GHANAIAN FEMALE STEM LECTURERS AND PROFESSORS TRANSCENDING

BARRIERS: THE KITCHEN IS NO LONGER OUR PLACE.

by

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DEDICATION

First, I dedicate this dissertation to the Almighty God. Without Him, I can do nothing. I also dedicate this dissertation to all female international students of color and especially Ghanaian female doctoral students who travel far and wide to seek Science, Technology, Engineering, and Mathematics doctoral degrees around the world. I feel your struggle and your determination to succeed and be an example to women of color or Black women that everything is possible with determination and perseverance. Finally, to my unborn children, daddy loves you and prays wholeheartedly that you will follow my footsteps and do better than I did.

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ABSTRACT

The low involvement of girls and women in STEM fields can be noticed at all levels of education, with an inclination for female participation to diminish as the level of education rises (UNESCO, 2016). This is reflected in the labor market where their participation further diminishes all through their career path, and women are generally missing in higher level managerial and decision-making positions (UNESCO, 2016). This is a phenomenological qualitative study which sought to examine the lived experiences of 11 Ghanaian female lectures and professors in the Science, Technology Engineering, and Mathematics fields.

The research questions guiding this study were: 1. What are the lived experiences of Ghanaian female lecturers/professors who graduated from STEM doctoral programs? 2. What facilitated the resiliency of Ghanaian women who graduated from STEM doctoral programs? 3. What support systems did Ghanaian female lecturers/professors ascribe to their success while seeking after their doctorate? 4. How have their lived experiences affected their practice as STEM lecturers/professors? Data sources included phenomenological interviews, artifacts, and the researcher's journal. Utilizing Seidman's (2006) structure of phenomenological interviewing approach afforded me the opportunity to collect rich data that served as a detailed foundation for the findings and conclusions (Soesbe, 2012). Colaizzi's (1978) phenomenological data analysis method was used as a data analysis methodology.

I. INTRODUCTION

I was born in Kumasi, Ghana in the mid-1980s. I was born into a Christian home and my grandmother from my mother's side gave me a Christian name "Samuel". My grandparents had four girls. After the demise of my grandfather in 1989, I lived with my grandmother, mother, and three aunties. My step aunt also lived in the same house. In total, I lived with six beautiful women and a male and female cousin. I have two brothers and a sister, but only youngest brother and my sister lived with me. Growing up, my grandmother did not differentiate house roles based on gender but rather saw all of us in the house as human beings. Although some roles were unconsciously taken by the women in the house, Mrs. Evangelist Augustina Ayisi (grandmother) made sure gender-based roles never existed in the house. Day in, day out, Mrs. Ayisi told us in family meetings and personal encounters with her that the man is never superior to the woman. Her popular quote still resonates with me: "What a man can do, a woman can also do, and even better." Some of the traditional women's duties such as sweeping, disposing trash in the dumping area, fetching water, cooking, scrubbing bathrooms, etc. were assigned to anyone. Growing up with my closest cousin Olivia, we swept classrooms early in the morning and carried all trash on our heads to the dumpster.

I was immensely influenced by my mother's cousins, whom I prefer to call uncles (in line with my relationship to them). They also attended very prestigious universities and high schools. My dream was to be like my older uncle (Bra. Kwasi). He inspired me to aim higher. Also, he instilled in me respect for women because we were all raised by women. During my undergraduate journey, he always reminded me not to forget the toil and struggle of my grandmother. My dad left Ghana in 1990 to seek greener pastures in

Europe and that is the reason why I will talk less about him. I grew up mostly knowing the educated members of my mother's family. In the family there are professors, lecturers, scientists, nurses, lawyers, educators, business men, accountants, musicians, and many educated ones that I am not as familiar with personally, but I do hear my aunties talk about them. As the first grandchild and the first son of my parents, I was given anything that my family could afford to make learning easier for me. Culturally, the oldest child is tasked by every family member to be a role model, lead a good life that will serves as a path for the younger ones to follow. For me, the task was to be a good Christian and also achieve excellent academic success. The least educated cousin has a high school diploma. My late grandmother ran a school that educated all of my cousins and siblings from elementary to middle school. I am proud to be a product of this school. My male cousins and I were tasked to take corn to the corn mill machine every Tuesday to grind so it could be fed to the students in the school. Since my grandmother and the whole family knew the essence of education, I had the best of education.

In elementary and middle school, I did not perform exceedingly well in Math and Science. I decided to pursue General Arts in Kumasi High School. I dropped out of the Elective Math class due to my inability to perform to my expectation. None of my cousins or siblings pursued science. The dream of my grandmother was to see all of us become medical doctors, but she did not push us to pursue science courses in high school. After high school, I got accepted into the prestigious University of Ghana, Legon. I was offered Geography and Resource Development, Sociology, and Study of Religions. In college, I admired the female lecturers/professors. Particularly, the teaching skills of Dr. Rabiatu Deinyo Ammah in the Study of Religion department always inspired me to know

women's experience in a postcolonial or patrilineal society. In 2012, I started my master's degree in South Carolina. As an international student, I encountered many challenges. In some of my classes, I was the only student of color. Mingling with fellow students was an issue. I felt depressed, experienced micro aggressions, racism, stress, loneliness, and also felt abandoned in the middle of nowhere. My fellow international students in different states also experienced similar feeling of isolation, homesickness, academic stress, institutional challenges, etc. Throughout all these storms, I was encouraged by my grandmother and mother who constantly called to motivate me. After graduation, I lost my grandmother to breast cancer. I decided to pursue her dream of seeing me as a doctor. That is one of the paramount reasons to pursue this doctoral degree, even though it is not Doctor of Medicine.

In my beginning and intermediate qualitative class, I conducted two pilot studies which focused on the lived experiences of black female professors in STEM and social sciences. I had the opportunity to interview lecturers/professors with PhDs. Their experiences motivated and influenced me to channel my dissertation interest to tell the stories of these lecturers/professors so their voices can be heard from a different gender perspective. During the interviews with the participants, they shared some of their resiliency strategies, struggles, support systems, persistence, and contemporary issues they encountered and are still facing in their career journey. Professor Dansoa shared her experience in the first few months in the PhD program:

> I was three months pregnant when I arrived in…. [state] to pursue a doctoral
> degree in Biochemistry. I was fortunate to know the only Black faculty member in
> the entire college who later became a father, a mentor, an advisor, a professor, but

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I still encountered problems in school. My White colleagues deserted me and their

actions meant I was not capable to be in the PhD program. Life…was not easy for

an African in a White state like…... I encountered racial problems from children

in stores and within the community.

In the interview with Professor Jackson, who also studied in the United States, she shared

gender and cultural issues in STEM higher education:

I answered a chemistry question correctly and my male colleague said that any

brilliant female science student is a witch. My male friends stopped talking to me

because I scored higher than them. In one of my chemistry classes, a professor

told me that I was not needed in the class. He doubted my competence but at the

end of the semester, I had an A.

Professor Dansoa described strategies to succeed in a PhD program. She stated that

"building group among the class mates. I formed a writing group with one Asian, and a

Caucasian woman. At the end of the day we all supported each other till we all made it

but I was the first to graduate," Their stories were very touching and motivating. I felt

compelled to conduct this study based on the stories from my participants.

Additionally, I had the opportunity to work in at the LBJ Institute for STEM

Education and research at Texas State University as a doctoral research assistant. While

conducting research for the institute, I chanced upon studies that talked about the leaky

female STEM pipeline. Numerous studies discussed the experiences of minorities in

STEM fields in the United States and other Western nations. None of these articles and

dissertations addressed the experience of the Ghanaian woman or the African woman.

This was when I made up my mind to pursue this topic. I am a big women's advocate and

interested in women's education because of the influences from my grandmother, mother, and female lecturers/professors. My experiences as an international student and other encounters also influenced my decision to do this study. The PhD journey comprises of uncertainties. The feeling of homesickness, academic stress, and institutional challenges are some of the daily encounters. As I entered this program, my hair color has transitioned from black to grey. Although I had very few grey hairs, my hair is full of grey now.

All these experiences shaped me to research about the experiences of Ghanaian female STEM lecturers/professors' doctoral journey. I wanted to know how they thrive, survive, and achieve academic success in a typically male dominated field either in Ghana or abroad. I have experienced education in Ghana and abroad and it was very imperative to understand the encounters of the doctoral journey of females who either got their doctoral degree in Ghana or abroad.

Statement of the Problem

Historically, two demographic groups have been underrepresented in STEM programs and vocations—women and people of color. Very little research on STEM focuses on gender and ethnicity using longitudinal studies (Espinosa, 2008). Searching for published literature about the experiences of female Ghanaian professors in their doctoral journey and especially the experience of female professors' doctoral journey in Science, Technology, Engineering, and Mathematics (STEM) led to the recognition that there are few studies in this area. Most articles, books, and dissertations focus on why are there few women in STEM fields (Ofosu-Mireku, 1999) or causes for the underrepresentation of Ghanaian women in science and technology related careers

(Ofosu-Mireku, 2004). Other literature also focuses on experiences of women in STEM domains in Ghana (Boateng 2015), implications of being a female scientist or engineer in Ghana and the influential factors on female students' selection of STEM fields in high school and higher education. Also Masanja's (2010) study on STEM education only centered on East African nations. None of these studies specifically target the experiences of Ghanaian female STEM professors in their doctoral journey and how their experience affects their profession as lecturers/professors.

There is limited research on female professors' doctoral journey in STEM education in Ghana and as a result, there exists insufficient information to serve as a basis for improving the deep-rooted gender imbalances in higher education. Traditional beliefs, practice, and the post-colonial education system which has given priority to African males are the core root of this gender gap (Edewor, 2006; UNGEI, 2012). While inequities persist, there is some increase in the number of women teaching in STEM fields (UNESCO, 2016) and to help more women pursue STEM fields, their experiences and stories need to be examined to better understand how they encounter culture, racism, gender, ethnic, and traditional barriers (Burnette, 2013; Edewor, 2006). Morley (2005) argues that "gender, higher education, and development have rarely been intersected, leading to a silence in terms of policy, literature and research" (p. 111). According to 2013-2014 enrolment by gender statistic of professors (lecturers) in both private and public universities by the Ministry of Education in Ghana, males made up of 5,173 and female's made up of 1,185. This statistic represents all professors teaching in all academic fields. The total number of female doctoral students in public, public special, and private universities totaled at 160 as compared to their male counterparts who totaled

570 (Ghana Ministry of Education, 2015). There is a clear indication that there are few female professors in all fields which STEM education is a part. Knowing the experiences of the few female STEM professors in their doctoral journey will help inform colleges, STEM faculties, administrative staff at STEM departments, and all educational stakeholders about the experiences Ghanaian female STEM doctoral students encounter and the resiliency strategies they adapt to persist and graduate. Manuh (1995) unequivocally contends that more female's experiences, in their own words, are expected to get at females' developments of their identities and self-images. Against this foundation, this study investigates the experiences of females in STEM in Ghana and an in-depth conversational interview was utilized to design recommend policies which will promote social change, equity, and justice.

Since science, technology, engineering, and mathematics (STEM) are comprehensively seen as imperative to the national economy (Boakye & Rodriguez, 2016) there is a need conduct this study on Ghanaian female professors' doctoral journey in STEM fields and how their profession affects their practice as STEM lecturers/professors because a study conducted on their experience will help provide information for female students who wants to pursue STEM degrees in higher education. By so doing, the research gap will be filled to aid as a concrete information to serve as a basis for improving the deep-rooted gender imbalances in Ghanaian STEM higher education. More women in STEM is important for the growth of Ghana's economy.

Additionally, "it is estimated that the developing countries of Africa need at least 2,000 scientists per one million in population for effective industrial development. If this critical mass of scientist personnel is to be assembled with the relevant supporting

technical personnel, no country can afford to leave 50 per cent of its population of scientific, technological, mathematics, and development education" (Ghana Business News, 2016, para. 6). Since Ghana is striving to develop economically, the government has devices a strategy which relies on speeding the growth and transformation of the economy by harnessing the country's boundless resources potential through value additions made conceivable using science and technology (Amu, 2005).

Considering the leaky pipeline and the low number of women representation in pure and applied science courses in Ghanaian colleges which ranges of one per cent to 22 per cent (Ghana Business News, 2016), I believe my study needs to be conducted so that the findings from this study will address this gap in the knowledge base. Analyzing these statistics carefully portrays a problem. Why are there more females in the country but they earn fewer diplomas, certificates and degrees than men? These statistics call for an investigation or research into the lived experiences of lecturers and professors during their doctoral degree journey and how they persevered in a male dominated environment. It is also hoped that they will prove to be useful for current and future female students in STEM doctoral fields, and for those designing programs aimed at recruiting and retaining them as students and as beginning faculty. Understanding the challenges and strategies of the lecturers/professors can help women enter into the field and complete. Again, female students will have the chance to learn resiliency strategies from the experiences of the lecturers/professors who have trolled that journey and survived. Furthermore, since Ghana has a higher percentage of females, more females in STEM will be needed to boost the industrialization market and also boost the economy. Again, more Ghanaian

women in STEM will help transform the agricultural sector through their knowledge in science and technology.

Purpose of the Study

In Africa, women perform many more tasks or roles as compared to men (Dolphyne, 1991). In numerous high and low-income nations, women have sole obligation for caring for children, old parents, other family members, spouse, and also farm for food (Adu-Yeboah, 2011; Blickenstaff, 2005; Narayan, 2000; Prah, 2002). At times, women who embark on Higher Education studies need to consolidate all these competing demands with their scholastic work, and this strains their student life (Bolam & Dodgson, 2003; Kwapong, 2007; Reay, 2003; Watkins, et al., 1998; Wilson, 1997). The objective of this study was to investigate these challenges and to gain a deeper understanding of the lived experiences of female STEM lecturers/professors in Ghanaian universities', beginning with their doctoral journey and including their experiences as lecturers/professors.

The purpose of this study was to provide an additional platform for the voice of the silenced group of female STEM lecturers/professors who are the center of this research project. As such, it aimed to examine the barriers and challenges that women encounter as STEM doctoral students; establish the characteristics and attributes prevalent among the women who succeeded in completing the STEM doctoral degree in different countries; and explore the factors that contribute to the under-representation of females in the STEM professoriate.

Significance of the Study

In Africa, females' participation in Science and Technology courses at the university level remains lower than for men (Hoffmann-Barthes, Nair, & Malpede, n. d). At the same time, there has been an increase in university enrolment in these fields (Hoffmann-Barthes, Nair, & Malpede, n. d). Even though enrollment numbers are up, there still remains a low female participation in STEM fields of study. There has been a gradual increase of female PhD STEM program entrants from 0 to 22 from the 2008/2009-2014/2015 according to an enrolment report by gender for Kwame Nkrumah University and Science and Technology (KNUST) which is the nation's largest STEM university (KNUST Basic Statistics, 2009). These statistics showcase a rise in female enrollment but it does not address their experiences in a male dominant environment. This study is vital to present and potential future female doctoral students and in addition to departments and faculty members who need to comprehend what female STEM doctoral completers recognize as helping them to be successful (Culpepper, 2004). The long-term objective of sharing findings from this study is to improve the atmosphere of STEM graduate school for females while the transient objective (Culpepper, 2004) is "to help women now enrolled, survive, and succeed" (Johnsrud, 1995, p. 77).

My study was conducted to contribute more detail and concise information to policy makers such as Ghana Education Service, international student offices, STEM graduate programs, the Ghana Ministry of Education, the University Teachers Association of Ghana (UTAG), and the Ghana Ministry of Gender, Children and social protection. It is hoped that findings from this study can contribute to modifying and creating new policies which will enforce gender equity and increase enrollment,

participation, and success of women in STEM graduate programs. Additionally, the findings are necessary to inform and retain current and future female students in STEM doctoral fields.

Research Questions

This dissertation explored four central questions:

1. What are the lived experiences of Ghanaian female lecturers/professors who graduated from STEM doctoral programs in Ghana or abroad?

2. What facilitated the resiliency of Ghanaian women who graduated from STEM doctoral programs?

3. What support systems did Ghanaian female lecturers and professors ascribe to their success while seeking after their doctorate?

4. How have their lived experiences affected their practice as STEM lecturers/professors?

Theoretical Framework

Since this study was conducted in Ghana, which was colonized by the British until 6 March 1957, and examined the doctoral experience of Ghanaian female STEM lecturers/professors, postcolonial and postcolonial feminist theory were viewed as providing valuable lenses for data collection and analysis. Thus, postcolonial and postcolonial feminist theory was used to guide this study.

In attempting to explain postcolonial feminism, it is imperative to describe succinctly the meaning of postcolonial theory, postcolonialism, and its influence on postcolonial feminism. Adusah-Karikari (2008) defines Postcolonial as "the time period after colonial rule; but in some instances, it refers to the literature that has been written in opposition to colonialism" (p. 61). Quayson (2000) also defines postcolonialism as that

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which includes "studied engagement with the experience of colonialism and its past and present effects, both at the level of local societies, as well as at the level of more general global developments thought to be the after-effects of empire" (p. 93-94). What postcolonialism theory aims for is to seek justice "It seeks to speak to the vast and horrific social and psychological suffering, exploitation, violence and enslavement done to the powerless victims of colonization around the world. It challenges the superiority of the dominant Western perspective and seeks to re-position and empower the marginalized and subordinated 'Other'" (Smith, 2007, p. 12).

Postcolonial theory is utilized to eliminate oppression, "powerlessness and worthlessness" (Greenwood & Levin, 2007, p. 31) built by the inequities widespread during colonization. Furthermore, postcolonialism theory "pushes back to resist paternalistic and patriarchal foreign practices that dismiss local thought, culture and practice as uniformed, "barbarian" and irrational" (Dussel, 2000, p. 472). It recognizes the complicated method of creating an identity that is both distinct from, yet impacted by, the colonist who has left (Parsons & Harding, 2011). Kayira (2015) offers a deeper understanding of the effect of colonialization on African countries and education:

Colonialism goes beyond territorial conquest: it affects one's epistemological stance, worldviews and perceptions. Although most African countries gained independence in the 1960s, the impacts of colonialism continue to be present through modern-day globalization as a form of neocolonialism. Education systems in many countries in southern Africa continue to be grounded in Western viewpoints, marginalizing local Indigenous ways of knowing and being (p. 106)

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Postcolonial theory serves as a platform to challenge the dominant truths embraced by Western thought (Adusah-Karikari, 2008). It concentrates on rethinking the conceptual, institutional, cultural, legal and other boundaries that are taken for granted and thought to be universal, but have their origins in Western belief systems and act as structural barriers (Kayira, 2015). The objective of postcolonial theory is to offer voice to unacknowledged voices recuperating from decades of colonial rule and oppression (Adusah-Karikari, 2008). Postcolonial theory identifies "language, questioning authority and madness as empowering" strides for the postcolonial subject (Odenmo, 2010). The theory is "joined by the common political and ethical commitment to challenging and questioning the practices and consequences of domination and subordination" (Chibber, 2012, p.2) and also a "radical critique" (p. 2). This theory has been chosen for this study to give a voice to the marginalized Ghanaian women in STEM fields.

Dirklik (1994) explained the usage of the term postcolonial and asserts that there are numerous usages which carries a variety of implications that should be recognized for analytical purposes. Three uses of the term appear to be particularly conspicuous: "(a) as a literal description of conditions in formerly colonial societies, in which case the term has concrete referents, as in postcolonial societies or postcolonial intellectuals; (b) as a description of a global condition after the period of colonialism, in which case the usage is somewhat more abstract and less concrete in reference, comparable in its vagueness to the earlier term Third World, for which it is intended as a substitute; and (c) as a description of a discourse on the above-named conditions that is in-formed by the epistemological and psychic orientations that are products of those conditions (p. 332). Therefore, postcolonial criticism can still be viewed as a more or less particular set

of reading practices, if it is comprehended as preoccupied essentially with analysis of

cultural structures which intervene, challenges or reflect upon the relations of domination

and subordination – economic, cultural and political – between (and often within)

countries, races or societies, which typically have their underlying foundations in the

history of modern European colonialism and imperialism and which, typically, continue

to be noticeable in the present era of neocolonialism (Moore-Gilbert, 1997).

Postcolonial feminist theory is principally interested with the representation of

women in once colonized nations and in Western locations (Tyagi, 2014). Aidoo,

Dangarembga, Desai, and Markandaya exhibit their postcolonial feminism in intricate

ways, "problematizing unequal gender relationships for third world women" (p. 10)

affected by culture, race, class, and caste, all subsumed under the umbrella of a nation

(Ahmad, 2010). The project of postcolonial feminism includes women living in the

developing and developed world and this theory is also called 'Third world feminism'

(Mishra, 2013; Weedon, 2002). Postcolonial feminists have routinely pointed out the

courses in which the ""woman question" powered colonial practices and mediated

relations amongst colonial and native male elites" (Jyoti, 2015, p. 65). What is more of a

concern for Postcolonial feminists is to work for cultural, economic, social, and religious

freedoms for women (Mishra, 2013). In Tyagi's (2014) study, the author tried to

elaborate more on the struggle of the postcolonial woman and how readers can

understand postcolonial feminism theory in relation with postcolonial and feminist

theories:

> Postcolonial feminist theory is primarily concerned with the representation of
>
> women in once colonized countries and in western locations. While postcolonial

theorist struggles against the maiden colonial discourse that aims at

misrepresenting him as inferior, the task of a postcolonial feminist is far more

complicated. She suffers from "double colonization" as she simultaneously

experiences the oppression of colonialism and patriarchy. She has to resist the

control of colonial power not only as a colonized subject, but also as a woman. In

this oppression, her colonized brother is no longer her accomplice, but her

oppressor. (p. 45).

Tyagi went on to explain that as in his battle against the colonizer, the man even exploits

the woman by misrepresenting her in the nationalist discourses. Not just that, the woman

likewise endures at the hand of Western feminists from the colonizer nations who

misrepresent their colonized counterparts by enforcing silence on their racial, cultural,

social, and political specificities, and in this manner, operate as potential oppressors of

their "sisters" (Tyagi, 2014). Postcolonial Feminism assists in reshaping feminism from a

universality to a movement of people's experiences and struggles (Fisher, 2013). The

theory aided in understanding the experiences of the STEM professors and through the

interviews, their stories were told and the study was conducted utilizing their own voices.

To know the experiences of these women was to interview the participants and

understand their stories. The interviews helped for their stories to be told and the study to

be conducted utilizing their own voices. Spivak (1988) brings up the issue of voice in her

most well-known essay 'Can the Subaltern Speak?' In the essay, Spivak investigates

conceivable outcomes to recuperate the long silenced voices of the subaltern women.

Furthermore, it is the obligation of postcolonial feminists to speak for them. However,

when Western women task themselves to speak for the others, they just displace them,

supplanting their voices with their own (Boehmer, 2006 cited in Mishra, 2013).
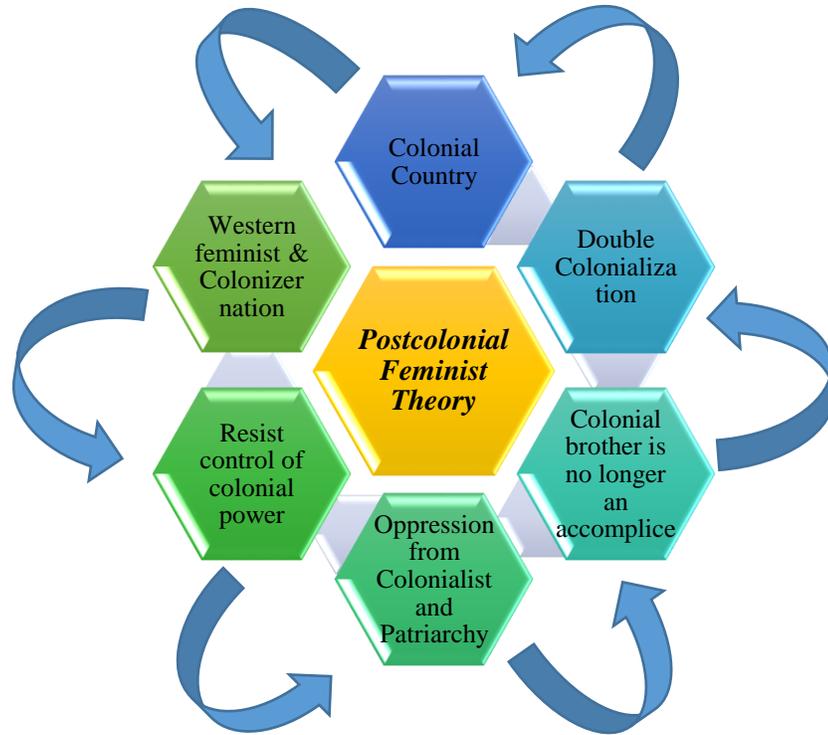
Figure 1. **Postcolonial Feminist Theory**
Source: Tyagi's (2014)

Postcolonial feminist theory was employed in my study to provide a platform for

the oppressed voices to be heard. Figure 1.1 showcase some of the experiences of

postcolonial women as stated by Tyagi (2014). As stated earlier, I asked about

participants' experiences and struggles through interviews. The participants "having a

voice, speaking, and more importantly, getting heard" (Neimneh, 2014, p. 50) were

significant issues for me in this study. Postcolonial and feminist theories provided an

avenue for the participants of this study to find "ways to think, speak, and create that are

not dominated by the ideology of the oppressor" (Tyson, 2006, p. 423). The most

important thing about giving a voice to the participant is opined by Spivak (2006),

catching the imbrication between feminism and postcolonialism, she explains double-

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silencing of colonized women: "If, in the contest of colonial production, the subaltern has no history and cannot speak, the subaltern as female is even more deeply in shadow" (p. 32). Without the participants in this study having the voice to tell their experiences and stories they would remain in the shadow. Without a listening subject, such as researchers to listen and publish their voices and institutional agency utilizing the findings to improve their policies, the women (subaltern) cannot speak and be heard (Neimah, 2014).

In Ghana and Nigeria, the British longing to make judgments about women based in 'customary law' regularly urged them to give African males greater traditional powers than the culture legitimized (Aniekwu, 2006). "The postcolonial men re-colonized the bodies and minds of their women in the name of preserving their cultural values" (Mishra, 2013, p. 132). To defeat the impacts of colonialism on Ghanaian society and in the educational systems and structures of Ghana requires consciousness of those effects (Fletcher, 2013). Women seek to liberate themselves by way of education, struggle, and hard work (Mishra, 2013). Postcolonial feminist academics have critiqued, extended, and molded mainstream postcolonial theory by gendering it (Khoja-Moolji & Chacko, 2011). Gendering postcolonial theory, as Lewis and Mills (2003) call attention to, alludes to the insertion of feminist interests into our comprehension of colonialism and postcolonialism. This is where postcolonial feminists enter to imagine a world in which differences are celebrated and enjoyed (Mishra, 2013). Postcolonial feminism in this study centered on challenges encountered that focuses on social, cultural, economic, and religious freedoms (Mishra, 2013).

The Bronfenbrenner's Ecological Systems theory was also utilized as a guide for this study. Figure 1.2 portrays the effects and what is entailed in the ecological system

and how it affects the human being. Bronfenbrenner (1979) states that the "ecology of human development involves the scientific study of the progressive, mutual accommodation between an active, growing human being and the changing properties of the immediate settings in which the developing person lives, as this process is affected by relations between these settings, and by the larger contexts in which the settings are embedded" (p.21). The theory includes the mesosystem, microsystem, exosystem, and the macrosystem.
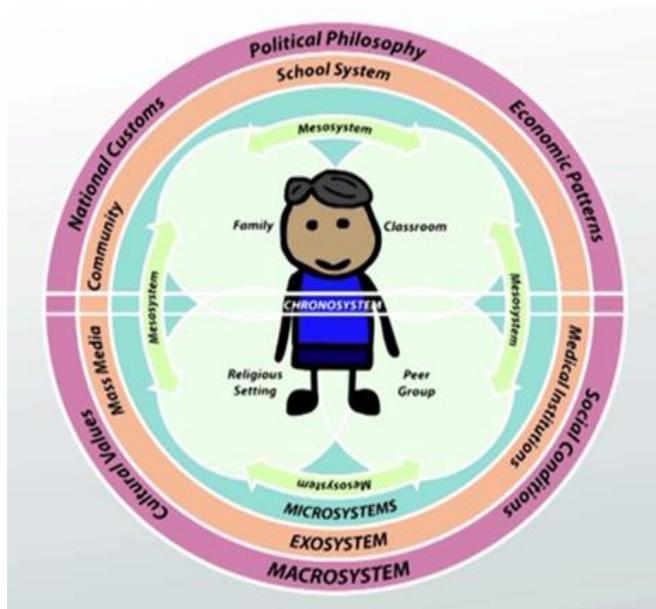
Figure 2. The Bronfenbrenner's Ecological Systems theory
Source: Lisa Roundy (n. d)

"A microsystem is a pattern of activities, roles, and interpersonal relations experienced by the developing person in a given setting with particular physical and material characteristics" (Bronfenbrenner, 1979, p. 22). A mesosystem consists of the interrelations among two or more settings in which the developing person actively participates (such as, for a child, the relations among home, school, and neighborhood peer group; for an adult, among family, work, social life, and peers) (Bronfenbrenner, 1979). An exosystem refers to one or more settings that do not involve the developing

person as an active participant, but in which events occur that affect, or are affected by, what happens in setting containing in one setting about the other (Bronfenbrenner, 1979, p. 25). The macrosystem refers to consistencies, in the form and content of lower-order systems (micro-, meso-, and exo-) that exist, or could exist, at the level of the subculture or the culture as a whole, along with any belief systems or ideology underlying such consistencies (Bronfenbrenner, 1979, p. 26). The theoretical frameworks helped with revealing significant stories of encounters of female STEM Ghanaian lecturers/professors teaching in Ghana.

