STEM education in Botswana: understanding the gender disparity in enrolment and graduation in post-secondary education

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ABSTRACT

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Widespread education for all children was approved as part of the United Nations Convention on the Rights of the Child in 1989. In 1990, the World Summit for Children acknowledged girls' education as a development tool, and gender parity in education is integral to the Millennium Development Goals (MDGs), as it is the third of the eight goals.

This qualitative study sought to gain a better understanding of the factors driving gender disparities in enrolment in and graduation from Science, Technology, Engineering and Mathematics (STEM) post secondary education programmes in Botswana, in the context of closing the gender gap in education at all levels. The methodology included analysing official documents, published reports, and research findings of studies conducted elsewhere in the field of STEM education.

Research findings suggest that low graduation of girls in post secondary institutions arises from a wide range of issues such as the rigid patriarchal systems of social groups and other socio-cultural practices found within Botswana society. My study has also found out that the school curriculum is one of the institutionalized forms of creating disparity in the education of boys and girls. I have argued that the some of academic subjects in Botswana's secondary schools are gender-biased and this ultimately lead to the gender disparities in enrolment and graduation in STEM disciplines. I provide

plausible recommendations that Botswana can adopt to drive toward gender parity in STEM education.

DEDICATION

This thesis is dedicated to Sakhile Koketso, my wife, for her steadfast love and innate humanity. The study is also dedicated to the Malala Yousafzais of the world, who face complex obstacles in their pursuit of that which is their universal right*: education.* To my son and all the male feminists out there, this thesis is devoted to you too. I also dedicate this thesis to my three daughters, that should they face any obstacles outlined in this study, they may rise against them and conquer.

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I also wish to heartily thank my mother, Gabatsoswe Koketso for raising me to be gender sensitive. I was able to relate to the feminism theories I was exposed to during my studies because of you *Mme*. To my daughters, Tshepi, Vuyi and Motheo, thank you from the bottom of my heart for your support. TK, my son, thank you for staying up late waiting for me to come back from classes just to ask me how the lectures went and constantly

asking: “Daddy, are you done with your thesis”? This kept me going my boy. Many thanks Sakhile for proofreading and formatting the entire the project.

Kea leboga betsho!

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KEY TERMS

Gender

Gender Equity

Gender Equality

Gender and Development

Gender Mainstreaming

Women in Development

Women and Development

STEM

LIST OF ABBREVIATIONS AND ACRONYMS

BIDPA	Botswana Institute for Development Policy Analysis
BIUST	Botswana International University of Technology
BPFA	Beijing Declaration and Platform for Action
BRSTIA	Botswana Research Science and Technology Investment Agency
CWRP	Committee of Women's Rights Promotion
EFA	Education for All
GDP	Gross domestic Product
HIV/AIDS	Human ImmunoVirus/ Acquired Immunodeficiency Syndrome
ICAO	International Civil Aviation Organisation
ICT	Information and Communications Technology
LDCs	Least Developed Countries
NCST	National Commission for Science and Technology
NSB	National Science Board
MDGs	Millennium Development Goals
MIC	Middle Income Country
OECD	Organization for Economic Co-operation and Development
OSAGI	Office of the Special Adviser on Gender Issues
RNPE	Revised National Policy on Education
SADC	Southern African Development Community
SARDC	Southern African Research and Documentation Centre

STEM	Science, Technology, Engineering and Mathematics
TIMSS	Trends in International Mathematics and Science Study
UB	University of Botswana
UN	United Nations
UNDP	United Nations Development Programme
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNICEF	United Nations Children's Fund
USA	United States of America
WHO	World Health Organisation

Chapter 1
Introduction, Problem Statement, and Methodology

"A better understanding of women's experience would permit, even force, a far reaching revision of the broader fields of higher education and intellectual life in (Botswana)" Patricia Palmieri (1979)

1.1 Introduction

The year 2015 marks the 20th anniversary of the ground breaking Beijing Declaration and Platform for Action (BPFA) adopted at the 1995 United Nations' Fourth World Conference on Women held in Beijing, China. The BPFA is a comprehensive and transformative framework for action to rally humanity forward towards that elusive goal of gender equity and the empowerment of women and girls. Botswana, one of the many countries that attended and participated at that conference, was party to a consensus that pinpointed education as a way of attaining gender equality. Education has been a key development priority for Botswana since it gained independence from British colonial rule in 1966. According to the Revised National Policy on Education (RNPE) of 1994, the country's foremost educational priority is to produce a competent and productive workforce. The policy also gives priority to universal access to basic education, parity and quality. However, in pursuit of this goal, the country finds itself amongst those that are battling with the issue of gender imbalance in terms of enrollment and graduation. It should, however, be noted that the policy has contributed significantly to the development of the country in so far as making certain that Botswana has the necessary

skilled force to drive her developmental agenda and making sure that Batswana children achieved the purported 10 year basic education.

Gender imbalance in education remains a global concern, particularly in developing countries. International organizations such as the United Nations (UN) and the World Bank have over the recent past intensified efforts to enhance girls' education. Amongst a plethora of issues concerning girls education is the large gap in enrolment and graduation in Science, Technology, Engineering and Mathematics (STEM) between female and male students in post secondary education. Various commentators in the field have observed that in numerous segments of the global society, female representation in the bands of science, technology education, engineering, and mathematics in both educational and vocational settings is extremely low (NSB, 2006; Plonski and Saidel 2001; Roger and Duffield, 2000; van Langena, Boskerb, and Dekkers; 2006). STEM education could provide young women with access to employment in fields with relatively higher salaries. Gender disparity in STEM excludes a large proportion of girls and young women from this opportunity.

The unemployment problem often contributes to the vicious cycle of poverty befalling many women in the third world as unemployment rates continue to climb and remain stubbornly high. Global Employment Trends (2012) reported that in 2011, 74.8 million youth aged 15–24 were unemployed largely in part because they lacked the requisite skills to find meaningful employment, an increase of more than 4 million since 2007. The global youth unemployment rate, at 12.7 per cent, remains a full percentage point higher than they were before the 2008 global economic crisis. Globally, young people are nearly

three times as likely as adults to be unemployed. The unfortunate truth is that women and girls are the hardest hit.

There seems to be some hope for unemployed youths (especially women) globally: if more developing country governments could recognize the potential of STEM education, as one option amongst many, to provide youth with the necessary education and skills required to secure meaningful employment. For instance, the aviation industry, with projected annual growth of 5% up to 2020, reports that close to half a million pilots and 700 000 aviation industry personnel will be needed by 2032 (International Civil Aviation Organisation (ICAO) Training Report, 2013).

It is therefore imperative for Botswana to begin to understand the factors that thwart women to enter these male dominated STEM territories and to more importantly begin to address them. My study follows many with similar dimensions and seeks to explore the factors that drive STEM enrolment and graduation in post secondary education in Botswana.

This chapter provides a brief background to the study followed by a discussion of the research problems and a justification for the study. An overview of the methodology is provided and the significance and limitations of the study are discussed. The chapter also provides an outline of the thesis; a definition of the key terms and outlines the structure of the thesis.

1.2 Personal and professional background

I come from a family of five boys, who were raised to always honor and respect all human beings regardless of their colour, creed or gender. My mother, Mme Gabatsoswe

Koketso, by design or coincidence, mastered the art of gender socialisation. I say by design or coincidence because I have little or no proof of how she could have handled the discourse of gender socialisation had the scenario been different. Thus, I am still to sit down with her and ask her how she did it or if she could have done it differently if she had had, say three girls and two boys in the family. This was our home then, well her home to be honest: we did all the chores at home that in the families of our peers were divided between boys and girls. We cooked, did our laundry, fetched water and firewood and cleaned the house. We swept the house and the yard.

My situation is different though. I have been blessed with three beautiful daughters and a son. In the patriarchal society of Botswana, this would mean that my children would be assigned chores according their gender. However, in my home, my children are fully aware of the fact that women and men are born equal and therefore share chores equally, and access opportunities equally. That is what I have learnt from Gabatsoswe and that is what my children have grasped early in their lives. My belief is that we mirror the socialisation processes that we were exposed to in our formative years. So my interest in the current study is largely a continuation of the work that my mother began in me when I was young.

The reason behind the choice of the research topic, and more specifically the research questions, stems from my personal history as articulated above, and the history of public policy in my home country of Botswana. I have previously worked in the Botswana public sector as an English teacher and senior manager within the Ministry of Education and Skills Development. This study is borne of out the concern I have regarding the predicament of girls/women education in Botswana. I have over twenty years experience

in the education sector as a teacher of English and also a Human Resources (HR) Specialist in Botswana and South Africa. Having been involved with educational planning and having witnessed the dynamics of gender at all levels of education in Botswana, I feel it is time that I made a significant contribution toward the discourse to support women and girls rise above the challenges they face in Botswana with my study.

As an HR practitioner, my primary concern is ability, or lack thereof, of developing countries' to identify and nurture talent that is critically imperative for their sustainable developmental efforts. It is evident that in Botswana, as it is in many developing countries, there is a shortage of qualified professionals in STEM related occupations, with women being seriously under-represented.

1.3 Problem statement

Botswana is a patriarchal society (Millennium Development Goals Report - MDGR) (2004:39). This was confirmed by the government when giving progress on the achievement of the Millennium Development Goals in Botswana. Consequently women are subservient to men and have historically suffered from diverse practices of discrimination and disempowerment by virtue of their gender. Areas where women have historically been subordinate to men include access to and control of resources such as land, cattle, power, education and business opportunities. According to Allen (2000), Botswana gained independence as a duplicate of her coloniser in that bourgeoisie, and bureaucracy were reinforced through a peaceful and colonially-mediated process, with no particular commitment to the freedom of women beyond the right of suffrage and the same ambiguities about women's status embedded in its Constitution as could be found

elsewhere in southern Africa.

I agree with African scholars like Kolawole (1998), who proclaims that gender inequity in many African societies is an artifact of the maneuvering of culture, in which undesirable images of women derived from traditional conceptualization plays a fundamental role in women's mental absorption of negative values and images. She opines that culture is often used as a sledgehammer of oppression to propagate inequality and gender injustice against women in Africa. The National Gender Programme Framework by the Government of Botswana and UNDP (1998:3) cites sexism in educational syllabuses and the gender stratification of careers amongst the reasons that women are still subordinate to men in Botswana.

There has been an increase in gender-sensitive education policies in sub-Saharan Africa in the last decade. These gender-sensitive interventions seek, among other things, to remove imbalances in school access, participation, and achievement between boys and girls (Chilisa, 2002). However, the under representation of women in the various fields of STEM has long been recognized globally, and is of grave concern to developing countries like Botswana.

Sublette (2013) has observed that the recent past has seen global industries beginning to recognise a growing gap amongst countries in the production of college graduates in areas of STEM. Researchers from various industries believe this gap will create a significant loss of competitive edge in the STEM fields, which will leave a number of countries pursuing STEM graduates from other countries and may ultimately worsen the position of countries like Botswana in the industry of science, technology and innovation.

Proponents of STEM education, as well as industry leaders, believe that increasing mathematics and science requirements in schools, as well as embedding technology and engineering concepts in the curriculum, will better prepare students for advanced education or careers in STEM fields. In the developing world, STEM fields have been gaining attention due to a lack of appropriately skilled workers in the relevant occupations. In the USA it has been observed that there are not enough people to fill the current job market and for the jobs being filled, the skills needed are not meeting industry standards, leading to less than adequate performance and productivity.

It is against this backdrop that countries like Botswana begin to acknowledge that this will be a major problem in the future as the global competition for talent rages on. According to Shabaya and Konadu-Agyemang (2004, p. 396) education is a *sine qua non* for effective participation in the modern economy. Many African women by virtue of their lack, or low levels, of education are still confined to the fringes of national economies in menial jobs, due primarily to poor access to education and training (MDG Report for Africa, 2012). In Botswana too, proportionally more women than men are limited from actively participating in the national economy, particularly in the fields related of STEM. This can be linked directly to the country's education system where it has been observed that there are currently more men enrolled in STEM education than women (Baryeh, 2001).

Globalization has presented us with its inseparable twins of neoliberalism and capitalism, which continue to tear apart old relations of production and reproduction in its search for wage labor, it also splits apart old kinship relations and old gender relations. In these critical periods of social and economic disorder and revolution, gender relations are also

undergoing transformation—and space is opened up for women to challenge both old and emerging relations of male domination before the new ones can solidify. Such a space, a liberatory moment in capitalist social transformation, has been opened up in Botswana, and women's groups have seized it with enthusiasm as observed by Allen (2000). There is a great amount of optimistic feeling amongst feminists. Their strong belief centres on the fact that if the statistics of women increase in engineering and other STEM areas, the culture of these areas will be required to change and the presence of women can reshape relationships between the genders (Hodgkinson, 2000).

Table 1: University of Botswana Enrolment statistics by Gender

Faculty/School Student Enrolment by Gender 2010/11 -2013/14								
Faculty/School	**2010/11**		**2011/12**		**2012/13**		**2013/14**	
	M	**F**	**M**	**F**	**M**	**F**	**M**	**F**
Business	1,526	2,615	1,596	2,715	1,417	2,359	1,307	2,299
Education	775	1,195	950	1,422	1,516	2,515	1,443	2,506
Engineering & Technology	788	173	1,098	267	1,158	298	1,079	298
Graduate Studies	660	731	690	797	708	766	819	1,017
Health Sciences	305	266	358	325	328	335	363	372
Humanities	1,009	1,796	1,102	2,031	996	2,005	834	1,653
Sciences	912	365	1,111	489	1,097	606	1,094	649
Social Sciences	959	1,656	1,048	1,679	951	1,662	861	1,582
Total Enrolment	**6,934**	**8,797**	**7,953**	**9,725**	**8,171**	**10,546**	**7,800**	**10,376**

The data presented in Table 1 above comes from the University of Botswana's (UB) institutional planning unit (see Appendix B). The data shows that for the academic years 2010/11, 2011/12, 2012/13, and 2013/14 a gender gap does exist in STEM programmes. Females are not enrolling in these programmes as much as males and therefore not choosing STEM related careers. For example, for engineering and technology, the enrolment of female students was 18%, 19.5%, 20.4% and 21.6% respectively. For the sciences, the enrolment for females was 28.5%, 30%, 36% and 37.2% respectively. It can therefore be concluded that while in sciences female enrolment seem to be heading toward some gender parity, the same cannot be said for the engineering and technology which seem to stagnate at an average of approximately 20% female enrolment. There are no significant disparities between female and male enrolment in the health sciences with enrolment statistics hovering around 50% between males and females.

