stock broker, like the guys with the red coats. You know, like the New York Stock Exchange (NYSE). It is so crazy, those people going up and down jotting down figures. I find it exciting that you have to know so much.” This level of knowledge and the ability to “think on your feet” is what Y aspired to attain. Y, however, opted to take an internship position at an insurance company. In Kenya, the insurance industry is the largest employer of Actuarial Science graduates, and Y thought this would be good hands-on training to learn to apply the mathematical models she had learned in school.

Y’s goal is to continue to learn all she can about mathematical modeling and the financial markets, and to become an expert in the area: “I have not gotten there yet, but I would like to get to the point where I can have an intellectual conversation with someone like Warren Buffet.” She is working towards this goal by learning as much as she can about investment advising, a subject she still finds challenging and exciting.

#### *Gender and Cultural Issues*

*Gender and cultural influences in the family.* Y’s family was the greatest source of empowerment and this stems from her parents’ awareness of cultural and gender issues that affect girls and women’s success in education and especially SMT subjects. This knowledge informed their parenting as they sought to instill in their daughters confidence in their abilities and encourage them to determine their own paths based on interests and abilities rather than societal expectations.

The first example of this awareness and consequent intervention was the fact that her parents recognized the cultural expectations that girls and women bear the burden of

housework, a practice that deprives girls of valuable study time and affects their academic performance. Y's mother reported that they hired domestic help so that their daughters would not be overburdened with household chores to the detriment of their school work.

Y's mother stated that her husband knew that the Kenyan society gives girls and women messages that imply they are not as competent as boys and men in academic and professional pursuits. He sought to debunk these myths by affirming his daughters' abilities and reminding them that being female does not limit their abilities and career aspirations. He encouraged them to determine their own paths based on objective assessment of their abilities, not culture-influenced self-appraisal. Y said of her parents' perceptions of education and ability, "I think to them it did not matter whether you were a boy or girl. Everyone has unique goals in life and they are there to help you achieve them. They do this by encouraging and discussing with me what I want in life."

Y's mother also talked about several issues surrounding vulnerability of female children in Kenyan culture that they were concerned about as parents of female children. One of the reasons girls drop out of school is pregnancy, often resulting when girls are coerced into relationships by older males or even male peers. Aware of this vulnerability, Y's parents decided to make the extra effort to drop off and pick up their daughters from private tutoring and elsewhere, to minimize the probability of "negative influences" on the girls. Coordination of this was not easy, with both parents being professionals with many demands on their time; but they saw it as the only way to guarantee the safety of their children.

Consistent with their empowering approach to parenting and contrary to what many parents perceive as their role in their children's education, Y's parents saw themselves as supporters and encouragers of their children's dreams. They let their children including Y choose their own paths based on self-assessment. They only stepped in when they felt Y needed to re-evaluate her views of her abilities, and did their best to provide experiences to this end. They made the topic of cultural gender expectations one of regular discussion at home, with the aim of helping their children break away from harmful stereotypes that could potentially get in the way of their accomplishing their goals of congruent career choices.

Y's mother, a retired Biology teacher, is passionate about girls' SMT education. During her working years, she took part in an in-service program called SMASSE ( Strengthening of Mathematics and Science in Secondary Education), initiated by the Teachers' Service Commission, with an aim to equip Science teachers with tools to teach Math and Science in a gender-responsive way that does not exclude girls/women from these subjects. What she learned in SMASSE workshops proved useful both in her career, and in her parenting, and she sought to apply the principles at home, helping Y and her siblings see Science as an aspect of everyday life and not just a laboratory experience. She would point out all the "Science specimens" all around--plants, animals, food, etc, so as to make Science practical and exciting to the children.

Y realizes her position of privilege in having the support to help her pursue a career in SMT in spite of the challenges she faced in her education, especially high school. She witnessed and admired her mother's commitment to girls' SMT education through participation in the SMASSE programs and vowed to continue that legacy.

Consequently, one of her career goals is to help steer girls away from gender stereotypes that limit academic and career development.

*Gender and cultural influences in school.* School policies and practices can convey gender-typed values, and in Y's case this came across as gender-typed expectations of her from the high school Math teacher. This teacher had very low expectations of Y and her performance evaluation was based on perceived low ability of girls. The result was that this teacher provided feedback that Y was performing well in the class, but Y and her mother knew she had potential to do much better and consequently they sought help from a private tutor to help Y reevaluate her ability and performance in the subject.

The class situation was made worse by the fact that, according to Y's mother, most of the students in her daughter's class did not like Math and their performance was reflective of this. For this reason they discouraged Y when she was trying to improve her grades, and minimized her accomplishments. These students would verbalize their disdain for Math and Y found that there was not competitive challenge at school, by the mere fact that most of the students were performing poorly.

In addition to society's devaluation of girls' and women's abilities in Math, Y's mother, after being a teacher for three decades, attributed some of the difficulties her daughter had with her school teacher to a shift in the education system during the eighties, and later she saw people choosing education as a career of last resort after all else had failed. She says, "Maybe the challenge in school is because of teachers who teach not because they want teaching as a profession, but as an afterthought when they

miss other careers. You know that teacher will not put the life of the child at heart, and even the way they teach will influence the child not to take Science.”

When Y joined the Actuarial Science program the issue of gender disparities in education, especially SMT education, again became apparent; women comprised only 40% of the class even though this was a parallel program at a public university. Parallel programs many times have more women than the regular public university programs because they are run like private universities and admittance is largely driven by financial ability. This paucity of women in this particular program, an innovative program by Kenyan standards at that time because it was the first Actuarial Science program at JKUAT with only 20 students, was another reminder to Y that women are still getting left out of crucial SMT areas, and was reflective of the differential access to and participation in SMT careers.

Despite the gender disparities in the class, Y did not perceive any differential treatment from her professors: “We were all treated the same.” She said her professors did not offer any preferential attention or affirmation, and had the same expectations from all the students. The same was true of Y’s male classmates; she did not perceive any negative attitude from them: “We were just students; the issue of gender did not arise.” Her perception was that everyone in the classroom knew they had the qualifications to get into the program regardless of gender.

Although Y and the other female students did not perceive differential treatment, they felt the need to form an all-female study group because they felt there was an unspoken challenge to do as well as or even better than the male students so as to make a statement about their own abilities, as well as women’s abilities in general, with regard to

pursuing and succeeding in male-dominated careers. Y's mother reflected, "The girls were very few and they helped each other . . . all the girls finished the program." The cooperative effort saw them get through the challenging course work, which sometimes seemed too difficult to comprehend: "I must say it was really tough. I said, 'Yes I love Math but do I really want to do this?' You do calculus seven and you are thinking . . . it was perseverance."

Y is glad she persevered through the program not only because the Actuarial Science degree has opened doors for her to pursue something she loves, but also because it has allowed her example to inspire other girls and women. In fact, the main motivation for her participating in this study was to make a difference in girls' education: "The main reason I did this is because I want to try and help others. I have not made it but I have tried. Someone will read what you are doing (referring to this research study) and they know there is hope out there." Y would like to see more girls believe in their abilities to pursue SMT careers and beat the stereotypes.

*Gender and cultural influences in the society.* Y feels fortunate to have grown up believing in herself and her ability to pursue her dreams. She did not perceive any messages questioning her abilities during her young formative years. After making the choice to pursue Actuarial Science at the university, she has noticed that sometimes people look at her in a questioning way, wondering why she chose that major: "In relation to school people wonder what you do, as in why a lady would do actuarial. There is shock and they wonder why." Y finds herself feeling impatient with this kind of attitude and believes this attitude can hinder many women from pursuing SMT careers, because they may feel the need to conform to gender expectations of careers.

According to Y, however, this reaction is not too common, possibly because she surrounds herself with friends who are like-minded when it comes to values of gender education. She however says that sometimes people look at her in wonder and amazement when they realize her career path: “Once they get to learn I did actuarial there is this . . . they get jazzed (surprised), but there is no preferential treatment, just respect.” Y believes that even this surprise on people’s faces should not happen because Kenyan society should have realized that women have the ability to pursue these male-dominated careers. She sees her role as one of helping change perceptions and encouraging girls just by being a role model they can look up to and emulate.

Y talked about the gender role socialization process in Kenyan society that leads to feelings of incompetence among girls and women: “Girls really feel inferior at a young age when they are told to wash the dishes and let the boys play . . . it is about changing this mind set.” She would like to be involved in “beating the stereotypes such as ‘girls can’t drive a lorry (truck)”, to let young girls know that ability is not tied to gender. “You never know how you change someone’s life. No matter how small what you do is, it will impact someone. You help one person and there is a ripple effect.”

### *Participant Z*

#### *Case Story*

Participant Z was brought up in a large urban town as the third born of six children; she has three sisters and two brothers. She attended public primary and secondary schools. Her mother was an English teacher and her father was an industrial trainer who had pursued graduate studies in engineering. Z’s parents had big dreams for their children’s education and careers but despite this they did not push them in any way

to pursue educational or career paths they did not want for themselves. Z says her father wanted her to be a doctor when he realized in her early schooling years that she had great academic potential.

According to Z her educational experience in primary school was nothing out of the ordinary and did not have a significant impact on her perception of Math and Science. In fact she had trouble recalling whether she had a favorite subject in primary school and thought at that time school was easy. Her teachers in primary school took note of her Math efficacy from as early as lower primary school and chose her to take part in Math contests in her school district. When she was in standard three she won her first Math prize and did so every year until she finished primary school. This left her without doubt that she excelled in the subject.

Not all her Science classroom experiences were positive during her early years. She recalls that she did not like Science at all during primary school because “the teacher was boring.” This not-so-positive experience did not deter her from the Sciences later in life, because she considered herself too young anyway at that age to make significant life decisions. She also found school to be easy in general and the Science experience did not significantly affect her grade.

High school was overall a good experience for Z and her favorite subjects were Physics, Math and Music. Z’s Physics teachers were especially inspiring. In form one and form two, the Physics teacher made class fun and exciting, something to look forward to, and this made the subject appealing. In form three they got a new teacher who was female and she brought a serious tone to Physics but also inspired the students by making it a practical subject. The teacher made Physics very real to Z by always teaching from an

inquisitive perspective. She used to have the students to ask any “why” question and she would give an explanation using the laws of Physics. This made the subject come alive in the world around.

In addition to having inspiring teachers, her school also influenced Z’s career choice by virtue of it being a provincial school. National/provincial schools in Kenya admit the best students in the country and tend to have competitive learning environments. In addition, the students know they are among the highest achieving students in the country and aspire for the careers requiring top grades. This environment got Z to start thinking about what she wanted to do and she began aspiring to careers considered prestigious in Kenya, namely architecture and engineering.

Teachers in high school again noted and frequently commented on Z’s high ability in Math and Physics and encouraged her frequently not only to pursue these subjects, but to tutor students weak in those subjects. This worked to further reinforce her self-efficacy in the subjects. In the end, however, Z says this may have worked against her by making her overconfident, a fact to which she attributes her less-than stellar performance in Physics. During the second year of high school, Z had to choose whether to do all the three Sciences; Physics, Chemistry and Biology. Because she wanted to eliminate any possibility of doing Medicine, she dropped Biology, knowing that without it she would not be considered for medical school, thus opting to do only two Sciences and Mathematics.

During form four when it came time to choose university majors, Z chose Architecture, Engineering, Bachelor of Education and Bachelor of Science, in that order. When KCSE results came out, she found out that she scored a B in Physics meaning she

missed both Architecture and Engineering, and had to choose between BEd and BSc. She was not sure about going into Music, Math or Physics Education, three subjects she loved equally, so she ended up choosing the latter.

For the first two years of college all the BSC students take classes together and only choose an area of specialization at the end of the second year. Z chose to major in Physics and ended up being the only woman in her class for the next two years. Her major professor said this choice was not so easy because of peer pressure from the other female students to pursue either Biology or Chemistry, or even Math. He added, however that one of the first things he noted about Z when he taught her was her strength of character; although she got along well with her peers and was involved in many social activities, she was able to stand her ground against peer pressure when needed.

Z, on her part, experienced the pressure to pursue Biology or Chemistry more as an unspoken expectation. Although no one actually verbalized it, she felt the expectation for her to go the way the other female students did: “The pressure to pursue biology was unspoken – of course, there is that pressure because it is like a guarantee no woman will pursue physics ... no one was telling me to do bio but most people go with the flow.” Z went ahead with her choice anyway. Shocked and amused that a female student “was attempting to do Physics,” the male Physics students did not expect Z to last in the program. They were wrong: she stayed on and by the second year they were surprised to find her getting the same grades, often even better grades than many of them. By third year they were used to her presence in the classroom and “even forgot I was female.”

Z felt fully supported during her college years, sometimes perceiving it as “too much support” from her classmates and her professors. She reports that if she had a

problem, “I had more than thirty people willing to help.” She took most of her classes from her academic advisor, who built on the foundation of practicality she had received during high school. He impressed upon his students that Physics was a “pioneer” Science, the Science that provides the foundation for other Sciences to build upon. He gave examples like the discovery of electricity, space research, etc, and this further inspired the students to see Physics as a practical subject with everyday applications. The academic advisor also took the initiative of broadening the students’ career aspirations because he noted that most students thought the only thing they could do with Physics was to teach it in high school, a thought unappealing to many of them.