The theoretical lenses employed in the study are Post-Colonial Feminism and the Bronfenbrenner Ecological Systems theory lens. As a male researcher from the 'Third World' who has stayed and gotten most of my education in Ghana, it was an inevitable choice of position to embrace these theories. This position continues to remind me as the researcher of the subject I speak on behalf of or for without underestimating the position (Fernandes, 2013). "The position of privilege from which most Western white middle-class feminists examine the issues of all women' has been a point of criticism in the feminist discourse" (Fernandes, 2013, p. 16). Likewise, because the study is grounded in the colonial and post-colonial context in Ghana, a post-colonial lens was a logical choice that would aid in "understanding the 'Third-World' woman and issues concerning her in a much self-effacing way" (Fernandes, 2013, p. 16). Urie Bronfenbrenner's (1977) framework describing the ecology of human development was utilized to explore the effect that different levels of society possibly have on the lecturers'/professors' doctoral journeys and lifespan development (Denis, 2012). Bronfenbrenner explains the impact that he believes the environment has on developing human beings (Denis, 2012). As

indicated by Bronfenbrenner's theory, each of the complex layers has an impact on one's lifespan development (Ideal Essay Writers, n. d). In order to investigate doctoral journey and experiences, there is the need to examine the lecturers/professors and their individual environment as well as the interaction taking or took place in the larger environment (Ideal Essay Writers, n. d). This makes Bronfenbrenner's theory a perfect fit for my dissertation.

Researcher Positionality

As I conducted this study by interviewing Ghanaian female lecturers/professors, I asked questions that elicited their experiences in their doctoral journey and how their experiences shape or affect their practice. To conduct this study, I identified my positionality as a researcher. Positionality "…. reflects the position that the researcher has chosen to adopt within a given research study" (Savin-Baden & Howell, 2013, p. 71). I was mindful of my subjectivism and objectivism. To attain a genuine objectivism is a naïve mission, and I can never truly separate myself of subjectivity (Bourke, 2014). However, I was ever mindful of my subjectivities (Bourke, 2014). That is positionality. My position as a researcher, a Ghanaian man studying abroad who is seeking to make their voices heard convinced them to share with me their sincere encounters in their doctoral journey. As a man born and raised in Ghana and having benefitted from the patriarchal society, I definitely have my own biases which were bracketed during the study, to the degree that is possible. My experience of getting educated in Ghana from elementary through to university was an advantage because I know the education system from the students' perspective (Adusah-Karikari, 2008). Also, as an international student, I was able to connect with participants easily, because nine out of the eleven participants

were educated outside Africa and some of them asked me about my experiences and shared some of their stories during the recruitment stage. This experience aided me to gain access to participants, establish rapport, and conduct the interviews.

"There's no enunciation without positionality. You have to position yourself somewhere in order to say anything at all" (Hall, 1990, p. 18). As stated earlier, positionality in this study served as a space in which objectivism and subjectivism meet. Freire (2000) states that as a researcher, it is imperative to be watchful that you do not endeavor to speak for the participants of the study. Freire again postulates that such endeavors on my part would in certainty be opposing freedom/emancipation, as my position presents me as an oppressor. In order to be a partner and an advocate, my study reflects the voices of the lecturers/professors who were interviewed for this study (Bourke, 2014).

Additionally, as the researcher I have identified my insider and outsider perspective. The insider perspective is alluded to as an emic account whilst the outsider perspective is recognized as an etic one (Holmes, n. d). An emic characterization is located within a cultural relativist perspective, identifying behavior and actions as being relative to the person's culture and the circumstances or framework in which that behavior or action is both rational and important within the culture (Holmes, n. d). My emic perspective here is being a Ghanaian male who has experienced the male superiority and dominance over women in the Ghanaian society, and also relative to having been a student in Ghana. I identified and suppressed personal preconceived ideologies and cultural biases against women. Also, I disposed of or neglected prior suspicions so that the genuine "voice" of the female lecturers/professors may be heard (Holmes, n. d). An

etic account is positioned within a realist perspective, seeking to explain differences across cultures in terms of a general external standard and from an ontological position which accepts a pre‑‑‑defined reality in regards of the researcher‑‑‑subject relationship (Holmes, n. d cited in Nagar and Geiger 2007). My etic perspective is the desire to be culturally neutral. Olive (2014) stated that "the etic perspective encompasses an external view on a culture, language, meaning associations and real-world events" (p. 5). I respected the experiences of the participants who do not belong to the same ethnic group or tribe as myself. Again, the utilization of an etic perspective to this research is useful as it empowers experiential comparisons to be made across the multiple cultures and countries that the female STEM professors and lecturers studied. The comparison of varying cultural experiences empowers the researcher to create more extensive cultural themes and concepts from the data collected (Morris, Leung, Ames, and Lickel, 1999). Furthermore, although I am a Ghanaian and that counts as an insider, being male and a student rather than a professor makes me as outsider (etic perspective). I had gatekeepers who were professors and they helped mitigate the power dynamics between student-professor relationships. They approached the lecturers and professors on my behalf before I contacted them for an interview. Due to the use of the gatekeeper, and my willingness to provide an additional platform for their voices to be heard, the participants felt unthreatened and unequivocally told their lived experiences.

During the execution of this study, I reflected on my influence on this research. This is termed reflexivity. Reflexivity is part of my role in qualitative study in order to establish credibility and trustworthiness (Adusah-Karikari, 2008). Reflexivity is "the concept that researchers should acknowledge and disclose their own selves in the

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research, seeking to understand their part in it, or influence on the research" (Cohen, Manion & Morrison, 2011 p. 225). Furthermore, I persistently placed myself on a continuous "mode of self-analysis" (Callaway, 1992, p. 33). Again, this study sought to examine the experiences of Ghanaian female lecturers/professors doctoral journey but there are scanty research and studies conducted on this topic. Being aware of my positionality, nevertheless, my role as the interviewer, was to listen and observe so I could collect accurate and credible stories that reflect the genuine experiences of the Ghanaian female STEM lecturers/professors doctoral journey. This practice redacted my jaundiced expectations. My positionality as a postcolonial feminist, being raised by women, and passion to seek for equal right for women was seen as either an insider or outsider and can also be my biases. "Positionality is thus determined by where one stands in relation to 'the other'" (Merriam, Johnson-Bailey, Lee, Ntseane, & Muhamad, 2001, p. 411). More critically, these positions can switch: 'The loci along which we are aligned with or set apart from those whom we study are multiple and influx. Factors such as education, gender, sexual orientation, class, race, or sheer duration of contacts may at different times outweigh the cultural identity we associate with insider or outsider status' (Narayan 1993, p. 671–672).

<div align="center">**Delimitations**</div>

The purpose of this study was focused specifically to selected female STEM lecturers/professors in public universities in Ghana. This study does not describe all the challenges and experiences of all female STEM lecturers/professors, since it was limited to the experiences described by those selected for the study. The age of the lecturers/professors in this study were wide range, limiting age-specific findings. A

limitation to this research study is one that is prevalent in all qualitative projects. This study is limited to 11 participants. Furthermore, since I am not surveying all female STEM lecturers/professors in all public and private universities and college in Ghana but rather some selected public universities across the country, the results or findings from the study may not be generalized to represent the experiences of all female STEM lecturers/professors from Ghana. The study is also not focusing solely on Ghanaian female STEM lecturers/professors who were educated solely in Africa but around the world. Their experiences may be varied and certainly cannot be generalized to every specific country that each participant was educated. Ghanaian women, women of Ghanaian descent, and Ghanaians born and educated in other countries may have different or similar experiences. Since this study is focusing on only Ghanaian women, their doctoral experiences may be different from male counterparts who also pursued STEM PhDs. This requires additional research into this area.

Chapter Summary

Chapter one discussed my life experience and the drive to pursue this study. The main influencer to pursue this study is the opportunity I had to work with the LBJ Institute for STEM education and research which enlightened me on the leaky pipeline for females in STEM fields. Also, what drove my passion to conduct this study is my admiration for female faculty members in my undergraduate education and the nonexistence of gender roles in my home when I was growing up with my grandmother. This chapter additionally explained the statement of problem, purpose of the study, significance of the study, research questions guiding the study, theoretical framework, researcher's positionality, and study delimitations.

There are six chapters in this document. Chapter two provides a review of the literature relating to the history of education in Ghana, the experience of women in higher education and STEM higher education, and the experiences of African women in STEM fields. Chapter three focuses on the overall study design and specific study methods. This includes the research design, data collection, data analysis, building trustworthiness, and ethical considerations. Chapters four and five present study findings. The first four emergent themes are discussed in chapter four and the last two are discussed in chapter five. The final chapter discusses key findings of the study, recommendation for policy and practice, recommendations for future research, my researcher's reflection, and a final conclusion.

II. REVIEW OF THE LITERATURE

The literature review attempts to look at the experiences of women in STEM higher education in Ghana. The inadequate number of studies done on Ghanaian women in STEM higher education, makes it relevant to extend my review to women throughout Africa. The reason is, most African countries have very similar cultures and were either colonized by the British, French, Portuguese, or Spanish. The effects of colonization on the economic and education of countries in Africa are very identical. Also, to understand the experiences of women in higher education in Ghana and Africa, I wrote a brief history of Ghanaian education. In addition, a brief review will also be presented on the experiences of women in STEM higher education.

A History of the Development of Women's Education in Ghana

Before Ghana gained independence from the British, the country was called Gold Coast. Ghana was the first country in Africa to gained its independence in 1957 (Enos, 2003). The historical backdrop of formal education in Ghana goes back from 1592 (Agbemabiese, 2007). Although the Portuguese impact on the Gold Coast is barely remembered today, Portugal was one of the primary European nations to have an impact on the economic and educational life of the country (Graham, 1971). The Portuguese were likely the first to open a school there, their focus then being generally to convert the locals at Elmina to the Catholic faith. King John III had given directions to the Governor at Elmina in 1529 "to provide reading, writing, and religious teaching for African Children" (Graham, 1971, p. 1). Even though there are no records to indicate enrollment, it is plausible, nevertheless, that only a few of the boys attended this school. Prior to the British arrival, there was no formal education system (Graham, 1971). Education was

transmitted from parents to their children (Bardley, 2000). Mothers taught their girls and fathers taught their sons. At the time formal education was brought into Ghanaian culture, just boys were permitted to go to school (Bardley, 2000). According to Bradley, the British understood the concept that the only assured way to keep a country of individuals reliant, stagnant, and subservient was to deny girls, the sheer spine of society, formal education (Bardley, 2000). This ensured future generations of weak people. This assertion by Bardley (2000) is congruent with Tamale and Olako-Onyango (2000) who opined that in Africa "a systematic and deliberate colonial policy ensured that African women were excluded from the various 'ivory towers' that dotted the continent" (p. 2). The historical backdrop of education reform in Ghana goes back to 1592, when the Danes and Portuguese initially arrived in what was then called the Gold Coast, now Ghana. Since then, educational reforms have had a wide range of objectives, for example, training teachers to secure skills important in spreading the gospel to developing an elite class to run the colony alongside the colonial masters (Agbemabiese, 2007). After Ghana gained freedom in 1957 the education framework, then based on the British system, has experienced a progression of changes and constantly looking for the model which would fit the necessities of the nation and the desire of its citizens. (MacBeath, 2010).

Interest in formal education for girls and women started between 1800-1850 in the Gold Coast colony (Graham, 1971). In 1821 the Wesleyan missionaries opened a girls' school in Cape Coast and another girls' school was established in Aburi in 1854 (State University 2016; Bardley 2000; Graham, 1971). The curricula used in school was gender-biased. Women were trained to be needle workers, "western-style housewives, petty traders, and farmers rather than scientists, professionals, and civil service workers"

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(Bardley, 2000, p. 2). Also, the girls' school taught women reading and sewing. As students received religious education as part of their basic education, the main reason for educating young people was to equip them to work in the European commercial market on the coast (State University, 2016). Women who received education from the missionaries excelled in all courses and could read, write clearly, and answer questions on catechism (Graham, 1971). Even in the early in the 1960's, the Government proposed a change in curricula for elementary education which favored boys receiving education in "various trades related to the industrial and construction sectors of the economy; modern agricultural techniques; typing and shorthand together with simple office routine; elementary book-keeping and accountancy. Girls were trained in "some of the commercial and manipulative skills taught to the boys" and in addition received "training in such specialized fields such [sic] as domestic science and handicrafts" (George, 1976, p. 114).

In the first half of the nineteenth century in Gold Coast colony, there was an expansion of teacher training colleges to train both male and female students to be teachers so as to improve the quality of education and spread the Gospel (Bardley, 2000; State University 2016). By 1848 the Basel mission established a training college in Akropong. In 1845-1851 there was another training college established in Accra for 4-5 men receiving instructions to be teachers (Graham, 1971). But women were required to remain at home or trained to run affairs and to perform household chores while the men receive better education (Bardley, 2000; Graham 1971). All these authors ascertain that the education of women in Ghanaian society has been seen as inferior to men. Graham's (1971) study claimed, "in traditional African societies also, the aim of girls training was

generally to make good wives and mothers; and even at a very early age they were expected to help in running the affairs at home" (p. 71).

In 1948 the University College of the Gold Coast was established. It was later renamed as University College of Ghana in 1957 and is now University of Ghana. The Kumasi College of Technology was also established in 1952 (George, 1976). By 1959, the universities enrolled more than 1,100 students. These colleges were established to provide higher education to Ghanaians in the 1950s. In 1972, University of Cape Coast was also established. In 1971-72 there were 632 women among the 5,063 students in Ghana's three government universities (George, 1976). In the same year, out of 2,530 students, 382 women enrolled into University of Ghana undergraduate programs. In the University of Science and Technology 1972-73 enrolment, 119 women constituted 6.7 percent of the student population (George, 1976). In the 2008/2009 enrolment report by gender, no female students enrolled in a STEM PhD program in Kwame Nkrumah University and Science and Technology (KNUST) which is the nation's largest STEM university (KNUST Basic Statistics, 2009). Also, in the 2014/2015, females made up 22 students and males made up of 96 students of new PhD STEM program entrants in Kwame Nkrumah University and Science and Technology (KNUST).

The University for Development Studies (UDS) was built in May 1992 by PNDC Law 279 to integrate the academic world with that of the community in order to provide constructive and important collaboration between the two for the total Development of all the regions in the Northern part of Ghana, in particular, and Ghana as entirety (UDS, 2016). It started academic work in September 1993. The first batch of students admitted were 39 into the Faculty of Agriculture, (FOA), Nyankpala (UDS, 2016). The University

of Education, Winneba (UEW) was set up in September, 1992 as a University College under PNDC Law 322 (UEW, 2016). The University College of Education of Winneba consolidated seven diploma awarding colleges situated in different towns under one umbrella institution. The seven colleges are the Advanced Teacher Training College, the Specialist Training College and the National Academy of Music, all at Winneba; the School of Ghana Languages, Ajumako; the College of Special Education, Akwapim-Mampong; the Advanced Technical Training College, Kumasi; and the St. Andrews Agricultural Training College, Mampong-Ashanti (UEW, 2016).

This brief history of women's education in Ghana portrays their marginalization from pre-colonialization to post-colonialization. Also, the history showcases the preference for women getting education to be good wives and managers of the house (Bardley, 2000) instead of for contributing to the workforce and economic development of the country. It is imperative to examine the experiences of the few women who challenged the status quo to work harder and achieve academic success within a male dominant academy. Their journeys in doctoral programs, especially in male-dominated fields like science, technology, engineering, and mathematics is worth investigating.

Experience of Women in Higher Education in Africa

Higher education carries on to play an indispensable role, which is probably going to rise further, in the new knowledge-based and globalizing economy. Therefore, "beyond the question of the fundamental right to education of all levels, acquiring knowledge to navigate the complexities of this world is a necessity for everyone especially the groups that have been hitherto marginalized" (Assié-Lumumba, 2006, p. 15). Pertaining to this study, African women are known to be marginalized in terms in

higher education. This section focuses on some of the experiences of women in Africa are described as encountering encounter while pursing higher education. The experiences ranges from juggling multiple roles, race and gender, gender stereotype, gender biases, socio-psychological biases, and cultural Issues.

Juggling Multiple Roles

Women of color in higher education encounter multiple barriers en route to their degrees (Snyder, 2014). Also, in Africa, women are expected to perform many more tasks or roles as compared to men (Dolphyne, 1991). Motherhood is seen as bestowing upon a woman the obligation of bringing up a child. She is expected to get to work on time, as well as to tend to the needs of her children both at home and as related to involvement in school. She is also short of time to take care of her home simultaneously (Jayita & Murali, 2009). The demands for women seeking postgraduate degrees in Ghana are typically regarded to be more challenging than in some countries. At home, because of social roles or 'gender division of labor, female students convey the weight of combining their studies with other difficult required duties (Ohene, 2010).

Various studies on adult women students' encounters in higher education points out some similarities to stories of struggle to combine higher education with family life/responsibilities and full time work (Baxter & Britton, 2001; Edwards, 1993; Leathwood & O'Connell, 2003). In Ghana, the socialization women receive makes them the caretakers and nurturers of the house and the children, and these responsibilities do not change when they set out to achieve higher education (Adu-Yeboah, 2011). Kwapong's (2007) research in Ghana reaffirms women juggling multiple roles in addition to higher education. Her study reveals that even women participating in distance

education face issues such as combining household responsibilities with education, "inability to manage limited time, nursing mothers having problems of managing their babies, pregnancy related problems, and pressure from career obligations" (p. 73). As the women juggle their roles, fragmentation or compartmentalization of the self may happen (Baxter & Britton, 2001; Edwards, 1993), which leads to significant stress on family responsibilities and relationships. Notwithstanding family roles, women likewise work full time in professional roles, mostly at the institution where they finished their doctorates or other educated-related institutions. In this manner, having time to balance work, life, and school additionally poses challenges. When these adult students focus more on education instead of household responsibilities and the consequences of the mother's physical and psychological disconnection, there is a weight of guilt or self-blame for being an irresponsible mother (Adu-Yeboah, 2011; Snyder, 2014). Sometimes, there have been indications that in the absence of a mother, the children's academic performance deteriorated (Adu-Yeboah, 2011).

Race and Gender

The issue of race is another critical element influencing the representation of African women and their battle for legitimacy as Third World women of color in established scientific community (Beoku-Betts, 2004). Rosser (1999) described the experiences of women scientists and engineers of color from third world countries who studied in a North American university. Rosser stated that most of the women battled for acknowledgment as students into graduate schools in Canada from which they had officially obtained a Ph.D. in their nation of birthplace. Since their degrees had originated from colleges in purported "third world" or "developing" nations, the North American

scientists and engineers did not see them as "true" scientists with credentials acceptable to embrace genuine work in North America (Rosser, 1999). South Africa has made progress throughout the years in terms of race and gender equity, however women, and women of color particularly, continuously remain underrepresented and under-served in numerous institutions of higher education (Snyder, 1014). "In South African academic departments of Sociology, a high number of females enter the discipline as postgraduate students" (p. 557) and hence become part of the academic staff (Rabea & Rugunanan, 2012). Authors of several studies opine that higher education working environments are not favorable for female academics propelling their careers successfully in South Africa (and in addition to the rest of Africa). Unwelcoming scholarly environments are believed to be even more distressing for black female academics and much more noticeable at historically disadvantaged institutions (Mabokela 2004; Mama & Barnes 2007; Rabea & Rugunanan, 2011). The gender threats in higher education incorporate 'being presented to working environments filled by masculine values, masculine power, and masculine conversations (Butler 2005; Rabea & Rugunanan, 2011). Black women in South Africa experience race and gender issues in educational institutions, they feel not as good, not taken seriously, and their jobs are very stereotyped (Snyder, 2014). Women are expected to be teachers and earn small salaries (Snyder, 2014). Women of color who grew up into an apartheid South Africa come up with the notions that women are to be kept at the bottom (Snyder, 2014).

Socio-psychological Biases and Cultural Issues

Women in postcolonial Africa experience exploitation and oppression traditionally, intellectually, politically, socially, economically, sexually, and religiously

(Wachege, 1992). Wachege explained exploitation and oppression of African women by stating that "Women oppression and exploitation is a distorted way of life in which women are dehumanized, marginalized and subjugated by being denied their rights as real persons, being treated and mistreated as inferior beings and deprived of growth into human authenticity and self-fulfillment" (p. 10). These women are generally silenced, living in patriarchal social order where they are supposed to be submissive, meek and dutiful, and are not supposed to dine with men (Boateng, 2015).

In the society, women are seen as inferior to men intellectually and they hardly play a role in decision making (Boateng, 2015). According to norms in the society, women are supposed to constantly undertake domestic roles (taking care of the home). Notwithstanding when they add on career roles to their domestic duties, the latter are not to be compromised. Serving children and husband is a cardinal domestic obligation. By and large, it is not seen as appropriate for males to embrace housekeeping chores (Boateng, 2015; Lundgren & Prah, 2009). Customary beliefs cause parents to place more value on sons as compared to girls (Bardley, 2000). Girls typically take part in broad family household chores, work in the market with their mothers, and nurture younger siblings, while their brothers go to school, play, and study (Bardley, 2000). Accordingly, if parents need to pick between educating their daughter or son, they will more than likely pick their son who will more likely have admittance to civil service work, compared with the farming and informal economy work of his sister (Bardley, 2000).

Socio-psychological research has been criticized for concentrating on the individual, and assuming that girls are the problem, and also operating on a social deficit model (Acher & Oatley, 1993; Haggerty & Patusky, 1995) which sees women as inferior

to men in many of the characteristics regarded as key for success in science. Psychosocially, women in the academic world receive subdued and unsubtle messages from their workplace that deny them of their feeling of belongingness. Women are imperceptible in meetings, their voices are suppressed, and their lives are monitored in their workplace (Mama, 2008). Culturally, women are characterized as mothers, spouses, and domestic workers (Boateng, 2015; Mama, 2008; Prah, 2009). In accordance with traditional beliefs, men were the sole supporters of the family, and were allowed to obtain formal education. "Disciplinary chauvinism in the Ghanaian academy manifests when the women's professional identities are addressed beginning with the prefix of "woman". Examples are "woman scholar", "woman scientist." Their professional identities are, thus, neutralized" (Boateng, 2015, p. 56). Marital "success" is broadly comprehended to be contingent on women not "over-qualifying" themselves on the scholarly front. High scholarly performance is often seen as "unattractive" to prospective male accomplices, as has likewise been reported by past observers (Gaidzanwa, 2001; Manuh et al., 2007; Pereira, 2007 cited in Mama, 2008).

In Olivia Kwapong's (2007) study on widening access to tertiary education for women in Ghana through distance education, her findings opened up some cultural and gender biases that affect women in the Ghanaian society. The participants of her study spoke about some of their challenges encountered in the classroom such as "low participation in class discussions due to male domination in discussions and suspicion of husbands" (p. 73). Kwapong went further to discuss sociocultural expectation of women and its effect on their education and performance: "Society and some husbands also frown on a wife going for domestic help. It is flagged as laziness on the part of the

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women. Some men just simply enjoy only the food and services of their wives. This puts much stress on professional women and affects their studies as well" (p. 75). Kwapong proposed a solution or suggestion on how to make things better for women seeking education in the modern world. She stated that "society is changing, and both men and women need to wake up to the realities that modernization brings and adjust their way of life to create space for women and provide both traditional and modernized support systems to enable them to enhance themselves professionally" (p. 75).

Influence of Colonialization on Education

In understanding women's roles in the society, Sudarkasa (1987) findings explained that "economically, pre-colonial women's activities complemented those of men; women producers and traders were not subordinate to men. If men were farmers, women were food processors and traders. Where women and men were engaged in the same productive activities, such as farming or weaving, they produced different items; neither was differential value attached to the labor of men and women working in the same local industry nor were men given different rewards from that of women for their labor" (p. 8). Nevertheless, all these changed with the establishment of colonial politics and economy as the prevailing public institutions of the colonial administration in the country (Ofosu-Mireku, 2004). Along these lines, a "gender-based division of labor [started]as Gold Coast (Ghana, after independence) men who had education became clerks, village administrators, teachers and opinion leaders for the colonial administrators and traders" (p. 8).

The effect of colonialization by the British in Ghana and its effect on women's education cannot be minimized. In alluding to the experiences of women in higher

education in Ghana, it is vital to observe the dialectic relationship between gender and colonization (Adusah-Karikari, 2008). The status of women in Ghana is surrounded by cultural/societal standards and the legacy of colonization (Adusah-Karikari, 2008). To support the issue of how colonization and societal patriarchy perpetuate the gender inequality in education, Aidoo (1995) stated that:

> Most women are now not equipped educationally and technically to play prominent roles in Ghana's industrialization process. The colonial system saw to it that women were either excluded from schools or else were given a fifth rate imitation of the education of the poor in Europe.… On their part African men exploited their traditions to support the colonial system which kept women in their place. (p. 217)

Adusah-Karikari (2008), Tamale, and Olako-Onyango (2000) studies contend that women in Africa under colonial rule by and large entered the scholarly world later than their male colleagues. "A systematic and deliberate colonial policy ensured that African women were excluded from the various 'ivory towers' that dotted the continent" (p. 2). Adusah-Karikari utilized Staudt (1981) study to explain the effects of colonization on African women education. Staudt (1981) attests to the effects of colonization on African women, noting that not only did missionary education excessively offer educational opportunities to males, but men's education was additionally granted/given higher preference than that of women. Her research study builds an argument to understand how culture and colonialism supports the alienation of women from education. The body of studies helps to understand the current experiences of women and their underrepresentation in STEM fields.

<center>**Experiences of African Women in STEM Fields**</center>

This section addresses some of the experience that women in Africa encounter in pursuit of degree in Science, Technology, Engineering, and Mathematics (STEM). The encounters encompass gender stereotype, gender biases, insufficient role models, inadequate mentors, educator influences, and cultural expectations.

Science and Gender Stereotype

The status of females in sub-Saharan African colleges is a reflection of female's position in the nation (Adusah-Karikari, 2008). Females are underrepresented in sub-Saharan Africa colleges and the individuals who can seek higher education tend to focus on customary female fields, for example, arts, education, social science, and humanities (Adusah-Karikari, 2008). Science, Technology, Engineering, and Mathematics (STEM) have been distinguished as the foundation of wealth creation and important for nation building. It has been established that the interest of females in STM, especially in Africa, has been low. In the colleges, they experienced lack of support and/or gender biases (Boateng 2015). One reason is because African women have been urged to seek out arts and humanities and have been discouraged from seeking out science subjects, as science is seen as a manly field (Adusah-Karikari, 2008). Adusah-Karikari pointed out a study conducted in Cameroon and Egypt (Cochran, 1992; Rathgaber, 2003). The findings from the Cameroon study indicated that females are a long way from being urged to study science and are constantly told that science is not an appropriate field of study for them (Rathgaber, 2003). In Egypt the researcher uncovered that middle-class and upper-class women were more likely to pursue scientific and professional subjects, while lower-middle class women pursue agricultural science, humanities, education, nursing, and

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social sciences (Cochran, 1992). Women in STEM who take interest in higher education, similar to male STEM students, go to college with their STEM backgrounds and have scholarly relationships with their colleagues, professors, etc. inside or outside the classrooms (Boateng 2015). Analyzing their experiences to the academic relationships, they either encounter continuity of their relationships or a change (Boateng 2015).

Colonial Influence on Science and Gender Biases

In the colonial era, Africans were famished of education. They had been offered a wide range of mediocre choices of higher education (Ajayi, Goma, & Johnson, 1996). In 1945-60 the colonial powers started to offer colonial universities-identical in structure, curriculum and statutes, and awarding of metropolitan degrees, and staffed, financed and observed by the colonial authorities, African nationalists got a handle on at them (Ajayi, Goma, & Johnson, 1996). In Africa, colonialists had a greater say as to whom gets which education (Mbow, 2000). At the point when colonial companies presented cash farming and export, technical education to boost yield was offered to men; men were included in cash crops and women in subsistence farming (Mbow, 2000). An example cited by Adusah-Karikari (2008) is the "1935 British Commission on Higher Education in East Africa and chaired by One de la Warr was paternalistic in the extreme" (Oloka-Onyango 1992; Tamale & Olako-Onyango, 1997, p.18). The commission affirmed that the education or training that women needed was focused on sewing, home economics and hygiene, domestic management, nursing and midwifery (Tamale & Olako-Onyango, 1997). Neither the technical arena—engineering, the general, medical and animal sciences, or agriculture— nor the 'esoteric' arts, were opened up to gender parity (p. 18). Cultural and colonial influences on female alienation from science fields is reiterated by

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Adusah-Karikari (2008) when she quoted Van Allen's (1976) view on the sex differential

education in Africa to colonialism. He stated that:

> When they needed literate Africans to form a supportive mediating
>
> structure for colonial governments, they sought young boys for schooling.
>
> Even when girls were sent to mission schools, they often were not taught
>
> the same subjects. Girls' "training homes" taught some "domestic
>
> science" and the Bible in vernacular. (p. 35)

This is a clear indication on a deliberate attitude from cultural and colonial plan to

prevent women from the venturing into the STEM academy. Both elements support the

suppression of women and prevent them from contributing their quota to the African

STEM academic society. The data solicited from participants will be beneficial for policy

makers to design policies that will promote women's empowerment and access into

STEM fields.

Gender Biases and Violence Against Women in the Academy

In 1993, the Association of African Universities, acknowledged that the time was

ripe to effectively discuss the issue of gender equity. The association commissioned a

paper to be discussed during the AAU's 8th General conference and 25th anniversary

Celebration in January 1993, in Accra, Ghana. "Katherine Namuddu, Senior Scientist

with the Rockefeller Foundation, presented a well-researched paper entitled Gender

Perspectives in the Transformation of Africa: Challenges to the African University as a

Model to Society" (Ajayi, Goma, & Johnson, 1996, p. 185). In the debate that followed, it

turned out to be clear that, most of the leaders of African universities, most of them male,

'were not even aware that gender parity was an issue' (Ajayi, Goma, & Johnson, 1996).

Sadly, in Africa, there are far fewer women pursuing science and engineering

fields at college than men. In situations where women are present, the huge challenge is

to retain them. In addition, the few women who set out on training in scientific

disciplines are prevented by discrimination and suppressed motivation bringing about

very few women scientists on the continent (UNESCO, 2013). Young women only make

up 7 to 12 % of engineering students in Africa (UNESCO, 2013). In Africa, the overall

percentage of young women seeking higher education in science, technology, engineering

and mathematics (STEM) disciplines is moderately low, although the situation varies

greatly according to country. As indicated by the Education for All Global Monitoring

Report, approximately 30% of women in Niger study engineering at the tertiary level but

only 6% in Mali (UNESCO, 2015).