However, it should be noted here that these are enrolment statistics only and they do not reflect graduation rates. The norm at UB, as it is with other universities around the world, is that students often switch their majors and for UB, the trend has been that female and male students drop out of the STEM fields for other disciplines such as the social sciences. However, there have been a few studies conducted that primarily looked at the graduation levels of females across the STEM domains. For example, the following table presents data that compares male and female graduates in physics at the UB for the academic years 1997 up to 2001.

Table 2: Female University Graduates in Physics at UB, 1997 – 2001 (based on Mpuchane, 2002)

Year	Male	Female
1997/98	28	1
1998/1999	43	10
1999/2000	33	5
2000/2001	19	2
2001	4	2

Table 2 above, derived from the study by Mpuchane (2002), shows low graduation rates amongst female physics students. For instance, for all the five academic years put together, 127 (almost 87%) of the graduates in Physics were men, as compared to 20 (13%) women.

Williams (2002), firmly asserts that male students are 60% more likely than female students to receive associate's degrees in STEM-related fields while a paltry 33% of females graduate in these fields. In their investigation of the factors that influence under representation of women in the STEM fields, researchers often converge around the notion that women are less likely to engage in informal interactions with their peers because of their minority standing in STEM majors and this lack of full engagement leads to them departing from STEM programmes for social sciences and other areas.

1.4 Objective

The study's main objective is to understand and isolate the factors that influence disparities in gender enrolment and graduation in STEM education in Botswana.

Additionally, the study intended to investigate whether Botswana has a defined STEM education policy and if so, if that policy was gender sensitive.

1.5 Research questions

The study was guided by the following research questions:

1) Is there a STEM education policy in Botswana, and is it gender sensitive or gender blind?
2) What are the factors that lead to gender disparities in STEM enrolment and graduation education in Botswana?

1.6 Methodology

The research employed qualitative research methods in the form of analysis of primary and secondary documents. These included Botswana national policies and key reports on gender matters such as:

- The National Policy on Women in Development (WID) 1995,
- The National Strategy for Gender and Development (NSGAD): Bridging the gender Gap (2013),
- The Draft National Policy on Gender and Development (GAD) (2013),
- Revised National Policy on Population and Development (2010),
- The Revised National Policy on Destitute Persons (2002),
- The Revised National Policy on Education (2004),
- Botswana Country Report on the Implementation of the Beijing Platform for Action (Beijing Plus 20 years) and,

- The Botswana National Science and Technology Policy (1998).

I also contacted the University of Botswana via email to solicit STEM enrolment and graduation statistics by gender for the academic years 2010/11, 2011/12, 2012/13, and 2013/14 (see Table 1). I come from Botswana and so it was easy for me to have access to the data through established relationships I have with the lecturers and staff at the institution. Data analysis from these secondary sources assisted me in understanding further the factors that influence gender disparities in enrolment and graduation in STEM fields in Botswana.

1.7 Data collection

As indicated earlier, the study mainly used available published and unpublished documentation in the form of government documents, policy documents, annual reports, organizational profiles and pamphlets, and available academic literature on the topic. Ghauri and Gronhaugh (2002) have observed that the use of secondary data can be advantageous in that the researcher experiences an enormous saving in resources, in particular their time and money. Secondary data enables researchers to analyse far larger data sets such as those collected by government surveys as this also allows researchers to have adequate time to think about the theoretical aims and substantive issues, as data is ready for analysis and interpretation.

My study data collection techniques involved email exchanges with lecturers and officials at UB (see Appendix A). Through my personal connections, I managed to get access to the enrolment statistics across the STEM areas by gender from the University of Botswana's institution of development planning unit. A brief review and analysis of these

available statistics on women in STEM in Botswana formed part of the data collected for the study. Statistics from previous studies like that of Mpuchane (2002) also formed part of main data collected for the study.

1.8 Data analysis

Qualitative methods were used to analyse data for the study. The study used descriptive statistical analyses for resolving the second research question of the study. In particular, research question 2 was resolved qualitatively with analysis of studies, reports and newspaper articles as well as analysis of statistical data both from previous studies and the one that I sourced from UB. For research question 1, I relied on the analysis of the reports, documents and studies conducted within the topic of study. That is, evidence to the presence or absence of a STEM policy was sought in review of the aforementioned secondary data sources and a conclusion was reached thereupon.

1.9 Definitional Aspects

Various writers have put forward definitions of the key concepts used in this thesis. The following subsection seeks to conceptualise some of them.

STEM: an acronym referring to the academic disciplines of science, technology, engineering, and mathematics.

STEM fields: STEM fields are also known as STEM careers in science, technology, engineering or mathematics.

Taken separately, the four STEM subjects are defined by the National Research Council as:

1. *Science* is the study of the natural world, including the laws of nature associated with physics, chemistry, and biology and the treatment or application of facts, principles, concepts, or conventions associated with these disciplines.
2. *Technology* comprises the entire system of people and organizations, knowledge, processes, and devices that go into creating and operating technological artifacts, as well as the artifacts themselves.
3. *Engineering* is a body of knowledge about the design and creation of products and a process for solving problems. Engineering utilizes concepts in science and mathematics and technological tools.
4. *Mathematics* is the study of patterns and relationships among quantities, numbers, and shapes. Mathematics includes theoretical mathematics and applied mathematics.

Finally, STEM is a term that is typically used in the USA when addressing education policy and curriculum choices in schools from kindergarten to grade 12 through college to improve competitiveness in technology development. It has implications for workforce development, national security concerns and immigration policy (Ask.com).

Gender

Gender is a socially constructed notion of the role of women and men, rather than a biological phenomenon (Raditloaneng, & Mulenga, 2003). The concept of gender has a lengthy and intricate genealogy (Haraway, 1991) but is commonly interconnected to the observed distinctions concerning women and men and to the uneven power relations based in those observed differences (Scott, 1986). Geographer Nightingale (2006)

fittingly places gender in a manner that argues that the meanings and practices of gender vary from place to place (and among different groups of women and men in the same place): 'Gender is the process through which differences based on presumed biological sex are defined, imagined, and become significant in specific contexts' (p.171) The processes that define this concept are always changed by other dimensions of perceived difference (e.g., age, ethnicity, physical ability) and develop through everyday practices in place, including of course practices relating to daily mobility (Pratt & Hanson, 1994). As in the case of mobility, geographic, cultural and social context are essential to understanding the meanings and practices of gender.

Gender equality

Gender equality refers to the equal rights, responsibilities and opportunities of women, men, girls and boys. Equality does not mean that women and men will become similar but that women's and men's rights, responsibilities and opportunities will not depend on whether they are born male or female. Gender equality implies that the interests, needs and priorities of both women and men are taken into consideration — recognising the diversity of different groups of women and men. Gender equality is not a "women's issue" but should concern and fully engage men as well as women. Equality between women and men are seen both as a human rights issue and as a precondition for, and indicator of, sustainable people-centered development" (UNDP, 2008). It is therefore important to understand the concept of gender equality as it fits into my study.

Gender equity

The crucial component of my study is the concept of gender equity across the STEM disciplines in post secondary institutions in Botswana. It is therefore important to discuss

and define this concept to further contextualize my study. It is also worth noting that, this concept was first acknowledged by Botswana's latest policy review on her education. The 1993 Revised National Policy on Education (RNPE) defines 'equity as access to educational opportunities and the distribution of educational outcomes must be fair, that is, individuals should not be disadvantaged because of their economic background, geographical location, gender, ethnic origin, religion, or disability' (p.33). It was stated in the report that the Commission's main aim was to achieve greater equity in education. Geographical location, gender, ethnic origin and disability were discerned as the barriers to equity as far back as 1993.

Twenty-two years later, the barriers stated above still haunt Botswana's education system. Schools that are situated in the remotest areas of the country are often under resourced in terms of staffing and learning materials. Most schools in these areas do not have electricity, science, and computer laboratories which make it difficult to enhance the teaching and learning of STEM related disciplines. It has also been observed that some teachers refuse to serve in these areas denying school children the possibility of being taught by the best teachers in the areas of STEM.

Setswana is the national language of Botswana. The country's native culture is referred to as Setswana culture while the citizens are called Batswana, with an individual called Motswana.

1.10 Significance of the study

The importance of this study cannot be overemphasised. Botswana's future economic development will be based primarily on technological advancement. The reliance on technological growth presupposes the existence of skilled human resources produced by a

sound educational system and a well-planned training strategy. Economic performance, technological excellence, skilled human resources, and education and training are interdependent (RNPE, 1993:25).

Botswana and the rest of the sub-Saharan Africa are rich with opportunities and minerals to sponsor their growth; and education, as argued earlier, is a *sine qua non* for economic development for many countries of the world. Science and technology have long been recognised as the basis of development and prosperity of Africa. Economic prosperity of African countries is interlinked with its skilful utilisation and management of science and technology. This underscores the importance of skilled human resources in the STEM fields in Africa.

STEM education remains at the center of the creation of critical thinkers, increases science literacy, and enables the next generation of innovators in Africa and elsewhere. Innovation leads to new products and processes that sustain economies across the globe. It is clear that most jobs of the future will require a basic understanding of mathematics and science. Eberle (2010) has observed that the 10-year employment projections by the U.S.A. Department of Labor show that of the 20 fastest growing occupations projected for 2014, 15 of them require significant mathematics or science preparation. This can safely be said for Botswana and the developing world as well.

The under representation of women in the various fields of STEM has long been recognized globally. It is of grave concern to developing countries like Botswana and others African countries. Girls' education is not only a fundamental right, but it is also an important catalyst for economic growth and human development (Oxfam, 2000; Klasen,

2002). While the profits of STEM education for women in sustainable social and economic development are numerous in some major parts of the world, Africa still lags behind other continents in terms of provision of STEM education for girls. Female education and training in Africa is generally symbolised by lower performance and achievement levels than those of boys, especially in STEM and other technical disciplines (Gachukia & Kabira, 1991).

Making STEM education a priority remains critical for a country like Botswana. The findings of the present study add new knowledge in this area and perhaps accentuate the understanding of this complex situation, thus leading to better provision of post secondary education for girls in Botswana. Kesamang, & Taiwo (2002) have opined that:

> "If the nations of Africa are to join in the foreseeable future the community of nations where science has become a dominant socio-cultural factor, concerted efforts must be made to critically study the contemporary socio-cultural milieu within which African school-going children are being raised. This would be with a view to synthesizing those factors within the African culture that impinge one way or the other on the ease with which the African child learns school science" (page, 919).

The present study is therefore important in beginning the processes of critically examining the socio-cultural climate under which girls' education are influenced in Botswana, particularly in the areas of STEM, as earlier argued. Commentators and researchers within women-and-development circles converge around the notion that in the future, when majority of women may have jobs, it will become an important task for

many governments, particularly in the developing world, to devise new educational and training programmes which will ultimately assist to minimize the productivity gap between males and females. This is true for Botswana, as she has put in place infrastructure that supports the notion stated.

More importantly this study is significant, as it is the first to "pull all the STEMs" under one roof, since many preceding studies done in Botswana have focused on one of the disciplines in STEM, (for example, Duncan, (1989); Mpuchane (2002); Baryeh, Squire, & Mogotsi (2001); Kesamang and Taiwo (2002); Sebusang and Masupe (2003); Koosimile, (2004)). It is hoped that, the findings of the present study will add new knowledge in this area and perhaps highlight the importance of understanding of the phenomenon that will lead to better provision of education in Botswana.

1.11 Limitations of the study

This study was limited by a number of factors:

- My study could not acquire graduation statistics by gender at the University of Botswana for the academic years 2010/11, 2011/12, 2012/13 and 2013/14.
- My study could have benefited greatly if the researcher had had the opportunity to interview females that are in STEM related causes and those that have dropped out of the STEM related courses to understand and isolate the factors that impinge on their enrollment and ultimate graduation in this field.
- Future studies in this topic should therefore be ethnographic in that semi-structured interviews could be conducted as the primary source of raw data to examine the factors that lead to gender disparities in enrollment and graduation in

STEM areas in Botswana.

1.12 Outline of the thesis

This thesis is organised into five chapters. Chapter 1 provides the introduction of the study including the statement to the problem and purpose. This chapter describes the qualitative research paradigm and the overall research design adopted for the thesis. The information provided in this chapter is vital because it informs the reader of the background issues, structures and terms that will be used.

Chapter 2 is a contextual chapter. It traces the development of education, and education policy in Botswana. Gender relations are also discussed as they further provide the context of the study.

Chapter 3 reviews literature on STEM education and gender disparities in enrolment and graduation in Botswana and in the subject as has been studied elsewhere. This literature review is instrumental in the development of a framework for analysing the findings and for making recommendations. The research topic straddles a few academic disciplines and fields; these include Feminist Theory, Education, Gender and Women Studies, Gender and Development, Gender Mainstreaming Framework and therefore borrow material from the various subject areas.

Chapter 4 presents the results of the study. A detailed discussion of the factors that influence gender disparities in STEM fields in Botswana's post-secondary education. The research questions and objectives are discussed in terms of the findings of the study.