This positive learning environment somewhat surprised to Z because she anticipated college to be full of obstacles due to her gender. She had heard that female students in the “hard Sciences” like Engineering were made to feel unwelcome in their classrooms, were graded more harshly than the men, and had to work twice as hard to get the same grades. Her experience was nothing like this, although she stated that her male classmates found it amusing that a woman was “attempting to do Physics.” She said they welcomed her enthusiastically and were more than willing to help her with any difficulty she had, just like they did with each other.

At the end of her college education, Z graduated at the top of her class. After several disappointing jobs in sales and marketing, customer service and banking, she accepted a teaching position in a private girls’ high school in Nairobi. This particular school’s policy is to employ female teachers whenever possible and Z easily got the job, being one of very few women who have studied Physics at the college level. She taught the same way her teacher did, beginning each class by answering “why” questions from

her students and pointing out the relevant topics in the text books. She felt by doing this she would inspire her students the same way her teachers did in high school and university. She taught for four years and “enjoyed every minute of it.”

During her fourth year of teaching she met a parent during a parent teacher conference who asked her if she had ever considered pursuing higher education. Z had been considering a Masters but was unsure how to get started, so the discussion sparked her interest. Learning of an organization which sponsors women to pursue graduate studies in Germany, Z applied and forgot about it.

Six months later she was called for an interview to assess her qualifications and interests. Z states that during the interviews she was confident she would be taken because “where was the competition?” Most of the women being interviewed were in the Arts and Humanities and she felt confident that the sponsors would categorize the applicants into subject areas and choose. She was consequently offered a full scholarship to pursue a Masters degree in Physics at the University of Leipzig, one of Germany’s most prestigious universities.

Schooling in Germany was a completely different experience. Her classmates had done their undergraduate degrees in Germany and other developed countries, and had the technological knowledge she lacked, saying her laboratory experiences in Kenya were with prototypes, not real equipment. She consequently struggled with learning about all the different types of machines, their different software, and how to interpret the data that was generated. When she went to her professors for help she would be handed a manual “in Deutsch” and was expected to read it and figure out how to proceed.

This strategy did not work and she went to her sponsors and explained her difficulty with the technical aspect of her academic program. The sponsors came to an understanding with the school to deregister Z for one year and let her audit undergraduate class laboratory sessions to learn about the equipment and accompanying software. At the end of the year Z was able to operate the equipment and software well enough to complete her degree in two years.

In retrospect, Z now considers the resource-poor universities in Kenya as a barrier for her because her laboratory experiences during her undergraduate studies were with prototypes of equipment, not the real thing and this impeded her progress in Germany, a very technologically advanced state. Her lack of experience with “real” equipment meant she had to learn in one year what her counterparts had learned in at least four years, making the experience very stressful. Z found that other foreign students who were from Asia and other European countries were more familiar with the technology and she was able to form friendships with them so they could help each other.

The decision to pursue Physics both at the undergraduate and graduate level was not without consequences. Z found that people, especially men were wary of her as soon as they learned she was pursuing Physics. She says of people’s perception of her as a woman doing a “male” Science; “you are chatting with people, having fun until you open your mouth and say you are doing Physics. Suddenly you have grown horns.” Z feels irritated that the Kenyan society still adheres to outdated views of male and female abilities and is of the opinion that change is long overdue.

Z feels fortunate that her parents did not conform to society’s gender values regarding women’s education. She says they were very supportive of her education from

primary school through college, providing everything she needed for school. Their support was not intrusive and they left her to make her choices regarding subject and career preferences. Although her parents, especially her father, strongly wanted her to be a doctor, they left the decision to her and did not push her in any way to pursue that profession. Even when she dropped Biology during her second year of high school, her parents did not question her choice and let it be, even though they knew that her choice eliminated a medical career. She still wonders to this day why they never said anything to her but is glad they were not pushy. Z's perception of her family's influence on her career choice is that it was more indirect, more of an inherited ability and interest in the Sciences, her father having had a Masters in Engineering.

#### *SCCT Constructs*

*Self-efficacy.* Self-efficacy refers to a subjective evaluation of one's ability.

Participant Z was well aware of her abilities in Math and Physics and states that from an early age she found that math made sense and was quite easy. Z knew her ability was exceptional and this was evident as she talked about the prizes she won for Mathematics, starting from standard three and each subsequent year until the end of primary school. Z was confident in her ability in Physics and Mathematics during secondary school and this was reinforced by the fact that teachers would ask her to tutor a few students who were weak in the subjects.

During college Z found that she understood the subject material just as easily and even got the same or better grades as the male students in her class. This confidence is also reflected in her evaluation of the likelihood of her getting the German scholarship. Z said she knew she would be chosen because of her subject area and to her there was no

competition. She also is aware that getting admitted to the University of Leipzig was the result of her exceptional academic potential. She says of the university, “It is a very good Science university, probably the best Science university in Germany. Even the chancellor studied there.” During her Master’s program, even though she struggled with the technology she found that after studying it for a year she was comfortable enough to finish the degree. This she did in one year, compared to her classmates who had exposure to equipment and software for many years, some beginning in high school.

Related to self-efficacy is the degree of congruence between one’s perceived abilities and objective abilities. Z’s appraisal of her abilities and performance and the objective capabilities are congruent and this is evident in several situations. She recognizes that she is good in Physics and Mathematics and her teachers also do, as seen in their selection of her to do Math contests, asking her to tutor students and their verbal affirmations of her skills. Lastly the examinations also serve as an objective confirmation of her skills throughout school, the only anticlimax being the B grade in KCSE which came as a surprise. Even then Z did not doubt her ability; she was of the opinion that she may not have put in enough effort into studying hence the “B” grade.

*Outcome expectations.* SCCT theory posits that people choose careers which promise positive outcomes or consequences. Z had had a positive classroom experience in Physics and also had high self-efficacy in it. When choosing her college majors (Architecture, Engineering, BSc Physics) she did so because she was confident that her experience would continue to be positive in the Science subjects because she found them easy. Although her KCSE results were disappointing, Z was still sure that she wanted to pursue Physics and Math in college. She says of that experience, “Yes I was disappointed

but did not kill me; it was not the end of the world. I can't say it was disastrous that I didn't get into a particular field. As long as you reached university you knew you were set. As long as I was admitted to the university that is all that mattered. I would have been devastated if I had not made it to the university."

Her post-graduation expectations regarding employment were that she would find a job, because "people find jobs." She consequently did not worry about what she would do with her degree because at that time, to her getting the degree would guarantee employment. She said of her expectations to find work after college, "Those were the days when Kenya was still good and you did not have to worry too much about your future."

*Environmental supports.* Environmental supports are those factors that lead to the development of self-efficacy and mitigate the effects of barriers and challenges. Z had her parents' unwavering support when she was going through school and this came in several forms. One was that they bought her all school materials without question. She said, "If I needed three books I would get three books." This ensured that she only concentrated on her schooling without having to worry about not having the necessary supplies to do well.

One of the obstacles many students in Kenya face is lack of supplies and being sent home for non-payment of tuition and fees. Z's parents made sure this was not a problem for their daughter. This support also involved giving her the freedom to choose whatever subject she wanted to pursue and did not in any way push her toward their preference, Medicine. Z consequently had the freedom to choose the subjects she felt she was good at: Math, Physics and Music.

The provincial school that Z attended, also played a supportive role by allowing students the freedom to choose only two Sciences as opposed to doing all the Sciences, which is common in many schools, especially national/provincial schools. By focusing on her strong Sciences, Math, Physics and Chemistry, Z was able to harness all her efforts into these areas. In this school, Z was able to pursue other interests, like Music, which many students in Kenya are not able to do. She said of her subject combination, “We could choose anything we wanted whether it made sense to anyone else or not. I did Physics and Music.”

Z’s academic advisor during college also contributed to Z’s positive experience as a Physics major. He gave his students extensive information regarding careers available in Physics in order to broaden their career aspirations. He was aware that many students do not choose the subject because they believe the only career available to them is teaching at the high school level. He also recognized the importance of role models in career choice, and would invite people who were already working in the various fields so that students could have mentors and role models. Being aware of the other options helped Z choose this subject that she loved and performed well in, instead of choosing something else based on misinformation and peer pressure.

After seeing her potential, Z’s academic advisor also encouraged her to think about pursuing graduate studies. When she accepted the high school teaching position he encouraged her not to settle for that, but to consider teaching at the university level. He had even asked her to join his department as a teaching assistant/tutor saying, “We would be very proud to have a woman in the Physics department here”. Due to family

circumstances the high school job seemed more appealing, so Z accepted the position, but her professor's encouragement to dream bigger stayed with her.

The other students majoring in Physics as well as the professors also offered their support to her if she had any challenges in the academic material. Z says of their support, "I had plenty of support, too much support in fact. If I had a problem I had more than thirty people willing to help." This made her feel part of the class.

Z went to pursue graduate studies at the prestigious University of Leipzig in Germany five years after graduation. This was made possible through funding by an organization that sponsors women to pursue graduate studies in Germany. This was another contextual support available to her, and her chances of getting the scholarship were increased by the fact that she was the only woman applying to study Physics. This organization worked closely with her and when she had challenges with the very technologically advanced academic program, they were able to talk to the school to allow Z to audit undergraduate class laboratory sections so as to learn about the equipment and accompanying software that she needed to be at par with her colleagues. During this time Z was able to form friendships with other international students, who also helped her with the labs, having come from countries that were more technologically advanced than Kenya: "I met some guys from Thailand and Holland who were nice and willing to help."

*Environmental barriers.* Barriers can hinder the development of self-efficacy and lead to negative outcome expectations. Although Z experienced some obstacles at various stages of her schooling, they did not deter her from her goal of pursuing an SMT career. In primary school it was her classroom experience in Science which was not very positive; in fact, as she recalled, "The teacher was boring." This could have been a

potential drawback for her by denying her an efficacy-building experience at this young age, but it did not because she saw it as an instruction method shortcoming.

During college Z experienced a lot of peer pressure from other women in the BSc program when it came time to choose majors at the end of the second year. Most women were choosing Biology and Chemistry and there was some pressure for Z to follow suit according to her academic advisor. This pressure would have derailed Z from pursuing a career that was congruent with her interests and strengths.

Another potential barrier is that Z was perceived negatively in the social circles just because she was a woman pursuing “a man’s Science”. She said in social situations, conversations would change drastically when she mentioned she was a Physics major. Reflecting back, she said, “You are chatting . . . and things are going well until you mention you are in Physics. Suddenly you have grown horns.”

Graduate school in Germany also came with its own set of challenges, some related to the culture and others more specific to schooling. Z found that she was fighting not only against gender stereotypes but also against racism. This challenge added one more issue she had to deal with so as to succeed in school. Z felt that she had to prove that she was just as capable of succeeding in the graduate program as the other students from more developed countries, which she did after she took the time to learn the technological aspects of the academic program.

The academic environment was also challenging because Germany is a very technologically advanced state and students learn about all this beginning very early in their schooling years. Z, on the other hand, reported having had very little experience with “real” equipment during her undergraduate training in Kenya. Her laboratory

experience was with prototypes, not real equipment and this did not prepare her at all for pursuing graduate studies in a highly industrialized and technologically advanced country like Germany.

*Coping efficacy.* Coping efficacy refers to one's evaluation of one's ability to overcome barriers and challenges, and Z believes her ability to overcome obstacles is above average, a seven on a scale of one to ten. She believes this is because of her upbringing, especially the spiritual grounding instilled in her as she grew up: "Of course my faith is important . . . that is my upbringing." This faith saw her through the challenges of studying for her Masters in Germany, which Z cites as the most difficult of her educational challenges. She says of how she persevered through the process, "It was a lot of hard work, a lot of prayers."

Z also used her problem solving skills and goal-oriented behavior to find solutions to problems she encountered in her education. She knew right from the start that she did not want to pursue a career in Medicine, but was also aware that she could be pressured into it, so she took the proactive step of dropping Biology during form two. This guaranteed that she would not be considered for a career in Medicine. During her studies in Germany when she was facing academic challenges and her professors were not helpful, she was able to advocate for herself by talking to her sponsors so they could liaise with her professors to provide her time to learn the technological aspects of her degree.

Z's ability to take a firm stance with her beliefs and values also helped her avoid situations that would have interfered with her career goals. Dropping Biology even when many in her family firmly believed she should become a doctor is an example of this.

This action guaranteed she would not be forced into a medical career that she did not want. In college when it came time to choose academic majors, Z did not bow to peer pressure from fellow female students who were choosing Biology or Chemistry.

Another of Z's coping strengths was her ability to identify and use available and relevant information to accomplish her goals. When she realized she was not getting much satisfaction from working in the corporate environment, she was quick to take advantage of an opportunity to teach Physics at an all girls' school because it fit in with her goal of working in Science. She also saw this as an opportunity to practice what she had learned, to be an inspiration to girls. Later when a parent in her school informed her of a German organization that funds women to pursue graduate studies, she immediately turned in an application, seeing this opportunity as again congruent with her aspirations for higher education in Science.