As a student, I have heard men call brilliant and excellent women all sorts of

names in the STEM academy. These women in higher education face discrimination as

stated by the UNESCO (2013) report. My attention was drawn to an article called

"Bitches" at the academy. This is a true story told by an author in the academy. In the

anonymous letter addressed to the author, the nameless writer stated that "'You

Bitch!!!!!'…'We don't need your views in the press or on the (sic!) radio'... The letter

demanded that the author '... keep whatever nonsense you have in your head to yourself

(Tamale & Onyango-Oloka, 1997, p.1). The letter was obviously a reaction to several

recent investigations of gender-insensitive articles in the community media. Another

form of name calling can be traced from a recent graduate from The MasterCard

Foundation Scholars Program at BRAC, in Uganda. Rebecca stated that "When I was at

my school, the boys used to call us 'half-men. Because if you're a lady and you go for

sciences, you're a half-man" (Kouassi, 2016). This is an act of verbal abuse and violence towards women in the academy. The act of verbal abuse and violence towards women identified in Tamale & Onyango-Oloka's study, (1997) is supported by Bardley (2000), who contends that violence and gender-biased curriculum against girls have an effect towards education. In higher education institution, women encounter sexual harassment, violence, omission from professional development opportunities, prejudices concerning their scholastic abilities and intellectual authority, and prejudices against them as mothers (Adusah-Kakari, 2008; Heller, Puff & Mills, 1985).

The name calling and abuse encountered by women in STEM fields as reported in Bardley (2000), Tamale & Onyango-Oloka (1997), Kouassi (2016) and Tamale and Onyango-Oloka (1997) guided the construction of my research and interview questions to ascertain whether participants encountered such acts of discrimination from their male colleagues and faculty members.

Experiences of African Female Scientists Who Studied/Studying Abroad

One of the consequences of the failure of African governments to provide adequate funding for their higher education institutions is that after undergraduate education, many science graduates who have the opportunity or the means seek further education in Europe or North America (Beoku-Betts, 2004). African women who pursue STEM education and other programs abroad encounter also challenges during their studies. White faculty in the UK questioned female African graduate students' scholarly capacities, assumed that they must be situated in remedial classes and criticized their accents and language skills, which led these students to feel unsupported, racially stereotyped, and marginalized (Beoku-Betts, 2004). Smith's (2014) study about the lived

experience of Black African nurses educated within the United States, shed light of participants encounters (five males and four females). The study uncovered that the African students experienced isolation in the classroom which brought about feelings of segregation and discrimination. A few of the participants negotiated the effects of this isolation by building relationships with other minority students. Others students were determined to proceed with their programs regardless the difficulties they encountered. In the same study, the participants felt valued when their classmates asked questions about their culture. The chance to share their culture helped to develop an inclusive environment and relationships. In addition, participants stated that the use of study groups and the formation of friendships, helped build a relationship and provided both academic and emotional support. In Sanner, Wilson, and Samson's (2002) study of eight female Nigerian nursing students studying in one of the colleges in Canada, their findings revealed that the African students were perturbed about their own accents and in addition issues with understanding Canadian accents. One African teaching assistant stated that some Canadian students blamed his accent as a reason they under performed in a course. The same researchers stated that participants in the U.S reported that when they recognized that their American peers resented their heavy Nigerian accents, it made them feel uncomfortable. Furthermore, they reported that American students regularly rolled their eyes or seemed baffled during student presentations or general classroom discussion.

Insufficient Role Models, Mentors, and the Educator Influence

The dearth of female scientists and female science teachers as role models and mentors (Ofosu-Mireku, 2004) for women starts from K-12. Science classrooms are

dominated by male students, teachers and professors (Ofosu-Mireku, 2004). The

exclusion of girls from science subjects begins at the elementary school level, when

school children are exposed to images that perpetuate gender stereotypes and pass on the

message that science and technology are not for girls (Pandor, 2011).

Educators in some rural parts of Africa are still of the view that boys will go to university

and will enroll in fields such as medicine, engineering, architecture and so on, while girls

will only pursue education to become secretaries, teachers, designers and so on

(Angeline, 2011). This perception or mentality of educators informs how they teach and

attend to the girls in classes, particularly in mathematics and science, and this ends up

influencing the performance of the girls (Akinsowon & Osisanwo, 2014). There is

evidence that demonstrates that teachers are more attentive to boys and offer them more

opportunities for hands-on practical work while the girls are almost overlooked or not

given as much attention as the boys. Barley's (2000) study in Ghana provides the

evidence that numerous girls lack role models and auxiliary teachers to guide them to

higher accomplishments. Also, gender disparity emerges as women in academia do not

have senior mentors or adequate networks to help them navigate through the

inconsistencies exuding from these ambiguities and men subjectively use standards and

expectations based on their encounters without any regards to the barriers and difficulties

women in academia face (Etzkowitz et al., 2000; Morimoto et al., 2013). Interests of

female students in STEM are disregarded by male faculty (Murray, Meinholdt, &

Bergmann., 1999). Many females in science and engineering graduate fields report that

male faculty and students engage together in extra-curricular activities that improve the

advancement of friendly mentoring relationships with the avoidance of women (Murray, Meinholdt, & BergmannMurray, 1999).

Role models may be particularly essential to women in light of the fact a lack of female role models in nontraditional careers (e.g., engineering, science) has been distinguished as an obstruction for women who select to enter these professions (Basoc & Howe, 1979; Betz, 1994; Betz & Fitzgerald, 1987; Hackett, Esposito, & O'Halloran, 1989; Nauta et al.,1998, cited in Quimby & DeSantis, 2006). Undeniably, researchers have demonstrated that female students see role models to be particularly essential for women who want to seek nontraditional careers (Gilbert, 1985; Smith & Erb, 1986). Female professors in STEM serve as role models for female students. According to findings from Carrell et al., (2010) female students perform considerably better in their math and science courses when their professor or teacher is a woman. Carrell et al's (2010) assertion is supported by findings from Young, Rudman, Buettner, and McLean (2013) which state that female STEM professors presented several advantages to women without disadvantaging men, and all students assessed female STEM professors as more supportive role models than male professors. For women, seeing a female professor as a role model was connected to increased implicit science identity and decreased implicit gender stereotyping. Consequently, female role models may be most productive at the automatic (i.e., implicit but not explicit) level when women respect them and view them as identical to themselves (Rudman, Ashmore, & Gary, 2001).

Women Professors in STEM

To date, less than 8% of vice-chancellors in Africa's universities are women. A comparable imbalance describes the professoriate. However, there have been some

cumulative gains in the representation of women among faculty and student populations, even though this is unevenly distributed, remaining concentrated at the lower levels of the hierarchy and in less prestigious regions, even within specific fields of scholarship (Mama, 2011). Especially given the limited resources on research specifically on Ghanaian women lecturers/professors in STEM fields, it was necessary to research journal, articles, and dissertations on women STEM lecturers/professors in general. Women in STEM encounter diverse challenges in the STEM fields. Sadly, as we understand, for many women in science, technology, engineering and mathematics (STEM), the route to academia ends long before they attain a faculty position and are the "lucky" beneficiary of biased student beneficiary/evaluations (Leifer, et al, 2015). There are more women in STEM fields today than any time in recent memory, though bias still influences women in STEM, and not just in student assessments/evaluations (Leifer, et al, 2015). The experiences of six women professors in Ivy League colleges are told by Leifer, et al (2015). Some of the challenges these professors encountered began right from the hiring process. An extensive collection of research demonstrates that large portions of these materials, and how the women professors are assessed by search committees, reflect bias in favor of male candidates (Leifer, et al, 2015). Letters of recommendation, for instance, have a tendency to have a very different character for women than for men, and their tone and word preference can influence the feeling/impression that the hiring committee forms about candidates. The professors also stated that their teaching assessments, are also one-sided and those favor men (Leifer, et al, 2015).

Across the United States at higher-level educational institutions, women faculty members almost perpetually remain in the minority among the tenured STEM faculty members (Rollor, 2014). At some STEM academic institutions, female faculty additionally deal with actual discrimination in their surroundings before and during their tenure decision process (Rollor, 2014). There is immediate proof that some men in STEM higher education environments are inert to the convergence of female faculty members (Rollor, 2014). At Princeton University, 24% of the women faculty in natural science and engineering stated that their associates "occasionally" or "frequently" participate in unprofessional behavior on gender-related matters (Rollor, 2014).

Chapter Summary

The review of literature has provided a fair idea on the experience of women in higher education and specifically African women in STEM higher education. The studies showcase that women are underserved educational wise through teachers' neglecting them in classrooms and paying higher attention to their male counterparts. Additional, their neglect climbs to higher education. Culturally, more importance is placed on education of men than women. Even in universities and colleges, the literature draws our attention of the lack of mentors and role models for female students. It will be a disadvantage not to address the issue of postcolonial effect on women education and how the patriarchy system in postcolonial countries still dwells on such practices to suppress women education. It is important to pay higher attention to the numerous experiences of women in the classrooms so as to close the gender gap in STEM and also to seal the leaky STEM pipeline.

The review of literature uncovered that there are few research studies that target specifically the experience of Ghanaian female STEM students' journey and none that target specifically doctoral experiences. The closest research study focused on women of color navigating doctoral education in South Africa (Snyder, 2014). The author even recommended that "future research should also explore the experiences of women in doctoral programs in other fields such as science or professional programs such as law" (p. 29-30). There were other studies that analyzed data in multiple countries without settling on one country. Most of the research studies focused on what factors discourage Ghanaian or African high school female students from pursuing STEM education in higher education or the experiences of Ghanaian or other African national's women in STEM undergraduate programs.

III. METHODS AND OVERALL STUDY DESIGN

Chapter three presents and showcases the overall methodology and study design that was employed for this study. It encompasses a description of the rationale for the methodology, site selection, the researcher's role, and the data collection and analysis procedures means of assuring trustworthiness, and ethical procedures.

Research Design

This study adopted the descriptive phenomenological approach to qualitative inquiry, which seeks to elucidate the meaning of the lived experience of a group of people related to a specific phenomenon (Adusah-Karikari, 2008). Phenomenology targets obtaining a profound understanding, description, and meaning of the everyday experiences of a group of individuals, female STEM professors for this case (Creswell, 1998; Patton, 2002; Van Manen, 1990). Van Manen (2007) also defines phenomenology as follows: "Phenomenology is a project of sober reflection on the lived experience of human existence–sober, in the sense that reflecting on experience must be thoughtful, and as much as possible, free from theoretical, prejudicial and suppositional intoxications" (p. 12). Selecting qualitative research is a deliberate attempt to give a "voice" to the participants (women) who are mostly silenced in a patriarchy or a male-dominant academic environment. As I researched the life stories of the participants, what Creswell (2013) calls "the phenomenon to be explored," it was essential to document participants' own or factual experiences. Blatt (1981) stated that, "A person is defined by the stories he tells about himself as well as by the stories that are told about him." Bogdan and Biklen (1998) described giving voice as "empowering people to be heard who might otherwise remain silent" (p. 204) or "who have been silenced by others" (Ashby, 2011, para. 4). I

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practiced bracketing in this study. Bracketing includes setting aside what I already know about the experience being examined and approaching the data without preconceptions about the phenomenon (Dowling, 2004; Lopez and Willis, 2004). My aim was to elicit the lived experiences of Ghanaian female STEM lecturers/professors' doctoral journey in Ghana and abroad and describe how their experiences have had an impact on their profession. For that reason, the research questions were:

1. What are the lived experiences of Ghanaian female lecturers/professors who graduated from STEM doctoral programs?

2. What facilitated the resiliency of Ghanaian women who graduated from STEM doctoral programs?

3. What support systems did Ghanaian female lecturers and professors ascribe to their success while seeking after their doctorate?

4. How has the lived experience affected their practice as STEM lecturers/professors?

Phenomenology

Phenomenology is a development in the early 20th century German philosophy that explains the structure of the objects of awareness and of consciousness itself. The phenomenological approach has its early roots in Kant's differentiation between "noumena" and "phenomena," things as they are in themselves, and things as they appear to us (Braungardt, 2016). The philosopher who began the development was Edmund Husserl with his book "*Logical Investigations*," published in 1900/1901 (Braungardt, 2016). Phenomenology as a research tool and methodology focuses "…on descriptions of what people experience and how it is that they experience what they experience. One can employ a general phenomenological perspective to elucidate the importance of using

methods that capture people's experience of the world without conducting a phenomenological study that focuses on the essence of shared experience" (Patton, 1990, p.71). In addition, Creswell (1998) explains that as a phenomenological researcher my duty is to "search for essentials, invariant structure (or essence) or the central underlying meaning of the experience and emphasize the intentionality of consciousness where experiences contain both the outward appearance and inward consciousness based on memory, image and meaning." (p.52). Creswell (1998) goes on to state that a "phenomenological study describes the meaning of the lived experiences for several individuals about a concept or the phenomenon" (p. 51). Patton (2015) additionally explains that "by phenomenology Husserl (1913) meant the study of how people describe things and experience them through their senses. His most basic philosophical assumption was that we can only know what we experience by attending to perceptions and meanings that awaken our conscious awareness" (p. 116).

For the purpose of this study, therefore, descriptive phenomenology was employed to explore, analyze and describe a phenomenon while preserving its richness, breadth and depth, so as to gain 'a near-real picture' of it (Van der Zalm & Bergum 2000, McConnell-Henry et al 2009, Streubert and Carpenter 2011 cited by Matua & Van Der Wal, 2015). To be sure that my phenomenological research was thorough, I leaned on Pereira's idea which states that "to be judged valid, a phenomenological study must take into consideration methodological congruence (rigorous and appropriate procedures) and experiential concerns that provide insight in terms of plausibility and illumination about a specific phenomenon" (p. 19). The goal of this study was to epitomize the participants'

journey and lived experiences during their doctoral education and along with how their experiences have had on their practice of profession.

Study Setting and Participants

Workplace is defined as a place where people work, such as an office or factory (Oxford Living Dictionary, 2016). Locating interviews in a space where participants feel comfortable and certain that their privacy will be maintained was crucial for participants' recruitment and retention (Smoyer, Rosenberg, & Blankenship, 2014). The site for this study is the current workplace of the participants which is the universities, including (see four public STEM offering universities in Ghana (see figure 3 showing the 10 such universities in Ghana). Two of the participants scheduled the interview to be conducted in their homes.

All these universities offer Science, Technology, Engineering, and Mathematics (STEM) related programs. Furthermore, there are fewer female STEM lecturers/professors in the country to focus on just the two oldest universities but it was rather imperative to target the four oldest public universities (see fig. 3) to acquire the 11 participants for the study. The other aim for selecting these public universities was to acquire different points of views and a more extensive picture of the contexts from the female STEM lecturers'/professors' encounters as women. Additionally, it was essential to select these universities to ascertain the impact of participants experiences in their doctoral journey on their students.

Figure 3. Public Universities Offering STEM Programs in Ghana

The diversity of the participants helped acquire a deeper understanding of the

experiences of lecturers'/ professors' who were educated in the Western world to

participants who were educated in African because the participants compared their

experiences and resources exposed to, and how the experiences encountered as doctoral

students are currently affecting their practice of profession.

For the purpose of this study, 11 participants were selected through criterion-based and snowball sampling. Criterion-based based sampling, a subset of purposeful sampling, is a strategy widely utilized in qualitative research for the identification and selection of information-rich cases (Patton, 2002). This includes recognizing and choosing participants or number of people that are particularly knowledgeable about or experienced with a phenomenon of interest (Creswell & Plano Clark, 2011 as cited by Palinkas, et al., 2015, p. 534). Criterion-based selection first determines what attributes of the sample are essential to your study and afterwards includes a search for individuals or sites that meet the stipulated criteria (Tisdell & Merriam, 2016). As the researcher, I explained the criteria to be utilized, but additionally positing why the criteria are important (Tisdell & Merriam, 2016).

I selected participants ranging from 30 to over 70 years of age with varied professorial ranking from Lecturers to Professors. Participants had taught for at least a full academic year. Snowball sampling, which is also a subset of purposeful sampling, was utilized to identify additional participants by asking participants initially identified to refer me to friends and colleagues who they think meet study criteria (Emerson, 2015). Additionally, I recruited participants by looking at university faculty pages to ascertain if they met the criteria. Faculty members who fit the criteria were emailed and requested to volunteer to participate in the study. A synopsis of the study and my contact details were emailed to all potential participants. Some of the participants called, text, and emailed to either confirm or decline participation.

Participants were identified by the following criteria: a) Ghanaian; b) female; c) Black; d) doctorate in STEM field e) Professor, Associate Professor, Senior Lecturer, or

Lecturer in a Ghanaian public university. The faculty ranking system in Ghanaian universities includes: Lecturer, Senior Lecturer, Associate Professor, and full Professor (Kwame Nkrumah University of Science and Technology, n. d; University of Ghana, 2016). For an appointment to the position of Lecturer, applicants must possess a Master's Degree in the relevant discipline with at a minimum of two years teaching/research experience (Kwame Nkrumah University of Science and Technology, n. d; University of Ghana, 2016). Doctoral Degree holders are given a preference. For an appointment to the position of Senior Lecturers, applicants must have a PhD and hold the position of a Lecturer or equivalent for at least four years in a recognized reputable institution. Next, for appointment to the position of Associate Professor, applicants must have a PhD and hold the position of a Senior Lecturer or its equivalent position for a minimum of five years in a recognized reputable institution. Finally, for an appointment to the position of Professor, Applicants must have a PhD and hold the position of first an Associate Professors and/or analogous grade for a minimum of FIVE years (Kwame Nkrumah University of Science and Technology, n. d; University of Ghana, 2016).

Data Collection Sources

Creswell (2003) describes four data collection sources: observations, interviews, documents, and audiovisual materials. Data collection tools for this study included phenomenological interviews, artifacts, and the researcher's journal (see Table 1).

Interviews

Any approach in which participants can describe their lived phenomenal experience can be utilized to collect data in a phenomenological study (Gubrium, & Holstein, 2002).

Table 1. Data Collection Sources

	Interviews	Artifacts	Researcher's Journal
What and When	Two 1-hour long in-depth conversational interviews face to face, with a follow-up phone call for clarification purposes. In some cases, the first and second interview were conducted in the same visit, given travel issues associated with going to participant's universities and limited time.	Artifacts were solicited from participants.	Document detailed thought and questions which cropped up during the interview.
Data Type	Phenomenological interview	Valuable/important picture(s) and artifacts from participants and government reports (Ghana Ministry of Education Statistics on Student enrollment and hired lecturers/professors by gender.)	Observation and reflection.
Purpose	Participants journey	Used as an icebreaker during the interview to trigger memories	Record observation and reflection
How	Audio-recorded	Photographs/ or Memorabilia	Notebook

Qualitative interviews have long been a fundamental research method (Oltmann, 2016) and are widely viewed as one of the ideal approaches to "enter into the other person's perspective" (Patton, 2002, p.341). "Qualitative interviewing begins with the assumption that the perspective of others is meaningful, knowable, and able to be made explicit" (Patton, 2002, p. 341). Mason (2003) argues that when a person chooses to utilize

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interviews she/he likewise presents, "an epistemological position which allows that a legitimate or meaningful way to generate data ...is to talk interactively with people, to ask them questions, to listen to them, to gain access to their accounts and articulations..." (p.64). See appendix B for the interview questions for the study.

Interviews permit or grant the investigation of respondent experiences and perceptions in great detail (Britten 1995, Dicicco-Bloom & Crabtree 2006, Patton 2002). There is no prescriptive quality to a good interview. However, there is one fundamental paradigm (Englander, 2016) as indicated by Giorgi (2009) "What one seeks from a research interview in phenomenological research is as complete a description as possible of the experience that a participant has lived through" (p.122). The phenomenological interview will be utilized as a method of exploring and gathering experimental material (Heinonen, 2015).

For the purpose of this study, I solicited for stories from the participants via interviews (see Table 1.) in order to understand their experiences in doctoral school, how they survived in a male-dominated field, and the strategies and resilience tactics they devised to graduate. I utilized Siedman's structure for in-depth, phenomenological interviewing. In this approach the interviewer utilizes, mainly, open-ended questions. Their main task is to build upon and investigate the participants' feedback to those questions (Siedman, 2006). The objective was to have the participants reconstruct their experience within the phenomenon under study.

I utilized Siedman interviewing model as a guide to interview participants, insofar as that model encourages prompting participants to discuss their past and present experiences and to reflect on the meaning of their experience for the future. The Siedman

interviewing structure involves three-interview series. Conceivably the most distinctive

of all its elements, "this model of in-depth, phenomenological interviewing involves

conducting a series of three separate interviews with each participant" (Siedman, 2006, p.

16). People's behavior becomes significant and justifiable when situated in the context of

their lives and the lives of everyone around them (Seidman, 2006). The three-interview

series are focused life history, the details of the experience, and reflection on the

meaning.

The first interview focused on the life history of the participant. It was a one-hour

interview. During the first interview, the researcher's job was to put the participant's

experience in context by questioning the female lecturers/professors to tell as much as

they could be expected about their past experience in their doctoral journey (Siedman,

2006). It also focused on the participant's decision to pursue a doctoral degree. The

interview started with an artifact which the participant had been asked to bring, that was

utilized as an icebreaker. The participants described the artifact and its importance to

them. Additionally, the interview helped examine the participant's doctoral education

experience and journey through the PhD trajectory, including the challenges, success,

resiliency strategies, and coping strategies in the program.

The objective of the second interview was to focus on the factual details of the

participants' current lived experience in the topic area of the study (Siedman, 2006). The

researcher asked participants to reconstruct these details (Siedman, 2006). The second

interview explored how participants' past experiences affected or influenced their

practice of profession (present experience). Also, participants were asked to provide

advice for Ghanaian or women of African descent about who are either seeking to pursue

a STEM doctoral degree or who are pursuing a doctoral degree in STEM field. In order to put participants experience within the context of the social setting, I asked the lecturers/professors, to narrate their current relationships with their students, community, and people within the department (Siedman, 2006). I also asked participants to share stories about their current experience on campus as a way of eliciting details (Siedman, 2006).

During the interview, the participants were requested to reflect on the meaning of their experience. I incorporated the reflection on the meaning of their experience, which is ordinarily the third interview in Siedman's scheme, into the second interview due to time constraint and travel issues. "The question of "meaning" is not one of satisfaction or reward, although such issues may play a part in the participants' thinking. Rather, it addresses the intellectual and emotional connections between the participants' work and life" (Siedman, 2006, p.18). Making sense or making meaning necessitates that the participants speculate how the elements in their lives have led them to their current situation (Siedman, 2006). It additionally demands that they look at their current experience in detail and within the setting in which it happens (Siedman, 2006). The combination of investigating the past to illuminate the events that drove participants to where they are currently, and "describing the concrete details of their present experience, establishes conditions for reflecting upon what they are now doing in their lives" (Siedman, 2006, p. 19). There were follow-up interviews for clarification and further explanation of statements that were not clear or needed further explanation. The follow-up interviews were conducted through phone calls. Again, given travel issues associated with going to participant's universities and limited time, some of the interviews were

conducted together instead of as two separate interviews. In these cases, the second and third interview were merged into one.

Epoché is an important practice in phenomenological research. The phenomenological reduction is an obligation to embrace the phenomenological attitude, also termed as the epoché (Bevan, 2014). The epoché is to be viewed as a critical-position-taking attitude that demands the phenomenologist to embrace and welcome a decision to take nothing for granted (Bevan, 2014). "Hence, the epoché is an attitudinal shift that is directed at moving the phenomenologist out of his or her natural attitude and adopting a critical stance" (Bevan, 2014, p. 139). This important position requires the phenomenologist to scrutinize his or her own position with respect to the phenomenon under investigation (Bevan, 2014).

Artifact

In qualitative research, an artifact is anything created by humans that can be picked up and observed (Leong, 2008). A cultural artifact is something created by an individual or a group of people that gives information about that group (Leong, 2008). The researcher in a field-based study gathers artifacts produced and/or used by participants of the group, describes how these artifacts work for the participants and/or the group, and investigates how members talk about and name these artifacts (Education State University, n. d). "Sometimes researchers ask participants to create an art piece or a collage or to bring an artifact that is representative of their learning or experience" (Merriam, & Tisdell, 2016, p. 174). As the investigator, I asked the participants to bring an artifact to the first interview for which they have connected experience or trigger memories related to their PhD journey. This was used as an icebreaker during each

interview session. Merriam and Tisdell (2016) explains that "…artifacts that participants create or use to express themselves, or photographs taken by the researcher or the participants all can be a valuable source of data and can provide another avenue of expression that can be captured in symbols as well as words" (p. 174). Requesting participants to bring an artifact for discussion also alerted them in advance to think what they specifically wanted to say about the object.

During the interview, it was imperative to ask good questions concerning the artifact(s) that participants presented. Merriam and Tisdell (2016) advise that "it is important to ask about the artifact's history (how and when was it produced and has it changed over time?) and its use (is it a decorative item? If it is used, by whom is it used, and how is it used?)" (p. 176). The questions posed helped participants to dig deep into memory lane and produce excellent information which was important for this study. For example, a participant submitted a picture in a lab with her colleagues wearing a lab coat. A lab coat draws out stories from participant's experience in graduate school. Some of the artifacts consisted of photos, newspaper publications, and description of religious items that were important to them. Others who did not present an artifact at the interview rather described pictures, people, and words that held symbolic meaning important to understanding their doctoral experiences.

Researcher's Journal

The researcher's journal was my personal tool to record observations and all relevant experiences. This helpful document detailed my thoughts following interview and questions which cropped up during the interview but were not part of the initial interview questions. Reflective observations are likewise a part of the data collection

process as observational data (Castillo, 2008). According to Patton (2002) these notes permit the researcher to document facial expressions, gestures, and visible emotions showed by the participants in their life settings. As I recorded or documented personal observations in the researcher's journal, I was helping myself to store relevant information on the phenomena under study. Furthermore, as the researcher, I additionally, integrated documented impressions and feelings of the participants into the data collection process (Castillo, 2008). Focusing on details or interest during the interview assisted me as a qualitative researcher to effectively enter the world of the participant (Denzin, 1978).

Right after the interview, I went to a quiet location with my journal, and documented personal impressions, reactions, and observations about the interview (Taylor & Bogden, 1998). Journaling has its own benefit for scholars. The benefit of journaling that I sought to gain is clearly articulated by Janesick (1998) who states that she perceives journal writing as 'a type of connoisseurship by which individuals become connoisseurs of their own thinking and reflection patterns and indeed their own understanding of their work' (p.3) and continues to expound that journal writing is 'a tangible way to evaluate our experience, improve and clarify one's thinking, and finally become a better ...scholar' (p.24).

Data Analysis

After collecting the participant's descriptive responses, I analyzed the data utilizing Colaizzi's (1978) phenomenological step for data analysis (see Figure 2.2). The following clarify how data collected was analyzed utilizing Colaizzi's (1978) method.
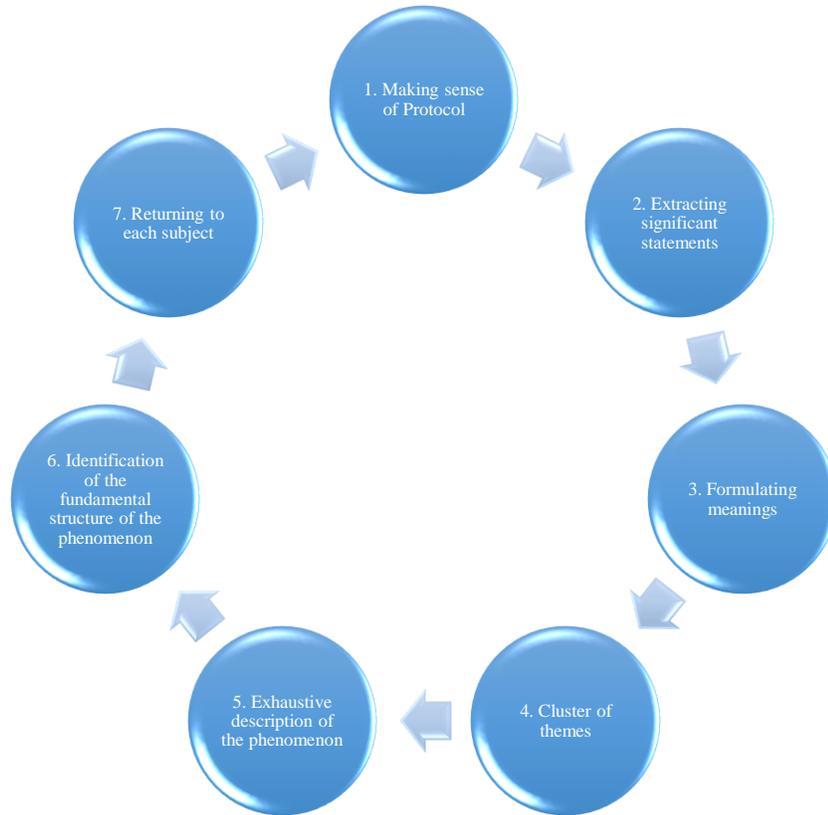
Figure 4. Colaizzi's (1978) Phenomenological Method of Data Analysis

Step 1: Making sense of protocol

The first step requires the phenomenological researcher to read and reread the participants' descriptions of the phenomenon to gain a deeper feeling for their experience and make sense of their story (Colaizzi, 1978). To make sense out of the data to be collected, I recorded the interview and then had them transcribed professionally. After acquiring the transcribed interviews, I then listened to the recorded interviews and read and reread the transcribed interviews. Additionally, I made corrections to the transcript while listening to the recorded interview. Listening to the interviews and cross-checking the transcripts helped eliminate errors and additionally helped me submerge myself into the participants' experiences. Each transcript was read several times to gain an overall sense of the whole data. During this stage, ideas, feelings, and thoughts that emerged

were documented in the researcher's journal and was analyzed alongside the transcript. This aided to examine the phenomenon as experienced by participants themselves (Shosha, 2012).

Step 2: Extracting Significant Statements

"Return to each protocol and extract from them phrases or sentences that directly pertain to the investigated phenomenon; this is known as *extracting significant statements*" (Colaizzi, 1978, p. 59). For each transcript, significant statements that relate to the phenomenon under study were next extracted (Shosha, 2012). These statements were recorded on a separate sheet taking note of their pages and line numbers (Shosha, 2012). I utilized NVIVO software to bracket or extract statements which related to participants' resiliency strategies, challenges encountered, success stories, how their experiences affect their profession, and all other experiences encountered during their doctoral journey.