Chapter 5 presents conclusions emanating from the findings of the study. The chapter also presents plausible recommendations that Botswana may implement to rigorously

correct the status quo of the gender imbalances in the enrolment and graduation within the STEM fields.

1.13 Chapter summary

In this chapter I have presented an overall introduction to the topic under study. The study methods adopted for the study were deliberated in this chapter as well as its significance and relevance to the country of Botswana. The background issues and key terminology have been discussed in this chapter. The chapter closes with the presentation of the thesis chapter outline.

Chapter 2
Education and Gender relations in Botswana

'If gender is everybody's responsibility in general, then it's nobody's responsibility in particular'.

Pollack and Hafner-Burton (2000)

2.1 Introduction

This chapter presents the context of the study. The context of the study is responsible for study-to-study variations for the following reasons: firstly, context is often responsible for one of the "most vexing problems in the field": the inconsistent research findings between research studies (Johns, 2006, p. 389). Secondly, context helps suggest areas where our research is applicable by identifying the setting of the study with which our audiences can identify. Rousseau and Fried (2001) have espoused similar justifications. They reason that contextualisation informs hypothesis development, site selection, measurement choice, data analysis and interpretation, and the reporting of research. Thayer-Bacon (1997:242) declares that people make sense of the world because of their contextuality, the social setting and its past. Thompson (1990:280) also asserts that 'the primary goal of social science is to understand meaning in the context in which it is produced and received'.

The chapter therefore describes the context under which the study is conducted by first presenting the broad country setting. Secondly, Botswana's political, economic and educational climates are discussed. The country's educational reforms are discussed in order to show the effort the government has undertaken to improve efficiency, effectiveness and quality of education and training. Lastly, the chapter traces the

development of gender relations in the country and also presents the current successes that Botswana has made toward achieving non-sexist society.

2.2 Botswana geographical location

Botswana is a landlocked country in Southern Africa that borders Zimbabwe, Zambia, South Africa and Namibia. The country has a surface area of approximately 570,000 square kilometers (Parson, 1984), which is about the size of France. According to the Population and Housing Census of 2011, the country's population was 2 038 228 with an annual population growth of 1.9% between 2001 and 2011. Women and girls comprise 52% of the population. The country is predominantly rural with 78% of the population living in the rural areas while 22% resides in the urbanized eastern margin of the country (Central Statistics Office, 2011). Female-headed households form the largest majority of those living below the poverty datum line in Botswana.

2.3 Economy

Botswana has maintained one of the world's highest economic growth rates since independence in 1966 at an average of 8.7% between 1966 and 2008 (BIDPA and WHO, 2013). Through sound fiscal policy and prudent management, the country has been able to transition from the category of Least Developed Countries (LDCs) to an upper Middle Income Country (MIC) with a per capita GDP of US$ 8,533 in 2011 from per capita GDP of US$ 70 in 1966 (BIDPA and WHO, 2013). The revenues from the mining sector, beef and tourism have enabled the country to invest in improving the quality of life of citizens, thereby contributing to reduction of poverty, especially amongst women and girls.

The country's unit of currency is the Pula, and is the strongest in the continent. On 4 March 2015, 1 pula was equivalent to 0.13 CAD or 0.10 US$ (OANDA currency converter.com).

2.4 Government and politics

The government of Botswana was initially based on the British Westminster model but due to the social, cultural and economic differences between Britain and Botswana, the Westminster model was changed to conform to local political ethos. For example, Batswana political moderates wanted traditional leadership to be incorporated into government by creating an advisory body called the House of Chiefs (Botswana government, 2008a). The Constitution determines that the House of Chiefs comprises 15 members: eight ex-officio members from eight tribes, four members elected every five years or when a vacancy occurs, and three specially elected members who, unlike the other 12 members, should be proficient in English as a requirement, must not be politicians or should not have been active in politics in the past five years, must not be civil servants and must be aged over 21. The House of Chiefs does not have legislative or veto powers but it acts as an advisory body to parliament and government.

The moderates of the Bechuanaland Democratic Party, which was led by the first President of the country, Sir Seretse Khama, preferred a democracy similar to the British government so that they could exclude the socialist ideals of the Bechuanaland Peoples Party. This led to a nation with a strong democracy and a history of political stability. A democratic government has ruled the country since independence in 1966. The National Assembly is the single house of parliament, while the President takes both the role of the

Head of State and the Head of government. Executive powers are vested in the President by the Constitution of the country. The President exercises his powers either directly or through other public servants subordinate to him. The President also presides over the cabinet, which comprises elected members of parliament who have been appointed to lead specific portfolios. Each minister is responsible to parliament for the administration of his/her ministry.

Multiparty competition has been the order of the day in Botswana since independence in 1966. The Botswana Democratic Party (BDP) founded in late 1961 as the Bechuanaland Democratic Party by Seretse Khama, has won every election since 1966. Other parties, which competed in the elections, included the Botswana People's Party (BPP), the Botswana Independence Party (BIP); and the Botswana National Front (BNF), which put up its first candidates in 1969. To date, opposition parties include the Botswana Congress Party (BCP) (formed in 1998 as breakaway of the BNF), and the Umbrella for Democratic Change (UDC), founded in 2012. Other parties of the alliance include the Botswana Movement for Democracy (founded in 2010 as spilt of the BDP), and the Botswana People's Party.

Judging by the recently held general elections in the country, the party's popularity has dwindled. The party's popularity amongst eligible voters in the 2014 general elections was 46.7%. In 1999, the BDP managed 57.15%; in 2004 it got 51.73% while in 2009 it amassed 53% of the vote (Dube, 2015).

2.5 Local government

The country is divided into ten Districts: Ngamiland, Chobe, Central, North East, Ghanzi, Kgalagadi, Kweneng, Southern, South East and Kgatleng (Botswana Government, 2005a). Districts divide the country into politically and administratively manageable segments. In addition to the Districts, the Ministry of Education has further divided the country into regions. As a result, schools are administered according to these regions, which cut across Districts (see figure 1).

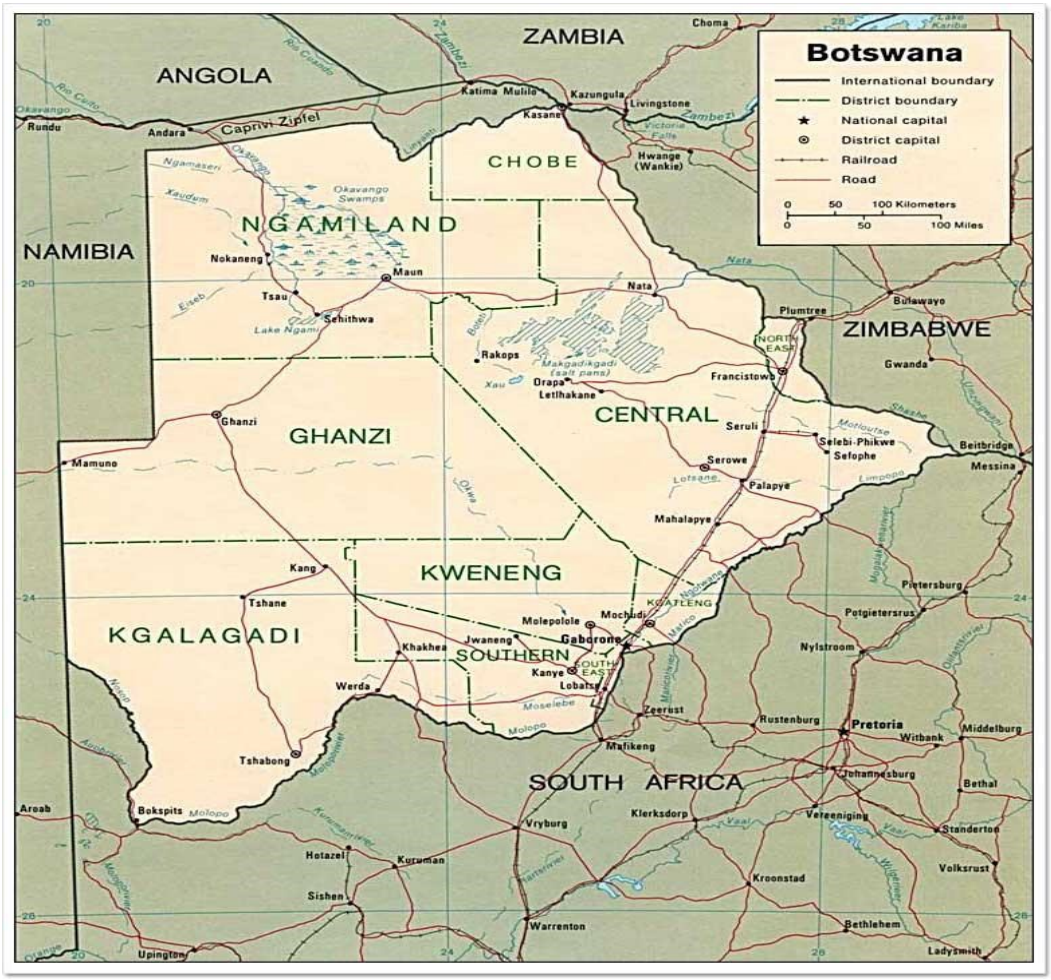

Figure 1: Map of Botswana

Source: www.botswanatourism.co.bw/maps/maps.html)

2.6 History of Education in Botswana

2.6.1 Traditional education

Botswana's education system has transformed over the decades from pre-colonial times, through early post-independence and into the modern era. Before the arrival of the colonizers and missionaries, the traditional form of education was characterised by the schools of *Bogwera* (initiation schools for boys*)* and *Bojale* (initiation schools for girls who had just reached puberty). Their primary aim was to socialise children into the accepted norms and values of their various cultural groups. According to Schapera (1934), in these schools life skills were imparted like sewing, cooking and weaving beads for girls, while boys were taught skills like hunting, tending livestock and making shields and spears. That curriculum was based on gendered identities and was embraced by all.

2.6.2 Europeans influence on the educational landscape

The second stage of the country's evolving education system was marked by the arrival of the London Missionary Society (LMS) led by Robert Moffatt and his team circa 1824, which was credited with the introduction of western education. Mafela (2014) asserts that western education was initially introduced to Batswana as a concomitant part of conversion and evangelization. It involved the induction of natives into the Western codes and rituals, reflecting their subordinate role in the colonial socio-political dispensation. The LMS built the first primary school in Kuruman and other churches followed suit in building schools (Munger, 1965).

One effect this era was that Botswana lagged behind other countries/ colonies in the region in terms of quality education as the colonisers paid little or no attention to the

colony in terms of financial and administrative support. During this period, many of the tribes did not like the fact that the language of the classroom was Setswana instead of English, which eventually led to the establishment of Tribal Schools Committees to run the schools in 1910. It is at this point forward that Batswana began to have a say over the nature and content of their education. This of course, enabled aspects of the people's experiences, histories and lifestyles to be featured in the curriculum.

In order to succeed in the running of these schools, the chiefs introduced an education tax to help pay the teachers who would give English lessons to Batswana children. The tribal schools were also financed by local treasuries, which received half of the $3.00 (US) annual tax paid by all African men (Halpern, 1965). Towards independence, it became apparent that tribal committees could not continue running the schools. After independence these were taken over by the Ministry of Education (MOE), which led to the third stage of the evolving education system.

2.6.3 Botswana education system post-independence

The third and last stage of the country's evolutionary education system saw an education law passed by an act of parliament upon attainment of independence in 1966 that dismantled Tribal School Committees and introduced the Ministry of Education, currently known as the Ministry of Education and Skills Development. This ministry was now responsible for education in the country at primary, secondary and tertiary levels. An immediate achievement by this new ministry was the mushrooming of primary and secondary schools and teacher-training colleges. The University of Botswana was also created through the efforts of the government in 1977 after rallying all Batswana to

contribute toward the building of this institution. Batswana families were asked to donate a cow each toward the building of the University and they duly obliged. This stage is also characterized by the two national educational policy reviews, which will be covered in the next section.

2.6.4 Educational reforms to date

Botswana has had two education policy reviews since independence. Researchers interested in the development of education in Botswana have argued that the Government of Botswana has advanced the delivery of teaching and learning in a methodical fashion via a mixture of very attentive and coherent policies that are in line with National Development Plans (Leburu-Sianga & Molobe 2000:24). The improvement of the education system of Botswana has been channeled through two policy documents to date, the Report of the National Commission on Education: Education for Kagisano (Social Harmony) of 1977 whose primary intention was to guide the education system of Botswana for the subsequent twenty-five years, and the Revised National Policy on Education of 1994. The former was largely responsible for the development of secondary education as the total number of public secondary schools increased from nine to fifteen with tremendous inroads made in the training of teachers, which increased by 32% (Republic of Botswana 1977a: 119). The first National Commission on Education's objective of expansion of secondary education in both qualitative and quantitative terms was achieved because by 1990 there were 143 community junior secondary schools and completion of basic education was at 65% of the population (Mautle 1996:109).

Conversely, there was consensus within the government of the day that even though education in the country had grown tremendously, it had reformed little as it failed to respond to fresh demands in terms of attitudes, skills, and abilities (Republic of Botswana 1977b: 1); Molosi 1993:41). This was also complimented by the mood among the public that the country was no longer delivering quality education as a result of the expansion programme. Consequently, the country converged around the notion that it was time for Botswana to reexamine the ways it was delivering education to its masses (Republic of Botswana 1977b: 1; 1992:3). These concerns gave birth to the RNPE of 1994. Some of the objectives of the policy are to:

i) Raise the educational standards at all levels,
ii) Achieve efficiency in educational development,
iii) Make further education and training more relevant and available to large numbers of people,
iv) Improve the management and administration of schools to ensure higher learning achievement,
v) Improve the quality of instruction,
vi) Implement broader and balanced curricula geared towards developing qualities and skills needed for the world of work, and
vii) Embark on measures aimed at raising the status and morale of teachers (Republic of Botswana 1994b: 5-11; 1997b: 8; 1999:16-17).