The ability to reframe situations into a more positive light has also helped Z deal with the challenges in her educational experience. When she got her KCSE results and realized she had a "B" in Physics, she was able to convince herself that the grade did not necessarily mean the end to her Science career aspirations, ". . . it was not the end of the world. As long as I was admitted to the university, that is all that mattered." This reframing helped her focus on the next step which was to decide whether to go into BEd Math/Physics/Music or BSc Math/Physics.

Social networking was important to Z when she encountered challenges. Her family offered the most important and constant support throughout her education experience, from primary school through college. This changed when Z went to Germany and her family was no longer close by. Now she had to reach out to other people for

support. She talked about this change: “In Kenya if you have a problem in the lab you just go smile at someone and they’ll help. You know someone always has your back. Not in Germany, they don’t have that culture of helping each other. They have a very competitive culture.” Z was able to appraise her classmates and she found that other foreign students were friendlier and more willing to answer questions. She said, “I just had to look for people who were friendlier. I met friends who knew what they were doing and were willing to help.” This group became close and they were able to help each other through the academic and social challenges of studying in a foreign country.

*Goals.* A goal is an intention to pursue a certain course of action and in SCCT is related to self-efficacy and outcome expectations. Z always knew she did not want to be a doctor and never wavered from this decision. She knew she wanted to pursue a career that had nothing to do with Biology, a subject she disliked and understood less well. In addition dealing with sick people did not hold any appeal to Z, in fact the thought made her very uneasy. At this early age however, Z did not have a clear picture of what she wanted to do with her life with respect to career, but she knew whatever she chose would be related to Mathematics and Science, two subjects she loved and excelled in from an early age.

It was in high school that Z’s love for Physics blossomed and she started to feel certain this was what she wanted to pursue for a career. The college majors she chose in form four were congruent with this decision; she chose Architecture, Engineering, BEd and BSc in Math/Physics/Music. Even with disappointing KCSE results, Z’s goals did not change and she was certain she still wanted to do something that was Math- or Physics- related and consequently made the choice to pursue BSc Physics.

Z's reflective stance helped her make her goals more congruent with her strengths. When she realized after three frustrating jobs in the private sector that she did not like careers involving a lot of persuasion or routine, she decided that teaching would be a more congruent career and went to teach at a private school. During this time she realized teaching was where she wanted to be, and started considering graduate studies. After four years the opportunity to go study Quantum Physics in Germany arose and she pursued it.

### *Gender and Cultural Issues*

In this section is a discussion of the three levels at which gender can elicit differential opportunities and reactions that directly or indirectly influence a woman's choice to pursue a career in Science Math and Technology. These are the family unit, the education system and the society at large.

*Gender and cultural influences in the family.* The family is perhaps the strongest socialization influence in human development. In this social unit gender role expectations start to emerge through modeling, and are reinforced through rewards and punishment. In most Kenyan cultures chores are assigned based on gender and children quickly learn what is expected of them, often through modeling. But in Z's family, male and female children were treated the same, and were offered the same opportunities and support in their educational pursuits. Z said that she perceived this support as crucial to her accomplishment because she felt confident she could do whatever she put her mind to.

According to Z her parents had the values of gender equity because of their education experience and exposure to different values as a result of their career pursuits. Z's mother was a teacher and Z credits her upbringing to the exposure her mother

received in her profession. Z says her mother's views of gender and education came partly from the experience of teaching children and being aware that academic ability was not tied to innate gender attributes: "My mom was a teacher. I think teachers tend to be more perceptive about life, so for her, she was already seeing there is no difference between girls and boys, girls can also do well. Families that differentiate do so out of ignorance, and if they knew what a difference their daughters could make in their family lives, they would not discriminate."

In Z's family the children pursued interests in which they felt they had inherited ability or interest. Z's words regarding this were ". . . as we grew up (we are six children) me and my big brother took after my father; we are into Math and Physics and Engineering. The rest were into Biology and languages." Z says that her parents' expectations would be for everyone to do well in school. "We grew up where everyone had to do well in school. It was more of, 'All of you must succeed' and my mother was a teacher so we had to succeed somehow and get good grades, it did not matter your gender." Four of the siblings including Z ended up in Science; one of her brothers studied Civil Engineering, the other Botany and Zoology and her sister is in Biochemistry. The other two siblings are pursuing Arts/Humanities careers and Z's parents fully supported those career choices as well.

Z's parents and family noted her high academic potential from an early age and frequently voiced their expectations that she would be a doctor when she grew up. At that time in Kenya the perception among parents and teachers alike was that if one was a good student the profession of choice would be Medicine. Z on her part knew she did not aspire to be a doctor and thought "I can't stand the thought of dealing with blood and

body fluids.” She saw herself as better suited to the physical as opposed to biological sciences.

*Gender and cultural influences in the school.* School is an important socialization institution where children learn what is expected of them in society, both directly from the academic material and indirectly from school policy and informal interactions. For Z, being a good student superseded being female, and her teachers were quick to tap her potential in Mathematics early on in her schooling years, mainly through subject-specific contests in the school system. This served as an important empowerment avenue for her by reinforcing her abilities, laying the foundation for Z to pursue a career she perceived as more congruent with her abilities and interests.

Most students in Kenya attend boarding secondary schools, and most of these are gender segregated, a decision that was made by the government during the early years of independence from colonial rule. The creation of girls’/boys’ only boarding schools was intended to provide a more gender responsive learning environment without the distractions of co-education. This was the case for Z who attended an all girls’ secondary school run by Catholic nuns. Because all the students were female and high achieving, gender was not a conscious consideration in the choosing of subjects to pursue and consequent career choices.

College education was a different experience, and every step of the way Z was confronted with the issue of gender, necessitating strength of character not to bow to the pressure to pursue a different Science. Z attended Jomo Kenyatta University of Agriculture and Technology (JKUAT), a Science and Technology college with the lowest female enrollment ratio in all the universities: 25%. It was in this environment that Z

made the decision to major in Physics, a decision that put her gender again starkly evident.

Z's female peers in college put pressure on her to pursue a more "female appropriate" Science, according to her academic advisor, and Z herself was starkly aware that the male students in the class did not expect her presence in the class and their response to her was shock and amusement. Z's strength of character and her well developed self-efficacy in Math and Physics gave her the confidence to make this choice and stay with it. Having felt empowered early in her family and previous school settings gave her the courage to go against cultural expectations, to be self-determining in choosing her own path based on her needs, abilities and interests.

Being female in higher education in Kenya often presents several potentially disempowering consequences. Z's academic advisor identified a social phenomenon in Kenyan colleges that puts female students at a disadvantage and often compromises their academic performance and sense of safety on campus. This phenomenon is called the "gold rush" and it is where male students who have been in the university longer rush to find romantic partners among incoming freshmen, taking advantage of the fact that these women are new in college and don't know their way around. This professor identified this as a negative distraction from academics and noted that many times the women get derailed from their academics and do not perform very well. Those women like Z who do not fall into this trap have to develop strategies that will help them resist the "gold rushers" and concentrate on their academics. Z's advisor said he often talks to students outside of class cautioning them to be aware of this potential distraction.

The academic advisor realized the difficulties the students are faced with related to their career choices, and took it upon himself to talk to the students, especially the female students, about different career options in Physics available to them in addition to teaching, the only career most students could identify. Also aware of labor market prejudices against women Science, he worked hard to get his female advisees into employment settings through internships. He did this knowing that once the employers saw the performance and potential of the interns, they would be more willing to hire them. He has accomplished this goal with all his internship placements and many students are grateful for the opportunity.

This professor felt compelled to help Z and other female students because he recognizes that women have significant contributions to make in Kenyan society and particularly in the Sciences. He sees his role as one of offering women opportunities to realize their full potential in Science and specifically in his subject area of Physics. He hopes that by so doing he will make a contribution towards changing perceptions of women and their abilities in educational and employment settings, and this has motivated him to go above and beyond his job expectations to mentor students. He is saddened by the Kenyan society's adherence to outdated stereotypes, and sees change as long overdue.

*Gender and cultural influences in the society.* Gender biases did not end in the classroom and Z frequently found herself having to deal with such prejudices in social settings. She narrated experiences of being in social situations where she would be taking part in conversations and feeling quite comfortable, then having to deal with looks of shock and disapproval especially from men when she revealed the fact that she was majoring in Physics at the university. Such revelations would frequently mean disrupted

conversations and awkwardness: “You are in a party chatting until you mention that you are doing Physics. Suddenly you have grown horns.”

This cultural attitude has frequently made her feel like a social outcast for pursuing a subject she is passionate about. Z attributes the fact that she is still single at 30 years of age to her choice of profession: “Maybe it is an excuse as to why I am not yet hooked up but I think that is one of the main reasons. You can be in a group and when someone asks you what are you doing. People go silent and are like ‘are you serious?’ ”

Although being female has brought obstacles in Z’s education, her gender has sometimes worked to her advantage and offered her opportunities to inspire girls and women in their career and educational pursuits. Two examples illustrate how her gender has brought opportunities for her to empower others, in essence bringing about a ripple effect in her environment. She was hired to teach Physics at an all girls’ school that gives preference to female teachers in the hiring process. The school’s goal in doing this is to provide the students with female role models, and Z took advantage of this privilege and did her best to inspire the girls she taught by showing them how practical Physics was. She also actively counteracted gender stereotypes and instilled in her students the belief that women can excel in Sciences. Z talked about how she would challenge these societal views, “I always asked my students ‘Why should it be a shock, why should it surprise anyone that a woman is doing Physics? It should be normal but people are still shocked.’” She would talk to her students about societal double standards in academics and encourage them to pursue their dreams regardless of this.

Z was also offered a scholarship to study in Germany by an organization that sponsors women to study in Germany, furthering her education and also helping her be

influential to other women by virtue of her accomplishments. The organization that sponsored her seeks to empower women through higher education and they saw the potential in Z to influence girls and women in having studied Physics. Acquiring an advanced degree in Physics from a prestigious Science university in a highly developed country gives her the opportunity to show other women what is possible with determination and consistent effort.

This opportunity to mentor young girls is important to Z because she feels many young girls have their SMT career aspirations extinguished at a young age by teachers: “Girls seem to fear Science starting in primary, where the girls are ignored. They are told, ‘You don’t worry about Sciences, concentrate more on English.’ I tend to think it starts from a young age where in girls’ schools the emphasis is on English and Arts rather than Math and Science. They are told ‘These ones (Sciences) are hard; those (Arts and Humanities) are easy.’” Z would like to see this change and wants to be instrumental in making it happen.

## CHAPTER 5

### Results: Cross Case Synthesis

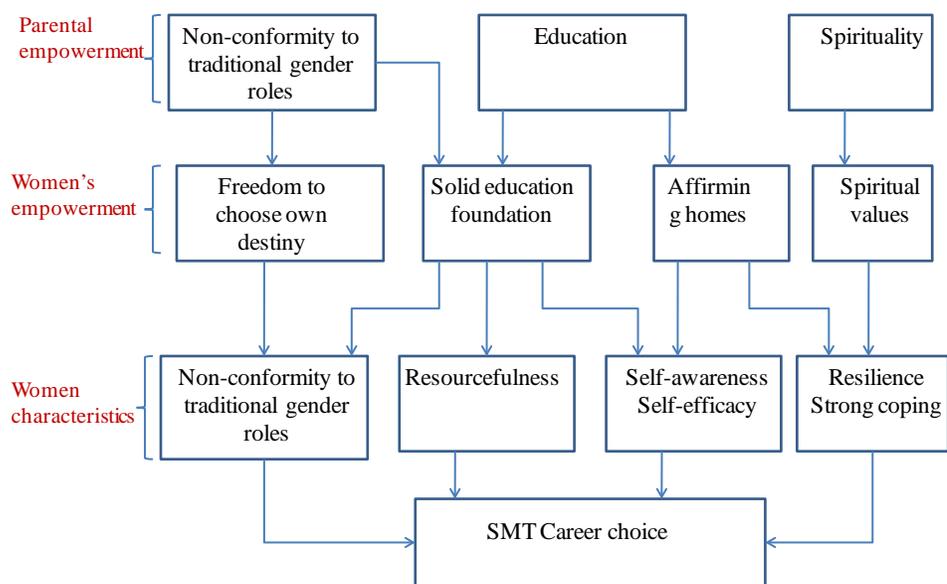
According to Yin (2009) one of the elements of multiple case study is cross-case analysis that seeks to tie together the individual cases under common themes. Cross case analysis for this multiple case study was conducted to look for common themes across the five cases that superseded the constructs of Social Cognitive Career Theory (SCCT). I analyzed all five narratives to look for cross case concepts above and beyond SCCT that describe aspects of the women's experiences that were most striking. As a starting point I used concepts from feminist literature. In particular I used borrowed from the feminist propositions that empowerment of women comes from valuing of women's strengths and abilities as well as from transformation of social institutions (Corey, 2001). I examined the women's home and schooling experience to see how they were different from the Kenyan society that in general does not value women's strengths as much as men.