Step 3: Formulating Meanings

Under this step, I formulated meanings from these significant statements. I spelled out the meanings of every significant statement, termed as *formulating the meanings*. The formulations uncovered and highlighted meanings hidden in the various contexts of the examined phenomenon (Wojnar & Swanson, 2007). In this step, the phenomenological researcher engages in something which cannot be accurately delineated, for here I am included in that ineffable thing known as creative insight; I leaped from what the participants said to what they meant (Colaizzi, 1978). While moving beyond the protocol statements, my formulations uncovered and highlighted those meanings hidden in the

various context and horizons of the examined phenomenon which are announced in the original protocol (Colaizzi, 1978).

Step 4: Clusters of Themes

I repeated the above for each protocol and arranged the aggregate formulated meanings into *clusters of themes* (Colaizzi, 1978). The challenges involved at this step are comparable to those discussed in step 3, since there is an endeavor here to allow for the emergence of themes which are common to all of the participants' protocols (Colaizzi, 1978). Classifying the meanings formulated into clusters of themes that are common to all participants; first, alluding these clusters to the original transcriptions for validation and affirming consistency between the researcher's emerging conclusions and the participants' original stories. Second, not surrendering to the compulsion to overlook data which do not fit or rashly producing a theory which reasonably disposes off the dissonance in findings up to this point. (Wojnar & Swanson, 2007, p. 176).

Step 5: Exhaustive description of the phenomenon

Within this step, Colaizzi (1978) states that "the results of everything so far are integrated into an exhaustive description of the investigated topic" (p. 61). What Colaizzi is trying to clarify is that, as the researcher, I merged the findings into an exhaustive description of the phenomenon being studied; employ a self-imposed discipline and structured to bridge the gaps between data collection, intuition and description of concepts (Wojnar & Swanson, 2007). Describing the phenomenon involves coding segments of text for topics, comparing topics for consistent themes, and bridging themes for their conceptual meanings (Wojnar & Swanson, 2007).

Step 6: Identification of the fundamental structure of the phenomenon

In this step, Colaizzi (1978) is of the view that "an effort is made to *formulate the exhaustive description of the investigated phenomenon in as unequivocal a statement of identification of its fundamental structure as possible*" (p. 61). At this step, I reduced the findings by ensuring that repetitive, obsolete, and overstated description were removed from the fundamental structure. This action was taken to highlight the fundamental structure. A few changes were made to create clear connections between clusters of themes and their extricated subthemes, which involved likewise disposing some obscure structures that debilitate the entire description.

Step 7: Returning to each subject

A final validating step was accomplished by returning to each participant, and, in a series of interviews questioning the participant about the findings thus far (Colaizzi, 1978). First, I emailed each participant their biography. Second, I emailed participants the research findings and followed up with a phone call to discuss the results. Third, I clarified with participants to ascertain if the findings and their profiles were revealing their identity and also if they were true to their experience (Shosha, 2012). Amendments were made to three of the participants statements. I integrated the amendments/changes and clarifications into the findings and profiles of the participants (Colaizzi, 1978; Wojnar & Swanson, 2007). Two participants requested the recorded interview and transcripts, which were emailed to them. I did not receive feedback or response from other participants. Three participants made changes to their profiles/biography.

Building Trustworthiness

In dealing with trustworthiness in this study, I asked myself, how can I as an inquirer persuade my audience or readers including myself that the findings from this study are worth paying attention to and worth taking account of (Lincoln, & Guba, 1985)? Again I ask myself "what arguments can be mounted, what criteria invoked, what questions asked, that would be persuasive on this issue" (Lincoln, & Guba, 1985, p. 290). Trustworthiness in this study was determined by implementing credibility, transferability, dependability, and confirmability (Maldonado, n. d.).

In this study, the process of credibility was followed by utilizing techniques which call for support or validity in qualitative research. Credibility "concerns the accuracy or truthfulness of the findings" (Ary, Jacobs, & Razavieh, 2002, p. 451). Qualitative validity "means the researcher checks for accuracy of the findings" (Creswell, 2009, p. 190). Here, talking about internal validity means focusing on the question, "How congruent are one's findings with reality?" (Merriam, 2002, p. 25). Lincoln, & Guba (1985) addresses several procedures that must be under credibility to ensure trustworthiness such as prolonged engagement, persistent observation, triangulation (sources, methods, investigators), peer debriefing, negative case analysis, referential adequacy (archiving of data), and member checks. I had prolonged engagement with the universities where these lecturers/professors teach sufficiently long to detect and take account of distortions that might otherwise creep into the data (Lincoln & Guba, 1985, p. 302). I had previously visited three out of the four institutions where data were collected when I was pursuing an undergraduate degree in Ghana. Also, in both December 2015, 2016, and January 2017, I visited two of the four public institutions where participants

work. I have visited some of these universities more than twice to familiarize myself with the universities and be abreast with the continuous infrastructural developments in the institutions. Additionally, I have had a prolonged engagement with participants so as to build trust. When recruiting participants in the four universities, I had the privilege to be introduced or referred to participants by a well-respected professor, a lecturer, and a former dean. The participants gladly accepted to participate in the study. Through snowball sampling, I had the chance to talk to some lecturers/professors who agreed to participate due to my familiarity with the referral source. Additionally, they accepted participation through email confirmation. "It is a developmental process to be engaged in daily; to demonstrate to the respondents that their confidences will not be used against them that pledges of anonymity will be honored; the interests of the respondent will be honored as much of those of the investigator" (Lincoln & Guba, 1985, p. 303).

The use of the technique of triangulation was used to "improve the probability that findings and interpretations will be found credible" (Lincoln & Guba, 1985, p. 305). Triangulation calls for the use of different methods thus can imply either different data collection modes; interview, questionnaire, observation, testing, or different designs. As stated in the data collection section, I collected data through interview, documents, and journaling (Lincoln & Guba, 1985). Step seven of Colaizzi's (1978) data analysis calls for member checking and this is an important aspect of building trustworthiness. Member checking is a procedure whereby "the final report or specific description or themes" are given back to the participants of the study (Creswell, 2009, p.191) to present them "an opportunity to provide context and an alternative interpretation" (Patton, 2002, p. 561). After the data collection and analysis, I sent profiles I wrote about each participant t to

ascertain if they represent what they said during the interview and if it resonates with their experience. This gave the respondent an immediate opportunity to correct errors of fact or interpretation. and challenges that they perceived to be wrong (Lincoln & Guba, 1985).

Transferability "is the degree to which the findings.... can be applied or generalized to other contexts or groups (Ary, Jacobs, & Razavieh, 2002, p. 454). Transferability can be achieved through thick and rich description and reaching maximum variation in sampling (Anfara, Brown, & Magione, 2000; Soesbe, 2012). Thick and rich description was utilized in my study as "a major strategy to ensure for external validity or generalizability in the qualitative sense" (Merriam, 2002, p. 29). This implies that enough description, information, and detailed stories were given to guarantee the information is trustworthy and appropriate (Soesbe, 2012). It was of very great importance to ensure the voices of Ghanaian female STEM lecturers/professors are prominent and clearly articulated, particularly concerning their doctoral experiences and the meaning created from those experiences (Soesbe, 2012). Seidman (2006) structure of phenomenological interviewing approach afforded me the opportunity to collect rich data that served as a detailed foundation for the findings and conclusions (Soesbe, 2012). In the end, I was able to formulate the essence of participants' experiences. It is imperative to give distinctive descriptions and thick and rich text so a reader can decide to what extent the study parallels her or his own circumstance and to what degree the results can be transferred (Merriam, 2002).

Dependability is developed when "the researcher attempts to account for changing conditions in the phenomenon chosen for study as well as any in the design" (Marshall &

Rossman, 1995, p. 145). Dependability is often established with an audit trail which includes maintaining and preserving all transcripts, notes, audiotapes etc. (Maldonado, n. d). Audit trails clarify the methods of the study, how participants were chosen, illustrate how data were collected and analyzed, and how decisions were made throughout the inquiry (Merriam, 2002). I had my research journal with me at all times to capture a record of questions, new ideas, reflections, decisions made, and problems or issues experienced right after each interview. Coding-recoding is also a way of reaching reliability. Ary, Jacobs, and Razavieh (2002) opine that the method expects the researcher to code the data and then set it aside for some time. I went back and recoded the data. I then compared the two sets of data to each other. This helped to determine how similar the two-data sets looked after coding and recoding.

This study achieved confirmability through measures already discussed in relation to triangulation and audit trails (Soesbe, 2012). A confirmability audit analyzes the product to attest that the findings, interpretations and recommendations are supported by data (Lincoln & Guba, 1985). Ary, Jacobs, and Razavieh (2002) also iterate that the audit trail is the fundamental strategy used to exhibit confirmability. The auditor's first concern is to determine whether the findings are grounded in the data, a matter effortlessly determined if appropriate audit trail linkages have been set up (Lincoln & Guba, 1985). Likewise, confirmability can be addressed through peer review and the identification of a researcher's positionality and/or reflexivity (Ary, Jacobs, & Razavieh, 2002). Next, the auditor will wish to achieve a judgment about whether inferences based on the data are logical, looking carefully at analytic techniques used, appropriateness of category labels, quality of interpretations, and the possibility of similarly attractive alternative (Lincoln &

Guba, 1985). I worked closely with my chair during the various phases of data analysis, as a means to help attest that the findings, interpretation, and recommendations are supported by the data.

"Researchers should explain their position vis-à-vis the topic being studied, the basis for selecting participants, the context of the study, and what values or assumptions might affect data collection and analysis" (Merriam, 2002, p. 26). This is termed as the "researcher's position" (Merriam, 2002, p. 26). Others also refer to it as positionality. My positionality as a researcher has been thoroughly explained in Chapter 1. My values or assumptions as a male and a Ghanaian educated and raised by a Ghanaian family that might affect the findings or the study is clearly explained. I also discussed my experience and its effect on the topic being studied.

Ethical Considerations

The study is unique and sensitive because as a male researcher I was collecting data from female lecturers/professors in a male dominated field and because "women are a minority in terms of statistical visibility at the university, both as administrators and faculty" members in Ghana (Adusah-Karikari, 2008, p. 110). Because of their numerical disadvantage in STEM and all academic fields, it was critical to pay attention to the ethical considerations and confidential information of participants. Ethical consideration pertains to me as a researcher to be responsible and provide assurances of confidentiality and maintain those (McHaffie, 2000). As a doctoral student, I applied to the Texas State University's Institutional Review Board (IRB) for approval. To guarantee that ethical issues were not infringed, before each interview, I communicated the purpose of the research and provided a synopsis of the research being conducted. Polit and Hungler

(1999) explain that the essence of informed consent signifies that participants have enough information regarding the research, are capable of understanding the information, and have the ability of free choice, allowing them to consent to or reject participation in the research voluntarily. In line with IRB expectations, I presented the consent form to the participants to read and sign and also informed them about how their identity will be protected from identification through the use of pseudonyms throughout the whole study as well as not providing details so specific as to reveal their identities despite the use of pseudonyms. I assured participants that data solicited from them would be stored in a safe box, or digitally protected with a password, with the only person having access to some part of it being my chair.

I communicated the essence of confidentiality as a researcher to the participants and also built trust through prolonged engagement, including through communications before I traveled to the study sites. Since I did a face-to-face interview, I used every effort to guarantee that the principle of confidentiality is upheld (Streubert & Carpenter, 1999). I believe this built trust and helped eliminate participants' anxieties about providing detailed information about their experiences.

Chapter Summary

This chapter presented the overall qualitative method of the study, which utilized phenomenology. A sample population of 11 lecturers and professors was selected for the study. This chapter discussed the imperatives of utilizing participants' voices for phenomenological study. The chapter also discussed how I utilized the Seidman (2006) structure of phenomenological interviewing approach as a guide to collect rich data and the most relevant data. I discussed avenues of building trustworthiness through

concealment of participants identity, building confidentiality, member checking, and building a prolonged engagement with participants. my position as the research in this study was clearly defined. Finally, the utilization of the Colaizzi's seven steps of phenomenological method of data analysis for my study was clearly defined. The chapter examined the research process of the study, and how data was obtained, the specific kinds of data collected and how data was stored to prevent the revelation of data source and participants' identity. The following chapter presents and discusses the data analyzed.

IV. DISCUSSION OF FINDINGS

This chapter presents the findings acquired from the interviews, documents, and researchers' journal to answer the research questions guiding this study. The purpose of this phenomenological study is to investigate these challenges and to gain an understanding of the lived experiences of female STEM lecturers/professors in Ghanaian universities', beginning with their doctoral journey and including their experiences as lecturers/professors. It is hoped that the analyses of these findings will help provide or enhance the expectations of STEM PhD programs for Ghanaian women or women of color who are currently pursuing a doctorate in STEM fields or hope to pursue a doctorate in STEM education and the colleges and professors who will be admitting these students into their departments. The research questions for this study enquired particularly about:

1. The lived experiences of Ghanaian female lecturers/professors who graduated from STEM doctoral programs.

2. Elements that facilitated the resiliency of Ghanaian women who graduated from STEM doctoral programs.

3. The specific support systems Ghanaian female lecturers/professors ascribe to their success while seeking after their doctorate.

4. How their lived experience has affected their practice as STEM lecturers/professors?

This chapter reports the participants' profiles and emerged themes and based on the data collected from the participants and the universities. Documents relating to the numbers, status, and female students' rights in higher education were collected from two

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of the universities where participants work. The chapter presents themes that emerged

from analysis of multiples forms of data, with an emphasis on the interviews responses,

and as related to the research questions adopted for this study. Data was analyzed

utilizing Colaizzi's (1978) phenomenological method for data analysis and Nvivo 11.

NVivo and Excel were used as a tool to help manage data that was collected from

interviews and observations (Arturo Alvarez, 2014). In summary, this chapter provides a

depiction of the themes that emerged from the data collected from the interviews with the

lecturers and professors and submit an analysis that centers on the experiences of these

women and how their doctoral experiences are affecting their practice of profession in

Ghanaian universities.

Overview of Participants Individual Profiles

The participant selection procedure discussed in the previous chapter culminated

with 11 volunteers for the study who met study criteria and were available for interviews.

The 11 female STEM lecturers and professors came from four public STEM offering

universities across Ghana. Participants were at different ranks and from diverse STEM

departments. During data cleaning, confidentiality was tended to. Identifiers were

removed from quotes and profiles to avoid revealing identities of participants,

particularly as the participants are of a small number of women in similar positions at

universities (Kaiser, 2009). These lecturers and professors were assigned pseudonyms

(see table 2) to protect their identity. Any pseudonyms that appears more than once and

throughout the student represent a participant telling their lived experiences.

Table 2. Demographic Overview of Study Participants

Participants Names	Age	Marital Status During PhD Education	Teaching Rank	Department	Children During PhD Education	Location PhD was Attained	Years of Teaching
Adu	30-39	Married	Lecturer/ Senior Lecturer	Health Sciences	0	Europe	6-10
Afrakoma	60-70	Married	Associate Professor/ Professor	Life Sciences	2	North America	30+
Augustina	30-39	Married	Lecturer/ Senior Lecturer	Applied Sciences	1	Africa & Europe	6-10
Ayisi	30-39	Single / Unmarried	Lecturer/ Senior Lecturer	Health Sciences	0	Africa	1-5
Esther	60-70	Single / Unmarried	Lecturer/ Senior Lecturer	Biological Sciences	0	North America	20-29
Ellen	50-59	Married	Associate Professor	Science and Technology Education	0	North America	6-10
Gyamfuaa	40-49	Single / Unmarried	Lecturer/ Senior Lecturer	Health Science	0	North America	1-5
Nari	40-49	Married	Lecturer/ Senior Lecturer	Engineering	2	North America	11-19
Owusua	50-59	Married	Lecturer/ Senior Lecturer	Natural Science	0	Europe	11-19
Priscilla	50-59	Married	Lecturer/ Senior Lecturer	Life Sciences	0	North America	6-10
Tiwaa	60-70	Married	Associate Professor/ Professor	Biological Sciences	1	Africa	30+

The 11 participants are all full-time professors, have taught for at least a year, and possess a doctorate degree. The age of the participants ranges from 30 to 70 years. Eight of the participants were the only Black and woman in their cohort. Six of the participants were married prior to beginning their doctoral studies and two married during their doctoral journey. Out of the eight married participants only four lived with their husbands

during their doctoral journey. Four of the participants had a child during their doctoral

journey. Three of the participants were single and remained during their doctoral

program. Two of the participants graduate from an institution in Africa and six graduated

from a North American institution. Two participants attained their doctorate from a

European institution (See fig. 5). One participant attended an African and European

institution.
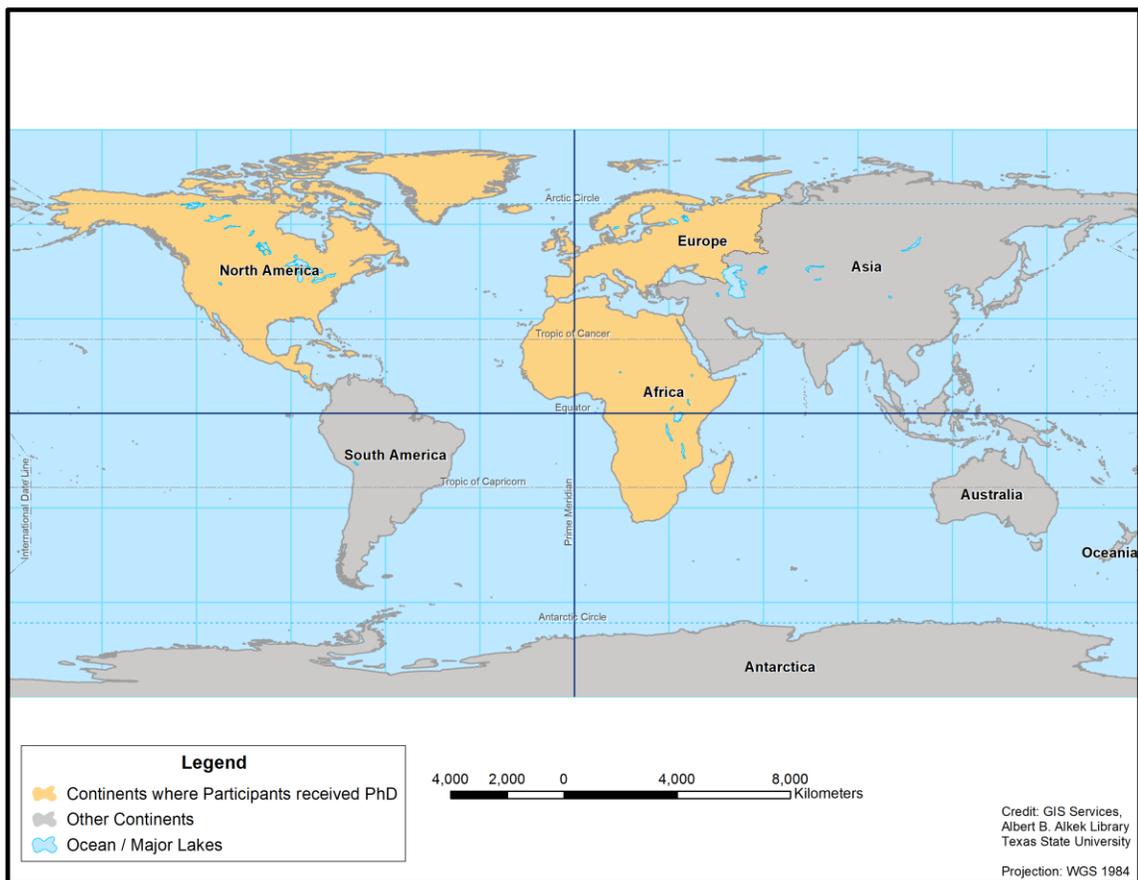
Figure 5. Continents where Participants Received PhD

Their teaching ranks was made up of two Professors, one Associate Professor,

four Senior Lecturers, and four Lecturers; the Ghanaian university system does not

include a rank of assistant professor. Their years of teaching ranged from 1 to 30+ years.

For six of the married participants, their husbands were also pursuing a doctorate degree

simultaneously as them. One married participant's husband was pursuing a Master's degree at the same time the wife was pursuing a doctorate. Another married participant did not talk about the whereabouts of her husband.

Adu

The interview with Adu was arranged per her schedule at a convenient place of her choice. Before the interview, Adu forewarned that she would be running in to check up on her new-born baby. Her artifact was not ready during the interview but she described the artifact and its relevance to her PhD journey.

The picture was of herself and two Caucasian women on the street of a European country. The picture was taken during a parade. She wore a gown as did her colleagues in the picture. The picture reminds her of the journey through her doctoral program. The picture was taken in her first year in the PhD program. Adu is in her 30s and a lecturer/senior lecturer at one of the STEM offering universities in Ghana. She attained her doctorate degree in Europe. She started her doctorate journey in the 2000s. She was a recipient of a renowned European scholarship for her PhD. She was the only Black female student in her research group/cohort. Adu has been teaching and researching for six years.

The interview started by the participant explaining the reason for pursuing a PhD. She stated that after completing her Master's degree, she felt that it might not be enough because of her interest in a career in research or academia. She then decided to pursue a doctorate degree because she wanted to attain a higher level in academia and research. She was married before entering the PhD program. While pursing the doctorate degree, her husband too was in another Western country pursing a doctorate degree as well. She

had a child before entering the PhD program. The child was with her in-laws while she was in the university. Adu's most significant achievement in her doctoral journey is the experience and exposure and the techniques learned. What motivated her to persist and graduate through the PhD journey was the Doctor title, and that she felt she could not go back to Ghana without the title.

Afrakoma

Afrakomaa did not present an artifact but described a picture with her daughter walking around campus at her inaugural lecture. Her PhD was dedicated to her daughter and the husband for the roles they played. Afrakoma is in her 60s and an associate professor/professor at one of the Ghana's leading universities. She has been teaching and doing research for over 35 years. She had a full scholarship from the African American Institute through the university to pursue her PhD. Afrakoma was the only female, Black, and African in her cohort.

Afrakoma's passion for science started in high school. She was very good in science courses. Growing up, her best courses were in the sciences. Her passion for these courses was the influence of a female STEM teacher who is an American. Her passion led her to pursue a degree in the science field in the university and continued to get a PhD. She started her PhD at a time when very few women were enrolled in STEM programs. She enrolled in the PhD program with a bachelor's degree. Afrakoma entered the program three months pregnant. Her husband was also pursuing his postgraduate studies as well. She had two children before graduation.

Her most significant achievement was when she received her PhD degree during commencement. She received a standing ovation from most of the men. What motivated

Afrakoma to graduate from the PhD program stems from two female role models who were lecturers and hall directors at her former universities in Ghana. Their roles as lecturers, riding in cars, and sitting in their offices to confer with students motivated her to succeed. Also, having a lecturer from the same tribe in her undergraduate program served as a role model. Her desire to be a lecturer motivated her to persist and graduate. A European undergraduate faculty member also encouraged her, that she would be a good teacher.

Augustina

Augustina scheduled her interview at her workplace. Her artifact was not available at the interview but she talked about a picture of her in the lab with colleagues. The picture symbolizes her journey throughout the PhD journey. Augustina is a lecturer/senior lecturer but has submitted an application to be promoted. She had her PhD training from both Africa and Europe but defended her dissertation in an African institution of higher learning. She is a double scholarship recipient. She received a scholarship from the government of Ghana and a renowned European scholarship.

Augustine is in her 30s and has been teaching for over six years. When asked about her decision to pursue a STEM doctorate, she stated that her interest in science dawned from her early ages. She did science in secondary school and further pursued science at the university level. She was interested and motivated in knowing more about nature, so she chose to study science. Augustina entered the PhD program in the early 2000s. She got married within the PhD journey. Along the journey, she became pregnant, and had to defer for a year to give birth and take care of the child before reentry. This

delayed her progress or graduation for a year. Her husband was also pursuing his PhD simultaneously.

Augustina explained her main motivation to persist and graduate. She stated that her aim was to be able to get the doctorate degree and additionally to attain the highest degree in education. When questioned about the most significant achievement during her doctoral journey she articulated that having a doctorate degree is one of her biggest achievements. Furthermore, the experience obtained from conferences and meeting researchers is also part of her biggest achievements. Augustina spent four years to complete the doctoral degree instead of the assigned three years. Her husband graduated a year before her.

Ayisi

Ayisi is in her 30s and has been teaching for over a year. She is a lecturer/senior lecturer rank. She obtained her doctorate degree in an African country. After her bachelor's degree in 2009, she applied into the Master's program in the science field and in the course of it, she made good progress and her master degree was converted into a PhD. Although her intentions were for a master's degree, she still had the thought of pursuing a PhD later after working for a while. Ayisi entered the program and graduated unmarried and without a child.

When asked about an artifact, Ayisi rather described God and family as a symbol to represent of her doctoral journey. She explained that her family was genuinely there for her and their encouragement extremely helped her to forge ahead. God was her source of strength at any point in time in the doctoral journey. The motivation behind her strength to persist and graduate was again, her parents. She reiterated that the absolute

motivation was her parents. They full sponsored her education and she felt that she owed it to them to persist and graduate. Additionally, she felt that there was an uncomfortable feeling of failure too. She stated that "if you quit it will be more like 'Ah you failed' and so I didn't want that."

Ayisi's most significant achievement during her doctoral degree was getting the degree done. She mentioned that, colleagues in the department were passing comments that "if you do _____you will keep long oo—if you do _____you won't finish early." She enrolled in the program with that mindset thinking that "eeei will I even finish this course? Why didn't I do anything in botany and finish it" that was it. Graduating from the program was a significant achievement and that made her happy.

Esther

She is in her 60s and has been teaching at the university for over 20 years. Esther is a lecturer/senior lecturer. In the 1980s she enrolled as a PhD program in a renowned institution in North America. She was the only Black and African student who was admitted into the department. She is also a recipient of a prominent scholarship in North America. She entered the program unmarried and without a child. As a mature student who had worked and taught before entering the program, she was respected among her peers.

Esther began the interview with a smile before talking about her story of ending up in a PhD program. Interestingly, she started by saying "it is a bizarre story." It was not her intention to pursue a PhD but rather she "was pushed into it" and ended up at a renowned institution in North America. She had an experience working in Europe before traveling to North America to pursue her PhD. Her desire was to pursue the PhD degree

in Ghana. This was because she disliked her previous experience in a European country when she worked with a scholar. So after going through an interview with a panel including the Vice Chancellor of the university, later she was promoted from a part-time lecturer to a full time lecturer. Next, she received a scholarship form from the university administration to apply for a scholarship for her PhD. She abandoned the forms but was asked to fill and return it. Afterwards, she was informed that she has been selected to pursue a PhD in North America.

The visual representation which Esther discussed as her artifact to represent her doctoral journey was an image of supervisor who made life easy and her pathway smooth. Even after she graduated and returned home, the supervisor passed through her workplace in Ghana when he was on a tour with others and brought her books. What motivated Esther to persist and graduate was that she could not return to Ghana without a degree. Again, her employer had given her a study leave to get the PhD and return to teach, so she could not return empty handed. Another important motivation was one of her close relations who knew she was pursuing a PhD abroad, so it was impossible to return without the degree. She did not want to be branded a failure. Esther identified her significant achievement in the doctoral journey to be the acquisition of confidence in presentations.

Ellen

Ellen was a faculty member before seeking a PhD degree. In her institution, it was a requirement as a lecturer to have a PhD. This informed her decision to upgrade her qualification. She is a recipient of a renowned scholarship in North America. In the early 2000s, Ellen started her PhD in North America. She relocated to North America with her

three children and the mother. She did not have any children during her studies. The presence of her mother provided time to focus on her studies. The mother took care of the children. While pursuing her PhD degree, her husband was concurrently studying in Europe for his PhD as well.

Ellen is in her 50s. Her teaching experience spans over 16 years. Ellen was not the only Black or female in her cohort but rather, she was surrounded by mostly international students. She had a difficult start in the PhD program due to the lack of acclimatization to the extensive reading and writing of long papers. After settling in the program, Ellen took the opportunity to take extra courses in Ethnography and Sociology.

While she did not bring an artifact that symbolizes her PhD experience, Ellen postulated that the visual representation of her journey throughout the PhD program would be the word "Determination." She believes that with determination and hard work, you can achieve anything. Ellen's motivation to persist and graduate was her target upon entering the PhD program. The target was to graduate at the stipulated time and return to continue her career. According to her, there was no time to waste. She also met other Ghanaians who had been in the university for seven and eight years and had not graduated. This motivated her to persist and graduate. The most significant achievement in Ellen's PhD journey was identification of two new findings in her dissertation. Another significant achievement she stated was her ability to publish papers with her supervisor.

Gyamfuaa

Gyamfuaa loves teaching and research. She teaches health science courses. She believes she has the passion to teach and once the love for teaching is present, she never

gets tired doing it. Her teaching career after the PhD has extended more than five years. But Gyamfuaa's teaching career started long before she obtained a bachelor's degree. She started teaching with a certification in the health sciences. After the government of Ghana changed the system and transitioned from offering a certificate to diploma in health science education, she then decided to get a bachelor's degree. Gyamfuaa performed extremely well in her bachelor's program. The Dean in her department wrote to the Ministry of Health and she was appointed an instructor in the department. Her predisposition to remain in academia and the university requirement to be a lecturer spurred her to pursue a master's degree and eventually a PhD in North America. She won a scholarship to pursue her PhD. Interestingly, she wrote her Master's thesis whiles she was in her first year in the PhD program.

Gyamfuaa is in her 40s. She is at the rank of Lecturer/Senior Lecturer. She started the PhD program in the early part of the year 2000s. She journeyed through the program unmarried. One challenge she faced during the program was leaving her daughter behind in Ghana. She faced financial challenges bringing her over but with the help of the African colleagues, she was able to raise the required funds to bring her daughter over. Along the dissertation journey, she brought her daughter to live with her. Her program had the presence of international students but in some of her classes, she was the only Black student. With her first research supervisor, she was the only Black in her research team.

What motivated Gyamfuaa to persist throughout the journey and graduate was the goal to finish quickly and return to Ghana to further her career. This goal motivated her to take 12 credits per semester. The most significant achievement in Gyamfuaa's entire

PhD journey was the whole dissertation process. The whole dissertation process stands out because one of her best publications came from her dissertation.