Furthermore, the diversification of the curriculum saw the introduction of practical subjects like Design and Technology, Home Economics, and Agriculture; and the number

of qualified local teachers in the teaching force had increased from 101 in 1976 to about 2 500 in 1991 (Republic of Botswana 1991a: 323).

Whilst achievements have been made in most of the objectives mentioned above, it is worth noting that the objectives of making tertiary education and training more relevant and available to a huge proportion of the population and implementing a broader and balanced curricula geared towards developing qualities and skills needed for the world of work need some critical analysis as there have been sluggish improvements made therein. The objective of making tertiary education more accessible to a majority of people was and is a noble idea indeed but the country has failed to emulate other countries in the region like South Africa and Zimbabwe in establishing single sex institutions. These institutions could provide a partial solution to the challenges that the current system places before women and girls in pursuit of STEM related careers in Botswana.

2.6.5 Modern Botswana's education system

Botswana offers a three-level education structure involving 7-year primary school education, followed by 3-year lower secondary, and concluding with a 2-year senior secondary school education. The 10-year basic education cycle sees students automatically graduating from primary schools to junior secondary education whereupon they go through an examination to determine their passage to the last 2 years of senior secondary schooling. At junior secondary level, a multitude of vocational electives involving Art, Design and Technology, Business Studies, Home Economics, Religious and Moral Education are offered alongside traditional core subjects including English,

Mathematics and Science, to mention but a few.

According to Koosimile (2005) the current integrated science curriculum, which is a combination of Biology, Chemistry and Physics topics, was introduced in 1996 following the recommendations of the country's second National Commission on Education of 1993 and the subsequent publication of the RNPE of 1994. The three aims undergirding this curriculum state that:

'At the end of three years of Junior Secondary Science Programme, students are expected to have developed:

. An understanding of the basic principles and concepts of science as they are experienced in everyday life.

. Positive attitudes towards scientific skills such as curiosity, open-mindedness, creativity, objectivity, integrity and initiative.

. An awareness and appreciation of the interrelationships between science, technology and society in the context of science and everyday life.' (Ministry of Education (Botswana) 1995: ii–iii)

Until the advent of cost recovery measures by the government in the mid 2000s, education was offered free from primary to senior secondary schools, which resulted in wide access to education. The government of Botswana, through the RNPE recommended that cost sharing measures that saw the reintroduction of school fees at junior, senior and vocational training levels. The fees are 5% (P300 annually per child) of the cost that government incurs in providing for secondary education, while needy

children and orphans are exempt from this arrangement. Primary schooling remains free for nationals and refugees while non-Batswana pay a subsidized fee (unicef.org).

2.6.6 Educational physical infrastructure

Botswana has moved from the nine secondary schools at independence to 283 in 2012. Government schools constitute 84.0% of all secondary schools in the country while private schools constitute the remaining 16% (Central Statistics Office, 2012).

In 2012 there were 812 primary schools countrywide of which 93% were government owned while 7% were privately owned. In Botswana, district councils within the Ministry of Local Government run all government primary schools. There was an increase of 0.3 percent on the number of schools from 810 schools in 2011 to 812 schools in 2012 (ibid).

Botswana has done extremely done well in terms of tertiary level education. There are two public universities in Botswana namely UB and the newly opened Botswana International University of Science and Technology (BIUST). The origin of the BIUST can be traced to the national strategic shift that came with the RNPE of 1994. The RNPE shifted focus to 'quality' and emphasized an education system geared at the world of work. It acknowledged science and technology as the compelling mechanisms in transforming Botswana from a pre-dominantly agro-based economy to an industrial economy, hence the subsequent establishment of a National Science and Technology Policy in 1998. In addition to the two universities mentioned earlier, there is the Botswana College of Agriculture (BCA) which was established on the 31st of May 1991 by Act No. 9 - Botswana College of Agriculture Act 1991, of the Parliament of Botswana. There are two training colleges for secondary school teachers in Molepolole,

and Tonota Colleges of Education while the primary teachers are trained at Francistown, Tlokweng, and Serowe Colleges of Education.

It can be deduced from the above discussion and statistics that Botswana has not yet fully realised the benefits of early childhood education that currently is offered privately with the sad result that few Batswana can afford pre-primary education for their children that is crucial in the overall learning and development of all children. It is normally an acknowledged fact that early education is crucial to preparing young children for schooling in their latter years. Solid foundation for Mathematics (a subject at the epicentre of all the STEM disciplines) is laid during this stage of education. In fact, it has been agreed, "pre-primary education is concerned with the physical, psychological, and social development of the young child. It is based on the principle that learning starts from birth and therefore early intervention to facilitate the process of learning enables the child to cope with more complex learning (which may include STEM related disciplines) later in life" (RNPE: 61).

2.7 Gender relations in Botswana

Traditionally, women in Botswana were treated as if they were below men socially. This persists today despite efforts of the government and feminists alike. The problem of patriarchy is still regarded as the sole source of these gender oppression tendencies in Botswana. Often, women were more or less equated with children. They could not participate in *kgotla* (village council) discussions. Wives were expected to be submissive to their husbands; they were not allowed to question them, even when the latter were clearly in the wrong. There was no social equality between males and females. And yet women were respected as the custodians of customs and belief systems. Gender discrimination has been multifaceted and elusive, completely intertwined with culture and tradition.

However, Botswana has over the past twenty years achieved tremendous progress in the implementation of the BPFA. The legal and policy environment has been transformed and strengthened to promote gender equality and equity. As mentioned before, Botswana is signatory to BPFA and a number of international human rights treaties and their protocols, in particular on gender and human rights. The following are some of the treaties, charters and initiatives that the country has ratified:

- International Convention on Civil and Political Rights (ICCPR);
- Convention on the Elimination of All Forms of Discrimination Against Women (CEDAW);
- The Optional Protocol to CEDAW;
- African Charter on Human and People's Rights and Protocols;
- International Conference on Population and Development (ICPD);

- ICPD+15 Plan of Action;
- Convention on the Rights of the Child (CRC);
- African Charter on the Welfare and Rights of the Child;
- Protocol to Prevent, Suppress and Punish Trafficking in Persons, Especially Women and Children;
- Solemn Declaration on Gender Equality;

The ratification of these conventions and protocols has been blemished by Botswana's continuous refusal in the signing of the regional ones such as the Protocol to the Charter on Human and People's Rights on the Rights of women in Africa, and the Southern Africa Development Community (SADC) Protocol on Gender and Development. By refusing to sign these protocols, Botswana is denying its citizens the opportunity to benchmark her policies against her regional partners that in more ways than one, share the same cultural practices in so far as the plight of women is concerned. Countries such as South Africa are moving forward in the spheres of increasing women participation in the political arena where public policies such as those on gender equity and equality are debated and drafted. This and other gender relational challenges will be discussed in the following sub sections.

Despite all these efforts, the country still experiences immense gender relational problems such as the following:

Addressing Cultural and Religious Stereotypes

There are still a lot of problems in this area because of the patriarchal nature of Botswana society. Though the legal and policy environment has been strengthened to

limit discrimination by gender, the country still faces a lot of resistance from traditional chiefs who view these policies as aimed at diminishing the cultural beliefs that have been part of Botswana's society such as the ones that render men as heads of their households.

Faith is a major determinant of gender discrimination in Botswana society. Leaders of various religious denominations have also been targeted to address gender discrimination issues in their establishments and other religious settings (GeAD FBO Pitso, 2012). A considerable proportion of women belongs to religious organisations but is socialized to believe that gender oppression and discrimination is normal and sacrosanct (Beijing Country Report, 2014:20).

Violence Against Women and Girls

Gender based violence issues have been a cause for concern across many communities in Botswana. A study aimed at establishing the prevalence of, and attitudes on violence against women and girls was conducted in 2011 by the Gender Affairs Department in collaboration with Gender Links. The findings of the study discovered that 2/3 (67%) of women in Botswana have experienced some form of violence; 3/5 (62%) have experienced violence from their lovers; and that 48% of men admitted to have perpetrated violence some time in their lives. The results of the study are presented in Table 3 below.

Table 3: Trends in Violence Against Women in Botswana (2003 - 2012)

	Defilement of girls under 16	Rape Cases	Partner Killings	Common Assault
2003	303	1,506	54	10,656
2004	320	1,517	56	10,855
2005	219	1,540	85	11,803
2006	324	1,534	62	11,081
2007	391	1,596	101	11,899
2008	428	1,875	81	14,520
2009	487	1,754	93	15,133
2010	518	1,865	105	
2011	529	1,800	81	
2012	534	2,073	89	

Source: The Botswana Police Service, 2012 cited in Botswana Country BPFA Report.

Table 3 above gives the number of reported and known cases of violence against women for the period 2003 to 2012. The Botswana MDG Status Report (2010) indicates that violence against women (battering, rape and murder) is still high at 97 per 100,000 in 2009, compared to 104/100,000 in 2008. More worryingly, the Botswana MDG Status Report (2013) indicated that defilement of girls increased from 518 in 2010 to 534 in 2012 while rape cases increased by 11% during the same period. The number of what has come to be known as "passion killings" (where male partners in a relationship kill their female partners) has decreased from 105 in 2010 to 89 in 2012. Common assault cases remain high and are increasing. The situation is exacerbated by the fact that there is under-reporting of these cases because normally the victims feel pressured not to report the perpetrators, as they depend on them for their livelihoods.

Under representation of women in the political arena

The MDG Status Report has lamented the decrease of women in political office from 11% in 2004 to 7% in 2009. The status report further pointed out that women's representation in councils stood at 20%, which is far lower than the SADC's threshold of 30% (SADC Gender Protocol Barometer, 2012). A number of reasons have been advanced as hindering women's increased involvement and participation in political decision-making, but the most primary is the multiple roles that women perform in Botswana.

2.7.1 Gender Equality and Equity in Education

The importance of gender equality in education within the process of international goal setting was emphasized in the Education for All (EFA) Goals (UNESCO, 2000) and the Millennium Development Goals (MDG) (United Nations, 2006). My study is premised on the understanding that Gender mainstreaming and gender equity education are specific practices for creating a gender-equitable Botswana society. This is in no way despising the efforts that Botswana has achieved to date. The MDG 2010 Status Report states that Botswana has achieved universal education and the estimated Net Enrolment Ratio (NER) for children aged 7-13 was above 95% in 1999 and had reached 100% in 2000. The same report claim that gender equity had been achieved in the formal educational system. The report finds the country needs to, as a matter of urgency, ensure that the quality of education matches the volume of investment. In arguing this point, the report points out that the country hardly performs well in the standard tests like the Trends in International Mathematics and Science Study (TIMSS).

Ahead of this year's (2015) deadline, the SADC Gender Barometer (2012) has stated that

Botswana has achieved gender parity at all levels of education. Conversely, despite these successes, Botswana continues to encounter challenges in education and training as this study has argued in terms of gender balances in enrolment and graduation in STEM areas. There were 115 reported cases of pregnancies that accounted for 2.9% of girls dropout rate (Botswana MDG Report, 2010; SADC Gender Protocol Barometer, 2012). Additionally, 1,054 cases of pregnancy was responsible for 31.7% of all children who dropped out of secondary schooling, rendering teenage pregnancy the number one culprit responsible for girls' dropping out of school and somehow leading to the imbalances in STEM enrollment and graduation across post secondary institutions in Botswana because most girls never come back within the mainstream education setup.

While giving a speech at the 58th session of the Commission on the status of women meeting held in New York from March 10-21,2014, Botswana's ambassador to the UN, Mr Charles T. Ntwaagae reported that Botswana has made significant progress in mainstreaming of gender in national policies and programmes. He mentioned that to date, gender mainstreaming has been affected in 50% of the government ministries while a further 62.5% of Ministry Gender Focal Points have been capacitated for gender analysis. Institutions that are key in the economic sector have been capacitated on mainstreaming of gender into public finance. Furthermore, development of a Gender Mainstreaming Training Curriculum for Botswana has just been completed. This will be used to facilitate standardisation of information and process for gender mainstreaming.

2.8 Chapter summary

This chapter lays out the context of the study. I gave a brief historical description of the

Botswana's education system and of the two education review policies was conducted to further present the context of my study. The chapter proceeded with a brief discussion of the gender relations in Botswana Statistics (Table 3) have been used to exemplify some of the problems that women face in Botswana. The chapter closed with looking at some of the efforts that the country has put in place to rectify and improve the plight of women in Botswana.

Chapter 3
Conceptual and Theoretical Framework

"No citizen of the future Botswana will be disadvantaged as a result of gender, age, religion or creed, colour, nationality or ethnic origin, location, language or political opinions. The future Botswana will have eradicated negative social attitudes towards the status and role of women, the youth, the elderly and the disabled, and will be free from all forms of sexual harassment".

Vision 2016

3.1 Introduction

In this chapter I discuss and assess relevant theories, which are useful in answering the main research question of the study. The primary objective of the chapter therefore, is to identify and articulate what I believe to be the most effective theoretical frameworks for examining and isolating the factors that influence gender disparities in STEM education in Botswana's post secondary institutions. Firstly, a case is made for the framework that can best explain the rationale for the current study. The chapter will then proceed to cover the concept of women's empowerment through the discussion of the Gender Mainstreaming Framework (GMF). This discussion is covered to assist me in understanding the type of the responses that are available for Botswana to best address the problem under scrutiny.

3.2 Theories of Inequality, difference, and gender oppression

The consistent thesis of this study is that problems facing women are a direct result of the way gender relations are situated in Botswana. Therefore, the current study finds itself firmly positioned within the inequality, difference, and gender oppression paradigms. I

am convinced that discussions of these theories in the context of education and post secondary training can enable me and other feminists, activists, teachers and policy makers to unpack some of the contradictions and tensions that arise as women and their male counterparts intermingle (Mannathoko, 1999).