Analysis of the five case stories revealed that the women in the study are unique in the context of the Kenyan culture because they all seem to be empowered to choose their values and goals in life as opposed to conforming to external expectations. These women and their families are different from the dominant Kenyan culture in that they seem to be empowered to deviate from cultural and societal expectations and values regarding women's education. Kenyan society still views women as possessing inferior abilities when it comes to education and especially Science education. In addition, women are seen primarily as fulfilling the role of reproduction while men are seen as the dominant producers of economic goods. In this culture women's education is therefore

not seen as valuable as men's and many parents hesitate to invest as much in their daughter's education as they would for boys (Kiluva-Ndunda, 2001; Lindsay, 1980) .

The families in this study are different because they all value women's education as much as men's. The parents themselves are educated and they all have determined to pass on this legacy of personal and social empowerment to their children. The following analysis will look at the sources of this parental empowerment and how this is passed on to the children this enabling them to pursue SMT careers. I have summarized the relationships between the key themes in Figure 1 below.

Figure 1: Relationships Between Key Themes



### *Parents' Empowerment*

The parents of these successful Kenyan women seem empowered and empowering beyond what is typical for Kenyan families. Several themes were uncovered

in the cross-case synthesis and they are discussed in the following sections below in an effort to conceptualize the sources of this empowerment. These themes include spirituality, education and non-conformity to traditional gender expectations.

*Spirituality.* Spirituality seems to be one key distinguishing factor between the parents in this study and many Kenyans. Kenya is a religious culture with as many as 88% of the people ascribing to some organized religious belief, mostly Christianity (CIA, 2010). However to many Kenyans religion is an activity they participate in, not something that is core to their value system, one that influences their decisions and values on a day to day basis. These parents view spirituality as an empowerment resource that informs their values of equality, integrity and persistence in the face of challenges. By teaching their children these values they empowered them by strengthening their coping strategies. All the participants acknowledged that their Christian upbringing was important in how they evaluated challenges they faced.

Z said her upbringing strongly emphasized the importance of faith and this became central to her worldview. This was part of the value system she acquired when she was growing up and she summed it up simply, “Of course my faith is important . . . that is my upbringing.” Y also stated that her parents taught her to believe in a higher power that is greater than all her challenges. She reflected on how this was taught to her, “. . . that my strength comes not from within but from him”. X’s mother said they instilled in their children a reverence for God. She reflected on the purpose of this faith, “We made sure they fear God . . . to know . . . that where mom and dad cannot reach God will see them through.”

W's mother said they encourage their children to know that God is able to get them farther than they can imagine. W reflected on this faith upbringing and how it affects her worldview, "God has better plans for everything." V's father said they instilled in their children a strong faith, talking to the children and praying for them. He reflected on his wife's role in the spiritual aspect of their children's upbringing, ". . . she is the chairlady of our (church) parish. She has played a big role in talking to our children."

All these families have a strong Christian value system that has worked as a resource for them in by providing life principles to live by and also a way to find meaning in the face of challenges. This faith has helped these families aspire high believing that a higher power will make all things good for them. Spirituality thus strengthens their coping strategies and efficacy and is a source of strength and resilience.

*Education.* Empowerment for these parents also comes from their educational backgrounds; all the women in the study had at least one parent with a college education and each participant has a parent who is a teacher. Z's mother was a teacher and her father was industrial trainer with a graduate degree in engineering. Z believes her mother's professional experience gave her the opportunity to see that boys and girls can achieve equally and this translated into having expectations of academic excellence from all her children. Z says, "My mother was a teacher and I think teachers tend to be more perceptive about life. She could see that boys and girls were performing the same."

Likewise Y's father is a doctor and her mother is a Science teacher who was very involved in a government in-service program called SMASSE (Strengthening Math and Science Secondary Education). This is a training program for Science and Mathematics

teachers and aims to equip the participants with gender responsive Science and Mathematics pedagogy. In this program the teachers are taught how to make Science practical and how to help parents do so at home. Y's mother used the principles at home to help her children see Science as an everyday experience, not something one does in the laboratory. She says of Science, "Physics is switching on the light, the radio. Mixing sugar in your tea is chemistry." She reflected on how this thinking has changed from the previous generation, "It is our parents who were not educated who did not understand the mystery of Science. We the educated parents have an idea of what Science is and we are applying it daily."

X's father is an engineer and her mother is a Science teacher who has gone through the SMASSE training programs as well. She used that knowledge to identify and nurture the Science aptitude in her daughter from an early age. Being a teacher also gave her first hand experience on the gender stereotypes that abound SMT education and she sought to dispel this kind of thinking in her children. She reflected upon her role as a parent in encouraging SMT education, ". . . girls are getting off track because they have been told Science is hard and for boys. If someone can get those myths out of them it would help and parents are the ones to do that."

W's mother was a radiologist with a college education and her father was a teacher. W's father knew through his education and professional experiences that both boys and girls have the ability to pursue Science if that is where their interests lie. W's mother had also broken free of gender biases about women's ability to succeed in technical careers and pursued a career in radiology/radiography and made a reputation for herself as a professional with an ingenious ability to figure out problems. She

consequently had great appreciation for education in changing lives and had this to say, “I would love to see my daughter do a Masters or PhD . . . I love education.” W’s mother is of the opinion that education gives women independence and that is very important. This is what she had to say, “Education is very good and very important . . . this is so especially for girls so they can support themselves.”

V’s father was a Mathematics teacher and saw firsthand how cultural attitudes towards Science got in the way of his students’ success in Mathematics. He took it upon himself to dispel these misconceptions in his students but more importantly encouraged his daughter from an early age to see Math and Science as an avenue to succeed in life because there was less competition and more opportunities there. He talked about how even university admission requirements would be made lower for Science majors because they were so few and encouraged his daughter to take advantage of this scarcity of Science professionals. V’s father talked about his perception of parents’ roles in their children’s SMT education, “Show them that Science is good to pursue. Science subjects are considered hard but parents should encourage their daughters to do them.”

Being in the teaching and other Science professions has afforded these parents the opportunity to learn through academic programs and professional experience that there needs to be change in values of women’s education, that girls need to be given the same opportunities because they are capable of succeeding in education and especially in the Sciences just like boys. This requires openness on their part because there are professionals who have had the academic exposure but still adhere to traditional prejudices regarding women’s ability and position in the family. The fact that they were able to adopt new values shows openness on their part to learn and change.

The parents' participation in the formal employment sector also affords them financial independence that in turn gives them autonomy to make decisions that deviate from traditional economies which are characterized by gender based division of labor and the devaluation of women's abilities. Financial independence and professional knowledge gives these parents freedom to adopt lifestyles that may go against expectations of the extended family and society at large. They are able to do this because they are not dependent on the extended families that can put pressure to conform to cultural standards.

*Non-conformity to traditional gender expectations.* One of the ways that these parents have broken away from traditional views is seen in the high value they place on equity in gender access and participation in education. All of the parents stated how important it was to educate their children regardless of gender and they knew that this stance went against what many parents in Kenya believe. V's father who was also her Mathematics teacher wanted his female students (including V) to understand that Math is not a difficult subject and that they could perform just as well as the boys in other schools. He talked about his teaching methods, "I had to create a lot of interest in Math by showing them that math is needed wherever you go. If you become a doctor you will need Math." W's parents were of the opinion that male and female children deserve equal educational and career opportunities and said they valued their sons and daughters equally. W's father said, "We have two daughters and two sons and we love them all." W's mother said she would "encourage parents to educate their children regardless of gender."

X's parents were also aware of the societal prejudices against girls and women and consciously raised their children to reject them. X's mother said she would like to see

parents and teachers counteract stereotypes in girls, “someone should tell them that there is no difference in ability between the boy child and the girl child.” Y’s parents also rejected society’s devaluation of female children and sought to offer them the best opportunities they could afford. Y’s mother talked about this goal, “We had an understanding that we had to help the girls be successful in Science.” She said her husband also counteracted gender stereotypes, “Whatever they choose he encourages them to think of themselves not as girls but as human beings capable of a lot.”

Participant Z’s parents were not only supportive of all their children’s aspirations regardless of gender, they expected all of them to succeed in whatever they chose to do. Z summarized her parents’ expectations this way, “We grew up where everyone had to do well in school. It was more of, ‘all of you must succeed’ and my mother was a teacher so we had to succeed somehow and get good grades, it did not matter your gender.” In this family, gender did not determine success, rather hard work did and Z’s parents supported their children fully to help them succeed in school.

In summary, these parents’ empowerment arising from their spiritual values, professional pursuits and economic independence helps them to reject societal standards and prejudices and stereotypes. Instead they have formed their own value systems based on new information and experiences and have in turn empowered their children by creating family environments that are conducive to self-discovery and freedom to pursue unbeaten paths for their children.

#### *How Parental Empowerment Is Passed On To Their Children*

One major way that these parents have been able to empower their children has been through being a constant source of support and inspiration throughout their

educational journeys. The women all reported that their parents had the most significant influence in their education by creating an environment in which success in education was a very viable aspiration. The parents did this by valuing and affirming their children, providing a solid education foundation, teaching them strong spiritual values and giving them freedom to pursue their dreams.

*Affirming home environments.* Through being empowered and breaking away from cultural views of women's inferiority, these parents were able to create home environments for their children that were free from culturally sanctioned gender biases and the associated burdens. The women in this study all perceived their home environments as having affirmed their value as girls and women and gave them the same opportunities in education as the male children in the family.

Z said, "My mom was a teacher so she was already seeing there is no difference between girls and boys. We grew up where everyone had to do well in school." Y talked about growing up in her family, "To them (parents) it did not matter whether one is male or female. To them everyone has different abilities and they are there to support you." X said at her home they were all treated equally and this included shared household responsibilities, "My mom especially has tried to make things equal between us; there is no one role for us and another one for my brothers." W also talked about her parents' expectations regarding division of chores at home, "what he can do I can do and what I can do he can." V acknowledged too that her parents valued all their children the same. In fact she felt she got preferential treatment by virtue of being the only girl in the family, "For me it was fun now that I was the only girl in my family." This affirmation helped

her to believe in herself and know that she was capable of excelling in school and making a difference in society.

To these women being affirmed and receiving equal value and treatment as the male children in the family gave them a perception of self as valuable and capable of accomplishing whatever they put their minds to. This confidence was instrumental to their success in school particularly when they were confronted with obstacles in their education.

*Solid education foundation.* Another way that these parents' empowerment is passed on to their children is through their awareness of the importance of a good education foundation and how this impacts children's ability and opportunities to pursue higher education in Kenya. In Kenya only small fraction (12%) of high school graduates go to college (Republic of Kenya, 2005) and currently the requirement to join a public university is an average of a B+. This means that students have to perform well starting in primary school so they can get into a good secondary school which in turn will greatly improve their chances of qualifying for university admission. These parents' awareness and financial capabilities enabled them to choose good quality schools to take their children; schools with good teachers and high quality instruction.

Although the women all said that primary school was not very significant in influencing their decision to pursue SMT careers they acknowledged that their primary education built a solid foundation for what they learned later. One of the ways that the privilege of going to good schools worked was to influence their SMT career choices is by having good and inspiring teachers who made the SMT subjects come alive and seem practical and doable. The teachers in these schools also noted the potential in the women

and encouraged them and also provided efficacy building experiences. Getting a good primary education helped these women achieve good grades that saw them getting admitted to high quality secondary schools where they found even more opportunities to build self-efficacy in SMT.

Z said her primary school Math teachers identified her potential and entered her into Math contests where she won six consecutive prizes. In addition her Math and Physics teachers in secondary school made the subject fun and practical. Y also had teachers who entered her into Mathematics contests in primary and secondary school. She also had a Math tutor who taught her the practicality of the subject and saw and nurtured the potential in her. X's primary Science teacher made the classroom atmosphere fun and competitive and taught to different learning styles such as providing drawings of concepts. W's teacher in primary school inspired her by being very knowledgeable in the subject and being able to explain life using physical laws. V's Math teacher taught her the practicality of the subject and her Science teacher was a good female role model in Science who also was caring enough to provide guidance to the students who were away from home for long periods of time.

Going to good primary schools has had significant implications for these women's educational and career paths. In those schools they had numerous SMT efficacy building experiences through high quality instruction, having teachers who identified their potential and encouraged them as well as having role models in Science who served as inspirations to follow suit.

*Strong spiritual values.* Another empowering avenue is their strong spiritual upbringing that served as a coping tool in the face of challenges. All the women said

spirituality was part of their upbringing and that it was the most important resource they called upon when faced with difficulty in their educational pursuits. Z reflected on how she made it through the challenges of studying in Germany, “It was a lot of hard work and lots of prayer.” Likewise Y said her faith was very important to her especially when she sees her limitations, “Faith is definitely important, in terms of believing in a higher power; my strength comes not from within but from him.” X also stated that her faith gives her direction when difficulties arise, “My faith plays a big part in how I deal with issues. I read my Bible and go to church on a regular basis and I believe God has a good plan and a good future for me.”

Participant W also finds that her faith gives her the courage to have a positive outlook on life when difficult situations arise, “it is from there (faith) I get the attitude of everything happens for a reason and God has better plans for everything.” In a similar manner V also finds that when she has problems that even her parents do not seem to have solutions to her faith plays an important role in keeping her going and she stated, “It is just the belief I have in God that everything is possible that he can provide a way out. When things are beyond me God can help me out.”