Nari

Nari had not been exposed to a multicultural environment before coming into North America to pursue higher education. She experienced culture shock in North America. In North America, she encountered everybody living their life and neighbors not even feeling they want to say hello to you. That was a bit of a cultural shock for her at first and she had also come from this experience where everyone is given a chance "based on what they had to tell you, what their character was not because of their skin color." She is not afraid to speak her mind.

Nari is in her 40s and entered the PhD program in the 1990s. Her faculty rank is Lecturer/Senior Lecturer. She has been teaching for over 11 years. She received a grant to attend a prominent university in North America. During her PhD journey, Nari took time off to marry. She had two children before graduating. During graduation, she was the only Black among her colleagues. Her first paper publication and attendance of international conferences occurred in her undergraduate years. With her experience, she also writes papers for publication with her students. She believes in giving undergraduate students skills because of the way she has been shaped in higher education.

When Nari was questioned about the decision to pursue PhD in Engineering, she stated that it stemmed from her undergraduate days. She got the opportunity to carry out research in her second year. She volunteered to work in the lab and enjoyed the research experience. Based on the experience, she knew she wanted to do something with research. She then started looking into possibilities of how she could transition from

North America to Ghana and still be able to do research. So, she started thinking about a graduate school at that time and was actually a submatriculant. The submatriculation program is a selective offer for juniors or seniors at a college/university to explore graduate education and apply up to two courses to both degrees, at no extra cost for full-time undergraduates. She applied for a program where as an undergraduate instead of taking undergraduate electives she was taking the graduate level courses. As a submatriculant, she knew as an undergraduate, that it would not be difficult to transition into thinking about doing a PhD and then getting into academia.

When asked about an artifact which represented her doctoral journey, Nari's talked about her mother. She was her support and strength all the time. To this date, her mother has been constantly being there for her. For instance, her mother was taking care of her children whiles she pursued her PhD degree. What motivated Nari to persist and graduate from the program was her will power. She stated "The will power, I have started the thing and I better finish it." Nari is an individual who does not give up too easily. Upon all the challenges encountered in the program she decided not to dropout but rather stated that "am not actually going to do it and that was a major, major thing." One of the most significant achievements throughout the PhD program for Nari was graduating. She believed she could have quit. Nari cherishes her PhD experiences and she "will not give that experience up for anything because it's part of who I am."

Owusua

The artifact presented was a picture taken by the media in their town during a science exhibition. She was not so much involved in the research that was presented at the exhibition, but as part of the research team she was present. When the mayor arrived,

he spotted Owusua and then he walked to her at the back, and with all the camera, the print media and everybody taking pictures followed him. Meanwhile, all the media were supposed to be at the front. The mayor came and greeted her and asked questions. He did not leave at the end of the media event. He was still standing next to her and later pulled her along. So when the mayor was entering the lab to observe the experiment, he was with her. Wherever she stood, he also stood there. Her colleagues started calling her to come around. Meanwhile when her colleagues were setting up the experiments, they ignored her. One thing that encouraged Owusua was the fact that the recognition of the mayor. This event highly encouraged and inspired her. She stated that "In fact, initially I felt I was being left out."

Owusua is in her 50s and a lecturer/senior lecturer at one of the prominent universities in Ghana. Her initial intention was not to pursue a PhD degree but it happened when her husband relocated to Europe and he wanted her to join him. The husband did not want an educated wife with a Master's degree to be a house wife but rather to pursue a PhD. Additionally, she was already working in higher education and wanted to remain in academia. With that decision at hand, she realized that to be the best, it was prudent not to end her education at the Master's degree but rather push to a doctoral level. She initially wanted to go into the professions such medicine, but it's happened that she decided to pursue a natural science subject. Again, since she decided to teach, she realized there was a need to go higher above a Master's degree and pursue a PhD.

After joining her husband who was studying in Europe, she did have the opportunity to pursue a PhD. She was not fortunate to receive a scholarship like her peers

but still accepted the offer. She started the PhD in the 2000s. She was required to enroll in a language class to learn the basics to enable her to communicate with non-English speakers. She has been teaching for over 11 years. She happened to be the only Black and woman among her research team. What motivated Owusua to persist and graduate was the decision not to quit what she had started, and also to get what she wanted. She posited that "I'm not somebody who does not want to accept defeat and then allow my labor to go in vain." To persist and graduate, Owusua had to actually let go off other pleasures and other things to just stay focused. She also had to live within her means by eating less expensive food. The most significant achievement in her entire doctoral journey is the experience gained. She postulated that "the experience and then after that, I saw that I was empowered because I saw that it has served a strong tool for me to actually depend on."

Priscilla

Before Priscilla entered the PhD program, she already held a Master's degree, was trained as a scientist, and was employed. Her job required staff members to upgrade themselves. This issue prompted her to seek a PhD. To satisfy her desire of performing better at her job, and also identifying some problems in Ghana and wanted to address them, she pursued a PhD. One of the problems identified in Ghana was food security. She is in her 50s. Currently she is a lecturer/senior lecturer. She has been teaching for over six years.

In the 2000s, Priscilla started the PhD program in North America without her family. She received a nationally recognized scholarship to start the PhD program. She happened to be the only Black, female, and African in her department. After eight months

of being in the program, she encountered financial issues to bring her family over. She was fortunate to receive an out-of-institution scholarship which aided her to bring the family over. She had the help of her advisor who provided all the needed documentation. Her husband like his wife, also started schooling upon arrival.

Priscilla's described her visual representation of her PhD journey to be persistence. She explained that in the country where she obtained her PhD, it was quite difficult. Comparing her previous school for her Master's and the school where she obtained her PhD, she indicated that the PhD experience was exceptional and a student needed to be very determined, focused and it required her to think and to raise herself up from one level to the other. She stated that "I needed persistence."

Tiwaa

Tiwaa gladly accepted to be interviewed after asking questions about the research. She scheduled the interview to be conducted at her workplace. In the 1970s Tiwaa gained admission to start her Master degree in a local university. Tiwaa's case is slightly unique in that her professor, who was supervising her Master's degree program decided that, she was performing very well and they did not want to waste her time. The department decided to convert her Masters project into a PhD. When this news was conveyed to her, she gladly said yes. Her professor explained to her that the board met, they looked at her grades, the course record, the MSc course work and they felt she excelled. So there was no point in continuing with her MSc project work. She was asked to expand her thesis work into a PhD research project. She accepted the advice. Coming from a village, Tiwaa was not sure she would continue after the MSc to do a PhD. She received grants from the government to pursue graduate education for two years but the government halted the

grant when she decided to continue with a PhD program. This is because she was getting funded to graduate and teach in high schools and they would not fund her PhD since she would not use a PhD to teach in high school.

Tiwaa is an Associate Professor/ Professor and has been teaching for over 30 years. She was the only female among her cohort members. All the students in her class were Africans. After data collection, Tiwaa got married. In the middle of the program, she got pregnant and the pregnancy slowed her progress. After childbirth, her mother came around and helped with childcare as she continued with her education. Before and after marriage, her husband was living in a different country. Tiwaa decided not to marry when growing up, so she never entertained men. The reason why she had decided not to marry was that she liked her father so much and realized that he was not a very happy man because he had all daughters. He did not have a son. After approaching her father about her decision not to marry because she wanted to take care of all he would leave behind including everybody in the family, the father advised that he was happy that she was concerned about him because truly he was worried, but that should not make her stay without a husband, and that she would regret it if she did. The father further advised her that all her sisters would have their families and she would not have any and that she would be alone. The sisters will come and take from her, so she should marry and have her own. This advice changed her mind because the father stated that she would regret it if she stayed unmarried just to take care of the others.

Growing up, Tiwaa wanted to be like the lecturers' wives who graced their church in her village. As she progressed in education, she came to the realization that she could also become a lecturer, rather than a lecturer's wife. This motivation that inspired Tiwaa

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to persist and graduate was looking at the end product, to be like the lecturers. Additionally, she was encouraged by the way the people at the farms she worked and by the foreigners from Europe who held her in high esteem. She was motivated by the way she was approached by workers in the farms for advice. She realized that there was the need to learn so that when she advised them, it would be authentic. Without completion, she would have disgraced herself, and the people who thought she was good. All these factors pushed her to succeed. The most significant achievement in her doctoral journey is the development of the sampling procedure. She published five papers from sampling procedure developed. There was no artifact presented for discussion.

Emergent Themes

The purpose of this study was to gain a deeper understanding of the experiences of Ghanaian female STEM professors' and lecturers' doctoral journeys. The interview questions adopted served as an essential tool to elicit the stories of female faculty members to tell their story openly about their experiences. Due to the participants' selection of the location for the interview, they spoke forthrightly about their experiences and the effects that the experiences have on them till today. Whether positive or negative experiences, they believed it has made them who they are in the society. All the women placed a value on the imperativeness of women education.

The focus of the research question was to explore and elicit the lived experience of Ghanaian female STEM lecturers and professors' doctoral journey. Six primary themes originated from the analyses of the data across the interviews:

- The Experiences of Sociocultural Issues in the Doctoral Journey

- The Experiences of Gender, Race, and Racial Discrimination in STEM Programs

- Support Systems for Women in STEM

- Resiliency and Strategies that Facilitated Success for Participants

- Impact of the Doctoral Degree on Faculty Members' Personal and Professional Life

- Effects of Doctoral Experience on Faculty Members' Profession of Practice

This phenomenological study employed data to assist in meaning-making, throughout the process of data analyses and collection. Also, the phenomenological model enabled the researcher to discover and comprehend the significance of the faculty members' experiences as disclosed by them. The six primary themes are discussed in detail below, along with prevalent subthemes.

The Experiences of Sociocultural Issues in the Doctoral Journey

These themes align with the first research question of the study focusing on the lived experiences of Ghanaian female lecturers/professors who graduated from STEM doctoral programs in Africa or abroad. The participants shared stories of encountering various sociocultural expectations of Ghanaian women and how they are required to take certain required positions in their homes and in the society. As indicated earlier, the study identified these three main sociocultural issues: Cultural expectations of women, Three-Handed Juggler, and Male chauvinist. Participants encounters with sociocultural issues during their doctoral study is explained below:

Cultural Expectations of Women. In every society or community, there are specific roles or expectations based on gender. Ghana, as a country in West Africa, is not different. Women are expected to perform certain roles whether they are single, married, divorced, old or young. The female faculty members interviewed narrated their

encounters with cultural expectations. Marriage and having children were expectations that were mostly mentioned by the participants. When asked if there was pressure to marry, Gyamfuaa responded that:

> Yeah, so that pressure was there and the pressure is still there, but for me I often say that I don't live my life for society. So, I do what makes me happy, and not what makes culture or society happy…. Often I hear, "Oh if you are not married, people will not respect you," and all that. I don't really care. I get respect. It depends on who you are and how you portray yourself. Even if you are married and you don't portray yourself well, you won't get the respect. So, for me, it's not a problem at all. As old as I am, they still put pressure on me to marry…., and I said I won't do it.

Gyamfuaa had pressure from fellow African students to marry and not from the North American students. When asked whether fellow students or faculty members placed pressure or asked her when she was going to marry, she opined that "not from American students. They were usually Africans, and since I got back home, it's been worse. Every day I get those questions. Now for me, no, I don't allow them to get to me at all."
Ayisi shed her experience concerning the pressure to get done so that she can get married. She had a fiancé who decided to wait till she graduate before they get married. She acknowledges the "little" pressure to marry from her fiancée. Ayisi earned her PhD from an African university. With her, she perceived the expectation of getting married as a little pressure. She said:

> I think there was somebody who we were hoping to get married when I finish. So, it wasn't that bad. I think maybe there was a little pressure in that regard that

hurry up and finish and go marry but it wasn't too strong to cause any effect. I guess he was but it wasn't too much pressure. He had offered to wait for me to finish. But of course, we had given ourselves a timeline so if I hadn't finished by…., I am sure then we would have gotten married despite the fact that I was still in school so I guess maybe that one also encouraged me to try and work a little faster.

Ayisi talked about the cultural expectation of getting married and having children. She continued to say that some of the older male students were also advised to get married.

So, people say "hurry up and get married." It was some male faculty not even my supervisors but generally male faculty you meet on the corridors of the institution will ask you "Eeei what are you still waiting for?" There was this particular lecturer in another department he would meet you and ask you "Eeei so how long have you been here? Then you mention three years. I am in my third year "What are you still waiting for? Haven't you finished to get married ooo". So, there were those moments but those were the things that we just laughed off. It didn't put pressure on me and it didn't affect me in anyway so I didn't think that that was a challenge but there are people who will meet you and say "hurry up and get married, you are growing old oo. Do you want to have children in your pension?" You know those things.…. I know even for one male student, because I think he was a little older and he wasn't married and he hasn't finished, So, before he finished, they kept saying "eeei you are still here. Hurry up and finish. You have to get married oo.".

Nari entered the program unmarried. She had expectations from her mother to marry and have babies because she was growing older. She made a deal with her mother that if she gives birth, she must come over to North America to take care of the child.

> Why do you think my mother came, because I came to Ghana in…. and got married and my mother started…oooh babies… and you are not getting younger… those things and I said I am still in school you know. If I have a baby, then it means you are taking care of those babies and she agreed. Yes, and that is why she had to come. So, it was some kind of a negotiation… Ahaa oh yes the pressures were there I mean …you are old enough…what do you do, you are sitting in America… goodness knows what you doing there…so the pressures were there but it was my life.

Owusua echoes the expectation of African women wherever they find themselves. As a married female student, Owusua said the expectation was "probably in a general sense, where they have to, somewhere along the line, break, go and make families, give birth and come back." Esther had a different cultural expectation of marriage from her family. Her family did not expect her to be married. She entered and completed the program unmarried. She stated that "No. My family we don't pressurize people into marriage. When they want to get married, they just do."

In a typical Ghanaian culture, women are expected to marry at an early age, have children, and be with her husband. These were the same expectations for these faculty members whom have chosen to seek terminal degrees. While in graduate schools they were still expected to combine academics with marriage, child birth, and motherly duties. This is in agreement with findings from Williams (2007) study about graduate

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students/mothers negotiating academia and family life which revealed that women conform to numerous traditional gender roles. Again, "they get married, have children, and care for elderly parents and spouses" (Williams, 2007, p. 74). According to Williams, some women endeavor to accomplish these gendered expectations while seeking degrees and careers.

Three-Handed Juggler. Women tend to juggle multiple roles more than men, and this resonates with findings from Nkwi's (2015) study. Nkwi asserts that women perform multiple roles such as "productive, reproductive, and community management" (p. 321). African women around the world tend to juggle multiple roles. Before marriage, they are cooks and caretakers of the house including caring for their younger and older siblings. When married, they perform housewife duties such as cleaning, cooking for the family, doing laundry, taking care of her husband, and other household duties. Women who have child/children in the marriage add an additional role as a mother. All the married faculty women talked about juggling multiple roles as a wife, housewife, student, and being a mother. During the interview, Nari told her story of performing multiple role as a married student:

> Incredible time management. Time management that was the key. It was difficult but you see one of thing learnt in those days is that you don't say no to help so I had my mother come when my daughter was born she came and stayed almost six months and then she left. And I was still writing my thesis. In fact, I had to do the experimentation with the baby so I had a really good baby…. was very cooperative so I would take her to the lab and in the stroller. We will pack all the things we needed to the lab and she will be in the stroller while I will be busy

finishing the final touches to the experiment and then also writing. And those

were difficult moments am also grateful to my class mates…they could have

complained and my supervisor pretended he has not seen this… it was a very

difficult time… extremely difficult times….

She continued to describe how she apportioned time for studies and her child.

Well you say baby time is this …but the baby doesn't know that the baby time is

this… so baby can do whatever they like. Yes, there was a plan in place and it

didn't always work but it had to be done. So, what I was doing …I was really

deprived I had to admit it. I was sleep deprived. I survive on very little sleep and

for a very long time my sleeping habits were bad. I had to make sure that I plan

the day and of course make room for things that could happen. So yes, I think it

might have affected my output although I was still trying to deliver on my

requirements.

Owusua who was educated in Europe clarified her gender role as a woman and how it

had an effect on having the opportunity to conduct a collaborative research with her male

colleagues. She said:

Yeah, with your male colleagues and you are a wife, and you have your domestic

role that you have to play, to taking care of the house, the family, and then also,

you have a divided attention. You have to close from work and go home and

cook. Your male colleague is going home to sit down and eat. The male

colleague remains in the office for a longer period. A female colleague cannot

because she has to go home. And you are presenting the same number of papers

to get the same promotion within the same period of time. You know, so these

are some of the, that's what I'm talking about the gender roles, so they can stay

on, they have their 'we are men's club' that they go and sit in a club and drink and

talk more about research, how to collaborate. But you cannot be there. You have

to be at home. So, when it comes to collaboration and other things, they are

looking at themselves and they work, and you have to find your own

collaborators.

Owusua additionally talked about cooking in home. In answering a follow up question

whether her husband cooks, she postulated that "Oh, he does, but you know men, it's not

something that is part of you, so you, sometimes you do and sometimes you assume that

she will do it."

Augustina posited her sociocultural role as a woman in her marriage.

Yes, I was doing everything a woman was supposed to do; cooking for my

husband and taking care of the house. And he was also in school and so I was

doing everything that a housewife would do and at the same time a student is

supposed to do…. Caring for the house. It's a full-time job…. And so, taking care

of a baby and going to school especially PhD you need to read, be in the lab and it

is not easy.

With the same interview prompt, Ellen explained her role as a mother who had her

children in North America while pursuing her doctoral degree. She posited about

combining academics with child care in North America:

I mean when they were ill you had to be at the hospital when you have a lecture.

Yeah, it was difficult. It was quite difficult. Because I was lucky my mom was

around, so all those rules like you can't leave children of less than 13 in the house,

you gotta do this, gotta do that. At times, you know you have to take kids to

school and sometimes in the day they would call you, you have an emergency,

and you would have to go and pick your child up. Yeah, there were challenges,

but hey, I did my best.

Priscilla added her voice to the struggle of married women combining academics,

childcare, and housewife duties together. Priscilla's experience and expectations from her

husband and society is congruent with findings from studies conducted by Coob (2005),

Das and Gupta (1995) which observed that wives are expected to be obedient wives, keep

the house sparkling, cook, do laundry, and other preparations. Priscilla stated regarding

expectations as a woman:

Well, you know African men; we were both students at the time, taking care of

the family in school but then I was also doing cooking in addition and we were

not used to buying food so I was always cooking at home and I expected that

sometimes he would help but I wasn't perturbed. Taking the children to school,

fine, but to cook…, sometimes I have to cook deep in the night so there will be

food for the week so that was one thing

I didn't like about him…

In the same vein, Afrakomaa who was educated in North America revealed the African or

cultural role and expectation of taking care of her child:

That was one thing I liked about the…… [North American] system, it was very

liberal. So far as it is your personal thing, nobody really cares. Is rather we the

Africans where it is not the norm for the father to be taking care of the baby. So,

when he was doing it, I felt that I was putting a burden on him although he did not

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complain but personally, I felt that is my job and had handed over to him but he understood. He was also studying but, he is ……. was going there during the day to the field but in the evening and night, he's home.

The experiences of these female faculty members' reveal that women are still expected to perform certain gender roles as a wife. To be a successful wife and a PhD student, there was a need to combine many cultural duties such as performing and meeting the expectation to be the caretaker of the house, cook for the family, respect for husband, caretaker for the children and her husband, and still focus on academics. These experiences and gender role expectations are succinctly summed up by a Currie, Thiele and Lewis (2002) study which asserts that "home and family responsibilities still isn't evenly shared and that women unlike men have to deal with the conflict between a home or family responsibility and the academic pursuit" (p. 126). These gender roles expectations of married women are still prevalent in Ghanaian society and marriages. The literature review indicated that these gender roles of wives have been present since time immemorial and being a PhD student does not change the cultural expectations.

Male Chauvinism. Author of *Daughters Who Walk this Path*, Yeide Kilanko submitted to an interview for *Afrocentricity Unleashed* (2012). During the interview, the African author was asked, would you say male chauvinism is highly prevalent in the African and Afro Caribbean society? The response was "I do think that male chauvinism is highly prevalent in African and Afro Caribbean societies. From what I know, African and Afro Caribbean societies are mostly patriarchal in nature. In my opinion, this only supports environments where male chauvinistic beliefs thrive" (Afrocentricity Unleashed, 2012). Also, a report from a study on women in the traditional African society by the

United Nations Economic and Social Council in 1963 affirmed male dominance or superiority in some African societies. The study indicated that "in West Africa, the legal and social position of women is generally the same' as for most African countries. The women are legal minors; the social conventions are all in favor of men." Participants for this study are Ghanaians, living and working in Ghana. Ghana is a country in West Africa and all the participants were born and had at least their basic education in the country. Four of the participants pointed out some of the male chauvinists they encountered in their undergraduate through to their doctoral journey.

Tiwaa was the only female in her class. She recalled her experience with some male chauvinist students in her class who always heckled her. She narrated her ordeal:

I was the only female in that class…. I started developing strange hair. So, they would tease me that "are you really a female," you know, that kind of thing. And it wasn't a good experience. "Are you going to marry?" Are you going to do this and I think that also influenced me. So, when I started my PhD it didn't wait for too long for this beard to grow and be this…... So, then I got married somewhere in-between. Actually, after the data collection I got married before I completed the write-up. So, I mean, that's how, but that was normal with the male chauvinists, they want to push you down a little… Oh, they said I would not get married. I was a male. Most of them, they teased me a lot that how can I develop a beard, but that time they were just coming up, and so they were [sic] used to it, even though I tried to overcome it and be myself, but inwardly, I knew I was suffering.

Similarly, Owusua described her confrontation with a male friend in an African university where she obtained her Bachelor's degree. The male friend believed that science was not meant for women.

> I was an undergraduate student and I went to pursue the…., I have some male friends which I interacted with to find out if I can do the chemistry. They were a year ahead of me and they had been giving me their study materials. So, one of them, I asked and he discouraged me. He said I cannot do it because I am a woman. And that he, a man, is suffering. I wasn't happy about the response. I was really, really discouraged. Then I talked to another friend, male friend, and then he said you can do it. He encouraged me, so I was happy. So, I took it up. So that also, sometimes those things come up where the male will look down upon you and feel that you cannot.

Likewise, Afrakomaa faced male chauvinism. She was educated in North America in the 1970s. Her experience with male chauvinism occurred in an African country where she obtained her Bachelor's degree. Her encounter was with an African faculty member in Africa whose assertion was that the furthest a woman must get in education was a Bachelor's degree, and after that marriage. This claim by Afrakomaa is in accord with Coob's (2005) research which stated that "it was untraditional for a woman to receive as good of an education" (para. 7). Again, the assumption of the lecturer dates back to the colonial influence whereby "discrimination in education is one of the main causes of female poverty, unemployment and underemployment. Even where education and vocation training are available, many educational institutions continue to offer stereotyped "feminine" skills to girls such as typing, nursing, sewing, catering and

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waitressing as opposed to scientific and technical knowledge" (Nkwi, 2005, p. 327).

Afrakomaa expressed the encounter in the interview:

> Honestly, I remember a graduate guy, if I had listened to that guy, I probably
> would have dropped. This is a big brother I look up to here in this university. At
> that time, he was a lecturer when we came in as students. He was a Christian
> brother so we were having fellowship together and we looked up to them. When I
> finished, my BSc and I was doing my national service here, incidentally, our
> batch was the first year that Ghana started doing the national service. So, we were
> called in to do the national service here with the understanding that the university
> was looking for scholarships for us and then one day, I met this lecturer and I
> called him big brother on campus and he asked me after the national service
> where am I going to work. Those days the jobs were not a problem. In fact, before
> we even graduate, the companies come to interview us and offered us jobs but I
> was called here to do the national service and go.…. He asked me what was I
> going to do after the national service and I said the university want to send me out
> to do my post graduate and come back and he said going to graduate school,
> haven't you had enough education as a woman? When he said that I said well, the
> department said they want me to join them and he said, I do not know what you
> are looking for as a lady with your B.Sc., you have married, what else.

Afrakomaa detailed strategies to overcome the male chauvinist's idea of abandoning her
graduate education plan.

> Honestly, it made me start thinking otherwise that is it a good thing if I want to
> accept to go out. Fortunately for me, my husband was someone who was

supportive. At that time, he only had the BSc but he didn't resist that he is not going so I should not go. He said if the opportunity is there and you want to, fine and then when I got pregnant, it became an issue. But as I said, my boss in [North America] was the one who encouraged me to come with the understanding that when I go, he can work out something for my husband to join but actually that comment from that lecturer whom I thought would rather encourage me, if I had listened, my future would have been ruined.

Female students and faculty members in science encounter persistent challenges and discrimination. A Guardian newspaper article on March 15, 2014 addressed the issues of sexism in science academia and how it is driving women out of science. Ayisi experienced sexism and male chauvinism in her laboratory. She obtained her PhD in Africa. She made an observation about the differential treatment meted on female students in the laboratory. She observed that laboratory research was assigned based on gender by male lecturers or supervisors. She explained:

Maybe one thing I can say is that I think it was a little subtle. It wasn't something that really stood out but it looked like with the females the expectation wasn't too high. They felt that you are a female so let's give you the easy work, that sort of thing. It was a little bit of subtle observation I made. Generally, the relationship was okay.

The subthemes of, cultural expectations of women, women performing multiple roles, and the issues of male chauvinists were pervasive among the participants who were educated in North America, Africa, and Europe. The participants cited situations where male students and faculty members either through verbal or covert action stated that

higher education was not meant for women, and science was meant for men. Women were expected to be content with having a Bachelor's degree and marriage. The data and findings from other studies suggest Male chauvinism, cultural expectations of women, and gender discrimination in STEM still appear to be pervasive across all continents. It is not an issue only pervasive in African but a worldwide issue.

The Experiences of Gender, Race, and Racial Discrimination in STEM Programs

Each year, many students travel from Africa to seek higher education in Western nations. As stated earlier, six out of the 11 participants earned their PhD's in North America. Two of the participants obtained their PhD in Europe and Africa respectively. One participant worked toward her doctoral degree at institutions in both African and Europe. The participants experienced both covert and overt racism and gender discrimination in Africa, Europe, and North America.

Racial Discrimination: Prove it Again. The interview with Gyamfuaa, a graduate from a North American university about her relationship with faculty members and administrative staffs elicited her experience with racism. During the interview, she told her story:

> When I was admitted, she was the one who was supposed to supervise my work, then along the line I noticed that she was a racist. I was the only African student among her students, and then any time I sent her work, you know, she would review the others and leave mine sitting there until I go running after her. I wasn't, in my first year ... In fact, the first two years I noticed that I wasn't progressing, and I had a zeal of finishing and coming back home. I decided that I wasn't going to be that quiet African. You know how we are trained here, you don't go

challenging superiors and all of that. But I had to put all of that behind me, and

then pursue my destiny.

She continued:

I went to report to the dean of the school, and I said, "I don't think my supervisor

is helping. I need a new supervisor." They called her and talked to her. I went

back. It was still the same. I went back to the dean again, and they said, "Okay,

you go around and talk to the other professors. If you find anyone who will like to

work with you, we are okay." So, I did, and I finally got somebody, the one who

finally supervised my work. She agreed to supervise my work, but she said, "I

need you to go back to your supervisor and tell her you are moving from her

research team to my team." For them, every professor put together the PhD and

master's students and call it a research team. It was a tough one, but I succeeded.

Then I got a second supervisor, I started working, and she was good, and so I

finished. White American, but different.

Gyamfuaa's experience with racism was not limited to one faculty member. She

recounted her experience with another faculty member who taught a research class.

Explaining her ordeal, she commented:

I remember in one of my classes…. research methods, I also had a serious grudge

with the professor. Oh, yes. Because the course was such that we did a number of

presentations throughout the semester, and then she would put all of that together

to give you your final grade. Throughout the semester, all of the presentations I

did, she graded me A. I got A throughout. Then at the end of the semester, I got a

B. How is that ... Exactly. How is that possible? So, I went to her and then she

explained in a funny way. I couldn't take it, and I said ... You know, and I was the only Black student in that class, so I ended up telling her, "Because I'm the only Black student in the class, you don't see why a Black student should get an A?" I told her that in the face, and then she opened up her eyes at me. I say, "Yes, I think you are a racist. How can you grade me A throughout and then you give me a B at the end of the semester? I don't understand. It has something to do with my skin color." Then I walked out.

Gyamfuaa's experience with the research methods professor coincides with a study in the United States which indicated that "Black women (76 .9%) were more likely than other women to report having to provide more evidence of competence than others to prove themselves to colleagues (Latinas: 64 .5%; Asian-Americans: 63 .6%; White women: 62 .7%)" (Williams, Phillips, Hall, 2014, p. 5). Black women in STEM always have to deal with gender and racial issues, and always have to prove their competency which the author called the "Double jeopardy." Similarly, Afrakomaa had to continuously prove her academic abilities to her colleagues, she believes because there was a perception that blacks cannot excel as their white colleagues. She disclosed:

Anytime somebody sees me, they ask, are you in home economics? And when I tell them I am in [Sciences] and they say 'wow'. So that was one of the first impressions. It looks like Blacks are not meant for certain areas…... I had my undergraduate here and we call it metabolism. It's something I enjoyed in [Science]. So, when the questions came, I was very comfortable with but none of them could not fathom that a Black could take a cumulative and get an excellent mark in it. So, all of them were asking, how did you make it, and I thought, so

Blacks cannot get "excellent" and interestingly, my supervisor there was a Black

American. In fact, it was through him I went to that university. So, I went to tell

him and he said well, [Afrakomaa], you shouldn't be surprised, that is the

mentality here. So, they don't think anything good can come from the Blacks…

Afrakomaa spoke about a male chauvinist and racist in her PhD class. She

happened to be the only Black student in the entire university and the only Black,

African, and female in her department. Afrakomaa started her PhD in North America in

the 1970s. Narrating her experience with a male student in her class, she stated:

I think we were quite close. Very close and I remember one of my mates was

Japanese. In fact, we were studying together, he was very good. I found him to be

very very good. In a normal day when we are in class, I fish for very good

candidates and I become friends with them. So, I found out that he was very good

so anytime I had a problem, not understanding a subject I don't hesitate to go to

him for discussions and for explanation. So, we ended up studying together and

then others were coming. There was also only one, he is an American and he also

didn't think that a Black should belong to a chemistry program so he always made

a lot of negative comments about me but then in the end, I finished my PhD and

he was still nowhere near finishing.