3.3 Inequality theories

Lengermann and Niebrugge-Brantley (1992) have stated that the theories of inequality describe women's situation in terms of liberal feminism's view of unequal opportunity structures and the understanding of women's position as part of a complex class system of exploitation both in terms of gender and class. As shall be seen in the discussion of the women empowerment theories of GAD, WID and the GMF, liberal feminism's explanation of gender inequality often commences with the pinpointing of the feminisation of labour and the prevalence of separate private and public spheres of social activity. Women's primary location is viewed to be within the private sphere and men's in the public domain, and the socialisation of the children is often seen as a preparation for their adult roles and work in the domains consummate with their biological makeup (Dorsey, Gaidzanwa, and Mupawaenda, 1990; Nyathi-Ramahobo, 1992).

To Batswana women, the private domain is characterized by reproductive tasks such as child rearing, house chores, support and care for the elderly, and unpaid and undervalued activities. In sharp contrast, the public sphere, abundant with social rewards of status, power, money, freedom, self-esteem and personal development is where men are positioned. Feminist researchers have consistently argued that gender inequality is created by a system that restricts women's access to the public sphere (such as STEM

related careers). Burdening and isolating women with private sphere responsibilities (thus restricting time and access to public sphere activities) identified earlier often causes gender inequality.

Studies conducted in Botswana and elsewhere in the region conclude that educational stereotyping is contributing to the marginalization of women in the sub-continent. Duncan, (1989); Motlotle, (1989); Mbilinyi, Mbughuni, Meena, & Olekambaine (1991) have identified gender stereotyping in subjects like Social Studies, Science, English and Setswana. They cite an example where pictures contained in the prescribed texts of senior secondary science reinforce the image that careers like medicine, engineering and geology are for men.

There is a general consensus that inequality theorists' main area of focus is access and equality of opportunity. The main argument in this sphere of reasoning is that studies carried out on the education of females suggest that increasing their access to education does not necessarily guarantee the improvement in the quality of their lives. They point to the theories of difference like institutional socialisation and social psychology to be the ones that indicate that gender based discrimination across institutions like the family and the school need to be urgently addressed in order to improve the status of women and girls. This therefore explains the need for my current study.

3.4 The theory of difference

Scholars from this doctrine believe that the situation of women is different from that of men and they pin this difference to the biosocial conditioning, institutional socialisation, social-psychological linkages and third wave feminism (Lengermann and Niebrugge-

Brantley 1992). The different personality structures of men and women, their different physical bodies, and different mental and emotional processes are often construed as the primary sources of difference between males and females (Connel, 1987). The central hypothesis of the theorists of difference is that the physiological make up of human bodies is the foundation of the social relations of gender. Their main theme is therefore that gender discrimination is a social fact. The socialisation of boys and girls in the home, school and the community is always different and it does have a crucial impact on the overall education of children.

Current research findings from the theories of difference have revealed that females are often treated as 'temporary relatives' in their parents' homes because it is believed that they will soon depart upon getting married. Additionally, it has been reported that teachers (males and female alike) often have negative attitudes toward the education of females at secondary and post-secondary levels (Taole, 1996; Fuller, 1994).

3.5 Gender oppression theories

Gender oppression theorists have asserted that women's condition is the result of a direct power relationship between men and women in which men, effectively implement those interests which underline their control, use suppression and oppression on women (Mannathoko, 2002). These scholars have reflected that the oppression of women can be understood through radical feminism and the socialist feminism lens. The perception of the radical feminists is that societies across the world are oppressive to their women concluding that every institution is a vehicle by which men dominate women resulting in gender oppression. They perceive gender oppression as a system of patriarchy and to them patriarchy is the most important source of inequality across genders (Measor and

Sykes, 1992). It has become the primary concern of the radical feminists to investigate how the structure of patriarchy spreads its web across societies. For example, in schools, males dominate females in classrooms, which consequently has a negative impact on the opportunities of women post-schooling. Secondly, radical feminists have made it their mission to investigate the sexual harassment of females in societies. Mahony (1985) argued that boys concentrate a lot of their time in school on the control of girls. The radical feminists have brought the issues of sexuality, patriarchy, reproduction, and children's socialisation into the human rights debate. Mannathoko (2002) has argued that capitalist patriarchy and domination are terms used to describe the multi-dimensional system of oppression based on patterns of production, class, gender, ethnicity and global situation.

3.6 Gender Mainstreaming Framework (GMF)

In the next section I will discuss the Gender Mainstreaming Framework (GMF) as the appropriate theoretical framework that fits into my study. The primary focus of my study is to highlight the issues of women's under-representation in STEM disciplines as Botswana has acknowledged that technology and other disciplines of STEM will be crucial to her developmental efforts. It is for this reason that the GMF theoretical framework will be utilised in this study. My understanding is that GMF, if implemented intelligently can address the issues of gender equity across the STEM and other areas affecting women in Botswana.

GMF has been viewed as an essential strategy to foster gender equity and gender equality since it was first proposed at the United Nations Fourth World Conference on Women in 1995. According to the United Nations Office of the Special Adviser on Gender Issues

(OSAGI), gender mainstreaming makes gender perspectives and the goal of gender equity central to any activity (including resource allocation, talent development, planning, implementation, and monitoring. MGE is the public social policy concept of evaluating the different implications for women and men of any planned policy action, including legislation and programmes, in all areas and levels. Mainstreaming essentially offers a pluralistic approach that values the diversity among both women and men (Booth and Bennet, 2002; Zebracki, 2014). It is a policy for making the apprehensions and strategies of women and men a fundamental element of the plan, ensure they benefit equally, so that inequality is not perpetuated. The ultimate goal of gender mainstreaming is to achieve gender equality.

Critics of this paradigm like, Stratigaki (2005) have maintained that the transformative effect of gender mainstreaming was minimal and its application has led to contradictory results. For instance, it opened important opportunities for specific policies in new policy areas, whereas in some other it weakened positive action. This scholar also declares that since 2003, gender mainstreaming has failed to affect core policy areas or fundamentally change policy processes in most parts of the world. This may be attributed to, in many areas, the rigid patriarchal societies that women's issues find themselves in. I agree with Stratigaki's observation because part of the problem girls and women are underrepresented in STEM careers in Botswana is because of the rigid patriarchal society Botswana is.

GMF as a modern concept, developed from historical concepts of Women in Development (WID), Gender and Development (GAD) and Women and Development (WAD). According to Leo-Rhynie and the Institute of Development and Labour Law

(1999) gender mainstreaming refers to "the consistent use of a gender perspective at all stages of the development and implementation of policies, plans, programmes and projects. Within the education sector, this would include not only the activities of governments, but also those of schools, colleges and education institutions, and, where appropriate, those of NGOs and the private sector as well" (p.9). I must point out here that the topic I chose for my study emanates from the fact that there is less activity within schools, colleges and education institutions like the UB and BIUST to infuse gender perspectives in their plans. It has been observed that GMF differs from previous attempts to infuse women's apprehensions into government activities because instead of just adding on a women's perspective to existing government policies, development plans, programmes and projects, it makes sure that a gender perspective informs these at all stages, and in every aspect of the decision-making process. Gender mainstreaming may thus entail a fundamental transformation of the underlying paradigms that inform education (Leo-Rhynie and the Institute of Development and Labour law, 1999).

As earlier mentioned, the concept of mainstreaming has developed out of a historical background of efforts to advance equality for women. In 1970, Ester Boserup used data and information collected from development projects in developing countries to underscore the different results on women and men of development and modernization strategies. In response to this, liberal feminists in the United States advocated the use of legal and administrative reform to ensure that women and their concerns would be better integrated into economic systems. This gave birth to the WID methodology, based on the rationale that women constituted a large untapped resource, which should be recognised as being potentially valuable in economic development (Leo-Rhynie and the Institute of

Development and Labour Law (1999)). It is for this reason that my study also finds itself embedded within the WID framework because it seeks to address the question of gender disparities in STEM education, which in my view, is a crucial element of Botswana's developmental path. This is so because Boserup's focus was on evaluating how work was divided between men and women, the types of jobs that constituted productive work, and the type of education women needed to fully participate in the developmental efforts of their societies. In sum, the WID movement that emerged during this period demanded social justice and equality for women. I agree with WID proponents, who argue that women face a plethora of problems as a result of their biological differences rather than gender. This argument can be mirrored in the subject/career choices of Batswana women in post secondary education. STEM related careers like engineering are often avoided by women simply because the belief is that women cannot carry heavy equipment involved with working in these fields.

In acknowledgement of the contribution of women to the overall economy and development, the government of Botswana developed a WID policy to improve the status of women and provide the basis for continuous review and monitoring of women's issues in the development agenda. The chief objectives of the policy was to strengthen links between the government, civil society particularly non-governmental organisations (NGOs), community based organisations (CBOs) and the private sector on women's matters (Government of Botswana 2000:2). The current situation on the ground is that women groups like *Emang Basadi* has experienced little or no support from the male dominated government of the day presumably to continue to control the public policy discourse through its rigid bureaucratic principles.

GAD was offered as an alternative to the WID approach in the 1980s because it began to question the previous propensity to examine women's struggles in terms of their biological distinctions from men, rather than in terms of their gender, i.e. the social relationship between men and women in which women have been subordinated and oppressed. A position I strongly agree with. The primary focus of GAD approach**,** which is related to the theory of oppression**,** is on gender division of labor and gender as a relation of power embedded in institutions and as a result of this, the approach uses two main bases in gender roles and social relations analysis. Thus the GAD approach is not concerned specifically with women, but with the way in which a society assigns roles, responsibilities and expectations to both women and men. My study also finds a space within this paradigm because it is concerned with what institutions produce at the end of the day, which is labour particularly within the STEM related careers as argued earlier.

GAD supports the WID opinion that women should be given the opportunity to participate on equal terms in all aspects of life, but its major focus is to assess the gender relations of power at all levels in society (particularly in rigid patriarchal societies like Botswana), so that interventions can bring about equality and equity between women and men in all sections of life. The state is expected to assist in this process of promotion of women's emancipation, and has been called upon, for example, to assume the responsibility of facilitating women's participation in the productive sphere by providing social services such as child care, which women in many countries provide on a voluntary or private basis. The GAD approach also places strong emphasis on legal reform (Leo-Rhynie et al 1999). In the GAD methodology, women are viewed as agents of change rather than as passive recipients of development assistance. The intervention

strategies of a GAD perspective do not seek merely to integrate women into ongoing developmental initiatives; they seek to bring about structural change and shifts in power relationships, and in so doing, to eliminate gender biases at all levels.

The WAD paradigm, which is related to the theory of inequality, stresses the relationship between women, and the work that they perform in their societies as economic agents in both the public and domestic spheres. It also emphasizes the distinctive nature of the roles women play in the maintenance and development of their societies, with the understanding that simple integration of women into development efforts would serve to reinforce the existing structures of inequality present in societies overrun by patriarchal interests.

The National Gender Programme Framework (NGPF) developed by the Government of Botswana and UNDP (1998:3) has advanced the following reasons as indication that women in Botswana are still subservient to men:

- Unequal access to control and decision making;
- The feminisation of poverty and labour;
- Restrictions on rights and freedoms which are not imposed on men, particularly within the marriage tradition, the prevalence and intensification of male violence against women;
- The sexism portrayed in educational curricula and the gender stratification of careers (like STEM careers);
- Imbalanced employment opportunities and the marginalization of women in the formal sector, and
- Male control of women's reproductive choices.

Spaces where women have historically been subservient to men comprise access to and control of resources such as land, cattle, power, education and business opportunities. The paradox is therefore that poverty further excludes women from decision-making structures at the political and governance structures even in the rural areas.

3.7 Botswana's Gender Mainstreaming Efforts

Numerous efforts have been put in place the government of Botswana to empower Batswana women amidst the rigid nature of patriarchy. For instance, the gender mainstreaming pilot project was conducted in the four Ministries of Labour and Home Affairs, Finance and Development Planning, Local Government and Commerce and Industry in 2002. Gender policies for these Ministries and Gender Action Plans were developed. The Women's Affairs Department is presently working with the Ministries and Departments in monitoring the implementation of the Action Plans.

The Ministry of Education and Skills and Development was not included in the pilot project and it is my opinion that this was an error. Educationists and scholars alike often converge around the notion that effective change in societies often starts with the reengineering of the education system to conform to the needs of the time. This reasoning is shared by Bellew & King (1993) who opines that, "the benefits of education are by now well established. Education improves the quality of life. It promotes health, expands access to paid employment, increases productivity in market and non-market work, and facilitates social and political participation." (p.285)

In other words, Botswana should have realized that gender mainstreaming might become easier if the issues of gender discrimination were infused and introduced within the

school curricula. Thus, assuming the country eventually implements publicly funded early childhood, pre-school curriculum and materials would have to be designed in such a way that they are gender neutral right from that stage throughout the schooling life of Batswana boys and girls. My study recognizes the fact the education of women is an important investment, despite the shaky economic contexts within which Botswana have to provide for education. According to Leo-Rhynie et al (1999) not only does education have a significant multiplier effect, given the responsibility of women for socializing the next generation of citizens, it also enriches the potential of women for contributing to the social, economic and political aspects of their nations' developmental paths. I agree with scholars' assertion that education also has considerable potential, in its many dimensions and processes, for bringing about change that can rectify imbalances between women and men in STEM as well as other spheres of life in Botswana.

3.8 Chapter summary

This chapter has traced and discussed the development of the relevant theoretical frameworks for the study's two research questions. This has ultimately led to the selection of Gender Mainstreaming Framework as the most relevant theory for identifying and understanding factors leading to the gender disparities in STEM education in Botswana. The country's gender mainstreaming efforts are also discussed to solidify the fact that indeed GMF is seen as a solution to the problems affecting women and girls within the education context in Botswana. A strong case was made for education to be given a chance in Botswana to drive the country towards a gender equitable society. I therefore choose the GAD methodology as the most suitable for my study because its intervention strategies do not seek to integrate women issues into

ongoing developmental initiatives but rather to bring about structural changes and shifts in power relationships between women and men, which will ultimately water down gender biases at all levels of Botswana society.