This strong belief that everything will work for the good of these women has given them hope in the face of barriers that derail other women in their educational pursuits. It is yet another empowerment legacy that their parents have passed on, one that gives the women a framework to make meaning of their challenges so they don't seem overwhelming.

*Freedom to choose own destiny.* The parents' nonconformity to societal gender stereotypes has given their children the freedom to be self-determining, to choose career

paths that are based on their own assessments of strengths, weaknesses and interests as opposed to abiding by some external evaluations that can be and have been limiting to women in Kenyan culture.

This freedom is seen in the way the parents talk about their role and also in the way the women experience support from parents. Even though some of the parents had career preferences for their daughters, they let them choose whatever option the women wanted and provide the needed support, materially and socially. V talked about her parents' role in her education, in particular her father teaching her Math and her mother providing encouragement, "Yes that was important, the other part was my discovery." To her, her parents' support gave her the courage to find out what she was interested in.

W's experience of her parents' support was similar; she chose the path to pursue and they encouraged her. She summed this up simply, "They knew about my interest in Science, they knew I was interested in Medicine . . . they encouraged me to follow my heart." Her mother said, "She very much wanted to be a doctor . . . I still encourage her to think about further studies in Medicine." She wants her daughter to keep her eyes on the goal of becoming a doctor and views Biochemistry as a stepping stone.

X also liked the fact that her parents did not push her to study or pursue a certain career. They provided information on options but eventually let her make the choice. She reflected on this freedom she felt to pursue her goals, "My parents believe a lot in education and us doing well. But they also make it our initiative, they are not pushy." When she was having doubts about a career in health due to misinformation from peers, her parents encouraged her to still pursue it, citing her stellar performance in the Sciences and work ethic. In X's mother's words, "I told her . . . that if your ability takes you to a

higher level that is better' and I knew from report forms (school reports) and the way she manages things that she would make it.”

Y also felt free to choose whatever career she wanted knowing she would get her parents' full support. She reflected on her parents' views of career choice, “There was always the freedom to do whatever we wanted . . . their belief is that everyone is different and doing something to please them is a waste of my time and their money.” Z reported a similar experience, “. . . one thing I will always thank my parents for is that we were never pushed to do anything we did not want. My dad always said we could do whatever we wanted.” Even though her father had a strong desire to see his daughter become a doctor, he respected her choice not to pursue that career.

This freedom to pursue their own interests, dreams and goals has enabled these women to develop a strong sense of self and confidence not only in their academic ability but also their ability to overcome other life issues and to achieve their goals.

In summary, parental empowerment translates into empowerment for the women in several ways the first one being that the parents provide affirming home environments where these women developed a strong sense of competence. The second empowering avenue is the fact that the parents were able to provide a solid education foundation by sending their children to good quality schools. Their knowledge of the education system coupled with a desire to see their children succeed motivated these parents to do everything in their power including making financial sacrifices to see their children through school. Thirdly, these parents gave their children a strong spiritual foundation that included solid moral values and a strong coping through reliance on a higher power when faced with challenges. Finally the parents gave these women the freedom to choose

their own destiny that enabled them follow their dreams and interests and choose careers that were congruent with their interests and strengths.

### *Effects of This Empowerment on the Women*

Having grown up in affirming home environments, attending good schools that provided efficacy-building experiences, getting unwavering support from parents and having freedom to choose their destiny instilled in these women an ability to evaluate themselves and appreciate their strengths, weaknesses, likes and dislikes. Empowerment for these women has also given them the ability to be resilient, resourceful, to be non-conforming and a passion to empower others through their work. The next section will examine these factors and their influence on the women's decision to pursue their respective SMT training programs.

*Self-awareness.* These women share an unusual ability to be self-reflective even in secondary school when they were making decisions on what to choose as majors in college. This kind of self-awareness is not common in this age group and most high school students make these decisions based on teachers' evaluation of their abilities and opinions about what careers are appropriate for them. The participants readily identified and discussed areas of self-efficacy in SMT subjects, their perceived likes, dislikes, strengths, weaknesses as well as their interests and how this awareness contributed to their SMT career decision making process.

The first area of awareness was of the subjective experience of Science and Math classroom instruction as well as knowledge of what certain career paths entailed. Z knew she liked and was good in Math and Physics and was also aware of the fact that dealing with sickness/blood was not something she wanted to do and she ruled out a medical

career. Y knew she loved Mathematics but knew she could not pursue other Science careers because she did not particularly like the physical and biological Sciences. X was aware of her love of helping people and also the fact that she would need limited contact with patients hence chose Pharmacy as opposed to Medicine. Her awareness of her quiet and noncompetitive nature helped her rule out a career in Business.

W knew she loved the life Sciences and seeing the principles come alive around her. She says her career decision was made because she is good in the Sciences and she has an interest in the subjects. V appreciated the practicality of the Sciences and knew she did not want to pursue Science from a theoretical perspective but from a practical application point of view, hence the engineering choice, helping her use Science principles to solve real problems.

Another area of self-awareness was that of subject areas the women excelled at. High self-efficacy was evident across all the study participants and their academic ability was confirmed by high grades in the national examination. Participant Z felt confident in her abilities in Physics and Mathematics starting from an early age and stated “Physics was just easy, it made sense. In fact the teacher asked me to tutor two girls who were weak in the subject.” Participant Y talked about her experience with Mathematics saying “Math was my favorite subject. In fact secondary school was my highlight because I was always number one. Math is the only subject I got an A in.” Participant X had a similar experience, describing her ability in Mathematics and Chemistry as “excellent”. She got A’s in the three Sciences and in Mathematics too.

High self-efficacy was sometimes discussed in the context of the national examinations. For instance participant V said she was looking forward to the KCSE exam

because “I was ready and I knew I had to pass.” W said “I was not worried about the exam because I was prepared and I knew it.” This self-efficacy was confirmed by the examination results in which all the participants reported attaining A’s in the subjects they liked and were good at.

These women were also comfortable enough with themselves and their achievements to admit that there were some Science and Math subjects that they did not like and/or they were not good at. They all identified at least once Science subject they did not like. Participant Z loved Physics and Mathematics and hated Biology, which led to her dropping the latter Science at the earliest possible opportunity. Participant Y liked only Math and disliked all the Sciences and consequently chose to pursue Actuarial Science, a major that is heavily math-oriented and required mastery of Calculus 7.

Similarly, X liked Mathematics and Chemistry and found Physics and Biology unappealing because to her they required a lot of memorization. She chose to pursue Pharmacy in order to combine those two subjects of interest. Participant W had a fascination with Biology and Chemistry from an early age and found Mathematics and Physics as requiring too much memorization of formulas and consequently chose to pursue Biochemistry as the major of choice at the university. Likewise participant V cited Physics, Mathematics and Chemistry as the favorite Sciences and consequently chose Geospatial engineering as the major to pursue at the university because it was a practical application of her favorite Sciences.

All these women chose one, two or three of the SMT subjects as the ones they performed well in, subjects which they enjoyed. They combined this information with their perceived strengths and weaknesses and chose majors that were congruent.

*Resilience.* The ability to overcome challenges and stay focused on goals is another common characteristic the women in this study have in common. All the participants have had difficulties that in some way affected their education goals and academic performance and they have been able to overcome them and succeed. The empowered upbringing of spirituality, affirmation, and freedom to be self-determining has given the women resilience in the face of challenges of the education system.

All the women interviewed and their parents named several significant obstacles that they were able to overcome and succeed in their pursuit of SMT education and careers. They did this by taking a firm stance on issues they believed strongly in and they had the strength of character to do this even in the face of opposition. This strength was drawn largely from a strong spiritual grounding that influenced values and offered a framework to understand challenges. The spiritual principles were instilled from young childhood and were a constant source of strength to the participants.

Z chose to major in Physics amidst strong though mostly unspoken expectations to go into Chemistry or Biology. Her advisor described her as a social person but also very strong in character. Even after her disappointment at not getting into Engineering or Architecture, Z still kept her dream alive and in the end pursued a graduate degree in the subject she loved despite facing significant challenges with the technology in Germany. She credits hard work, persistence, and spirituality for her success

Y was able to work towards her goal of excellence in Mathematics even though her peers would discourage her and offer no challenge academically. Even though she experienced disappointment at not getting into a public university, she did not let go of her dream of an SMT career and was able to get her degree in Actuarial Science, a

program that was very challenging, one that had Y considering quitting. She kept at it and is now pursuing a Masters in the same area. She says hard work, prayers and the fact that the degree was her passion helped her keep going.

X faced health concerns in high school that affected her performance to a degree but she was able to refocus on her studies and excel. When choosing her major she was able to stand firm and get her father to understand her reasons for choosing Pharmacy; he eventually did. The Pharmacy program was also extremely challenging requiring students to be in class from early morning until dusk. Many students leave the program during the first few months of this but X was able to keep focused because she believed this was a calling for her. Reminding herself that this was her passion, knowing that there was a bigger purpose for her being in the program and hard work saw her get through the program successfully.

W was very disappointed and discouraged when she failed to be accepted into either the Medicine or Dental Surgery programs but found the strength to hold on to her dream. She saw this as a temporary setback and was able to find a program (Biochemistry) that will help her get to her goals eventually. Being in SMT means she has to deal with classmates and even professors who degrade her accomplishments but she is able to disregard them and continue to believe in herself and her ability to succeed. Her parents describe her as “firm and principled” in her dealings with people even at home, especially at the small family business where she and her siblings help out. This quality and her faith have helped her stay focused on her dreams.

V also experienced periods of difficulty in high school when her parents could not pay her school tuition and fees in time and the long periods of absence from school

affected her performance in the examinations. Despite this she managed to recapture her top academic position with extra effort, reframing the challenges and having hope that circumstances would change for the better. In college the coursework has been challenging and the social dynamics discouraging as a result of being disrespected by some classmates and having professors who think the women are not as capable of handling demanding internships as the men. Y says she has felt like giving up but always finds a way to surmount her barriers.

Through all these challenges all the participants have demonstrated goal persistence no matter how major these difficulties seemed. They are able to access internal strength, external support and a belief in a higher power to make meaning of the challenges they face. Their spiritual worldview helps them view setbacks as temporary, knowing there is an ultimate good that will come out of it and knowing that they are not limited by what they can do because there is a higher power. Their firmness of character and resourcefulness helps them look for solutions to these challenges that they admit seemed overwhelming at times.

*Nonconformity to traditional gender expectations.* Another characteristic that these women have in common is that they view themselves as non-conforming with societal and cultural norms, much like their parents. This can be seen in the role models the women identify; they all possess qualities that make them stand out from the crowd. Participant V admired her aunt who was a lawyer for being fearless in her defense of innocent people. Her other role model was an engineer who also made significant contributions towards social causes even though she was not affluent, something that was not common in that neighborhood.

W identified her mother as a role model first because she was in the medical field as a radiology specialist and for her investigative way of looking at problems and coming up with solutions for problems she was confronted with. W said that this was above and beyond what her mother's training imparted on her and came from her own unique way of looking at problems and the world in general.

X identified her father as the person she admired the most when she was young because of his leadership qualities and ability to work with people and influence them. X also said her father always strives for excellence in all he does and she finds these qualities admirable. He stands out as someone who does not follow the crowds and is self-determining and these are the qualities that X has embraced herself.

Y also identified her father as her role model for similar reasons; the fact that he does not follow the crowd and thinks critically about issues, setting himself apart from most of his peers. From his views on family and gender roles to how he handles his professional pursuits, he prefers to find his own path as opposed to following the masses. Y's mother confirmed that her husband does not conform to cultural prejudices of women's abilities. He encouraged his daughters not to limit themselves because of gender stereotypes but instead to choose paths determined by their interests and abilities.

Lack of conformity among the participants resulting from their empowered upbringing has allowed them the freedom to pursue subjects they loved without the hindrances that come with trying to live according to the prevailing cultural views of female inferiority in SMT domains. The women see themselves as nonconforming and chose role models who possess this quality and were consequently able to choose congruent careers based on their positive self-evaluations of their ability.

*Resourcefulness.* The women in this study exhibit an unusual ability to receive information from various sources and integrate it into their plans and goals. Many students in Kenya make decisions based on the limited amount of information they receive from the school but this is not the case with these women. These participants are not limited to these standard sources of information and are able to gather useful information about careers and majors from many sources. Even though all the women reported minimal career guidance from their schools, they received some information on careers from parents, relatives, peers and alumni and used it to actualize their career aspirations.

Z heard about the opportunity to study in Germany from a parent at the school she taught and recognized an opportunity to attain her higher educational goals. Y was able to utilize information from her high school alumni presentation as well as print media to put together a plan to pursue a math career. X used her parents, especially her mother, as a resource and realized that she could pursue Pharmacy with her Science interests and deep desire to improve the well being of those around her. W heard about Biochemistry from an aunt and saw it as an opportunity of staying on track with her goals of pursuing a medical career. V knew about engineering from a woman in the neighborhood and saw this as a congruent career for her given her love of the practicality of Science.

This ability to “think outside the box” has enabled these women be successful in their pursuits. By broadening their minds about potential sources of information, they have increased their opportunities and have been able to attain their goals of pursuing and SMT education.