Owusua who was educated in Europe in the 2000s, and spoke about her racial

confrontations with a faculty member and research colleagues. Owusua illustrated the

discrimination meted to her by a faculty member:

I would say that the climate in the lab was not an engendered place. In the sense

that I didn't have any problem because I was a woman. But the problem I had

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was because I belonged to a different race. You understand that. Because there

are other female colleagues in other labs who had a good relations and had no

problem. So, it wasn't because I am a woman but because I belong to a different

race. And then secondly, because probably I couldn't flow with them. I didn't see

much probably I didn't look at it. I always assumed that the environment that I

work in is neutral, even if there is any kind of a hostile attitude because I am a

woman, I try as much as possible to look beyond it. I don't let that deter me from

doing what I'm supposed to do. It shows up, it comes up, but people like that I

tend to rather ignore them. I tend to ignore them because I see them as a

stumbling block. So that's what I always do. So, I am quite a determined and

forceful person who will not allow you to pin me down.

Responding to a question about having equal access to support systems as her male

colleagues, Owusua told a story of a racial encounter. She believed she was denied access

to support systems not because of her gender but rather, her race.

Like I said, I never felt like being deprived, it's because of being female, but

rather because I belonged to a different race…. The assistants to my supervisor

who would have been the person to be there when my supervisor was not there

was not willing. A female, of course…. That's why I said I didn't think they had

a problem because I was a female but because of the race. No, no. She really

doesn't want to. There was an assumption which I found it to be very funny

because she thought I was probably competing with her and I didn't understand

because I don't see how… Oh, she's the deputy to my professor. She could have

been my co-supervisor. So, she had finished long ago and she's the deputy to my

supervisor. So, she actually had the managerial position as a student. But she

relates to the others, provide them with everything that it takes but when it come

to my turn, it's different. I actually approached her, she doesn't approach me. My

experience there, that why I left the place. I think it's better you stay in your

country and be happy there. Stay in somebody's country and then, but I got what

I wanted.

Esther begun her PhD in the 1980s. She was the only Black in her cohort. She described

her experience of discrimination in the lab with a technician. She felt discriminated

against by this technician not in the lab but during social settings. She indicated:

But one technical staff was quite rough but not so much in the lab. But when they

called us for Thanksgiving, all the people in the lab were going so I went and I

took a pie, baked apple-pie and she didn't serve it. So, I was quite, quite offended

but I didn't say anything to her because I learnt later that I think the husband

asked her why she didn't serve it and later on they ended up getting a divorce. It

wasn't about me, but she was a rough type and we were in the same lab. She

didn't interfere with my work and she wasn't, how do I put ... she didn't inhibit,

or when she had an information that that will help me, she would give it freely but

in social setting, she tended to be discriminatory...... It didn't register with me. I

just ignored it but some younger person may have been hurt. When I look at the

younger people now coming, I see they are led a sheltered life. In Ghana, we are

sheltered. When they come into contact with discrimination, they would be

shocked…. she was an American, White….

When I probed further to ascertain if she knew why the technician was not associating with her as other students in the lab, she said:

> I didn't have a clue of why she was doing that. Because our lab was made up of students from America, Korea, and myself. Yes. So, I don't know whether because she had something against Blacks, I don't know…. When you are not confident in yourself and you get into an institution where the lecturers are firm towards Blacks, your self-confidence or image will be destroyed.

Nari discussed issues of race and racism in her interview but she believed it mostly occurred during her undergraduate studies and less in graduate school. In her submission, she stated that "Actually …again this come back to the undergraduate years. I didn't see much of that in the graduate probably because I was too busy focusing on my issues. I didn't have time for anyone but it was more during the undergraduate years and maybe some of it that I brought on myself (she laughs)."

Out of the five of the participants who spoke about their encounter with racism, four were educated in North America and one was educated in Europe. They detailed their experience with conventional racial discrimination and neo-racism from both students and faculty members. Their experiences are similar to those reported in a study conducted by Lee and Rice (2007) which focused on the challenges of international students. The study uncovered that some African international students surveyed encountered conventional racial discrimination which centers on color, and what they called neo-racism which focused on culture (Lee & Rice, 2007). Gyamfuaa's experience with the faculty advisor who refused to supervise her work is identical to finding of Lee and Rice's which stated that students changed their faculty advisors' due to interpersonal

difficulties which they believed were because of cultural intolerance from their faculty advisors.

Stereotypical Perception of Blacks/African. Afrakomaa again talked about her interaction with a White faculty member who undermined her undergraduate science training. She posited:

I enrolled in one…. course and I think at one time I was not following a presentation from the lecturer so I decided to first discuss with my boss and he said, "you go to him and ask for explanation." So, I booked an appointment with this…. he asked what I wanted and I said I was coming for discussion because I was not following what he was teaching very much, then he asked me why did you enroll in this course in the first place? And I said, I am a…. major but we have to take some minor courses. Then he said, but if I had the option, I will not allow you to take this course. Then I said why? By that time, when we entered the program, they organized these pre-entry exams for us and one of the papers I had to write was…. and so, I did poorly in that, so that was the paper he was referring to that with that performance he would not allow me to register for the organic chemistry. It's a level 400 program. So, I said oh am sorry but when I was an undergraduate…. was my best subject and I wasn't having any problem.

Continuing her experience, she went on to say:

Then he said, which books were you using at undergraduate, and I gave him the books and he said well, those books are okay but maybe your organic chemistry lecturers are so weak so probably you did not have a good information imparted to you. I said I am not certain but if you don't mind can you give me the

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opportunity to finish this semester with the program. You have enrolled and I

cannot force you to with draw…... Those are some of the experiences when they

see you they don't see any potential, well preconceived ideas about you because

you are Black.

In previous research Latinas and Black women have regularly described being confused

for janitors (Williams & Dempsey, 2014a) something that men of color expressed as a

comparable experience (Bonilla, 2006). This experience is identical to Adu's encounter

with a security guard at her department. Adu obtained her PhD in Europe. She was the

only Black woman among her cohort members. She started her PhD in the 2000s. In

elaborating her experience with the security guard, she recalled:

there was time I was going to the institute in the evening, at around six or seven.

Then I entered the building then new security guy asked me, "Are you the cleaner

or are you …" No, they asked me, "Have you come to clean?" I said, "No, I don't

clean, I work here." Also, but on the hindsight, I know that normally around five

that's when the cleaners come and he knows that majority are Africans. So

therefore, me coming at that time, he thinks I'm one of them. He sees that I have a

transponder and I'm able to open the door. So, he is wondering which cleaner has

a transponder?

Another stereotypical misconception about Africans or African STEM students that Adu

reported during the interview is seeing Africans as the culprit for lost or damaged

laboratory equipment. Adu was blamed for lost and damaged equipment in her

laboratory:

Negative part, I mean, we're all Africans. Anywhere you travel, there is always this perception that, per certain class, you're not so well educated or equipped. There always a tendency when a machine spoils, they think it has to be you even if it's not even you. One of my challenges was the fact that when things get spoiled, their first question would be, "Did you use the machine yesterday?" I think that is it.

Another incident that bothered Adu was the perception that a missing syringe from the laboratory was with her, and that she has taken it to Ghana. She only had her supervisor to believe that truly, she has not returned to Ghana with the syringe.

Yes, I remember I did work with one equipment and then I left the equipment and I came for holidays in Ghana for about a month and I went back. Only to be told that something, a syringe that they could not find. I was like, "I left the syringe there. I'm not taking the syringe to Ghana to do anything. So where would the syringe go?" The whole department, nobody knows where the syringe passed. I mean you ask everybody, everybody had not seen it but obviously, somebody had picked the syringe and used it. I even had to send a mail to everybody asking if anybody has picked it up, still I didn't get any respond. So, during that period I remember some of the technicians were on my neck, "That syringe is very expensive, it's 150…..." And after several weeks my supervisor was like, he knows that syringe, I can't take it to Ghana to use for anything. So obviously, it was one them who has picked it up, I shouldn't worry. And then they'll order it.

Owusua also talked about the perception of low academic abilities of Blacks. Owusua's assertion is in congruent with Constantine, Anderson, Berkel, Caldwell and Utsey (2005)

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study which revealed that African students are typically perceived by Americans as less intelligent than themselves. According to Beoku-Betts (2004) study in the United Kingdom, White faculty members questioned African female students' academic capabilities. She narrated her experience with a faculty member who did not accept that she did her doctoral research by herself. This incident happened at the dissertation defense.

> So, my work involved two…. A… and …. B. I just want to simplify it. Now when previous researchers did the work, they said A is the most stable…. And that is what everybody knew in the research group. And then they publish on it. When I did the work, the same thing, I found that…... B is the most stable. And then my professor doubted it. So, I repeated. And I brought the analysis. He saw it. So, we had to give the work to the NMR (Nuclear Magnetic Resonance) technician to do independently. He did it and then he also found that this is the most stable. So, there's a question mark here. So, what did these people see to say that this one is stable? So, we gave it to the theoretical man, and we also did using theoretical means and they found out that this one is the most stable. So then this means that all the people who worked on this gave false results. So, they deceived the professor.

She continued the recount of the encounter by explaining:

> So that because they were silent on it, they still want to make sure that you as a Black person wouldn't come and then…. So, during my defense, the theoretical professor was my examiner. So, I did my presentation very well because he was there. But when it came to asking of the questions, he drilled me. Yes, but he still

doesn't want to accept that I did this. So, I knew where they were coming from. When it comes to this, you don't need to worry yourself because you know their notion about you…... So finally, he has to just let it be. I had to go to the board and write a lot of equations on the board to prove so many things.

Tiwaa obtained her PhD in an African country. Before graduating from her PhD program, she was offered a postdoctoral position outside Ghana. Although she was an African working in another African country outside Ghana, she encountered negative perception about people from a tribe closer to her village. Colleagues believed the stereotypical tag aligned with people from the village closer to her hometown. She recapped:

So, while I was in…...., everybody knew that I came through prostitution. And the Indians never liked me because of that. I felt so awful and they would ask me, oh, they say your tribe, you're all prostitutes. All the females are prostitutes and I said it's not true. Oh, and that…... tribe… But I couldn't say I was not a…., I didn't want to say that but just to disprove it. That in every tribe you have people who are prostitutes. That's all I was saying. And then they would say, one day somebody called me and said we were told that in your tribe you have to have a child by somebody before you go and marry, and that child belongs to your father's family. And I said I have never heard of that. It's not true. You know, these were the things that sort of dampened my spirit when I was doing my post-doctorate.

Tiwaa's account is identical to other research on international students in the United States who are likewise frequently subject to confusion about their culture and thus mostly stereotyped (Lee & Rice, 2007).

Odd one out: Racial Grouping. Dr. Jennifer Weaver, a professor from Berkeley Center for Teaching and Learning explains the importance of teamwork and grouping in STEM. She posited that "Try to highlight perspectives, skills and experience that will be useful in the group, and this may temper the reaction of students to only choose their friends, or at a minimum, to choose amongst their friends for this project more carefully!" (para, 5). Four of the participants talked about isolation, rejection, and incompatibility in racial groupings. Priscilla experienced racial grouping in class. She explained that in her class, there were groups based on race. She further stated that when homework was presented to students, they convened in racial groups to work. Priscilla was educated in North America and was the only African and Black in the department. She talked about challenges faced to complete her homework:

> Ok, the program was in a way that I was taking some courses outside of my department and some too in my department. So those that I was going out, I would meet different faces, different people. Also, there were these kinds of groups in the class; Chinese and Indians would meet separately, Chinese alone, Indians and the Caucasians would meet separately to do home works, and homework was a very common thing. Every week there is a home works to do, very stressful and it was such that we needed to have group work to do it but then you would approach each of the group and it will appear I don't belong, so I was always alone doing my home works…. But these were home works that would take you more than 5 days to figure it out so most of them I wasn't able to submit on time. It was tough, but they will submit easily.

Priscilla talked about strategies adopted addressing the issue of isolation and challenges to complete homework on time:

So gradually I read very wide and then once in a while I would get help from some of my friends and then there was one particular person who was ahead of me, about a year or two and he was also very helpful. He gave me his past home works and then I studied it and then I knew how to apply the concepts to mine, so it helped.

Nari's issue of racial grouping or gathering was different from Priscilla. She started her PhD in the 1990s in North America. She was the only Black woman among her colleagues. Nari chose to associate and mingle with colleagues from different races but she was called out for not associating with people of her kind and also sometimes colleagues from a different race forgot she was Black. She narrated:

So, I remember in the dinner halls, when you go in, the African Americans were always sitting in one spot and then the rest were elsewhere and I sat depending on who I walked in with. So, I would be coming from a class and I was …I think …by the time we got to third year, I was the only black person in the class…so I would be coming with people with different backgrounds, different colors and I would sit with them. And some people had taken note and felt that I was not associating enough with my kind. (She laughs) …you see ...to the point I had to tell someone that I associate with people not based on their skin color …but I actually told someone but I also had someone tell that because of the way I behave or the way I am, sometimes they even forget I am black then I said what

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do you mean by that? (she laughs) So these things were there…I just chose not to

focus on them …there are a lot of thing that I ignore just for my peace of mind.

When Adu was answering a probe related to racial issues and the climate in her

laboratory and classroom, she described the racial grouping in the department.

Yeah, it was there. Definitely like things associate with like. It's there but, okay

for me normally I don't look at that. I just go to learn, say hello, hi and then get

up. But obviously yes, we do associate more with our kind. Even me like this, I'll

be more with the Africans than with the Asians or the [Europeans] themselves.

But despite that, I think the classroom climate is friendly and it's okay.

The submissions by the four participants outside Africa indicate that students were

subject to racial discrimination, stereotypical perception of Blacks and African, and

isolation in groups. The results portray the continuous demand for Black students to

constantly prove it again. Gyamfuaa, Owusua, Adu, and Afrakomaa had to constantly

proof that they belong in the STEM field and are equally intelligent as their White

colleagues. Observantly, it can be noticed that the participants either ignored or refused to

pay attention to issues of race and racism. They were more focused on succeeding

although there was glaring evidence of racial issues.

Support Systems for Women in STEM

Participants addressed support systems that they ascribed to their success during

their doctoral journey. Their responses revealed the following sub-themes.

Family Support. The participants ascribed to family as a strong support system

that facilitated their graduation. Although there were family expectations such as

marriage, having a child, cooking for her husband and children, etc., which caused

hitches or challenges in their doctoral journey, family support was pivotal to doctoral student success. Reliance on an extended family system, extending beyond the nuclear family, is common in Ghanaian culture. This includes parents, aunts, uncles, grandparents, and other relatives, though the predominant family support identified in the data came from husbands, mothers, and fathers. Families regularly provide various sacrifices, particularly financially, to send their dependents to college. At points when this help is being pulled back for other reasons, it can cause emotional pandemonium. Ayisi recounted financial and emotional support provided by her parents throughout her doctoral journey.

> The real motivation was my parents. I felt that they had paid fees. Because they sponsored my education and I felt that I owed it to them to finish…. I think I had generally good support from my parents, my family. They were supportive. They didn't put too much pressure on me so it made things a little easier…... They didn't put too much pressure on me that "how come you are still there and haven't finished" and stuff…. And then of course I mentioned that I had support from my family so they also encouraged me so maybe after a very discouraging event, you talk to your mum or dad or somebody. You can do it.

According to Margolis and Fisher's (2002) study, women do not get the needed support to pursue science and quantitative courses that may provoke their enthusiasm for male-dominated fields such as computer science and engineering, consequently they enter low-paying areas. This was different from Owusua's story. Owusua also explained the positive influence of her father at the early stages of education which have impacted her until today. She explained the encouragement and support from her father and his

disapproval of early marriage, rather placing emphasis on her pursuing higher education. Her mother wanted her to perform cultural gender roles rather than attend to her education. She retorted:

> My father helped me a lot, he supported me, he provided everything that it takes for me to get up. I remember when I was young, I would be doing my homework and my father is sitting right by me, encouraging me. The moment my father gets up to go away, my mother will be like hey, come and do this for me. I remember it well. So, I was always hiding by my father, but he provided everything for me. He supported me, he pushed very hard, even when I was going to marry, at a point he said no you will not marry. Go and do your masters. And I said, Oh, daddy, it's okay. He said okay. You know, so I had that support from him.

Evan (1995) discussed the barriers to participation of women in technological education. In her study, she stated that the obstructions confronted by women in participating in courses are family responsibilities, absence of partner support, money related issues, and living in rural areas. The married participants in this study stated the contrary regarding partner support. Six of the participants talked about the positive impact of their supportive husbands in their doctoral journey. Afrakoma highlighted the supportive nature of her husband who was concurrently seeking a PhD. When explaining how she shared how she overcame the cultural assertion that she should be content with a Bachelor's degree and marriage and talked about how her husband supported her decision to travel to North America to pursue a doctoral degree.

Fortunately for me, my husband was someone who was supportive. At that time, he only had the BSC but he didn't resist that he is not going so I should not go. He said if the opportunity is there and you want to, fine….

Afrakoma described the additional supportive role that her husband played in her doctoral journey which made her to dedicate her dissertation to him.

So, the baby more or less grew up with the father, not having too much of a contact with me. Because most of the time, I am in the lab doing research. So, in the evening when we all supposed to come back, she was in the crèche when I had to take care of her, I was not around, and her father was doing it…... having that daughter and going through my PhD was quite a challenge for me. Because of that my PhD was dedicated to my daughter and my husband for the roles he played…...

Augustina also mentioned the supportiveness of her husband in her doctoral journey. Although they were both pursuing their doctorates simultaneously, her husband helped with domestic chores although culturally, that was seen as a feminine or wife's duty. She stressed the tribal differences and nature of men from her tribe and her husband's tribe. She placed emphasis on the supportiveness of her family in helping through her doctoral journey.

My husband is very supportive because well, he's' educated and he's a southerner. Our people always say I'm lucky because…... men are different. They're not like our…... men, so sometimes he just helps me. He makes his tea himself. He can cook. He cooks when I have something to do unlike our…... men, they will never step their foot in a kitchen. You have to do everything by yourself,

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so it's okay. He's very-very supportive. And my family too are supporting. Once

in a while they give me somebody to help, and so it's okay. Even as at now, that

is how I'm doing it.

Priscilla had a verbally supportive husband, but she also mentioned his unsupportiveness

performing certain traditional feminine duties in the home. Her husband was helping to

drop their children in school. In responding to a follow up question about how she was

handling family issues, she said:

Like we were starting classes at 8 o'clock and the bus will come like 6:15 so

sometimes around 7am the bus is gone so I had to quicken up then. If I didn't go,

my husband would go…... Well, you know African man; we were both students at

the time, taking care of the family in school but then I was also doing cooking in

addition and we were not used to buying food so I was always cooking at home

and I expected that sometimes he would help, but I wasn't perturbed. Taking the

children to school fine, but to cook, sometimes I have to cook deep in the night so

there will be food for the week so that was one thing that I didn't like about him.

Owusua, again mentioned the supportiveness of her husband who was also in graduate

school. Her husband was very influential in her decision to pursue a PhD. He was

providing financially with his 'small' stipend or limited support.

I have a very supportive husband. He's very understanding and he's also in

academia. So sometimes we go home together, sometimes he doesn't stay in the

office for a long time. He does sometimes, and sometimes we all agree to stay in

the office longer.…. By then my husband was receiving his small stipend and we

were dependent on it…. And then it's so amazing that I married a man who is also

supportive in the same way, so took over from my father and he also supported. So, these are the two key men. So, we cannot rule out and say that men are not supportive, men are supportive.

When Owusua was asked if her husband helped with cooking, she retorted: "Oh, he does, but you know men, it's not something that is part of you, so you, sometimes you do and sometimes you assume that she will do it." In answering a question on how committee members were selected, Owusua emphasized the role her husband played by talking to professors to serve on her committee.

My dissertation committee members, I would say, let me put it this way. Because it wasn't a choice that I made earlier on. The initial thing was that, it was my husband who went, we actually talked about it, and we looked through the profile of the professors who were there. And I realized that I would have wished to do a…. research. Then my husband went to talk to professors, you know, quite a number of them, and he found this one to be quite okay.

Adu had a child before she started the doctoral program. Before she left for Europe, she had to leave the child with her in-laws because her husband was also pursuing his PhD in another country. She stated that "I left the kid with my husband's parents and they knew I'll be gone for a number of years. So, there wasn't really any pressure for me to come for him so quickly." This provided her the liberty to focus solely on research and academics.

Although other research bolsters a reasonable accentuation on the part of female student's mothers play by providing a progressive support from their early years through postsecondary education (Maple and Stage, 1991; Valenzuela, 2006) there is a need to know the specific support they *provide* during their doctoral studies. The role of mothers

was extremely ubiquitous in married participants' accounts. Nari had an agreement with the mother to come to North America when she gave birth because it was the mother who insisted that she marry and have children. In recounting her story, she mentioned the importance her mother played in her education success by taking care of her child while she writes her dissertation.

> My mother, although she was in Ghana, when I had my baby, she came over to live…. she came and stayed almost six months and then she left. And I was still writing my thesis. You know…and she is being there even now.
>
> She is my one-woman supporter. She comes every time. Someone who has been there constant, that one, it's my mother.

Ellen was also a beneficiary of her mother's support in taking care of her children. She left Ghana with her children and mother to come to North America to start the doctoral program. Since her husband was pursuing his doctoral program in another country, her mother helped to care for the children while she focused on her education. She acknowledged how lucky she was to have her mother with her. Her mother's presence allowed her to leave her children at home with her mother. When Tiwaa was answering a question about how she juggled multiple roles as a mother, wife, and student, she attributed her success to her mother who stayed with her when she had a child. She mentioned that "My mom came to stay with me."

The parents of Augustina provided a maid to help support her with housewife duties. She recounted that "my family too are supporting. Once in a while they give me somebody to help, and so it's okay. Even as at now that is how I'm doing it." The maid took some duties for her to focus on her academics.

Institutional and Departmental Support. In the 2015/2016 academic year, there were 3,049 Ghanaian students enrolled in United States universities (Institute of International Education, 2016). According to the 2017 statistical report from UNESCO Institute for Statistics, Ghana sent 1,706, 543, 424, and 66 students to UK, Canada, Germany, Belgium respectively. As international students enrolled in institutions in Africa, Europe, and America, these students expect to receive institutional and departmental support to promote academic success.

Participants talked about both available and unavailable departmental and institutional support in various institutions in which they were enrolled. By and large, participants were pleased with the departmental and institutional support systems provided throughout their doctoral program. Tiwaa detailed the support system provided to aid her success throughout the program:

> Yes, whatever equipment I needed, the university gave. If I needed a vehicle to go to the out-grower's farm for sampling, they brought me a vehicle. All the way from…... to…… and then I would go. Because I had to cover…... and all those areas sampling. And then whatever I needed, like microscopes, they brought me microscopes from……, which I used. These are the things that I got from the university.

Afrakomaa described the accessibility and availability of faculty members to provide assistance which aided her to succeed. She debated if the interest in her work by the faculty members had something to do with her skin color. She described the support systems provided:

The support system even at the secretariat office, I always had access. If there is

something you want them to print. Those days' photocopiers were not common so

they were always available. If you want any help, they would do it for you

without any discrimination that you are black. So, we can always approach any of

the lecturers for explanation or any other assistance. You can move from one lab

to the other to carry out experiments. If the equipment is not in your own basic lab

but it's within the department in other labs, they allow access without any

hesitation. Some of the lecturers as I said as a Black, you look unique so many of

them are interested to see how you will succeed in the program so when they see

you, they will ask…. how is the work going, they kind of show some interest. I

am not sure it's out of curiosity to see how you will succeed or not but they

showed interest while I was working there.

The importance of teaching and lab assistance cannot be overemphasized. Burnette's

(2013) study which focused on the lived experiences of African-American women who

completed doctoral physics programs uncovered the importance of postdoctoral students

serving as advisers to female doctoral students. This was similar to the experience of

Esther and Nari who described the various supports received from postdoctoral students

in the laboratory and classrooms. Esther called the postdoctoral students teaching

assistants (TA) but Nari referred to them as senior students. In clarifying the exact

support received from the postdoctoral students, Esther responded:

The department had TAs who were very helpful. yes, but some of them were

senior doctoral students so they were quite helpful. You could go to them with

your questions and they would give you what they know and tell you some of the

references you can check on to boost your knowledge.

Nari stated that she did not seek departmental support and was strictly independent, but

she discussed the relevance of postdoctoral students in her laboratory.

Okay there was supervisory team and I told you about my three supervisors, yes

in each of those labs there were also.... I would say some postdoc. Maybe senior

student that could always talk to or see if they would be able to help you... the

professors...There was a graduate programs coordinator although until my defense

I never went to have any discussions… so professors were really running their

labs… I mean, once in a while, some milestones, you know, you have the full

department and faculty come together for examination like proposal qualifying

exams but I didn't really feel the need to seek for external support outside what

the lab was doing. I was very independent. Honestly, I think that was one of the

good things about me as a graduate student.

Two participants were given the leeway to take classes outside their program. Both Adu

and Ellen cited the privilege given by the department and professors to take classes from

different departments. This leeway given to take classes outside their program was

essential to help them acquire the needed knowledge to understand their research or

work. Adu stated the additional support provided for international students. Adu

addressed the support provided specifically by her department:

Some support program, for example the institute, they allowed you to take some

courses outside the institute if the supervisor felt you needed it to do your work.

For example, I did…. analysis. I can say NMR, you read a lot of NMR so he will

tell you to go to another institute to get taught before we come and start that work.

And in general, the colleagues and administrative staff in regard to

accommodation, even before I came, he told me, "Apply here for this

accommodation and that." Even before I came the accommodation was already

ready. And then also Even within the university, I do know they have some form

of aid for foreigners. For example, if you have a kid, they have an international

school, you can send the kid.

Ellen addressed support from faculty members. Faculty, staff, and institutions need to

support and encourage international students in male dominated STEM fields.

Choudaha's (2016) study advised that "International students need, deserve, and want

more in terms of academic and career support (p. 2). That is the experience Ellen gained

working with faculty members in her department. Ellen who had identical support

systems as Adu explained:

Yes, a few. The work I did had some ethnography, sociology, that kind of thing.

Because I was in…. management, you need, when you are doing…. assessment,

you need a little more than just science. So, there were other faculty from other

department to help me with the theories and a few other things…. So, we got the

opportunity to deal with different professors. And you know, most of them would

say or guide you, not necessarily in your research work but in the university

teaching, you know. Sometimes like publications, encouraging you to attend

conferences, sometimes they would support you and pay something for you or

apply for sponsorship for you. So, it depended on whoever you worked with. But

they really helped, mentored, while we were there, yeah.

Students who obtained their degrees from an African institution encountered challenges pertaining to support systems. Augustina who was educated both in Europe and Africa described similarities and disparities related to support systems received from both institutions. Ayisi additionally added her experience in an African university. Both participants had limited resources for their research in the lab and they waited for months before receiving equipment to continue their research. This assertion of the participants is in alignment with Boateng's (2015) research which concluded that "laboratories in Ghana lack scientific apparatuses and equipment, the few ones are obsolete, and are in derelict shape" (p. 165). Augustina pointed out similarities and disparities of her experience in Europe and Africa:

> Yeah. There are disparities because looking at…. [Europe] what you need to carry out your work is always available even if you have to order it from a different country. It comes quickly for you to carry out your work. But when it comes to [Africa] sometimes there are challenges. Even our initial isolation of our samples, it was a problem. Sometimes you don't have the media to use, the chemicals and if you order, it will take you some months before they come. Those challenges are there.

Ayisi shared a similar account of her experience with lack of equipment in the lab:

> Sometimes we have to wait for months because one equipment is spoilt and there is nothing that can be done and it is too expensive for you to buy on your own so you are waiting for the department to fix it or buy another one. And it takes quite a while.

Although she explained of the lack of support system for students in her department, she further went on to explain some of the support received from her supervisor.

> As at when I was there, I didn't see any laid down support system, for example an academic tutor or something. It was basically you and your supervisor. If you had any problem, the next person you could talk to was your head of department. But even with that it was a few situations I took note of with other students. I realized that if there was any problem, you were more or less on your own. You don't really have people fighting for you. They sort of look out for themselves so there was not laid down support system. But then of course you could get a word of encouragement and advice from any faculty.

Apart from the inadequate support systems from the institution in African, Augustina described the governmental support received to sponsor her doctoral program. The funding was essential in completing her doctoral degree.

> They were supportive in terms of the human support and also other moral support they have to give you and in terms of providing for you to be able to carry out your work; the monitory aspects were all available for you to be able to carry out your work successfully. As a student in…… the Ghana government pays for our tuition and other things. If you pay your fees you don't need to pay bench fee again at… or something like that to do your lab work. Those were all things that supported to be able to complete successfully.

Gyamfuaa and Priscilla who were educated in Europe and North America emphasized on the financial assistance furnished by the department and scholarships from Ghanaian government. Additionally, both participants indicated that they had assistantships to teach

and do research which provided financial resources. Gyamfuaa described the departmental support:

> Yes, yes, yes. There were a lot of financial aids to international students, and I got a number of them. The scholarship that I had, you know, was negotiated between the…. College where I did my one-year exchange program, and then the School of [Health Science] in the University of…. The scholarship was for me to teach, and then they pay 80% of my tuition, and give me a 20%. Then I pay the 20% and then they give me a percentage of stipend, then I paid the 20%. It was really good. Apart from being a student, I was either helping a professor do research, and of course I was also learning, or I was a teaching assistant.

Priscilla specified the governmental and assistantship provided for her academic support.

> My supervisor was having a grant so he put me on…I was supported by Ghana government scholarship but then he also put me on his research grant and so I was working for him and then I was paid. I was a Research Assistant.

Supportive Male Chair/Supervisor and Departmental Staff. The relationship between international students and their teaching staff and academic advisors has a compelling effect on international students' learning (Tseng & Newton, 2002). Based on where the participants were educated, they had different names for their dissertation chairs. The different names associated with their chairs were advisor, supervisor, and doctoral father. Upon entering their respective programs, participants were assigned a supervisor or advisor for research or teaching whom later becomes their chair or dissertation supervisor. Thus, a beginning adviser did not always end up as chair. By and large participants praised the supportiveness of their chairs, advisors, supervisors, and

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administrative members towards their academic success. The emphasis was placed on male faculty members who supported them throughout their journey. Only Gyamfuaa had a female supervisor/chair. Tiwaa had high praises for her supervisor:

> I had a supervisor who was very caring. And it was all the time with me…. And he was all the time around and if there were problems, he was very quick to come…. And whenever you came up with a problem, very quickly he hired somebody to assist you, particularly I needed some statistics to be able to assess the distribution of the pest phenology of the crop so that you knew if you are going to sample for monitoring, you knew the distribution according to the growth stage. So, I discussed it with my prof then…... he hired a statistician just to come and teach me, give me the basic information I needed to be able to do the work. My professor was a very good man.