Chapter 4
The Factors for STEM Gender Imbalances in post-secondary education in Botswana

How a society selects, classifies, distributes, transmits and evaluates the educational knowledge it considers to be public, reflects the distribution of power and the principles of social control. (Bernstein, 1977)

4.1 Introduction

This chapter presents the findings of the study. The study was principally guided by two main research questions: what are the factors that lead to gender disparities in enrolment and graduation in STEM in post secondary education in Botswana, and if Botswana had a STEM policy and if so, if it was gender blind. The following will be a discussion of what was uncovered in response to the two main research questions. The chapter will unfold in two main parts with the first part being the discussion of the responses to the first research question and the latter, the second research question.

4.2 Curriculum does matter

The factors generating gender disparities in STEM are multiple. It has been observed that educational institutions reflect the wider society and reproduce sex stereotypes and low expectations amongst girls. The subject choices of boys and girls in secondary school are highly stereotyped. For example, in the 1990 Cambridge Overseas School Certificate (COSC) examinations, 580 boys and 24 girls sat for Woodwork and 690 girls and 11 boys sat for Food and Nutrition. Many textbooks and curriculum materials perpetuate these stereotypes (RNPE, p.35). One key factor coming from the analysis of the literature is that the national curriculum often does not form part of the discussion of gender equity

education matters. Education theorists and curriculum experts such as Yale (2006) continue to advance the following observations regarding the omission of curriculum in matters relating to gender equity education. Firstly, that it is paradoxical to be troubled about women's entrance to education but leave curriculum out of the conversation; secondly, that curriculum is not sufficiently seen as a choice between executing new worldwide values or leaving cultural behaviors untouched, but is about choices within a situation where cultural traditions are neither untouched nor monolithic; and, thirdly, that attention to who speaks and who is heard in developing and assessing new practices remains important in any initiatives to extend education rights for women. In agreement, You (2006) submits that unequal gender treatment is often enveloped in a "gender neutral" covering and concealed deeply inside an institution, structure, or culture, whether in educational policy, access to education, school personnel structure, curriculum design and teaching activities, student–teacher interaction on campus, space and environment planning, or preventing and handling sexual harassment and sexual assault incidents. It is difficult to detect.

Closer to my research context, researchers believe that it is the socialisation process within Setswana traditional societies that largely influence subject choices between boys and girls. Chilisa (2000) argues that it is 'a reflection of the persistent and enduring cultural forces that sort and slot students into different subjects'. This standpoint of believing that cultural forces sort and slot students into different subjects often deliberately chooses to ignore the fact that curriculum does and continues to have a role in the engineering of the divide in enrolment and graduation rates within the STEM fields. On the other hand, it can be argued that that the hidden curriculum, in this case,

gender role socialization, does indeed matter in engineering subject choices for males and females.

Tuwor and Sossou (2008) argue that:

> "The school curriculum is one of the institutionalized forms of creating disparity in the education of boys and girls. There is evidence that in most African countries subjects in schools are gender-biased in terms of the different disciplines studied by both boys and girls. For example, boys are encouraged and supported by both parents and teachers to study mathematics, science, and technology, while the girls are exposed to domestic science and other female-related subjects such as nursing, teaching or vocational training" (P.374).

The diversification of the Botswana curriculum, with the culmination of the 1993 RNPE, to include practical subjects such as Design and Technology, Home Economics, Food and Nutrition, Fashion and Fabrics, and Agriculture can be solely be held responsible for the gender disparities that are seen in the post secondary education system.

The enrolment in these subjects has been based along gender lines save for agriculture, which is taken by all the students at the junior secondary level but by not all students at high school. Design and Technology is a subject highly populated by male students while female students largely opt for Food and Nutrition, Home Economics, and Fashion and Fabrics. The cultural context and justification for these is that girls must be taught how to cook, sew and primarily take care of the home whilst their male counterparts should and must be able to design projects using heavy machinery in workshops. These cultural and stereotypical views perhaps have formed a paradigm in which women were, and continue

to commonly be perceived as, the weaker sex (Caulder, 2013) and homemakers. This has cemented or contributed to the gender disparities and educational choices of many Batswana girls in the country. This depiction of girls and women as secondary citizens or the “weaker sex” as they are often referred to, does not only play in the minds of the young girls that they are inferior to boys but also exacerbate the perception that they cannot excel in STEM areas and other male dominated fields in their societies.

The Social Studies curriculum, which should be the one where issues of gender are addressed, is silent. In fact, numerous studies conducted on the mis/representation of women in its textbooks have shown that the curriculum actually perpetuates gender disparities. For example, the language in such textbooks is gender insensitive with words like *businessman* or *chairman.* The promotion of the patriarchal society in Botswana is further exacerbated by the Social Studies curriculum where images of men *Dikgosi* (chiefs) and how they run the *Kgotla (village councils).* Images of men dominating community decisions and conflict resolution are often depicted in the Social Studies textbooks. Allen (2000) posits that boys and young men were encouraged to hang around the *kgotla* (when not at the cattle posts), in order to learn "men's business” whilst girls stayed with their mothers and learned farming, domestic work and their proper role as men's "servants."

Due to the rigidity of the patriarchal nature of Botswana society as it is the case with many other societies in the African continent and the world, many scholars argue that the discriminations and stereotypes against women are rooted in legends, proverbs, folktales and other cultural constructions that have assumed mythical proportions, emanating in the internalization of these traditional self-perceptions, which shape and conditions women’s

own beliefs about themselves and their responses and behaviors to change and development (Kolawole, 1998).

The Setswana language, which is a compulsory subject for all Batswana children in secondary schools, has connotations of gender oppression and this status quo has gone unaddressed to date. To cite but two examples; the expression: "*Ga di nke di etelelwa ke manamagadi pele"* (an expression derived from men observing cows leaving for pastures with the bull leading the way). Loosely translated, this expression means that women were never born to lead men. The second example is the gender nouns in Botswana culture: a woman is called "*mosadi"* meaning one who stays at home while a man is called *"Monna",* one who sits the chair and presumably to direct and supervise all business within the household. These perpetrate the notion that men are strong and women are weak.

An important tenet of feminism is the focus on social justice. This perspective places women's experiences at the centre of analysis by examining the daily experiences of marginalisation and the micro politics of power (Anderson, 2002). This scholar warns that adopting a gendered analysis emphasises that differences between women and men and, indeed, among women themselves, need to be recognised. Indeed, researchers continue to maintain that the problem of curriculum bias repeatedly leads to male students having a positive attitude towards the STEM disciplines while women continue to carry a negative perception to these disciplines. These attitudes are usually reinforced by the gender bias in textbooks and other forms of mainstream media where women are rarely depicted as engineers or any other STEM related career. Female students often report feelings of isolation and intimidation as well as a drop in self-confidence in their

pursuit of degree programmes in STEM. More often than not, situations like these paint mental pictures in the minds of the girls that STEM careers are the single domain for men as they grow without any role models in the fields.

4.3 Lack of role models

Vignette 1: Women can do it

At 32, Gaongalelwe Mosweu is the vice president of Botswana Information Technology Society (BITS), a non-profit organisation that represents stakeholders in information and communications technology (ICT). She has been with BITS since 2006, where she also served as Secretary General. Her passion for computers started when she was eight years old. Though she started off with a Bachelor of Business Administration, Mosweu says she went on to study for Diploma in Computer Studies and Certificate in Internet Governance with IDM College.

Botswana Guardian Online (2014).

Lack of female role models in science and engineering is commonly cited as a major reason contributing to attitudes and performance of high school girls in math and science. This is not limited to STEM related careers but to Botswana society in general. The literature abounds with the notion that the under representation of women in political and decision making institutions like parliaments continues to exacerbate gender discrimination experienced in many circles. For example, Botswana has had the lowest number of women in parliament compared to other countries in the Southern African Development Community (SADC). There has been a dearth of women representation in parliament, the executive and local authority councils from 1994, 1999, 2004, 2009, and

to date. According to the BPFA Report (2000) in 1994, female representation in parliament was 9% and 19% in the executive while in 1999; there was an increase to 18.2% in the former and 23.5% in the latter. The shortage of women within the political spectrum does have a negative effect in the way public policy is shaped as men dominate its discourse. This lack of women in major spheres of influence like the parliament does in the end contribute to gender equity challenges in education and in particular in STEM because of the fact women are underrepresented when policy matters are discussed. It is my belief that if there was gender equity in parliament, there will be significant progress and willpower to eradicate gender inequalities in many facets of Botswana society.

The lack of role models is also exacerbated by the staffing situations in institutions of higher learning like the UB. The following table shows how dire the situation is or was as long ago as 1998 at the UB. A study conducted by Mpuchane (2002) found that out of a total of 180 staff members across the departments of Biology, Chemistry, Computer Science, Environmental Science, Geology, Mathematics and Physics (STEM fields), 156 (87%) were males compared to a measly 24 (13%) female staff members. The departments of Physics and Geology have 100% domination by male staff. One cannot help but feel pity for the brave women who attend these disciplines.

Table 4: Female Academic Staff in the UB Faculty of Science in 1998

Department	**Female Staff Establishment**	**% Female staff**
Biology	8/24	33.3
Chemistry	4/24	16.7

Computer Science	3/19	15.8
Environmental Science	7/29	24
Geology	0/10	0
Mathematics	2/26	7.7
Physics	0/24	0

The end result of the above captured picture is often that female students feel intimidated in the classroom as male students and of course male teachers largely populate these classes. My argument is that these male dominated environments do significantly contribute to the gender imbalances in STEM enrolment and graduation in Botswana's post secondary institutions as in most cases female students feel isolated and as such fail to excel in these domains. The gender disparities reflected in Table 4 previously, continue to persist in most contexts in Botswana. For instance, the Botswana Defence Force has only recently begun to enrol women in the army since its inception at independence. The effect is women's careers continue to be socially constructed as it becomes increasing clear that their traditional occupations are low status and low skilled occupations with poor salaries.

4.4 Self-perception

The reasons behind the gender disparities in enrolment and graduation within STEM areas continue to baffle many researchers. Numerous studies continue to converge around

a finding that self-perception seems to be a factor recounted in the majority of countries participating in international math and science testing of children. A study by Schibeci and Riley (1986) clearly documents causal relationship between perception and attitude towards science on the one hand and between attitude and achievement on the other. The researchers found that appropriate perceptions about science contribute significantly to the development of positive attitude towards science while positive attitude toward science in its own right enhances achievement in science. The same study found that, in the last year of high school, a greater proportion of boys consistently report that they perceive themselves as doing well in mathematics and science, and that skills can be acquired through work. In comparison, the majority of girls tend to believe that success in mathematics and science is a question of natural abilities. Furthermore, girls consistently dislike mathematics, physics and chemistry more than boys, and have a greater attraction to life and earth sciences. The self-perception aspect does continue to unravel itself when women and girls think that they are weaker than their male counterparts (Schibeci & Riley, 1986). The 2010 report on the status quo of women in engineering in Canada observed that the reasons for the gender gap are not fully understood, but also concluded that self-perception appears to be a factor reported in the majority of the countries regularly participating in Trends in International Mathematics and Science Study (TIMSS) research projects.

"Lifting heavy objects is itself a challenge for women because we are less physically stronger compared to men. "It is however something one gets used to with time."

Dube (2014*).*

The above quotation is further testament to the fact self-perception is a huge factor in determining whether girls and women will enter STEM related fields. The quotation comes as a response to an interview conducted by Dube (2014) in Botswana and it clearly shows that women consider themselves to physically weaker as compared to their male counterparts and as such jobs that of auto mechanics require physical power. Girls normally adopt self-conceptions and values that reduce the importance of interest and achievement in science and mathematics through the gender stereotypes that surround their daily lives. These self-conceptions among females lead to an arrangement of internalised weakness with respect of science and mathematics, with failure credited to lack of ability and success to luck (Adams, 1996). Earlier researchers (Schibeci & Riley, 1986) found three variables that are somewhat related in a time-line continuum:

Perception ➔ Attitudes ➔ Achievement

I agree with this finding because once one has a perception about something, in this case a STEM discipline, they will begin to have a negative attitude that will result in them failing to achieve a career in the field of STEM. This position is also embraced by numerous earlier scholars (Wiley and Harnschfenger 1974, Walberg and Rasher 1979) who found that 13 to 46% of the variance in science achievement is attributed to students' perceptions of the science learning environment while about 30% of the variance is due to attitude towards science. It is the opinion of these researchers that one's perception of science is significantly influenced by one's socio-cultural background. Jegede (1987) and Jegede and Okebukola (1988) embrace this stance by reasoning that socio-cultural factors play an important role in science learning in non-western cultures. They single out African worldview as one of such factors that impact negatively on the

ease with which the African child learns science. They opined that such socio-cultural factors that are a composite part of the African child's environment control, to a large extent, what the child learns in such an environment. I agree with these observations for STEM education in Botswana and elsewhere in Sub Saharan Africa, where these socio-cultural factors significantly impinge on the thought processes of an average Motswana. For example, a young person's death is always attributed to witchcraft even though the medical report may point to HIV/AIDS being the cause of the death. Suicides and other sudden deaths such as those caused by car accidents are normally attributed to the evil machinations of the witches in the immediate environment of the deceased. And when a person is struck dead by lightning, their death is often believed to have been caused by a 'witch doctor' or an evil medicine man or woman in the village. The deaths of young people are, more often than not, interpreted as having been caused by some supernatural power in Setswana culture. It is therefore these images and stories embedded within the traditional way of life in Botswana that can be blamed for the low enrolment and graduation of girls in the STEM disciplines in Botswana.