*Empowering others.* The participants in the study see their educational and career aspirations and pursuits as being beneficial not only to their personal advancement but also to society's, and women's in particular. Z says she takes every opportunity to challenge her students' stereotypes and uses her educational path as an example of what is possible when women don't conform to others' expectations. She wants young women to know there is hope, that they should keep their dreams alive and be persistent in their educational aspirations.

Y participated in this study because she believes her contributions will impact girls and women somewhere and give them hope that they can achieve their dreams to pursue SMT careers. She has been inspired by her mother's efforts to improve girl's learning experiences and hopes to follow in these footsteps. X chose to be a pharmacist because that is where her passions intersect with society's greatest needs and believes she can make a contribution that way. She would like to use her knowledge and abilities to ease some of society's suffering.

W's goal to pursue a medical career was partly driven by her desire to ease the pain and suffering in society and give something back. Her current goal is to get into pharmaceutical research and hopes to make significant contributions in drug development. V on her part wants to be like her childhood role model and inspire girls to pursue Sciences and also help the less fortunate in the society, especially the poor. Her way of empowering others is to go to girls' schools that she perceives as disadvantaged and inspire the students to pursue Sciences as a way to empower themselves.

All these women realize they have had a privileged upbringing and want to use their positions, professional and personal to help those who are less fortunate. They feel

empowered from their upbringing and the educational and career opportunities this has afforded them. To these women however, individual empowerment is not enough. They would like to be able to empower others by giving hope and inspiration through role modeling and through alleviating some of society's suffering using their professional skills. To them, their SMT education and careers should be used for the greater good of society.

### *Conclusion*

The ability of the women in this study to pursue an SMT education originates from their parents' empowerment. Their parents became empowered by going to college themselves and pursuing careers that gave them financial independence and consequently decision making autonomy within the family structure. In addition these parents acquired strong spiritual values that gave them high moral standards to live by as well as strong coping strategies when faced with challenges. These factors gave the parents the ability to determine their own family and professional values that do not conform to cultural gender stereotypes of education and careers. They chose for themselves and their children a way of life that embraces gender equity in access to educational opportunities.

These parents have passed on the legacy of empowerment to their children by having the foresight and financial capability to give them a solid educational foundation that is essential in SMT career decision making. They also gave their children the freedom to be self-reflective thus helping them to develop a high level of awareness. This encompasses self-knowledge of strong and weak academic areas, likes, dislikes as well as strengths and weaknesses. Using this information these women were able to make congruent SMT career choices.

The spiritual values these women attained from their upbringing were instrumental in helping them overcome the challenges posed by the Kenyan education system. These challenges included high cost of education which is a burden for many families, an inflexible and sometimes unpredictable university admission system that excludes many high achieving students from their desired majors as well as some health concerns. Relying on a worldview that everything happens for a good reason and believing that they had a higher power working on their behalf gave these women the strength to keep going despite the problems they faced.

Having attained or being close to attaining their goals, these women see themselves as agents of change in society. They want to use their education and careers to empower others, to give hope and inspiration, to alleviate suffering in society. They do not take their privilege for granted and realize there are others in society who have much less and will not be content with their individual career accomplishments. To them societal empowerment is the ultimate goal.

## CHAPTER 6

### Discussions and Conclusions

This study investigated the factors that influence Kenyan women's decision to pursue Science, Math and Technology (SMT) careers using a multiple case study design. The factors under investigation include self-efficacy in Math and Science and Technology subjects, SMT goals, environmental supports (such as family support, mentors) and barriers (e.g. school-related, social/cultural and policy barriers). Other factors explored were outcome expectations and coping efficacy and strategies. In this final chapter I will briefly discuss the significance of the study, the research questions, methodology and findings. The findings summarized in this chapter are based on two levels of analysis; individual analysis and cross-case synthesis. Next I will discuss the implications of the findings for career counseling theory and practice in the Kenyan context, the limitations of the study, as well as recommendations for further research.

#### *Summary of Methods and Research Questions*

Kenyan women represent a very small percentage of those pursuing careers in the areas of Science, Mathematics and Technology (SMT). This is the result of well documented social, cultural and policy barriers (Kiluva-Ndunda, 2001; Shabaya & Konadu-Agyemang, 2004). The purpose of this study was to investigate three key questions; 1) How Kenyan women ages 20-30 choose careers in SMT, 2) What helps Kenyan women overcome the cultural and policy barriers to education, and 3) What are the perceived future consequences of pursuing SMT higher education?

The research questions were investigated using a multiple case study design. Five cases were used in the study. Study participants were identified using the emergent

technique of snowballing. Each case comprised of a Kenyan woman in an SMT career and at least one parent/mentor. Historical educational interviews were used to gather data on the participants' perceptions of their educational experiences. The interview process used two questionnaires; the first one was a short survey to gather demographic information (see Appendix A) and the second one consisted of semi-structured questions (see Appendix B) guided by the following constructs from the Social Cognitive Career Theory (SCCT); a) self-efficacy, b) outcome expectations, c) goals, d) coping efficacy, e) environmental supports, and f) environmental barriers.

The data analysis occurred in two phases, individual case analysis and cross-case analysis. Each individual case was analyzed and presented separately using the above-mentioned SCCT constructs. Further analysis was carried out at the individual case level to determine if there are other emergent themes that were not sufficiently explained by SCCT. After individual analysis was completed a cross-case synthesis was conducted to look for patterns across all five cases.

#### *Summary of Results*

Social Cognitive Career Theory (SCCT) was used as an analytic template for this study. SCCT posits that people will choose careers in subject areas in which they have high self-efficacy (Lent, Brown & Hackett, 1994). According to the theory, positive outcome expectations are an important consideration when choosing a line of work. Strong environmental supports as well as high coping efficacy all support a career decision in a particular subject area. The women in this study all exhibited high self-efficacy in the Science subjects they were pursuing. The used words like “excellent”, “very good”, and “good” to describe their abilities in the sciences they had chosen to

pursue. Notably, none of the women had high self-efficacy in all the Science and Math subjects. Instead, they each had at least one SMT subject area they did not like or felt they were not very good at. They chose college majors that were congruent with their high efficacy subjects.

In addition all the study participants had positive outcome expectations of pursuing SMT careers that included high career satisfaction, financial freedom, personal growth, availability of employment after graduation as well, as being able to use the career to improve the well being of the society. The participants were well aware of the cultural and social factors that get in the way of women's education particularly in SMT and they saw part of their role as that of using their career accomplishments to help others in society.

Consistent with SCCT propositions, strong environmental supports were available to all the women and this support was mainly from parents. This family support was financial by way of paying for school and providing all necessary school supplies as well as social/emotional by way of unwavering encouragement to the women to pursue goals. Another environmental factor is role models that the women identified. Role models identified were non-conforming and each participant identified one inspiring role model in SMT. This finding is consistent with previous research that shows women who have influenced by role models in Science, Math and Technology careers have a higher likelihood of believing that these careers do not conflict with their other roles (Nauta et al., 1998).

High coping efficacy and a variety of coping strategies were seen in all the women, again consistent with what SCCT would predict. In particular spirituality was

cited as the most significant source of comfort when faced with challenges. The women and their parents reported that their Christian faith was central to their value system and when challenges arose they were able to defer to a higher power when they had exhausted their coping resources.

In addition to SCCT constructs, other themes emerged during data analysis related to factors that further enhanced these women's educational experiences that led to SMT career choices. The most notable theme was that of non-conformity to societal and cultural views of women and the value placed on women's education. All the women reported that their parents did not discriminate between their male and female children and in fact actively counteracted gender stereotypes in the way they raised their children. The women reported that chores were assigned equally and when there was a need for concentrated study time many parents hired domestic help.

The literature on Kenya documents that being overburdened by chores is one reason that Kenyan girls perform poorly in school because they do not have time to devote to studies. Science and Mathematics subjects are especially affected because they require more study time and work (Kiluva-Ndunda, 2001; Shabaya & Konadu-Agyemang, 2004). The women and their families do not conform to cultural stereotypes of women's abilities and roles within the family. The women reported that their parents gave them the same study opportunities as their male siblings and had the similar expectations of participation in household chores across gender. The parents/mentors reported were very aware of the cultural attitudes that get in the way of women's success in education and sought out to shield their children from these influences.

This non-conformity seems to stem from education that in turn affords these families financial/economic autonomy and freedom to go against tradition. All the parents were from middle class professional backgrounds and had had a college education. They said that they were aware that education broadened career and social opportunities that they wanted their children to go further in their education than even the parents did. They consequently did everything in their power to see their children through school and also gave their daughters freedom to break free from traditional gender roles. This finding is consistent with literature that suggests that working parents, especially mothers, are less conforming to traditional gender roles (Ex & Janssens, 1998; Thornton, Alwin, & Camburn, 1983). According to this research non-conformity influences parenting style in such a way that educated/working mothers/parents are more autonomy giving thus building their daughters' self-esteem and self-efficacy. In addition the children internalize the values of non-conformity that they see actualized in their parents' lives.

In summary, this research study was designed to answer three research questions that are summarized below together with the research findings:

1. How do Kenyan women choose careers in SMT?

The women in the study chose SMT career as a result of a combination of several factors that included having high self-efficacy in SMT subjects, having a good education from a young age that set the foundation for general efficacy but also SMT self-efficacy, having supportive parents/mentors/teachers who identified their SMT aptitude from a young age and encouraged them to follow

their interests, and lastly growing up in homes that affirmed them as women and freed them from gender stereotypes.

2. How do Kenyan women overcome social, policy and other barriers to pursue SMT education?

The women in the study were able to overcome environmental barriers by having strong coping efficacy; they all rated themselves as a six or seven on a scale of one to ten. They all employed similar coping strategies the most important of which was spirituality; deferring to a higher power gave these women hope that they would eventually accomplish their goals. Secondly, all the study participants had strong support from their families, mostly parents and siblings. The parents were committed to doing everything in their power see their children achieve their educational goals. They also offered encouragement during challenging times. These women were also able to develop their own peer support systems such as study groups and other support groups.

3. What are the perceived future consequences of pursuing an SMT career?

When choosing their SMT careers, the women in this study all anticipated a high level of career satisfaction from pursuing something they enjoyed and excelled at. They also anticipated attractive remuneration because of the high demand for Science professionals in Kenya. In addition to these personal goals, all these women anticipated making a contribution to society through their education and employment pursuits. These contributions included easing physical suffering, bringing down social/structural barriers such as poverty and

discrimination, particularly gender discrimination, as well as inspiring other women to follow their footsteps in SMT.

#### *Theoretical Implications of the Study*

Although the constructs of Social Cognitive Career Theory were useful in conceptualizing SMT career choices for Kenyan women, the theory needs to be adapted to include cultural and systemic factors specific to Kenya. In particular the theory needs to address the issues of parental support including level of conformity to cultural standards and how that affects the efficacy building experiences they provide for their children. Research done in western countries suggests that nonconformity has two levels of influences; directly because children internalize the non-conforming attitudes of their parents, especially mothers, and indirectly, because educated mothers grant more autonomy to their daughters which builds their self-esteem and self-efficacy, important contributors to academic success (Ex & Janssens, 1998). This concept needs to be addressed in the environmental supports aspect of the theory.

The support needs of the women seemed to change as they advanced in school therefore a career theory for Kenyan women needs to more specifically define the kind of environmental support at each level of education that leads to high self-efficacy at each education level. The results of this study suggest that in the early stages of education the support that matters is having a good educational experience that provides numerous efficacy building experiences (e.g. Math contests, encouraging teachers, affirming parenting) and building a sense of self that is self-determining. When it is time to choose university majors, providing accurate information and giving freedom to choose seem to lead to congruent SMT career choices.

Coping efficacy and strategies also need to be more fully described in a theory that seeks to explain SMT career choice for Kenyan women. In this study spirituality was a key coping strategy for all the participants and positively influenced their goal persistence. This is consistent with previous research that has found that spirituality/religiosity is associated with higher immunity to stress, better coping skills and generally lower levels of distress (Graham, Furr, Flowers, & Thomas Burke, 2001; Schafer, 1997). These women used their Christian beliefs to make meaning of their challenges, to defer to a higher power when they exhausted their resources and to maintain a sense of purpose and direction in their careers. These women's spiritual meaning-making is consistent with other research that has shown women to use spiritual and religious beliefs to confront and overcome limitations, determine their life purpose, and achieve personal growth (Mattis, 2002).

Social support both from family and peers was also identified as an important coping tool for these women. Two types of support were identified, emotional/social support such as encouragement and peer support related to managing academically challenging coursework. A modified SCCT theory would underscore the importance influence of both forms of support on coping efficacy and goal persistence. SCCT acknowledges the importance of contextual supports and opportunities, particularly the individual's perception of them, as determinants of career choice (Lent et al., 1994). It however does not detail the kinds of supports that lead to congruent career choices.

#### *Implications for Guidance Programs*

The findings from this study have implications not only to the theoretical conceptualization of career decision-making for Kenyan women but also to the practice

of career guidance and counseling in Kenyan schools. The results of this study show that parental influence is critical to SMT career choice for Kenyan women. This means that career counseling/guidance programs aimed at helping women choose SMT careers need to have a large component of parental and teacher advocacy. This advocacy needs to include an educational component to make parents aware of the detrimental consequences of stereotypes against women's abilities and the value placed on their education. System advocacy aimed at alleviating some of the policy barriers such as sending students home for non-payment of fees will also be important to help students stay in school and focus on studies instead of having to go home and miss out on important learning time while waiting for parents to get funds to pay for tuition.