Among the participants who were educated in the West, only Afrakomaa had a Black supervisor. In narrating the exceptionalness of her supervisor, she detailed:

> ….. my supervisor there was a Black American. In fact, it was through him I went to that university. My supervisor was typically somebody who will always be on you. When you go to the lab the first thing he will ask you, ……. what experiment are you doing today? When I tell him my work plan, the next morning when he comes in, the first thing he will ask is, what result did you get? Can we discuss? When you are working, you have to know that the next day, you are going to discuss your results with your boss and therefore if I get a result that I myself cannot even understand, I have to stay there and repeat until I get

something that I will explain meaningfully, discuss and explain. So, his

supervision was also very crucial in my success in the research.

A study by Tseng and Newton (2002) informed readers about the importance of a good

relationship between a faculty and international students. Adu responded to her

relationship with her supervisor whom she referred to as doctoral father. She recalled:

It was very friendly. They…... call their supervisor "…... "Meaning Doctoral

Father. My supervisor was very friendly, he's always there to ... And then I think

he was always sensitive because of the fact I was a foreigner and therefore I

needed extra attention. So, most of the time when he came to, for example starting

the experiment, he would get somebody else to introduce me before I start. And

then he was always worried about me, "is your family ok?" He would come,

"Okay, have you done your insurance?" That sort of thing or whether for example

the pace at which I'm conducting my research is a bit too slow for him. So, he

was quite sensitive of that fact, so he always willing to do extra things for me that

I realized even my…... colleagues used to say that, is because I'm a foreigner

that's why he's pampering me. He was quite supportive, mine was very

supportive.

It is imperative for male faculty members to support Black female students. Their actions

serve as an encouragement and support to female students who are navigating a

predominantly White male programs or fields. Owusua explained the imperativeness of

men to female students in STEM.

So, we cannot rule out and say that men are not supportive, men are supportive.

So, I want to encourage them that they should continue supporting the women and

encouraging them…. my supervisor is a very good person. He's very nice, he's

very open, he's very encouraging, and he personally sometimes supported me.

The first time I was there and had to travel to…… for a conference, you know, he

supported me, he bought my tickets and everything for me and I went and came

back. I think that was the first time somebody from his research group has

travelled for ….my colleague was surprised. The second time I went to…… for a

conference with my colleagues, he also supported me. He was very, very

encouraging.

As stated earlier, Gyamfuaa happened to be the only participant who had a female

supervisor/chair. She had two supervisors. Incompatibility made her leave the first

supervisor to work with a different one. But she had a positive experience working with

her second supervisor. The work of this supervisor has affected her career.

My main supervisor was like a mother …… my main supervisor in the PhD

program, was also an excellent researcher, so all that impacted my training…... I

got a second supervisor, I started working, and she was good, and so I finished.

My supervisor at that time I would say, that is somebody, I would say at that time

is somebody who didn't just give you the academic training, but also every day

when you enter her office she will say something to empower you. That's because,

I thought maybe, she had a lot of international students and she knew that we

were having a lot of challenges. All of that, you know, helped me throughout the

program.

Priscilla encountered problems in her journey but her supervisor supported her through

the journey. As the only Black African female in the program, she worked with a White

professor. Before graduation, her supervisor helped find a job for her. She detailed the specific support received from her supervisor and technician at the laboratory:

> Ok, regarding the positive, I left first. I left my husband and children in Ghana and I wanted to bring them along with me and so after eight months of being in…. alone, I had problems with finances, having to get money to bring them with me and so I applied for the Association of American University Women. My supervisor encouraged me to do that because he saw that I was not very stable in mind regarding my family being away from me, so he encouraged me. He gave all the support and I got it and he also approved that they come. They came and joined me and so all the documents and paper work I needed he gave them to me and I forwarded them to the…. Embassy and within a short time they got the visas and they joined me. …….. another support that I had from my supervisor was that when I was about to complete my thesis he looked for a job for me and I got it. So, I started working and then I had to continue with finishing the thesis. I could combine it then I submitted it and continued to work and I went back for my graduation; then I continued to work for some time before I came back. He was really nice. My supervisor was Caucasian- American; he was very kind.

Esther believed her supervisor made her journey smooth. She postulated that "my supervisor…... he made life easy for me." She described the staff at her institute to be supportive… she gave an example, "so typing the dissertation was quite a challenge. You see I had gotten around typing because when I had to present my essays the staff at…….. helped me. They typed it for me. So, I told you I had a good support system."

Nari revealed the supportive nature of the Black administrative assistants at her department. She had a good relationship with the administrative staffs at her department and after over 15 years' graduation, she is still in contact with them. They refer African students to her to mentor.

> Okay, actually I got along very well with the administrative staff. I mean I was one of the few Black people there and so they were happy to see me and how are things going and we will talk about…. sometimes. In fact, we now call it the office of diversity. In those days, it was called, I have forgotten the name of the office so these African American ladies and I have kept in contact with them even now they refer students to me to encourage. Just last semester they referred one young man. he had been at… school, he was at… and was struggling with his academics so they referred him to me and am mentoring by WhatsApp. So, they have my photos on their walls and the students come and they point me out. So, I have maintained that contact so the African American ladies in that department, it was Minority Programs Office… yes! so I have very good relationship with them.

In contrast to the positive and helpful experience from administrative staff in the European university Adu attended, she compared that to her current experience in Ghana.

> In my mind, the administrative staff that I met at the University of……., they were very corporative. I found them very corporative, even more than I find the Ghanaian administrative staff. For example, in helping you complete the procedure of registration, they're precise, they guide you what to do. If it was here the person would be a bit hmm. And the other academic staff, we got along way with them. And most of the times I deal with them official … A few personal

friends anyway and then outside working hours, a few social activities. But

basically, the interaction was basically a lot more formal.

It is important to realize that a good relationship with faculty members and administrative

staff goes a long way beyond making students feel welcome but it has an important

impact on the educational journey and success within their chosen field of study.

Different relationships and the help provided to students as they navigate through the

program affect the students they also encounter when they became faculty members.

Supportive Africans /African Students and Peers. In moving to another nation

for the first time, international students encounter a significant sense of loss (Hayes &

Lin, 1994). Again, traveling to another country, for many international students, implies

leaving their families and parting from familiar sociocultural and other supportive

networks, and this can bring about students encountering adjustment issues (Hayes &

Lin, 1994). In the interviews, participants described the need to have African students'

union. They believed that having such an association served as a family away from home

whom they can rely or depend on in times of need.

In Adu's statement, she stressed the Ghanaian church in that European

community as a source of support. The support system prevented homesickness because

she had left her family in Ghana to pursue a doctoral degree. She was always anxious and

looking forward to Sunday, so she can meet her fellow Ghanaian friends and have

something to eat.

Yes, when I went initially, okay I did a language course somewhere else in

another state and went to do my PhD in ……. After a week or two, I thought let

me look for the other Ghanaians in that area. So, there was a Ghanaian church.

So, I went there, they welcomed me, I made a lot of friends. During the weekends, we cook something like Igwengwene with some Waakye or Fufu, some of those stuffs. Yes, I think that is something that was very significant, well that help me not to miss home. I always looked forward to Sundays because I'll meet friends and I'll get something to eat, at times they will invite me to their parties I liked the environments, there were parties. So, it's one informal support system that was very significant. I mean when I needed something, the people normally I would ask, where can I get this or that and then they'd show me.

As it has been noted earlier, African students in Western nations depend on each other for support. This can be said about the experience of Gyamfuaa. She narrated her ordeal with a supervisor. When the second supervisor asked her to inform her first supervisor that she was not going to work with her again but rather with her second supervisor, she fell on the African students to gather and pray for her in her office while she met with her first supervisor. She described the experience:

So, she said, "Go and tell her you are moving from her team to my team." I said, "That's not a problem." I went and then I told her I was going. She got so furious. She was really angry. Why I was moving? And then I explained that this is the situation. I come from thousands of miles away and I notice I'm not progressing. I need to finish and go back home. It was a tough one. That was the biggest challenge in my program. At that time, I remember that day all the African students, they gathered. Every PhD student had an office, so they gathered in my office. Whilst I was there fighting, they were praying for me.

She continued to talk about the financial support provided by fellow African students to help bring her daughter from Ghana. She was in a difficult financial situation in bringing her child to North America. To prove that she was financially capable to support her daughter, she had to have a specific amount of money in her account. The African students helped raised the money.

> …. when I wanted to bring my daughter over, because it wasn't easy for me to stay throughout the period knowing that she's alone in Ghana, even though her dad was also around. When I finally decided I was bringing her over, there were so many problems, including money issues. You know, you need to have some amount of money in your…... Well, I had some money in my account, and then African colleagues who were around also contributed. You know how we do it. They contributed, you know, put it in my account to show, and after my daughter arrived I gave all of that money back, yeah, to them.

Augustina talked about how she made friends with fellow African students who were placed in the same hostel due to the nature of the scholarship program that aided her travel to Europe to pursue a doctoral degree. She has kept in contact with them after graduation. In explaining how she made friends from different African countries:

> Because of the nature of the program we have partners in Burkina Faso, Benin, Togo. I have friends all over. And where we used to stay at……... is a student hostel and so you have so many students from other African countries. And you make friends, and because of Facebook you have all these friends. Sometimes you just say hi to each other and we keep contacts.

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In answering a question related to support systems Nari benefitted from, she made mention of the African students' association in which she was a member and held a position. She said "…... I joined some associations I was a member of the African Students Association and I was even the vice president for one year." Similarly, Esther also the held a position in the African students' union. She briefly stated that "so, I was made the…... of the African Students Union once at……"

Dependent on God for Support. In the opening statement of Professor John Mbiti in his classic work *African Religions and Philosophy*, he mentioned that "Africans are notoriously religious" (Mbiti, 1969, p. 1). Africans are truly known for their religious nature. This was apparent in the statements of the participants. The participants described prayer and God as a supportive strategy in dealing with their challenges. Owusua articulated her reliance on God for success in her research and whenever she confronts a difficult situation in academics and in life. In response to an incident in the laboratory, she said:

> The protection is you just wear a lab coat and your eye goggles, and that is all. No other protection. But when you set up the experiment well, that is, you must set the experiment well, the gas must be connected well. There should be no leakage. So that's what they did for me. And I have to stand there to observe the reaction. That was a difficult moment for me, staying in the lab alone. I only prayed to God. But fortunately, the reaction didn't work. That reaction didn't work at all. So that period was difficult. I spent about six months on that particular reaction.…….. Oh, seriously, sometimes in the lab I have to go on my knees and pray to God. God help me. Please don't put me to shame, don't embarrass me.

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When asked a follow-up question to reaffirm Owusua's response, she replied "prayers, prayers, and strategies. Prayers, and I believe that prayers even work better because when you call the God Almighty up there, He knows everything and He guides you." Esther point the support of God for making her the receiver of the only scholarship that was given in a specific year to aid her pursue her doctoral degree. She disclosed that "And God was on my side, I got the only scholarship they were giving for that year." Nari described the spiritual and moral support from her mother. She detailed the support by stating that "what exactly is it that she does …just moral support …she prays for me." Tiwaa first explained the graciousness of God for the free resources provided by an international agency. She also detailed how she utilized prayer to solve challenges encountered. "I had free food. So, I really enjoyed it. Free accommodation. As their guest. You know, they are from.… international from…., the…... So, I had everything free. And so, I thought God was gracious to me." When workers at her research field pursued her for solutions to pesticide infestation, she relied on prayers.

> They look at me faced with a big problem. There was outbreak of armyworm, just like we are having now. But I think it was a different species. Because it didn't attack tree crops…... So, I told my professor I read somewhere that if you had the outbreak of particularly armyworm and it rained heavily, you don't have to control it because water, flooding was something they hated. They couldn't stand flooding. So, I told him, after I discussed it, I told the professor we have to spray. My professor never liked insecticides. They wanted us to use a different approach to avoid the use of pesticide. Then they said we have no choice but to

spray. So, I said well, let's pray that it rains tonight. Lo and behold, it rained

very heavily and the problem was solved.

A similar strategy employed by Augustina to solve difficulties or challenges is prayer.

When posed with a question on how she solves challenges, she stated that "It's like the

challenge in my pregnancy. I have to defer. In marriage, you just have to look to God and

pray and be positive and carry on with your work." In a like manner, Ayisi saw God as an

avenue for strength. She mentioned that "God is my source of strength at any point in

time."

Students employed different support systems to succeed in their doctoral journey.

Institutional or department support system was essential to provide students with

scholarships, graduate assistantship, laboratory resources, and other financial resources.

These resources are imperative to aid female international doctoral to succeed in their

academics. A compelling evidence of family, faculty and staff, African students and

peers, spiritual support were visible in participants account and must be taken seriously to

promote students' academic success.

Resiliency and Strategies that Facilitated Success for Participants

This theme addresses question two of the research question guiding this study.

The subthemes delve into strategies that these female participants embraced to counter

the problems encountered during their doctoral journey. These strategies serve as an

experience which they tend to pass on to future female Ghanaians or women of color who

dream to pursue STEM doctoral degree whether in Ghana or in a Western nation. While

these theme addresses challenges encountered it also celebrates their success chalked in

their journey.

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Impediments in Doctoral Journey. The intricate array of pathways that students take to STEM degrees is not effortlessly explored, and students now and again experience boundaries along the way to acquiring a degree (Malcom, S., Feder, M., National Academies, N. S., National Academies, N. E., & National Academies, 2016). Scott and Martin (2014) study on the perceived barriers to higher education in science, technology, engineering, and mathematics revealed that "male students perceived significantly fewer internal and external barriers than female students, indicating unique challenges faced by female students of color (p. 15)." Since the challenges of Ghanaian female STEM lecturers and professors' doctoral challenges is a grey area in research, a deeper look at the barrier/obstacles encountered by Ghanaian women is imperative to understand their resiliency to overcome their challenges to succeed. Two of the participants cited pregnancy as an obstacle they encountered during their doctoral program. Augustina mentioned pregnancy and marital issues as an obstacle on her research and academics. Afrakomaa also specified pregnancy and having a child as an obstacle because of the impact it had on her academic work. Augustina recalled:

> I don't remember any apart from the time I got pregnant and maybe as a married person when one time or the other you have some issues in your marriage those ones are…. As a woman, your emotions are different and so sometimes it's difficult when those things happen and you still have to go on, you still have to go.

When questioned about strategies adopted to solve this obstacle she mentioned that she took time off to have the child, and lastly, looking up to God. She explained that "it's like

the challenge in my pregnancy. I had to defer. In marriage, you just have to look to God

and pray and be positive and carry on with your work."

Afrakomaa narrated her encounter with a faculty member who realized that her academic

performance was not up to par and reported the situation to her chair.

> There was a time I felt down spirited and then I went to my boss. It was an
>
> elective course that I registered for, and when you go the lecture, the
>
> lecturer/professor doesn't teach anything but he will recommend several
>
> publications to read. … So, when we had a quiz I failed, I wasn't following
>
> because the papers were many and I could not read them well. Yea, I had a baby
>
> and my daughter was about a year, no, even in the months because that was in my
>
> first year so I couldn't cope with all those. So, the lecturer complained to my boss
>
> that it appears that I don't know what I am about.……. Later on, he said, I know
>
> you to be a very good student but when you knew you were coming to graduate
>
> program and you decided to start raising a family, you should have weighed the
>
> consequences before coming. That was my lowest point at that time…… But here
>
> I came and because of pregnancy, am not being able to do well on some of the
>
> courses.

In explaining measures employed to deal with these issues and how she solved them, she

stated:

> It means I just told myself, you must sit down and work on that particular course.
>
> So, as I said, I had friends, I like to study and consult other friends. There are
>
> friends in the classroom and we are taking this course together. So, I joined them
>
> and we were discussing the papers together. We will discuss and we will try to

find how this relates to the objectives of the course we are doing. Gradually, I was

beginning to understand what exactly he was expecting from us. So, in the end,

when we wrote the paper, I passed. I didn't get an A but got a low B. I was just

okay that I passed. It was the course I never, ever enjoyed at all.

Adu and Owusua each had a problem on different research they were undertaking. While

Adu could complete the procedure, she could not interpret the result. Owusua on the

other hand could not complete the process nor obtain a meaningful result. Adu recounted

the event:

Okay. One that is very vivid is, some spectroscopic analysis and worked with

NMR (Nuclear Magnetic Resonance). So, interpreting the results, you sort of have

to identify the molecule you are dealing with ... And I remember that upon all the

NMR I had learned, I couldn't interpret the spectra too well. I mean I couldn't

make head or tail of what compound it was. And even within institute there was

somebody who was supposed to do that, he also, I think when he realized it would

have been a lot of work, he also did not want to do it. Then I was stuck because I

didn't know what to do. I couldn't interpret the thing. There were some I had

interpreted; those were quite simple.

In solving the obstacle, Adu stated that "It was almost a challenge. In the end, my

supervisor ended up giving it to somebody else to work on that. I left it out of my thesis

and then he gave that aspect to somebody else to work on. I'm not too sure of the results

but I think the person did quite a good job."

Owusua mentioned an interesting event that caused an obstacle in her journey.

During the interview, she revealed:

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Something interesting happened. There was one particular reaction that I was performing, and I think it was not working. Not knowing the thing was not workable and nobody told me. My colleagues who are done, were working on my topic before I came, and they changed their topic for them because the thing was not working. But my professor sort of felt that the thing should work. So, when I came, they gave it to me. I didn't know, so I started. When I got to the difficult parts, I contacted the same thing. And they never told me. And I was going to them to ask them so what do I do, how do we do this. Well, they told me what they could do, if you do it that way, then that's it, but they didn't tell me that they did it and it didn't work and that the thing is not workable. But one thing that helped me was my professor was giving me a lot of other works that were done in similar areas for me to try. I tried all of them. Another difficult part, because it's…. synthesis I was to work with hydrogen gas. And in that research group they always want to avoid the use of hydrogen gas because of the nature.

Although her professor gave her a new project to work on she pointed out how she overcomes obstacles. The religious nature of solving problems was the stance Owusua maintained. According to her, the best way to solve issues or overcome obstacles is "Prayers, prayers, and strategies."

Financial challenges engulfed Nari as she journeyed through the program. It was communicated to her that her funding was running out. She felt it was not communicated to her ahead of time to make back up plans.

When the news that the funding has run out, I was called to my supervisor's office and then he tells me …I think it just one-month notice …start from this date …we

will no longer be able to support your final year and it was close. So, I started

thinking what should I do now…... I have to finish this? So that was major, major,

major difficulty. Well I told you about my academics…and when I was doing the

course work and there were too many course and I was like oh, I can't keep up to

these assignments…… At one point, I even got hit by a car because I was moving

from one lab to the other. So, it was in……. and across the street was material

science. I was crossing over the street to go check on my samples and a vehicle

just came…hit me. So, we have stories like that but at the end of the day we got it

done.

Different steps and strategies were employed by Nari to solve the challenges

encountered. She had to drop a class although personally, she does not give up easily. She

talked about the strategy utilized to deal with financial challenges.

Okay with the course I might have just dropped it…ok let me access my

capabilities and all the unnecessary ones were going. So that was how I dealt with

that one. It was difficult for me. I don't give up too easily so for me to decide that

am not actually going to do it that was a major, major thing. The other was this

issue with the funding…so I had to regroup very quickly. What am I going to do?

So I went, I struggled with it and I went to see my advisor again to ask him is it

possible for me to find a job…because when I started working in the lab I was

already working…I was doing work study and he told me no, you can't continue

doing work study and PhD together so drop that, and I dropped everything that I

was doing and worked full time in the lab on my research project and so when this

came up I had to go and ask him so is it now that I start looking and what

arrangement do I have to make to make sure that I can successfully complete this.

So, he was just talking to me and looking at my options.

While Nari was dealing with financial issues, Priscilla was dealing with family challenges. Priscilla brought her children and husband to North America while pursuing her doctoral degree. The children were at a school going age and two were attending schools far from home. Her challenge was chauffeuring them to school when they missed the bus. She recounted:

It was to do with family, because my kids were attending school and two of them were to go far away. You know in the US, ok southeastern state, the bus system so it was picking the children and bringing them back home but sometimes I had to study deep into the night and by the time I woke up the bus had already passed by and so I must drive the children to school before coming for classes, it was tough. That was a major challenge I had.

When questioned about how she dealt with the transportation issues, she responded:

My husband was there too, he was also a student and so when I had the chance I took them. Like we were starting classes at 8 o'clock and the bus will come like 6:15 so sometimes around 7am the bus is gone so I had to quicken up then. If I didn't go my husband would go.

The primary challenge or obstacle that permeated through Ayisi's doctoral journey was regarding lack of equipment. She mentioned the negative comments of people and its effects on her.

I think I have mentioned earlier with regards to the equipment. The lack of equipment was a big obstacle affecting progress of the work and in addition to

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that for example as I mentioned in my case I felt that, maybe that was a little

personal but I felt that because I didn't have the initial background in _____,

I felt like I was behind, yes. So that was a deterrent and sometimes people will

pass comments. Comments from other people will also discourage you sometimes

and for quite some time you will feel crippled which I feel is an obstacle. I don't

know how to coin it but sometimes words from people can discourage you,

sometimes your very own colleagues. Sometimes they feel they are up ahead of

you and they pass a comment that "So when are you getting done? Do you think

you can ever finish?" and you begin to ask yourself "will I ever finish?" and then

it cripples you for a week and you are not able to work. So, I think that is

basically it. But the one I can really pinpoint is the lack of equipment,

consumables, or resources.

The best strategy developed to overcome the challenge of lack of equipment was:

With regards to the resources I think I invested a little money as and when I

could. So, if I had to buy something myself instead of waiting for the department

to provide it, I would probably buy it. There was one situation I needed to use

some lab rat and ideally because I had paid bench fees, the department was

supposed to buy it but it was going to go through so many processes so I bought

themselves and then later I managed to get a part of the money back. So, these are

some of the steps.

Each student employed different strategies to solve problems encountered. Based on

where the participant was educated, they experienced different obstacles.

Overcoming Challenges Encountered During Dissertation Phase. During the interview, participants shared some of the challenges they experienced as they journeyed to success. In the process of writing their dissertation and collection of data, participants discussed the issues of child birth and data analysis, access to literature, work and how they had to combine these demanding needs. With the end goal of achieving a terminal degree in sight, they tackled these challenges. Afrakomaa described her experience holding up to the traditional demands of being a married woman and combining the duties with writing and research. She noted:

> Yes, it was off course, joggling that with my child and my husband…. then I remembered one incident, it was just normal husband wife misunderstandings, so I think I had some misunderstanding with my husband and then one weekend I think Saturday I was home, I was studying, by the time she had grown up. She was then about around 4 or 4 1/2 by the time we came back she was five. I just casually said, if daddy continues making me angry, I am going to leave and go to Ghana and I said, will you go with me and she said No, I won't go with you. I will stay with my dad and I was like why? Well, when you want to go you will leave us it means you don't love us, and I will stay with my dad. That thing remained in my mind for a long, long, long, time. That is some of the challenges but when she grew up, we became very, very close by the time we came back to Ghana…. There were challenges because sometimes you start, I remember one time, I was deep into the literature and I had set up an experiment supposed to last for an hour before I go to take data and I was writing so much that I forgot the one hour. So, I couldn't take the data and needed to repeat the whole thing altogether. With that, I

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advised myself that if you set up an experiment, don't start writing anything. So

those were some of the experiences.

In like manner, Tiwaa experienced the problem of having a baby and child care in the

middle of the dissertation journey. When asked to describe the dissertation experience,

she explained that "….it was very challenging. I think I have already mentioned that I

grew up a lot during that period intellectually and also personally. It tested my limits of

what I could and could not do. I will not give that experience up for anything because it's

part of who I am." She further stated that "all the things I have mentioned having to

combine my baby and also funding worries."

An equally problematic issue Ayisi and Priscilla encountered was analyzing their data.

Priscilla expounded her experience:

> Yes, the challenge was with trying to analyze some of the data. That was the main
>
> challenge. It was a bit confusing and difficult if I should put it that way but I think
>
> that was where I was able to contact the person I mentioned in the UK. And the
>
> other challenge was trying to get your supervisors to go through as quickly as
>
> possible. So, give them a bit of the script and well, they put it aside and do other
>
> things. You go see them and they haven't looked at it. So, it took a while for them
>
> to go through everything and have me submit finally.

To overcome the confronting issue, Ayisi devised a strategy to get a quick response from

her supervisor. She explained further:

> Oh yes. I think what I did was that I tried to see them as often as I could so if they
>
> told you to come within the week. Maybe you go there two days before the week

end and you remind them that they asked that you come in the course of the week so you just passed by to remind them.

Statistical Analysis System (SAS) was a software system that Priscilla was not privy to its use. She additionally provided avenues to override her struggle:

Yes, my data analysis. I struggled with it because you know the way this Statistical Analysis System (SAS) software system is, it is very tough and I told my supervisor that, he taught me, explained it to me because I was coming, I was from Ghana. At the time I did my Masters, SAS was not being used in the University. I didn't know anything about it so it took me a long time to understand it, figure it out. Even that, it was not that good until I completed and came back home and then I was, I started learning it slowly, then now I have mastered it. So, at that time I had not mastered SAS and so I was having lots of challenges with the data analysis, input statement making...and all that it was tough and so every now and then I go to my supervisor and he would offer his help.

Writing of the dissertation was a challenge for three of the participants. Esther, Adu, and Priscilla had issues with the writing of their dissertation. Esther started her PhD in the 80s. She complained about her computer usage abilities. At that era, they used Word perfect and she had to learn how to type. She explained strategies to combat her challenge:

I didn't know how to use the computer well. I had to learn to type. It was Word perfect and that time I wasn't using the apple…. So, typing the dissertation was quite a challenge. You see I had gotten around typing because when I had to present my essays to the staff at…. and they typed it for me. So, I told you I had a

good support system. They typed it for me so I presented my essay but the dissertation, I had to type it myself. Sometimes saving the file, I would save and instead of maybe say dissertation dot 1, I would say dissertation again. So, when I was printing to give to my supervisor I will print the old, and he will complain; ah...., I have marked this already and made corrections. Then I will go back and look through the files and find the correct thing. That is one of the challenges I had. It was a very severe challenge. The preparation of the dissertation itself not the facts I had to assemble but organizing the typing, organizing my files so I would present to my supervisor the correct file…. One of my seniors told me that when you are filing, use the same file name then do dot 1, dot 2, dot 3, so the highest number was the latest file, the corrected version. So that is how I overcome that challenge.

Adu specified her struggle with typing, formatting, and checking for grammatical errors in her dissertation and how she overcame the challenge:

I think during the typing especially, it got to a time where I was tired, I couldn't concentrate. I would have wish I had a break to just go and refresh myself and come back. But then looking at the deadline for graduation and I had to force myself to finish the typing…. Typing challenge? First of all, I got a friend who formatted my computer because my computer was giving me some problems. For example, numbering the heading automatically. So, I got a friend who was quite computer literate and then he did that for me. Secondly, it got to a time whenever I typed then I send it to friend to read through for me and do some editing, spelling mistakes, grammatical errors, et cetera. So that really improved the rate

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in which I was going. And the secondly also, I was going to the institute to type

but then it got to the point I stopped. I just stayed in the house 24 hours and then

did the typing.

Priscilla talked about writing in a professional manner suitable for academia. When

describing her challenge with the writing of her dissertation, she stated that "you know

how Ghana English is? I had to completely rearrange myself and write in the way that

was professional. It took me sometime."

Tiwaa explained the danger she had to go through to collect data for her study. Her data

was collected in a field and due to the danger posed by other farmers who wanted to burn

colleagues' crops, she had to be accompanied by a male assistant:

> It wasn't very easy going into the field. And at times you sampling to about 1:00
>
> p.m., you've not eaten anything because you went before 6 a.m. And it was more
>
> difficult getting into the…. [area] which was after seven months. Because after
>
> seven months, the…. was ready, matured enough and most of the lower leaves
>
> were very dry. It was dangerous, dangerous to do that. There are wicked people
>
> who want to destroy other people's farms, the out-grower's farms. They wanted to
>
> harm people by setting fire to their farms. So, the first thing I was told when I got
>
> there was that if you go to the farm sampling and you see a baobab fruit lying,
>
> leave, like if there's no baobab tree around on the farm and you see a baobab fruit,
>
> don't wait, just leave. Particularly, when the leaves are brown and dry, that's how
>
> they burned the fields.

She further explained how the challenge was overcome:

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And that put a lot of fear in me. So anytime you were going in you were praying that nothing will happen. Maybe there's one there, you didn't see and you are here and that kind of thing. But nothing happened. We saw fields burning, but not when I was in the field. So, these are some of the things that put fear in us while sampling on the field. And I had an assistant. Prof gave me an assistant. A male who would go with me. Because it's difficult to strip and look for the holes, tunnels, holes that led into the tunnels and do the scoring at the same time. So, the guy would thrash and then I would look for signs of damage and score.

Augustina, who had to do her research in a European university and did her course work in an African institution complained about challenges she encountered in writing her dissertation in the African institution. She also addressed step to solve the challenges encountered:

There can be challenges in terms of getting literature especially when you are in [Africa]. Internet access and even if you have the internet access the information is not readily available. Like we were in [Europe] you get everything you want, the library they have subscribed to everything, so whatever article you want you easily get it. But yet, some of them you're not able to get to read and also write your dissertation…. You just have to make do with what you have or you try your possible best to get internet access at all cost. And sometimes maybe you can just give an email to somebody and that place to search for a paper or article for you and you go.

Owusua who was educated in Europe had all the resources and instrument to her disposal but she was not familiar to the new instruments in Europe. She noted that "Yeah, I think I

have said a lot of, quite a number of challenges that I faced during my dissertation program. So, the first is getting familiar with the instruments that I need a lot of time."