4.5 Parents' lack of education

Parents' lack of awareness about the benefits of education and training for girls' plays a crucial role in maintaining gender inequalities in STEM and other areas of life in Botswana. Research continues to point out that there is an inter-generational transmission of behaviours and attitudes. Data from the TIMSS program also suggest that girls are more influenced in their career choices by factors such as the level of education and the number of parents in the household. It has been argued that educated parents can often play a critical role in the future careers of their children as they can easily assist the

children in weighing the pros and cons of a wide range of careers. It is also lack of education that results in the lack of awareness in gender equality issues that many women in Botswana find themselves grappling with. The ever-skyrocketing problem of teenage pregnancies has contributed a significant number of children growing up in single parent families and this further worsen the predicament of growing up in families that lack awareness in gender equality matters. It is also lack of parental awareness in terms of their inability to critically analyse whether the school curriculum is gender sensitive or not. The fact that a significant proportion of parents are illiterate, especially in the rural areas does not help the situation at all. Lemrini (2000) contends that in the developing countries of Africa, like others throughout the world, the number of illiterate women is sixty percent higher than that of men, and the rate of girls' schooling is thirteen percent lower than that of boys. The lack of parental education often leads to girls finding it difficult to envision their future careers based on their interests, instead of the circumstances they find themselves in. It has been observed that more often than not, parents encourage their sons to pursue advanced coursework in STEM related careers more than they do to their daughters (Mewborn, 1999; Mulemwa, 1999).

4.6 Early Childhood Environment

One major impediment to gender balance in STEM education is early childhood environment. Boys and girls in Botswana are from the beginning, raised up in varied environmental settings. Woolfolk (1998) reasons that parents often react to self-confident exploits of their sons and to emotional behaviour in their daughters. This means that boys are often encouraged to be more physically active and to learn how to address their personal problems while girls are influenced to always be obedient, gentle and careful.

The end result is that boys are often raised to be self-independent, while there is tendency to call on girls to be obedient and loving. Consequently, Woolfolk reasons that the most crucial learning ingredients to succeed in STEM learning environments which involve dialogue, problem solving, and laboratory exercises, tend to be more in line with environment which boys are used to. This situation is usually reflected in the kind of toys that parents buy for their sons and daughters. Girls' affection and obedient tendencies are often planted through the kinds of dolls, and kitchen utensils that they play with in their formative years while boys are bought Legos, aeroplanes, and super heroes like Spiderman etc. to further entrench in them that they can be inquisitive as to how aeroplanes fly and so on while the super heroes inculcate in the boys the idea that men and men only were born to save lives in terms of trouble and despair. Lee (2008), citing other scholars opine that, "there is biological evidence to suggest that men and women differ in spatial abilities. Hormonal changes can also contribute to differences since they fluctuate. However, there are other factors including environment, exposure to video games and other computer technologies, and support and/or discouragement by parents and mentors, which can contribute to and account for gender differences in cognitive ability. Men are often stronger in visual-spatial abilities, such as the ability to mentally rotate things in space. Women show strength in verbal tasks, language fluency, and memory, along with dominance in use of fine motor skills and attention to details" (p. 33).

4.7 Gender stereotyping

In Botswana, socio-cultural factors considerably influence the mental processes of the average Motswana child. These cultural beliefs and the ever-present gender stereotyping

are more pervasive and entrenched in Botswana's rigid patriarchal society and are largely responsible for having lasting effects women and girls' career possibilities especially the STEM related fields. Furthermore, Erasmus (1998) points out that debilitating stereotypes, despite being inaccurate, exert powerful negative influences in the minds of young girls and women.

Martorella, Beal, & Bolick, (2005); Saitoti, (2005) have all acknowledged gender stereotyping as a glaring problem for women in Africa. Their belief is that extensive acceptance of stereotyping of scientists and engineers, as predominantly a male domain, in all levels of the educational pipeline is still an acceptable norm in Botswana as it is with other Sub-Saharan societies. In Botswana, as it is in most patriarchal societies, female stereotypical tendencies accentuate dependence, personal relationships, and feelings (Smith, 1992). These stereotypes promote female achievement through conformity, by accepting the notions that success is achieved through being well behaved, and obedient (Adams, 1996). For example, boys are still directed into the so-called masculine areas such as STEM, while girls are concentrated in the so-called feminine disciplines like home economics, languages and teaching (Duncan, 1989). Furthermore, males' temper in classrooms is an accepted norm more than it is for girls. This further cements the notion by girls that they were born inferior to their male counterparts. The sad result of this is that girls are often afraid of challenging the existing stereotypes as a result of the way they were socialised. In embracing the aforementioned argument, Lantz (1985) also found that female personal beliefs about mathematics and science (key STEM disciplines) influenced their decisions to take these types of courses. She discovered that the masculine overtones permeating some STEM education courses

created stereotypes that discouraged girls from enrolling in them. Greenfield (1996) found that girls who ignored the stereotypes related to STEM education classes had different experiences in these classes. One notable reason for this difference includes teacher attention to students, boys' higher level of comfort with equipment, curriculum and classroom materials designed with boys in mind, instructional strategies used by teachers, and lack of encouragement for girls by adult teachers and mentors.

4.8 Women's social obligations

Girls in Botswana, as has been observed in other African countries, are faced with serious challenges that hinder their academic progress and achievement. Egbo (2000) has observed that, despite numerous attempts by governments in the continent to alter the laws on gender equity, women still make very few contributions within political and economic spheres. The sad situation is largely attributable, according to the reasoning of Nyathi-Ramahobo (1992), to the fact that, throughout Botswana and all of Africa, female children have a lower status than male children.

Girls' chores include gathering and carrying wood on their heads for long distances, fetching water from distant sources (especially in rural areas), caring for the siblings and the sick, cooking, and generally minding the house. These chores have been seen to overly burden them to the extent their time for learning is compromised. Lopi (2004) posits that analysis of men and women's time allocation captures the interdependence between the "market" and the "household" economies. Lopi continue to observe that in most parts of Southern Africa women work longer hours than men, and this clearly demonstrates the time pressures faced by women. Furthermore, it is the primary belief of many feminist researchers that there are systemic barriers that continue to impede

women's progress in many countries around the world. These barriers mirror diverse forms of discrimination that may be explicit or hidden.

The newest development is that young girls, who have unfortunately lost their parents to the HIV/AIDS scourge that have been ravaging the country for the past few years, find themselves to having to lead or head their families. For example a 9 or 10 year old may find themselves having to wake early in the morning to prepare breakfast and also get their younger siblings ready for school before they themselves get ready to go/walk to school. This often means that they arrive at school fatigued and so they struggle to focus on schoolwork throughout the day. Young women and girls are not the only ones that have to balance household chores with careers. Moemedi, a mother of two, who currently enrolled and graduated in National Craft Certificate (NCC) in Auto Electrical at Auto Trades Training Centre in Gaborone, reasons that:

"I am also constrained from doing some household chores expected of me as a woman because I attend to breakdowns and I sometimes arrive very late from work. I have however accepted the situation because it is the nature of my job.″

Dube (2014)

The feminization of labour, particularly within the home, often leaves girls not much time to engage with their schoolwork. Girls contemplating a career in STEM in Setswana culture may discover the issue of social obligations versus career a major quandary, and family usually takes preference. A study conducted by DG Connect has also confirmed that challenges facing women in the ICT sector include inadequate skills and knowledge about how to use ICTs in their daily activities and lack of or limited connectivity to

access information disseminated online. Power relations, whereby women and girls are ascribed responsibility for reproductive tasks in the family and community, which limits their time and opportunities to engage with ICT in ways that may enhance their lives. For example:

"In many rural areas women and girls are limited to occupying the domestic sphere. This limits their time to use and play with ICTs. Women still do not have control over decision making nor their time".

Botswana Guardian, (2014*)*.

4.9 Male dominance

The domination of men, as has been seen throughout this study, is largely to blame for the gender imbalances in enrolment and graduation within the STEM fields in Botswana. This domination continues to classrooms as evidenced by the following quote:

"Even at school there were only three of us who graduated (last April) in the auto electrical course because it is traditionally considered a programme for men. At times it is not like women are not capable to pursue careers that are dominated by men. It is only that they are not resilient enough to withstand the harsh realities of physically demanding jobs that are considered best suited for men".

Mmegi Online, (2014).

The first point that comes from the response above is the insinuation that indeed women enrol and graduate in low numbers as has been seen earlier with the discussion of the statistics of the UB enrolment and graduation statistics (see Tables 1 and 2). The

respondent does however pin the low number of women in STEM, particularly engineering to the lack of resilience on the part of the women though my study has continued to prove that this reason is superficial. Secondly, the respondent alludes to the fact that the Auto Electricals course she had enrolled in is traditionally regarded as a man's purview. It can be argued therefore, that the gender inequity issues (see Table 4) that permeates STEM education classes at the University of Botswana and many other post secondary institutions, can be traced to the teacher inattention to the sexism that infects their classrooms, in particular their inattentiveness to girls and what activities might motivate them to further do well in STEM disciplines.

4.10 Lack of preparation for STEM studies

A study conducted by Emereole (2008), investigated the understanding of scientific concepts amongst UB science students. This quantitative study revealed that there was no correlation between the students' conceptual knowledge of the processes and their demographic variables of gender, age, present programme of study, year of study, desired profession, secondary school science programme followed, their school and home environments. Their ability to provide correct conceptual definitions did not corroborate their stated level of familiarity with the science processes. No student gave correct definitions for three of the science processes, only 3% and less could give correct definitions for 10 of the 15 processes, and only for the processes of classification and communication were the percentages of correct definitions up to 23.3% and 8.2% respectively. It was suggested that science educators at all levels should ensure that their students acquire both conceptual and practical knowledge of the science processes. This

lack of adequate preparation has been fingered to be largely responsible for the often lack of interest on the part of the students especially girls to pursue STEM related careers post secondary. Egbo (2000) has reasoned that some of the constraints befalling girls are shortage of schools, poor facilities, lack of appropriate programmes and the poor quality of teachers. It is often the poor quality of teachers that exacerbate the problem girls face in schools which affect their subject choices particularly STEM related disciplines. Students in the remotest areas of Botswana are hit hard by this problem.

The next subsection will be the discussion of the response to the research question 1 which sought to establish if Botswana had a STEM policy and if so, it was gender sensitive or not.

4.11 STEM Policy in Botswana

Botswana neither has a STEM education policy nor an organizational framework for such policy implementation. Some work has been done on creating gender sensitive policies on science and technology, and on education. This is insignificant in relation to my study because statistics in enrolment and graduation continue to show that there is a huge gender disparity in this regard. In 1998, the government of Botswana developed a Science and Technology Policy and established the National Commission for Science and Technology (NCST), to perform a crucial role of directing government policy on science and technology matters. Other complementary institutions such as the Botswana Research Science and Technology Investment Agency (BRSTIA), the funding agency for research, have since started functioning on their mandate of ensuring that science and technology form a huge part of the development discourse in Botswana. Additionally, a

new Ministry of Communications, Science and Technology (MCST), grouping together all communications, science and technology functions, was set up in 2002. The ministry sees its role as encompassing three broad areas:

i) Promoting research on the use of locally available natural resources to achieve international competitiveness
ii) Information and communications technology (ICT) and communications; and
iii) Information and media for purposes of promoting universal access to information countrywide (Botswana Ministry of Communications, 2002).

Botswana has acknowledged education as a human right and an essential tool for achieving the goals of equality, development and peace as reflected in the RNPE. Non-discriminatory education benefits both girls and boys and thus ultimately contributes to more equal relationships between women and men. Equality of access to and attainment of educational qualifications is necessary, if more women are to become agents of change. The following are examples of progress and achievements that have been recorded to ensure that girls and women enter STEM fields and also return to school after teen-motherhood:

- The YWCA Teen Mothers and *Diphalana* Projects (UNICEF) initiated to enrol young mothers who had to leave school due to teenage pregnancy. *Diphalana* project aimed at ensuring that teen mothers could bring their children along to school and leave them to an adjacent day care centre where they could go at intervals to check and even breast-feed their children. Though the re-admission policy for girls who drop out of school due to pregnancy is fully operational,

major challenges exist. Secondary schools with day care centre facilities are still in short supply and more disturbingly, these teen mothers still experience stereotyping in their schools and communities.

- Female enrolment at all levels of the education system has increased though statistics are hardly available as to how many of these are in STEM fields.
- The curricula and teaching materials are continuously being revised to make them gender-neutral.
- The UB Science Programme targeting girls is growing and girls continue to enrol. Perhaps as a matter of monitoring and evaluating this programme, the UB should consider conducting a study to look at the challenges of women in STEM in order to seek answers as to as to why they graduate very few women in these fields.
- The pre-school policy education has been finalised and one hopes that it has taken into account the issue of gender as well.

Though efforts are in place to create more gender sensitive policies that are related to STEM education, the above-mentioned efforts and policy initiatives are not adequate to ensure that gender parity is achieved within STEM related fields in post secondary education in Botswana.

4.12 Chapter summary

This chapter addresses the two research questions of the study. Factors that influence gender disparities have been discussed in this chapter. Several key policies aimed at encouraging girls to pursue STEM related careers have been discussed in response to the second research question of the study. It has been concluded that Botswana does not have

a STEM policy and that existing policies relating to STEM education are fully gender sensitive, as they do not address all the factors that impede girls' entry into male dominated STEM fields.

Chapter 5
Conclusions and Recommendations

"Curriculum for gender equality is both important and difficult. There is no single model of what needs to be done – this changes in place and time – and targets have a place. But questions about 'what' and 'how' things are being done in the name of education are important issues that should explicitly be part of any processes of education reform"
(Yale, 2009)

5.1 Introduction

This chapter presents the conclusions of the study and will close with recommendations on what educationists and other relevant stakeholders can do to address the issue of gender disparities within the STEM related fields in Botswana's post secondary institutions.