In addition, the school system needs to offer flexibility to students when choosing subjects to pursue and be examined on and counselors can help students explore their strong SMT subjects. From this study, none of the women interviewed showed high self-efficacy in all the Science and Math subjects. Instead they indicated a liking for some of the SMT subjects and their self-efficacy statements reflected that. Making it mandatory for students to take all sciences or other subjects they are not competent in wastes time and effort that could be better utilized building on students' strong academic areas. Students should be allowed to pursue subjects they are strong in and enjoy and this may increase their chances of excelling in the national examinations and consequently pursuing higher education in related areas.

Another advocacy strategy is for career counselors need to work in collaboration with teachers and school principals to provide many efficacy-building experiences in SMT subjects. This may be in the form of Science fairs, and other positive classroom

experiences. In addition, positive role models in SMT careers will be an important component of career guidance. All the women in this study reported admiring and aspiring to be like people who did not conform to societal standards but pursued paths that set them apart from the crowd. All the women identified at least one role model who had chosen an SMT careers, showing this to be an important influence in career choice.

All the study participants indicated that one of the outcomes they expected from their pursuit of SMT careers was to use their education to improve the lives of others. They aspired to do this in different ways such as easing the physical suffering through medical careers, helping people break free of cultural and economic barriers such as gender discrimination and poverty. This could be an important incentive to girls and women to go into Math and Science careers because women tend to go into careers that provide opportunities for nurturing and social involvement (Nauta & Epperson, 2003). Career counselors working with female students can show them how SMT careers can improve societal welfare could be one way to get more women to go into these careers.

#### *Limitations of the Study*

The qualitative case study utilized five cases that were fairly similar in order to provide replication logic for a multiple case study (Yin, 2009). The women were all from a middle class semi-urban/urban background and had at least one parent in the teaching profession. All the women went to provincial schools, the highest cadre of schools in the Kenyan education system. Four out of the five participants were from the same ethnic group. The findings from this study have analytic generalizability that is limited to these factors. More research needs to be conducted with other groups of women to expand the knowledge base of SMT career decision making. This would include women from other

ethnic groups that have varying levels of gender role differentiations, those who attended lower level schools, those who do not have parents who are teachers or in SMT careers, as well as those who did not persist with their SMT career goals.

The method of snowballing that was used to identify participants may have created a self-selection bias in that the women who participated in the study were more similar to each other than to other women in SMT careers. Ideally, the case study would also have included other sources of data such as school records to make the findings more compelling. This study used only interview data, each case consisting of at least two interviews.

#### *Implications for Future Research*

The findings from this exploratory study form a starting point in the conceptualization of why and how Kenyan women choose SMT careers. More research is needed to investigate how diverse populations of women make SMT career decisions. These groups would include women from varied socioeconomic backgrounds, geographical locations, ethnicities, as well as those who did not exhibit goal persistence in the SMT. In addition, the SCCT constructs (self-efficacy, goals, contextual supports, outcome expectations, and coping efficacy) that seem to strongly predict an SMT career choice need to be more specifically defined within the Kenyan context and instruments to measure them developed for use in school guidance programs.

In particular, measurement instruments for environmental support, which seems to strongly influence coping and self-efficacy need to be effectively assessed in order for career counselors to bridge the gaps in environmental support. In addition, students' coping efficacy and strategies need to be more effectively measured so counselors know

how to effectively intervene to equip students with more coping tools to enable them overcome environmental barriers.

## References

- Agesa, J., & Agesa, R. (2002). Gender differences in public and private enrollment in Kenya: What do they mask? *The Review of Black Political Economy*, 30(1), 29-55.
- Arap-Maritim, E. (1984). Sex differences in the vocational aspiration and sex-role perceptions of primary-school children in rural Kenya. *Journal of Social Psychology*, 124, 159-164.
- Bandura, A. (1977). *Social learning theory*. Englewood Cliffs: Prentice Hall.
- Barak, A. (1981). Vocational interests: A cognitive view. *Journal of Vocational Behavior*, 19(1), 1-14.
- Brown, S. D., & Lent, R. W. (1996). A Social Cognitive Framework for Career Choice Counseling. *Career Development Quarterly*, 44(4), 354-366.
- Chartrand, J. M., & Rose, M. L. (1996). Career Interventions for At-Risk Populations: Incorporating Social Cognitive Influences. *Career Development Quarterly*, 44(4), 341-353.
- CIA. (2010). The World Factbook: Kenya. Retrieved January 3, 2010, from <https://www.cia.gov/library/publications/the-world-factbook/geos/ke.html>
- CIA. (2007). The World Factbook: Kenya. Retrieved August 25, 2007, from <https://www.cia.gov/library/publications/the-world-factbook/geos/ke.html>
- Corey, G. (2001). *Theory and Practice of Counseling and Psychotherapy* (6th ed.). Belmont: Brooks/Cole.
- Ex, C., & Janssens, J. (1998). Maternal influences on daughters' gender role attitudes. *Sex Roles*, 38(3/4), 171-186.

- Fassinger R. E. & Assay, P. A. (2006). Career counseling with women in Science, Technology, Engineering and Mathematics (STEM) fields. In Walsch, W. B. & Heppner, M. J. (Eds), *Handbook of career counseling for women* (pp. 427-452). Florence, KY: Routeledge.
- Fitzgerald, L. F. & Betz, R. W. (1994). Career development in cultural context: The role of gender, race, class, and sexual orientation. In M. L. Savickas & R. W. Lent (Eds.), *Convergence in career development theories: Implications for science and practice* (pp. 103-118). Palo Alto, CA: Consulting Psychologists Press, Inc.
- Forum for African Women Educationalists (2008). *FAWE: Advancing girls' education in Africa*. Retrieved December 12, 2008 from [www.cmc.edu/kravisprize/images/fawe/publications/15years\\_booklet.pdf](http://www.cmc.edu/kravisprize/images/fawe/publications/15years_booklet.pdf)
- Gall, J. P., Gall, M. D., & Borg, W. R. (2005). *Applying educational research: A practical guide* (5th ed.). New York: Pearson Education
- Graham, S., Furr, S., Flowers, C., & Thomas Burke, M. (2001). Religion and spirituality in coping with stress. *Counseling and Values, 46*(1), 2-13.
- Guba, E., & Lincoln, Y. (1989). *Fourth generation evaluation*. Newbury Park, CA: Sage
- Hackett, G., & Betz, N. E. (1981). A self-efficacy approach to the career development of women. *Journal of Vocational Behavior, 18*, 326-336.
- Hackett, G., & Byars, A. M. (1996). Social Cognitive Theory and the Career Development of African American Women. *Career Development Quarterly, 44*(4), 322-340.
- Hakim, C. (2000). *Research design: Successful designs for social and economic research* (2nd ed.). New York: Routeledge.

- Holland, J. L. (1985). *Making vocational choices: A theory of careers* (2<sup>nd</sup> ed.). Englewood Cliffs, NJ: Prentice Hall.
- Holmgren, J. L., & Basch, L. (2005). Encouragement, not gender, key to success in science. Retrieved December 20, 2008, from [www.carnegiefoundation.org/perspectives/](http://www.carnegiefoundation.org/perspectives/)
- Hughes, R., & Mwiria, K. (1989). Kenyan Women, Higher Education and the Labour Market. *Comparative Education*, 25(2), 179.
- Kamau, N. (2004). Outsiders within: Experiences of Kenya women in higher education. *JENDA: A Journal of Culture and African Women Studies*(6).
- Kanake, L. (1997). *Gender Disparities among the Academic Staff in Kenyan Universities*. Nairobi: Lyceum Educational Consultants Ltd.
- Kiluva-Ndunda, M. M. (2001). *Women's Agency and Educational Policy: The Experiences of the Women of Kilome, Kenya. SUNY Series, the Social Context of Education* (No. 0-7914-4762-6).
- Kithyo, I. M., & Petrina, S. (2002). Gender in School-to-School Transitions: How Students Choose Career Programs in Technical Colleges in Kenya. *Journal of Industrial Teacher Education*, 39(2), 21-43.
- Krathwohl, D. R., & Smith, N., L. (2005). *How to prepare a dissertation proposal: Suggestions for students in education & the social and behavioral sciences* (1st ed.). New York: Syracuse University Press.
- Krumboltz, J. D. (1996). A learning theory of career counseling. In M. L. Savickas & W. B. Walsh (Eds.), *Handbook of career counseling theory and practice* (pp. 55-81). Palo Alto, CA: Davies-Black.

- Lent, R. W., & Brown, S. D. (1996). Social Cognitive Approach to Career Development: An Overview. *Career Development Quarterly*, 44(4), 310-321.
- Lent, R. W., Brown, S. D., Brenner, B., Chopra, S. B., Davis, T., Talleyrand, R., et al. (2001). The Role of Contextual Supports and Barriers in the Choice of Math/Science Educational Options: A Test of Social Cognitive Hypothesis. . *Journal of Counseling Psychology*, 48(4), 474-483.
- Lent, R. W., Brown, S. D., & Hackett, G. (1994). Toward a Unifying Social Cognitive Theory of Career and Academic Interest, Choice, and Performance. *Journal of Vocational Behavior*, 45(1), 79-122.
- Lent, R. W., Brown, S. D., Schmidt, J. W., Brenner, B., Lyons, H., & Treistman, D. (2003). Relation of Contextual Supports and Barriers to Choice Behavior in Engineering Majors: Test of Alternative Social Cognitive Models. *Journal of Counseling Psychology*, 50(4), 483-496.
- Lindsay, B. (1980). Career Aspirations of Kenyan Women. *Journal of Negro Education*, 49(4), 423.
- Mattis, J. S. (2002). Religion and spirituality in the meaning-making and coping experiences of African American Women: A qualitative analysis. *Psychology of Women Quarterly*, 26(4), 309-321.
- Munene, I. I. (2002). University Academics: Demographic, Role Structure Characteristics and Attitudes towards Merit and Equity--A Kenyan Case Study. *Research in Post-Compulsory Education*, 7(3), 247.
- Nauta, M. M., & Epperson, D. L. (2003). A Longitudinal Examination of the Social-Cognitive Model Applied to High School Girls' Choices of Nontraditional

- College Majors and Aspirations. *Journal of Counseling Psychology*, 50(4), 448-457.
- Nauta, M. M., Epperson, D. L., & Kahn, J. H. (1998). A Multiple-Groups Analysis of Predictors of Higher Level Career Aspirations Among Women in Mathematics, Science, and Engineering Majors. *Journal of Counseling Psychology*, 45(4), 483-496.
- Osoro, B. K., Amundson, N. E., & Borgen, W. A. (2000). Career decision-making of high school students in Kenya. *International Journal for the Advancement of Counseling*, 22, 289-300.
- Republic of Kenya (2007a). *Careers guide book for schools*. Nairobi: Ministry of Education.
- Republic of Kenya(2007b). *Economic Survey*. Nairobi: Kenya National Bureau of Statistics, Ministry of Planning and National Development.
- Republic of Kenya (2007c). *Education in Kenya*. Retrieved May 30, 2008 from: <http://www.kie.ac.ke>.
- Republic of Kenya (2007d). *Gender in Education Policy*. Nairobi: Ministry of Education.
- Republic of Kenya (2005). *Sessional Paper No. 1 of 2005:A Policy Framework for Education, Training and Research*. Nairobi: Ministry of Education Science and Technology.
- Republic of Kenya (2003). *Kenya Demographic Health Survey*. Nairobi: Kenya National Bureau of Statistics, Ministry of Planning and National Development.
- Schafer, W. E. (1997). Religiosity, spirituality, and personal distress among college students. *Journal of College Student Development*, 38(6), 633-643.

- Shabaya, J., & Konadu-Agyemang, K. (2004). Unequal Access, Unequal Participation: Some Spatial and Socio-Economic Dimensions of the Gender Gap in Education in Africa with Special Reference to Ghana, Zimbabwe and Kenya. *Compare A Journal of Comparative Education*, 34(4), 395.
- Sifuna, D. N. (2006). A review of major obstacles to women's participation in higher education in Kenya. *Research in Post-Compulsory Education*, 11(1), 85-105.
- Thornton, A., Alwin, D. F., & Camburn, D. (1983). Causes and Consequences of Sex-Role Attitudes and Attitude Change *American Sociological Review*, 48(2), 211-227.
- Tumuti, S. (1985). Needs Assessment for Guidance and Counselling In Kenya. Kenyatta University, Department of Educational Psychology: Nairobi, Kenya.
- United Nations Educational Scientific and Cultural Organization, 2006. The Factbook on Education For All. Nairobi: UNESCO
- United Nations Educational Scientific and Cultural Organization, 2006. Gender inequalities in Kenya. Nairobi: UNESCO
- Wambua, R. (2007). The Making of an Engineer: Background Characteristics of Female Engineering Students in Kenyan National Polytechnics. *International Journal of Learning*, 14(2), 31-39.
- Yin, R. K. (2003). *Case study research: Design and methods* (3rd ed.). Thousand Oaks: Sage.
- Yin, R. K. (2009). *Case study research: Design and methods* (4th ed.). Los Angeles: Sage.