5.2 Conclusions of the study

The following section will be a discussion of the conclusions of my study. I must hasten to point out that the way education is currently dispensed in Botswana is not a conducive environment for rendering a gender sensitive curriculum. The implementation of gender mainstreaming within the education system in Botswana is weak. I cannot help but point a finger at the Ministry of Education and Skills Development for shirking their responsibility in this regard. Firstly, although gender mainstreaming started at the Ministry of Labour and Home Affairs, for all intents and purposes, to address the cultural impediments of gender equality in Botswana, the Ministry of Education and Skills Development should have been a key implementation partner in terms of formulating and implementing an appropriate curriculum for gender equality in Botswana's educational pipeline. I think that the Ministry of Education and Skills Development should be given a

significant mandate in this mammoth task and work to cascade gender equality to other ministries and public institutions like the *kgotla*. This will ensure that necessary steps are put in place to attain gender equality in all spheres of life in Botswana. The Ministry of Education and Skills Development should be responsible for the training of teachers and curriculum developers to address gender equity from all levels of the educational pipeline; from pre-school all the way to post secondary education.

Secondly, I conclude that the co-educational setup in Botswana continues to ignore the benefits single-sex schools in other countries particularly in STEM disciplines. My study has reconfirmed the fact that STEM education in Botswana is dominated by men (see Tables 1 and 4). With this in mind, it seems, to a certain extent, girls in co-educational establishments will tend to abandon STEM early on due to the findings advanced by researchers in field of single sex schools and those for co-education. Prominent researchers of co-educational establishments and single-sex schools have presented interesting findings for their arguments either side of the debate. For instance (Dale, 1974) on the subject of overall academic achievement, could not find compelling evidence in favour of single-sex schools. He did, however, note a certain polarisation of attitudes between the sexes in mixed schools, with girls in co-educational establishments and boys in single-sex schools being more favourably inclined to languages, while preference for Physics was more marked among boys in co-educational schools and girls in single-sex schools (though in the latter case some girls had taken General Science rather than Physics). Another scholar in this field Ormerod (1975) also noted similar results when it came to how students viewed science. He found a polarisation in terms of both preference and subject choice for both sexes in co-educational schools; specifically,

a greater preference of single sex educated girls and co-educated boys for physics and chemistry and the converse for biology as part of a general phenomenon affecting all subjects (Ormerod, 1975; and in Kelly, 1981).

Another dimension that can be used to build a case for single sex institutions is the problem of sexual harassment that many girls endure in Botswana. This area of research is fairly recent but is presenting much data that was somehow disregarded before. Research continue to point to the many abuses that numerous female students suffer as members of co-educational facilities, and the lack of punitive measures applied to male students and even in some cases male teachers who are guilty of this behaviour. According to Leo-Rhynie et al, (1999) gender-based harassment, which can include a range of behaviours, is based on the presumption of power relations that discriminate against girls and women. Gender based harassment relegates girls and women to an inferior position relative to boys and men, and makes a female feel embarrassed, frightened, hurt or uncomfortable because of her sex. Table 3 has shown that a total of 4,053 underage girls experienced defilement from 2003 to 2012 in Botswana and the whole story is never told as what happens to these unfortunate girls in the end. The impact on their social and educational experience can be overwhelming. In some cases girls escape either by terminating their attendance of particular subjects (particularly STEM subjects as has been seen with the enrolment and staffing data at the UB). It is against this background that a case can be built for single-sex schools and institutions of higher learning in Botswana.

Thirdly, my conclusion is that the Botswana curriculum does provide equal provision for boys and girls but does not take into consideration the observations of scholars mentioned

above. Put differently, the national curriculum ignores the issue of differences in attitudes between the sexes or between pupils in co-educational schools and institutions of higher learning. The danger here is that interests in STEM and specialization therein may be guided to a greater extent by a desire to conform to a received sexual stereotype in mixed schools (whereas single sex schools might reverse this trend than in single-sex schools) and this consequently limits girls and women chances of achieving gender parity in STEM related studies and careers. The conclusion here is that gender disparities in STEM education produce problems for individual girls in particular and Botswana society in general. During their formative years, girls experience lack of self-esteem and self-confidence (Graham, 2001, Jones, Howe, & Rua, 2000). In addition, they have low perceived ability in science, negative attitudes toward science classes, and lack of motivation to pursue advanced studies in STEM (DeBacker & Nelson, 2000). The costs of low performance in mathematics and science subjects are that women and girls are incapable to enter STEM related careers. For instance, a study carried out in Ghana (which has somewhat similar rigid patriarchal culture like Botswana) on post-secondary school subject choices found that: only 12% of girls elect to study science (physics, chemistry, and biology). Only 5% of girls enrol for mathematics. Less than 1% of girls enter middle-level technical training institutions.

Fourthly, Guidance and Counseling teachers in Botswana Schools are not doing enough to enhance students' knowledge in terms of careers that are in demand and ultimately encouraging all students across the gender divide, particularly girls, to enrol for these disciplines. I mentioned the aviation industry (which is growing at an annul rate of 5%) in chapter 1 as an industry that is guaranteed to provide hundreds of thousands of jobs up to

2032. These teachers spend the bulk of their time on students' discipline issues and often neglect the career counselling aspects of their jobs. This lack of knowledge about STEM career options further exacerbates the problem of girls' low enrolment and graduation in these disciplines in Botswana's post secondary institutions.

Lastly, the findings of the study tie in with the undergirding tenets of the liberal feminism of gender inequality, gender oppression and the theories of difference. From the gender stereotyping to self-perception, all these factors are firmly wedged within the theories discussed in chapter 3 and that the most feasible framework to address the concerns of my study is the Gender Mainstreaming Framework embedded within GAD principle.

5.3 Recommendations

The impediments to STEM gender parity in enrolment and graduation in post secondary institutions cannot go unabated in Botswana. The following subsection will address some of the possibilities that Botswana and her people can put in place to address the phenomenon under study. These are indeed plausible and require willpower by all relevant stakeholders. It is important for Botswana to create climate for mainstreaming gender equity within the education set up to achieve all or some of the recommendations that will be presented later in this section. In full realization of this fact, some countries like Taiwan introduced a Gender Equity Education Act that ensures that comprehensive foundation for promoting gender equity education is laid. Gender mainstreaming framework can be used to achieve the act's goal of gender equity education by: (1) discussing the importance of gender along with race/ethnicity and social class as a factor for consideration in the process of education; (2) ensuring gender equity implementation

and exploring ways to promote careers and job opportunities; (3) removing all structural barriers that affect equal access to educational opportunities, including legal, economic, political, and cultural restrictions; (4) increasing women's empowerment and awareness of their capacity to play an active role in development; (5) increasing the opportunities for and degree of participation by women educators in educational management and decision making (Leo-Rhynie & Institute of Development and Labour Law,1999).

The creation of an environment friendly for mainstreaming gender equity within Botswana's educational pipeline should also come with a discussion of how the whole exercise can be accomplished. I agree with what other countries continue to do in the area of mainstreaming gender in education. For example, in 2005, the Committee of Women's Rights Promotion (CWRP) in Taiwan's Executive Yuan included six tools in every government department's work on gender mainstreaming:

1) Gender statistics: Presenting statistical data divided by gender to understand the social circumstances of the different genders (as has been with the enrolment statistics at the UB in Table 1).
2) Gender analysis: Using gender statistics and related data to analyze, from a gender-aware perspective, gender circumstances and phenomena.
3) Gender budgeting: Prioritizing the creation of a friendly environment for the different genders when formulating the budget.
4) Gender impact assessment: Taking into consideration the perspectives of the different genders in developing programs, plans, policies, and legislation, and assessing and reviewing the impact on and benefits to them.

5) Gender awareness and empowerment: Using gender mainstreaming strategies and gender awareness courses and training to understand different gender perspectives and circumstances, which enhances the capacity of individuals to pursue and implement gender equity and gender equality.

6) Continuing education in organizations: Using gender mainstreaming curriculum and courses, or implementing a gender mainstreaming plan, within an organization allows its personnel to develop gender awareness and activate it in their workplace.

I fully agree with the six tools because I have seen, for instance, through the conduct of my study that using gender statistics can assist in understanding some of the gender disparities within STEM education in Botswana.

In the light of the observations and the findings of this study, I recommended that:

1) A pilot project aimed at introducing single sex learning environments should be considered as a matter of urgency. For instance, in STEM areas, girls and boys may be separated for the purposes of taking into account what the proponents of single sex education have championed in my conclusions.
2) A national cross-cultural audit should be conducted to identify and eventually eradicate cultural practices, including language, that demean women. For instance, the idea that, " *Ga nke di etelelwa pele ke managadi"* (see page 52 for translation) should be removed from the local lexicon as it is designed to oppress one group of people based on their biological difference.
3) A national association of women in science should be formed to lobby for and

direct positive change in STEM education to address the issue of lack of role models and so on.

4) The UB should intensify its project that encourages secondary school girls to study science. This project includes science clinics, publications, motivational video women's participation science technology, conferences, and visits to schools by female scientists.
5) A national curriculum audit should be a conducted to remove all images and connotations depicting women as second-class citizens. Taiwo & Kesamang (2002:932) recommend that:

"Both the primary and junior secondary school science syllabi in Botswana should be revamped to underscore in the most ameliorative manner how the linkages between traditional Setswana culture and scientific culture could be made. Pre-service science teacher education programmes should contain elements of Setswana culture that impinge one way or the other on the ease with which the child learns school science; and science teachers already in service should be 'in-serviced' as appropriate".

6) Botswana should develop a gender sensitive STEM education policy that will focus on six components:
    a. Improving pre-school and secondary preparation in STEM,
    b. Training new pre school, primary, and secondary mathematics and science teachers in gender equality and gender sensitive methods,
    c. Retraining of current mathematics and science teachers (currently dominated by male teachers) on gender equality and to develop and

strengthen gender sensitivity amongst them,

d. Increasing the number of undergraduate STEM degrees awarded,
e. Supporting graduate and early-career research, and
f. Ensuring that gender parity in enrolment and graduation in STEM is sustainably achieved at the UB, BIUST and other tertiary institutions. BIUST being a new institution charged with driving STEM education in Botswana, should as matter of urgency, address the issue of gender imbalances across STEM education in its key policies and implementation activities.

The STEM policy will be a statement of guiding principles, which will outline main beliefs that will guide procedures, programmes and practices in all levels of Botswana's educational pipeline. It will elaborate guidelines on how to address imbalances and inequalities that have stemmed from socially and culturally constructed differences between men and women in Botswana. Additionally, the STEM policy, will seek to compensate for the historical and socio-cultural imbalances that are mirrored in the STEM enrolment and graduation statistics within Botswana's educational landscape.

In closing, it would be worth reiterating that Botswana is a signatory to number of declarations that commit countries to facilitate representation of women in political and key decision making domains. Despite a plethora of domestic and international policies and conventions that Botswana has entered into and ratified, the gender equity and equality train has not effectively left the station yet. The country's reluctance to ratify the SADC gender protocol is testimony to the fact that there is little or no willpower to resolve the issue of gender imbalances in many facets of society in Botswana. It has been

proven that societies that continue to make significant progress in gender equality have taken the issue of women political representation and policymaking spheres as vital to their development agendas. The domination of positions of decision-making by men in this country could be concluded to be hindrance to the advancement of women. Botswana cannot be left behind. *E a re go tlogelwa tsatsing, se e kise mereting Batswana betsho!*

5.4 Chapter summary

In this chapter I have presented my study's main conclusion that the current education climate in Botswana is not conducive for the realization of gender parity in enrolment and graduation across STEM areas in Botswana. Amongst the many recommendations, I strongly recommend that Botswana, as a matter of urgency, formulate and implement a gender sensitive STEM policy that will seek to address the concerns of my study.

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APPENDIX A – My correspondence with the University of Botswana

From: Silas O. Mr.
Sent: 17 July 2014 08:54
To: DAMAN, O. (DR.)
Cc: OLUKA, Silas (Dr.)
Subject: RE: Update on the STEM stats request

Daman,

Find attached gender enrolment data as per your request. Unfortunately I don't have gender output data due to the current database configuration. The graduation data is not compiled from the database system.

Regards

Onalenna Silas

Ext 2795

From: OLUKA, Silas (Dr.)
Sent: 10 July 2014 10:48 AM
To: DAMAN, O. (DR.)
Cc: Silas O. Mr.
Subject: FW: Update on the STEM stats reques

Dear Dr Daman,

My sincere apologies for a delayed response to your mail: I took leave after a hectic 2nd semester session.

Looking closely at what you and PJ are seeking, I believe that my namesake, Silas, of Institutional Planning, could be better placed to assist, give the centrality of his office to matters of access and enrolments across disciplinary provision in the University. I have kindly herein copied this communication to Silas for information and due consideration.

Thank you.

Regards

Silas Oluka

From: DAMAN, O. (DR.)
Sent: 04 July 2014 10:16 AM
To: OLUKA, Silas (Dr.)
Cc: 'PJ Koketso'
Subject: FW: Update on the STEM stats request

Dr Oluka

Further to my earlier communication, I promised Mr Koketso that we will get back to him possibly with something to analyze. Do you have the latest on the student gender data?

O.A.D

From: PJ Koketso [mailto:lkoketso@gmail.com]
Sent: 03 July 2014 20:56
To: DAMAN, O. (DR.)
Subject: Update on the STEM stats request

Dear Dr Daman

This serves as a follow up to the request I made on 11 June 2014 regarding my research project: **STEM (Science, Technology, Engineering and Mathematics) education in Botswana: understanding the gender disparities in enrollment and graduation.**

What is the latest from your end?

I thank you.

Sincerely

****
Lesego Peejay Koketso (Mr.)

It's never crowded along the extra mile ...Wayne W. Dyer

Dear Dr Daman

Many thanks for this.
Much appreciated.
Best regards
L. Koketso