APPENDICES

## Appendix A

## Interview Survey

- Level of education
  - Bachelor's degree
  - Master's degree
  - Doctorate degree
  - Other
- Family background
  - Rural
  - Urban
  - Semi-urban
- Parent's employment status
  - Professional
  - Semi-skilled
  - Unskilled
- University attended
  - Private
  - Public regular
  - Public parallel
  - Local
  - Foreign
  - Other
- Degree awarded

- Current employment
  - Public sector
  - Private sector
  - NGO
  - Self-employed
  - Unemployed
  - Other

## Appendix B

### Interview Questions

- 1) What is your earliest recollection of knowing what you wanted to do for a career?
- 2) What were your favorite subjects in primary, secondary school? Which did you hate? Why?
- 3) When you were young, who was your hero/heroine? (Who outside the family might have influenced you?) This can be a cartoon character, novel character, etc.
- 4) Describe your educational history.
  - a) What kinds of schools did you attend?
  - b) What was your classroom experience like especially in Science and mathematics?
  - c) What type of academic and career guidance did you receive?
  - d) What role did family and mentors play?
  - e) What was your experience with the national examinations?
- 5) How was your school experience at each level of education? How did this experience influence your career choice?
  - a) Primary?
  - b) Secondary?
  - c) University?
- 6) How would you have described your Science and mathematics ability during your school years?
- 7) How do you feel about your career/employment situation?

- 8) How did you come to choose to current career?
- 9) How much guidance did you receive from the school?
- 10) What was your family's influence?
- 11) What other factors influenced your choice?
- 12) Did you anticipate any positive or negative consequences of choosing the career you did?
- 13) What barriers did you experience in the pursuit of your education?
  - a) Educational barriers?
  - b) Social barriers?
  - c) Policy barriers?
  - d) How did you overcome them?
- 14) What kind of support did you receive in your pursuit of education?
  - a) Family?
  - b) Mentors?
  - c) School?
  - d) Community?
- 15) The findings from this study will be richer if I can briefly talk to a mentor or family member about your education experience? Would any of the people who supported you be willing to speak with me? How can I get in touch with them?

## Appendix C

### **Family member/mentor Questions**

1. How would you describe the career interest progression of [participant name]?
2. How would you describe her experience with Science and math subjects in school?
3. What barriers do you think she experienced?
4. How did she overcome these barriers?
5. What role have you played in her education?
6. Do you have any other comments regarding [participant]'s education and career experience?

## Appendix D

## Informed Consent for Participants

## INFORMED CONSENT DOCUMENT

Project Title: **A Multiple Case Study of Social Cognitive Influences on Career Choice in Science, Mathematics and Technology among Kenyan Women**

Principal Investigator: **Dr. Deborah Rubel, Department of Counselor Education and Supervision**

Student Researcher: **Daphne Kagume, Department of Counselor Education and Supervision**

**WHAT IS THE PURPOSE OF THIS STUDY?**

You are being invited to take part in a research study designed to investigate the factors that influence Kenyan women's choice to pursue a career that is related to Science, Math or Technology. This research is critical because there are very few women in the said careers. Furthermore, the Kenyan government has stated that it would like to increase the number of women in SMT careers. The results from the study will have implications for career guidance programs in Kenyan schools. This research is being conducted in partial fulfillment of a doctorate for the student researcher.

**WHAT IS THE PURPOSE OF THIS FORM?**

This consent form gives you the information you will need to help you decide whether to be in the study or not. Please read the form carefully. You may ask any questions about the research, the possible risks and benefits, your rights as a volunteer, and anything else that is not clear. When all of your questions have been answered, you can decide if you want to be in this study or not.

**WHY AM I BEING INVITED TO TAKE PART IN THIS STUDY?**

You are being invited to take part in this study because you have been identified as a woman between the ages of 20 and 30 pursuing a career in Science, Math or Technology, and coming from a middle class family background. Your input is important in helping us develop programs to assist more women choose these careers.

**WHAT WILL HAPPEN DURING THIS STUDY AND HOW LONG WILL IT TAKE?**

If you agree to take part in this study, you will participate in an audio taped interview lasting between one and two hours. During the interview you will answer a short survey and this will be followed by an interview with Daphne Kagume. You will choose the location of the interview to suit your comfort level. During the interview you will be asked to identify a mentor/family member who can speak to your education experiences.

#### WHAT ARE THE RISKS OF THIS STUDY?

There are no foreseeable risks to participating.

#### WHAT ARE THE BENEFITS OF THIS STUDY?

**We do not know if you will benefit from being in this study.** However, we hope that, in the future, other people might benefit from this study because the findings will help us develop career guidance programs for Kenyan girls and women so they can choose more SMT careers.

#### WILL I BE PAID FOR PARTICIPATING?

You **will not** be paid for being in this research study.

#### WHO WILL SEE THE INFORMATION I GIVE?

The information you provide during this research study will be kept confidential to the extent permitted by law. To help protect your confidentiality, we will use code numbers on the questionnaires used for the interview and assign code numbers to the audiotapes and transcriptions. All identifying information will be removed from the transcripts.

You may be directly quoted but in no case will you be identified except by code.

The results of this project will be published. No identifying information will be made public.

#### DO I HAVE A CHOICE TO BE IN THE STUDY?

If you decide to take part in the study, it should be because you really want to volunteer. You can stop at any time during the study and still keep the benefits and rights you had before volunteering. You will not be treated differently if you decide to stop taking part in the study. You are free to skip any question you would prefer not to answer. If you choose to withdraw from this project before it ends, the researchers may keep information collected about you and this information may be included in study reports.

#### WHAT IF I HAVE QUESTIONS?

If you have any questions about this research project, please contact:

Principal Investigator

**Deborah Rubel, PhD** [Deborah.rubel@oregonstate.edu](mailto:Deborah.rubel@oregonstate.edu)  
(541) 737-5973

Student Researcher

**Daphne Kagume, MS** [kagumed@onid.orst.edu](mailto:kagumed@onid.orst.edu)  
(541) 753-1382  
254-722-971554 (Kenya phone no.)

If you have questions about your rights as a participant, please contact the Oregon State University Institutional Review Board (IRB) Human Protections Administrator, at (541) 737-4933 or by email at [IRB@oregonstate.edu](mailto:IRB@oregonstate.edu).

I \_\_\_\_\_ have read the informed consent to \_\_\_\_\_  
\_\_\_\_\_ and she has agreed to take part in the study and to be taped.

---

## Appendix E

Informed Consent for Mentors/family members

## INFORMED CONSENT DOCUMENT

Project Title: **A Multiple Case Study of Social Cognitive Influences on Career Choice in Science, Mathematics and Technology among Kenyan Women**

Principal Investigator: **Dr. Deborah Rubel, Department of Counselor Education and Supervision**

Student Researcher: **Daphne Kagume, Department of Counselor Education and Supervision**

### WHAT IS THE PURPOSE OF THIS STUDY?

You are being invited to take part in a research study designed to investigate the factors that influence Kenyan women's choice to pursue a career that is related to Science, Math or Technology. This research is critical because there are very few women in the said careers. Furthermore, the Kenyan government has stated that it would like to increase the number of women in SMT careers. The results from the study will have implications for career guidance programs in Kenyan schools. This research is being conducted in partial fulfillment of a doctorate for the student researcher.

### WHAT IS THE PURPOSE OF THIS FORM?

This consent form gives you the information you will need to help you decide whether to be in the study or not. Please read the form carefully. You may ask any questions about the research, the possible risks and benefits, your rights as a volunteer, and anything else that is not clear. When all of your questions have been answered, you can decide if you want to be in this study or not.

### WHY AM I BEING INVITED TO TAKE PART IN THIS STUDY?

You are being invited to take part in this study because you have been identified as a mentor/family member by primary participant in this study. Your input is important in helping us gain an in-depth understanding of the types of supports and barriers that help women choose SMT careers.

### WHAT WILL HAPPEN DURING THIS STUDY AND HOW LONG WILL IT TAKE?

If you agree to take part in this study, you will participate in an audio taped interview lasting about an hour. During the interview you will answer some questions about the education and career

experience of the person who identified you as a support person. You will choose the location of the interview to suit your comfort level.

#### WHAT ARE THE RISKS OF THIS STUDY?

There are no foreseeable risks to participating.

#### WHAT ARE THE BENEFITS OF THIS STUDY?

**You will not benefit from being in this study.** However, we hope that, in the future, other people might benefit from this study because the findings will help us develop career guidance programs for Kenyan girls and women so they can choose more SMT careers.

#### WILL I BE PAID FOR PARTICIPATING?

You **will not** be paid for being in this research study.

#### WHO WILL SEE THE INFORMATION I GIVE?

The information you provide during this research study will be kept confidential to the extent permitted by law. To help protect your confidentiality, we will use code numbers on the questionnaires used for the interview and assign code numbers to the audiotapes and transcriptions. All identifying information will be removed from the transcripts. Make sure this is integrated into prior sections.

You may be directly quoted but in no case will you be identified except by code.

The results of this project will be published. No identifying information will be made public.

#### DO I HAVE A CHOICE TO BE IN THE STUDY?

If you decide to take part in the study, it should be because you really want to volunteer. You can stop at any time during the study and still keep the benefits and rights you had before volunteering. You will not be treated differently if you decide to stop taking part in the study. You are free to skip any question you would prefer not to answer. If you choose to withdraw from this project before it ends, the researchers may keep information collected about you and this information may be included in study reports.

#### WHAT IF I HAVE QUESTIONS?

If you have any questions about this research project, please contact:

Principal Investigator  
**Deborah Rubel, PhD** [Deborah.rubel@oregonstate.edu](mailto:Deborah.rubel@oregonstate.edu)

**(541) 737-5973**

Student Researcher

**Daphne Kagume, MS [kagumed@onid.orst.edu](mailto:kagumed@onid.orst.edu)**

**(541) 753-1382**

**254-722-971554 (Kenya phone no.)**

If you have questions about your rights as a participant, please contact the Oregon State University Institutional Review Board (IRB) Human Protections Administrator, at (541) 737-4933 or by email at [IRB@oregonstate.edu](mailto:IRB@oregonstate.edu).

I \_\_\_\_\_ have read the informed consent to \_\_\_\_\_  
\_\_\_\_\_ and he/she has agreed to take part in the study and to be taped.

---

## Appendix F

## Glossary of Terms

1. BA Architecture – Bachelor of Arts in Architecture, a six year training program for architects. This degree has some of the highest entry requirements in the university admission process, comparable to Engineering and Medicine.
2. BCom – a business degree that is the equivalent of Business Administration (BA). In terms of entry requirements it is comparable to requirements to get into Law School.
3. BEd- Bachelor of Education degree. This degree has some of the lowest university entry requirements of all professional degrees and graduates qualify to teach in secondary schools.
4. BSc – Bachelor of Science degree, can be a general Science (BSc General) which is considered less marketable consequently less desirable, or students can choose a specialty area like Physics (BSc Physics). Some BSc specialties include:
  - a. BSc Actuarial Science – a four year program that is relatively new in Kenyan universities. Most graduates are employed by the insurance industry in the risk analysis department.
  - b. BSc Geospatial Engineering – a five year training program that trains engineering professionals in ground surveying using advanced technology. This program has some of the highest admission requirements.
5. BMed – Bachelor of Medicine, a five year academic program training for medical doctors.

6. BPharm – Bachelor of Pharmacy degree, a four year degree that confers the title “Doctor” to graduates who can work as pharmacists in public or private hospitals, pharmacies and pharmaceutical companies.
7. Bursary – A need based scholarship offered to a few students by the government
8. Form one, two, three and four – stages of secondary school, e.g. form one is the equivalent of 9<sup>th</sup> grade
9. KCPE- abbreviation for Kenya Certificate of Primary Education, a national exam taken at the end of standard eight that determines admission to high school
10. KCSE – abbreviation for Kenya Certificate of Secondary Education. This is the examination students take at the end of form four and determines admission to higher education institutions
11. Ministry of Education – part of the executive arm of the government that oversees early childhood, primary and secondary education.
12. Primary school – First eight years of formal education that correspond with 1<sup>st</sup> through 8<sup>th</sup> grades in the US school system.
13. Standard one through eight– Stages of primary school, e.g. standard one is equivalent to first grade
14. Secondary school – Corresponds to 9<sup>th</sup> through 12<sup>th</sup> grades in the US.
15. University – public universities have two programs that at times run concurrently.
  - a. Public regular – academic programs at public universities which are very competitive; admission depends on grade in KCSE. These programs are subsidized by the government

- b. Public parallel – academic programs at public universities that have less stringent admission criteria. These programs are fully funded by the students and cost about the same as the private universities
- 16. Polytechnics – tertiary institutions that offer technical training for those students who do not qualify for admission to public universities. Students graduate with a diploma (the equivalent of an Associate’s degree) or a certificate.
  - a. National polytechnic – offer diploma and certificate programs
  - b. Village polytechnic – offer only certificate programs
- 17. SMT – Abbreviation for Science, Mathematics and Technology