Issues Delaying Graduation. Numerous studies have reported the struggle of women to balance career and family (Sue and Zachary, 2009). The participants discussed the issues of marriage, pregnancy, family and childcare, and laboratory research as an obstacle that delayed their graduation. Augustina delayed her graduation for a year because of pregnancy. She spoke about uneasiness for a woman to be pregnant, have a child, and continue with her education:

> It's not the easy as a lady and especially at the time I got pregnant, and so because of that I even have to defer for one year to give birth, take care of my daughter before I continue. And that's the reason why I completed in…. I've taken four years instead of the three years. So, taking care of a baby and going to school especially PhD you need to read, be in the lab and it is not easy.

Afrakomaa added her voice to how pregnancy can slow down research and eventually graduation:

> Yes, having a baby affected my time to completion. Well, it didn't take me off, but it slowed me down. It slowed me down. There are things I would have done, but because I had to go to hospital because of antenatal clinic, I had to do this and the bodily pain and it slowed me down. But I didn't quit. I slowed the work down.

Marriage is a cultural expectation for Ghanaian women and Nari was no exception. She explained how she had to take two months off to go to Ghana to get the marriage

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ceremony completed. Apart from marriage, she had financial issues related to funding of her degree and taking multi-disciplinary courses:

> I had several challenges, first all this multi-disciplinary thing I had to learn completely new things. I knew nothing about cell culture. I had never grown cells. I had to start from scratch, learning the language…I had to …the struggles were actually getting the porous glass, it a new method so there were delays. There times where I didn't know I was going forward or backward. Until suddenly then there is breakthrough and then I made a bit of progress and then the issue of having baby…. Yes…it was…. and…. It took two months. I took time, came home got married after my proposal and then I went back.…. maybe that also delayed me a bit…then I had my baby in.... Like I said, I was still meeting my mile stones but maybe I could have done it faster…. you see then the funding….

When Adu was questioned about experiences she encountered during her dissertation phase that affected her time to completion, she responded:

> I think what really affected my time to completion was during the typing phase where I felt I should go at a certain rate. When it got to a time I realize I was tired, my back was aching because I was sitting down for too many hours and so I had to relax a bit. Maybe apart from that I could have gone faster. In general, the project that I did is trying to isolate some compounds from a plant extract, it may or may not get the compound isolated. So normally if I don't get the formula with one method, I have to change the method, try again. I have to change it but I know that's all part of the research work, that takes time anyway. So, all of those might have affected the time of completion too.

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What delayed Priscilla's graduation was the Statistical Analysis of her data. It delayed

her for six months. She detailed that "the statistical analysis…. about six months. I sought

help from the statistics department and that enhanced my understanding of the software."

  Debating Whether to Continue. Notwithstanding years of effort to inspire

female students to seek after degrees in STEM, new research by researchers at the

University of Missouri uncovered that gender is an essential marker in dropout rates for

university programs (Snibbe, 2016). The preliminary results of the Snibbe' study which

focused on why women lead STEM students drop out revealed that there was a notable

distinction between the dropout rate between males and females. Not surprising, study

participants reported events that made them contemplate whether to continue of dropout.

Ayisi narrated her account:

> I think there was one occasion or there were few occasions where I had a
>
> misunderstanding with my supervisor. I think he wanted me to do something and I
>
> felt it wasn't right and I also felt I had to go through the right channel but he
>
> didn't think so. He felt that you can get it done by so and so and so means and at
>
> that point I thought that is it worth it. But because I think it was resolved and I
>
> could explain the procedure and all that but at that point I felt whether it was
>
> really worth it. There were times when I was financially challenged. I felt like
>
> quitting because I was like 'Ah…. what the heck" because I had mates who were
>
> working and had started making some money with their first degrees and I felt
>
> that if I had forced and gotten a job, I probably would have taken my time to
>
> decide on what to do with my masters. There were times that financial challenges,
>
> and a few misunderstandings and like I mentioned, lack of equipment and all that.

I had a colleague, we met there, we started but at a point, he switched schools and

he left for South Africa. So, I was thinking should I have also applied to another

school?

Owusua also told about financial problems that engulfed her doctoral journey. Another

instance was related to a research results that her supervisor thought she falsified.

I had a very serious financial challenge. I think that also affected mostly. I never

mentioned it. I never had a scholarship or any support. So, it was one advantage

that without the financial support, livelihood is difficult. So, the initial plan was I

was to come, the professor has some funding which they normally refer to their

funding support as jobs. You'll be given a job, like for PhDs, so it's like you'll be

given a job and you'll be paid like those who are employed in the German system.

You enjoy all the allowances and other things. So, my colleagues they had their

job and so they were receiving their salaries. But when I came, I was to come in

the middle of my proposal and then later, it came out that the funding that he, the

professor, is using for the research work is not for non-EU citizens. So, once am

not a European citizen, I cannot benefit.

She continued to explain the incident relating to the falsification of a research results

which nearly made her pack up to return to Ghana.

….my professor gave me another work that somebody did, and he said we should

try it. But when I tried it, it did work. I was so excited I did the NMR. I brought it

to him, he looked at the signal then we repeated the work and it will not work

again. So, the professor thought I had deceived him. Yes, because we gave the

thing to him and you said the thing worked and we were all rejoicing. Then we

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repeat it and the thing didn't give us the results that I presented the first time. So, it was very, very embarrassing and that actually broke me down. I didn't know what happened. In fact, I nearly packed my things and left. I said I was done…. I wanted to leave. But my husband encouraged me. He encouraged me, he prayed with me.

Gyamfuaa pointed out the issue of her first supervisor made her think of transferring to another university. She said:

Yes. In fact, the story I told you about my first supervisor. I was so devastated that I didn't want ... I didn't want to end the educational process of getting a PhD, but my intention was to transfer to another university because I was determined to come home with that PhD. So, if my supervisor was not helpful, my intention was to transfer to another university....

Priscilla encountered difficulty with statistics and wanted to give up because she could not see any progression. She narrated the ordeal that made her nearly give up by stating that "Yeah, about not completing I had a problem like that because as I said I had a huge challenge with the statistics and I wanted to give up, I wanted to because I couldn't see any headway but eventually I got it. That was the major problem."

The Dissertation Defense: Grilling and Drilling Period. Three of the participants discussed the challenges encountered during the presentation of the final dissertation defense. The terminology used by the participants to depict their dissertation defense experience are *grilling* and *drilling* period. They additionally discussed how they survived through the process. When Gyamfuaa was asked to describe her dissertation experience, she defined the grilling period and explained the grilling process:

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Yes. So, it was opened up. I did a presentation for 20 minutes. When I entered the room, you know, it was such that there was somebody making sure the technology aspect was okay. My main supervisor was like a mother, patting me on the back and telling me to relax because she's sure I could do it and all of that. I did a 20 minutes' presentation, and then they asked the members of the public to leave, and so I was left with the university community. They also asked their questions, and then after that they asked the university community to leave. Then I was now left with the committee members. We call that period a "grilling period." they were asking and I kept asking myself, "These people, we did this together. You asked me to do this. Why are you asking all these questions?" You know? There were a lot of questions from the committee, especially the statistician. They grilled me for close to an hour.

When asked how she handled the grilling, she said:

Well, I guess I knew, because I had heard from previous students... That's why we call it "grilling." It wasn't easy. And I knew my work was quantitative, so I made sure I understood all the analysis I did, reasons why I had to choose A and not B, and all of that. I had to explain some cultural issues, you know. And I was able to do all of that, you know, so they were impressed. The part, actually, that I found it a little surprising, was the fact that they, the committee members, didn't ask me those questions throughout the supervision. They waited to grill me on that.

Priscilla also recounted her grilling period. She discussed the whole process dissertation defense in her institution. She talked about fears prior to the defense, and how she was made to justify why she utilized her selected methodology. She recalled the defense:

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So, the defense was such that I had information to present and I was very happy

that I was bringing in new things and so I prepared my PowerPoint presentation

and my supervisor went through it, gave his corrections and then the day came I

was very afraid because I was going to meet about forty to sixty people and do my

presentation. So, I started over by giving how I, by the introduction, objective and

then I went on and on, gave my results and discussions and then after that

questions came. The questions were basically on the methods. I had to justify why

I used certain methods. I had to explain critically why I used those methods and

why not other methods. It was tough. I was really grilled. It was really difficult

but then some questions I got correct, just that I didn't get them all.

In answering how she handled the question posed by the committee members, she said:

I could answer some, others I couldn't, but they gave me time to think like they

would ask a question and they will say you have to relax and think and then... so I

will do that. Some of them I was able to get others I couldn't get. I thought I

would fail but they said I didn't fail.

Finally, Owusua spoke about her defense process which she called the "drilling moment."

Before the final defense, she had an issue with her research findings because former

students in the department who had done a similar study had a different result than hers.

This made the theoretical professor on her committee questioned her findings. Although

they had rerun and retested her results he still did not accept that Owusua did the test and

had issues at the defense: She recalled:

So, during my defense, the theoretical professor was my examiner. Yeah, he was

the examiner. So, I did my presentation very well because he was there. But

when it came to asking of the questions, he drilled me. Yes, but he still doesn't

want to accept that I did this. So, I knew where they were coming from. When it

comes to this, you don't need to worry yourself because you know their notion

about you…. So, it was quite a drilling moment, he really drilled me. And I was

ready for it. So, by the time he finished, I had to take a very deep breath. The

presentation was not even as strenuous as the question time. So that was also

another experience altogether. So finally, he has to just let it be. So, it was quite

a, I had to go to the board and write a lot of equations on the board to prove so

many things. So, I invited a few Ghanaian colleagues who came to support and at

the end of the day, they just couldn't believe how everything turned out to be.

When asked to describe how she dealt with the questions from the theoretical professor,

she said that "so, I just decided to relax and give him the answer that I knew, whether it's

correct or it's wrong, I didn't bother. My professor encouraged me. The guy is really,

really helpful. He encouraged me that I should be myself, I should just say whatever I

know. Sometimes he tries to come in, but he also has to play to it well."

Expected Challenges for Future Female Doctoral Students. Three of the

participants proposed challenges that future female Ghanaian doctoral students should

expect. The primary concern for all three was on financial challenges. The next challenge

was being away from family and logistics concerns in the laboratory. Augustina talked

about challenges to expect when pursuing a PhD in some African institutions. She

acknowledged that having a full sponsorship takes a huge pressure off the student:

There will be challenges. I have had in a way that maybe money was not my

issue, because I was under a project and I was being sponsored, but if you're not I

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think money can be a challenge. In terms of logistics in science we have

chemicals, the lab, places to go and carry out your practical are all challenges

especially in Ghana. We don't have the places to do our works. And even if you

get sometimes you have to buy the ingredients by yourself. And the issue of

getting information is a challenge.

Tiwaa addressed the issue of obtaining scholarships for a doctoral program:

Yes, scholarship is one of the challenges, and now it's so very difficult. So many

people are aspiring to go for PhD but the funding is limited. Now the university

hasn't got any scholarship to give. So, it's not easy to come by, so you have to

work at it early. So that at least you will be able to get something. Getting a

school is not a problem if you make a good grade. But getting the sponsorship is

where the problem is.

She suggested the biggest challenge for doctoral students with a child or children will be

their family. She drew an example from a dialogue she had with a female student who

intend to seek a doctoral degree. She also pointed out to her own experience:

The biggest challenge, again drawing back from that student I interacted with,

will be family challenges. So, she told me, "Oh doc, I can't go to [North America]

because my children are small." She can't leave them behind and go to [North

America] and sit in a classroom for two years. That's the biggest challenge. In my

case, my daughter was already grown, and she was with me in [North America],

and only one. It was easy to manage. So, somebody with more than one child will

have a problem, and again, financial. If you don't have a scholarship. I was lucky I

had a scholarship. So, if you don't have financial aid, it will be a problem. Those

are, I think, the main challenges.

Whether married or single, students nursing a dream to pursue STEM education should

brace themselves to encounter challenges pertaining to caring for their families and if

they leave their family in Ghana, they will tend to experience homesickness and the

difficulty of leaving family behind. With all the challenges and obstacles encountered, the

participants showcased their resiliency to persevere and graduate. So, future students

must build a spirit of resiliency to persevere and graduate.

Importance of Mentors. Mentors are essential for the academic and research

success for female students in STEM fields. The presence of dedicated faculty members

and scholars to serve as committed mentors and provide directions goes a long way to

breed academic success (Jackson, & Winfield, 2014). Also, there is a need for role

models for female students in STEM at an early stage. The Oscar-nominated movie

Hidden Figures portrayed the critical and little-known part women played in the space

race by chronicling the professions of three amazing African-Americans: a

mathematician, an engineer, and a computer programmer (Catherine, 2017). It has

accomplished much to boost interest in STEM and technology by telling an engaging and

convincing story. Substantive role models like the African American women in Hidden

Figures aid by showing possibilities (Catherine, 2017). During the interviews, the

participant mostly described their supervisors, advisors, and chairs and a mentor. None of

the participants emphatically declared that they were assigned mentors when admitted

into the program. Mentoring was not an instituted system in their departments.

Participants discussed the lack of mentors in their doctoral program. None of the participants were assigned to a mentor when they entered their respective programs and this led them to adopt their chairs, advisors, and supervisors as their mentors. Owusua described the lack of mentorship and how the person who was to assume the role of a mentor refused:

> The mentoring aspect, there was none apart from my supervisor who actually was helping me by providing me with a lot of information to so far as my research area is concerned. I never had any mentoring. Where I thought I could have it, there was no relation. The assistants to my supervisor who would have been the person to be there when my supervisor was not there was not willing. A female, of course.

Afrakomaa opined that there was no mentoring or assignment of mentors in her department. The available mentoring was for undergraduate students. She also adopted her supervisor as her mentor:

> At my time, there was no mentoring at my department apart from my own boss. I knew about mentoring for undergraduates because I see undergraduates coming to my boss for discussions and so on. But at that time, they did not have anything for us as graduate students. So more or less your supervisor was your mentor and my boss was excellent in that area.

Similarly, Ayisi was not assigned a mentor. Her supervisor assumed the role of a mentor. She narrated the mentoring process in her department.

> It was beneficial in the sense that you received guidance and they supervised your work and you know people saying, "do this" or "do that" but like I

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mentioned earlier it was mainly you and your supervisors so there was no mentor,

someone who was probably assigned to you apart from your supervisors as your

mentor. So, I guess our supervisors were our mentors. And it was mainly about

your work. When you are able to cross that barrier, that formal barrier, then I

mean you could talk about life…... so he could tell me about life and all that but

generally it was strictly work.

Augustina was not assigned to a mentor when she was admitted into the program. When

responding to the mentoring process in her department, she stated:

Not somebody assigned to you as a mentor, but you have all the lecturers

available. You look up to some of them for inspiration. So, if you have any

problem you easily go to the person you think will be able to address it for you

and then you get that support.

In all, four of the participants were not assigned with a mentor or a faculty member but

they had to adopt a faculty member who they believe assumed to the role of a mentor and

guided them through their doctoral journey.

Mentoring by Supervisor, Chair, and Advisor. Other participants were

assigned to a supervisor when they entered the program. In some cases, the supervisor's

role was assumed to include mentoring the students throughout the program. The process

where mainly guidance through their laboratory research. Five of the participants

discussed the mentoring process. Nari stated that her supervisor was her mentor. She

described the mentoring process and the benefit associated with the process:

My supervisor was my mentor. It was mainly, at least for me, nothing personal,

no personal issues, very impersonal, very formal. It was mainly to do with the

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research and how the research was going and skills that I had to acquire to write

proposal and reviewing journals papers on behalf of the supervisor. That is the

kind of mentoring I got. It was my supervisor from…. he was more personal and

liked having conversations outside of the research, inviting us to his house and

this was once in the whiles. Well there was somebody looking out for my work

out put, there was interest in the work I was doing that's the way I see it. I had to

graduate, how, after all these not graduating?

In the case of Esther, she received mentoring from her supervisor and others in an

institute in her university. People within the institute provided any assistance to make her

doctoral journey a success. She explained the process:

The mentoring I had was from my supervisor and a few others from the ….

Institute because that is where I spent most of the day. And my supervisor would

discuss with me what needed to be done, and he will tell me you have to read this,

read that, read that. He would give me some of the reading material I needed, and

others in the institute. He would ask me how my work was moving, when I told

them, they would suggest, oh, look at this person's work, he did some similar

work to what you are doing. Now one thing my supervisor did was he sent me to

meetings, international meetings. So, he funded my transportation and my board

and I went to meetings in Canada, in the US, I didn't travel to Europe. Every

summer when there was a meeting, he would send me. Sometimes, my special

area, they had bi-yearly meetings. But they had some other meetings that were

relevant to what I was doing then my supervisor would send me.

The mentoring process in Ellen's department was such that students were assigned to different professors through research assistantship positions. She mentioned that "I'll put it this way. You know that we were assigned to different faculty. Sometimes we had to do what do you call, research assistantship or teaching assistantship." She further explained:

> So, we got [an] opportunity to deal with different professors. And you know, most of them would say or guide you, not necessarily in your research work but in the university teaching, you know. Sometimes like publications, encouraging you to attend conferences, sometimes they would support you and pay something for you or apply for sponsorship for you. So, it depended on whoever you worked with. But my them really helped, mentored you while we were there, yeah.

Adu was also mentored by her supervisor and some doctoral researchers at her department. She detailed the mentoring procedure:

> So basically, before you started anything you would have created a proposal together. So, when I went there together with my supervisor some of the doctoral researchers, they will sit there and tell you, you're going to do this, this and that. And then maybe this doctoral researcher will introduce you to this technique and then you continue doing your experiment. All the experiment was with us, any problem then I'll go back to my supervisor, discuss the problem with him and then decide on what to do. How to solve the problem…? Yes, then go back discuss it and then find a way how to solve the problem or if the problem can't be solved, see what next you can do. So basically that.

She continued to identify the role of her supervisor in the mentoring process by stating that "the supervisor was like, sort of the person guiding me, and then solving a problem but finally I could finish the whole research."

Influential People. Participants described people who served as motivators and role models as they journeyed through basic to higher education. Female lecturers, wives of lecturers, and male and female supervisors were mentioned as role models or people who served as influential figures in their academic journey. Tiwaa indicated that she was influenced by the wives or the lecturers who graced their church in the village on occasions. She recalled:

> You know, I come from a village background. And I didn't have many people to
> look at. To see, to say oh, this person is this. But I remember when I was a little
> child at…. uh huh. Anytime we went to church, you could tell the wives of
> lecturers from Legon, we were 17 miles from here. occasions you will see
> lecturers and their wives coming to church in my village. And the wives, the
> wives of lecturers fan themselves. So, I said that me, when I grow up I want to be
> a wife of a lecturer, to be like them. So, then the thing unfolded and I did well,
> common entrance, so I went to…. High School, a very good school there. So, I
> said, well, if I'm here then I can be more than a lecturer's wife. I can be a
> lecturer, but I didn't know how to, because coming from that village and there
> was nobody from the village who trained as a lecturer was a lady.

Afrakomaa saw the only two female lecturers and a European lecturer in her undergraduate university as people who motivated her to go into academia. In narrating, how they influenced her decision, she said:

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Somehow, at my undergraduate study, during that time there were only two

female lecturers in [university] and they were our tutors at …. hall. They were in

charge of the halls and whenever I see them come there in their car and go and sit

in their office and students will have to go and confer with them, I felt motivated

that I wouldn't mind to find myself in this condition someday. Because in those

days, we gave them lot of respect. So, their presence there and then one of them

happens to be from my area, sometimes she invites us, those of us from the area

into her house. When you go into her house and you find the environment,

everyone had accommodation on campus, nice, well kept, lawns, the living room

was pleasant and then she cooks for us a lot. If I can also be in this position

someday and the respect we give them, those actually motivated me to go into

academia. And then one of my…. lecturers encouraged me, he said you will be a

very good teacher.

Owusua mentioned the lack of role models in her early stages of education but her

supportive male professor encouraged her to academic success. She stated:

I would say that it has not been an easy journey because in the first place there

was no, a problem of getting a role model to look up to. And then secondly, I did

my doctoral research outside the country, in…. and I was the only black student

among the foreign students and whites, and it wasn't an easy journey. I had a lot

of challenges. But because I was determined, I was focused, I managed to go

through. I would say that I had a professor who was quite understanding and very

supportive. He also encouraged me most and in the truth, I was able to make it

through. But it wasn't an easy journey.

Lastly, Gyamfuaa indicated she owed her outstanding abilities to conduct and understand the research process to her female supervisor in her doctoral program. In narrating the impact of her supervisor on her research capabilities, she mentioned that "I owe that to my supervisor and that has made me what I can say a good researcher now, so that's what stands out. That my ability to do research, my ability to understand the whole research process stands out."

Having a role model or someone to lookup to in the early stages of women's educational journey was an influential factor for the female participants. The success and positions of these influential people or role models was a symbol to look up to and work harder to achieve their status or even do better. The absence of these people to guide, encourage, or influence the participants would have affected their career path or academic success.

The 11 participants in this study had idiosyncratic and intriguing stories to tell; the participants addressed negative and positive experiences journeying through their doctoral programs in three different continents. Additionally, the intent of this study was to uncover the lived experiences and resiliency strategy the helped the participants to persist in a male dominated and in foreign and African nations to graduate. The study provided an avenue for participants to draw on their experience in their doctoral journey and voice out expectations that Ghanaians or Africans female students should expect whiles pursing STEM doctoral degrees in Africa and the Western world.

Chapter Summary

The 11 female faculty members in this study shared intriguing and challenging experiences from their doctoral journeys. Their ages, teaching and research experience as faculty members were varied. The majority of the participants were attained their PhDs in North America. Whether they studied in Africa, Europe, and North America, as women they were still expected to perform multiple roles/duties while they pursued their doctoral studies. The expectations were particularly strong, from fellow Africans who expected women to marry, have children, and also perform cultural roles such as cooking, caring for child(ren) and husband, cleaning, etc. It is important to note that although some of the married participants pursued their doctorate degrees simultaneously as their husbands, they still had to perform most of the sociocultural roles associated with females in their home. Their educational status or the presence of their husbands did not call for equal share of responsibilities but rather, they had to juggle multiple roles.

The issue of male chauvinism was more prevalent among participants whose undergraduate education occurred in Africa. On the other hand, Race and racism in higher education permeated through the accounts of participants educated in Europe and North America. Participants had to constantly prove their academic abilities to faculty members, staffs, and fellow students. Excellent academic performance was not expected from Black African students and their academic performances were constantly questioned. Additionally, participants expressed their dislike for the negative perception of African students. They were viewed as unintelligent, cleaners, and suspected culprits for lost or damaged laboratory equipment.

Mothers served as an important support system for participants who had a child or children during their doctoral journey. Mothers provided child care services so that time that would be spent caring for children could be redirected towards participants' academics. These participants ascribed their success to their mothers' constant support for their academic success. The African students and community also served as a strong support system for new students to settle in their new environment. Continuing students also benefitted from the African community. Faced with multiple the challenges such as pregnancy and having children during their doctoral journey, research and financial challenges, and performing multiple roles, participants were nonetheless resilient. Common motivational factors for participants' success were their desires to give up, determination to succeed, fear of returning home without a PhD, fear of disappointing their families, interest in holding the prestigious PhD title, and their dependency on God.

V. IMPACT OF DOCTORAL EXPERIENCES ON LECTURERS'/PROFESSORS LIVES AND WORK TODAY

This chapter present the findings for research question four. This chapter focus on the impact that obtaining a doctoral degree in STEM has had on participants personal and professional life. Additionally, this chapter focuses on the effects participants perceived that their doctoral experiences have had on their professional practice. In this chapter, participants speculated how the elements in their doctoral journey and lives converged or combined to convey them to their current situation (Siedman, 2006). The chapter hones in on participants' past to illuminate the events in their doctoral journey and how it drives them currently in their personal, and their practice of profession. Thus, "describing the concrete details of their present experience, establishes conditions for reflecting upon what they are now doing in their lives" (Siedman, 2006, p. 19)

Impact of Doctorate Degree on Faculty Members' Personal and Professional Life

Under this theme, I share responses from the participants which discuss the critical impact of the doctorate degree on their personal and professional lives. All the 11 participants agreed that the acquisition of a terminal degree in their chosen field of study has been an added value in different facets of their lives. They cherished their doctoral degree and the skills acquired through the process. Participants' responses have been grouped within personal and professional sections.

Personal Life

Participants mentioned that their doctoral degree has accorded them respect within their communities, academia, and among female colleagues. Two participants talked about how their experience has personally improved their relationship with

students. Another salient point made was the capacity to read, publish papers, and do research.

Respect and Recognition. Tiwaa, Owusua, Gyamfua, and Augustina pointed out how their doctoral degrees have accorded them respect and recognition in their personal lives. Tiwaa revealed that in her village, she was the first female to earn a doctoral degree. The village has bestowed her with respect. An additional benefit mentioned by Tiwaa is the financial aspect. She stated that she earns more than her siblings and that helps her to contribute more when they are undertaking a project at home. She recounted:

> Yeah, my personal life first. Even in my village, I was the first female to get a PhD. So, everybody respected me in the village. But I make sure that any time I moved, nobody recognized me. And then I will be walking in the village and somebody will say oh, as for your sister, [Tiwaa], she's blessed, she's gifted. I'll say yes, we noticed that when she was a child. And then I just go away. So, my personal life, yes. And even amongst my siblings, because financially, it has moved them a little higher than them. And when we're doing something at home, I used to contribute more because when we are given more, more is expected.

In addition, Owusua posited that her doctoral degree has brought about recognition in the society and within her family.

> Personal life, it gives me some kind of recognition in society and also in the family. When I came back and they call me doc and I was like wow, is this thing real? I was like hey, call me by my name, you know?

Likewise, Gyamfuaa acknowledged the value that her doctoral degree has added to her life. Although she indicated that her doctoral experience robbed of her social life, she

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mostly dwelled on the positive aspect of her doctoral degree. She does not brag about her educational level, but by how she models herself and her works, people get to know she is a person of value. She explained:

> My social life, when I was a PhD student I didn't have social life, and since I graduated it's been like that. I find it difficult going out to socialize when I know I have deadlines to meet, grants to write, papers to mark, and all of that. So, on the negative, my social life is gone. But on the positive side, it has added a lot of value to me as a person, and I'm not the type who goes about bragging, "I have a PhD, I have a PhD," but by virtue of the work I do, by virtue of how I comport myself, people get to know that I am a person with value. So personally, that's what I will say.

Finally, Augustina noted that the doctorate degree has placed her at a higher pedigree among her colleagues. She mentioned that "Personally as a lady with a PhD it gives you some standing if you're among colleagues. It gives you that outstanding nature. You stand out in person and then in my career."

Professional Life

Participants appreciated the value that their doctorate degrees have had in their professional lives. After graduation and entering academia, they have benefitted from their status as doctors. Participants mentioned some of the benefits accrued like attending conferences, improvement in research abilities, attainment of leadership positions, and being time conscious.

Exposure to Conferences and Trainings. Participants recognized the advantages that they have accumulated since they hold a doctoral degree and are faculty members in

their respective universities and departments. Afrakomaa asserted that she would have regretted if she offset her doctoral program because of her pregnancy. She was proud to have traveled around the world and presenting at conferences. She detailed how her doctoral degree has impacted her professional life:

> A lot, as for that I haven't regret a day, I would have rather regretted if because of the pregnancy prior to entering the program I didn't go, I would have regretted a lot. The opportunity to do that has propelled me because after getting my PhD and coming here, I had several opportunities to travel outside, things that I could not have done on my own, I attended conferences, trainings courses. At least I can also boost I know quite a bit of the world. I have been to several countries and it was fulfilling to me.

Similarly, Ellen also mentions the benefit of attending conferences, and submitting her works to be published in book chapters. She admitted that she can publish in both science and social science journals although her doctoral degree is in science:

> …. like I was telling you, I took so many courses that now, although my background was in science, now I can publish in the science journal. I can even publish in social science. Because you know, I learned all those ways of doing things. Professionally, like I said, there's attending conferences, networking, submitting book chapters and all those things, it has really helped me come this far.

Increased Knowledge to Work and Conduct Research. The expectations of having a doctoral degree and reading widely has broaden the knowledge base of participants. After acquiring a doctoral degree, professionally, participants stressed they

had greater familiarity with conducting research and applying the specific techniques of their fields. During the interview, Augustina described how reading widely has increased her knowledge and how her instructional skills helps her to teach her students:

It has increased my knowledge because of the reading round that I have done that's increased my knowledge. And in my teaching, I have more experience and I know a lot that I'll be able to deliver to my students.

In like manner, Gyamfuaa also believed that the doctoral degree has increased her ability to understand why certain thing are done in research and it has added value to what she does:

Professionally, it has added a lot. Before the PhD, I was doing research, and there were certain things I didn't understand. It was in my PhD program that I got to know why you must do certain things in research. I can't describe myself that I was a good researcher prior to PhD. I became a researcher after my PhD. So professionally, it has added a lot of value to me…. So professionally, it added a lot of value to what I do.

The impact of Adu's doctoral degree was in two-fold. The first impact she reported was conducting research in an ethical way. She stated:

Professionally, I think within every organization there are rules and regulations. One thing that I learnt from my supervisor is that if he knows that thing is illegal, he doesn't even encourage you to do it or engage in it. So professionally it taught me that, you need to abide by the rules and regulation of the organization in which you're in. You need to do everything ethically. When conducting research, you

state the results you have, you can't concoct it. It was easy, these days it is easy

for somebody else will easily find out.

The second impact mentioned was that her doctoral degree has aided her to understand

some current techniques in her field. She stated that "professionally, it has helped me to

know some of the current techniques that are there in my field which I wouldn't have

known in any way that I can apply."

Effects of Doctoral Experience on Faculty Members' Profession of Practice

Becoming a scientist—actually, becoming an academic or scholar in any field—is

not simply an issue of matter of formal learning and evaluation in definitive or particular

domains of knowledge (Delamont, Atkinson, & Parry, 2000). For example, to become a

biochemist, say, includes other thing other than just learning biochemistry. It additionally

includes the procurement of broader cultural knowledge and individual experience

(Delamont, et al., 2000). One must learn not just about biochemistry, one should likewise

learn what it is to do the science, and be a biochemist (Delamont, et al, 2000). 'This

depends on socialization into the culture of the discipline. It also rests on a crucial shift

from the kind of learning that is characteristic of secondary schooling and undergraduate

education (Delamont et al., p. 1, 2000). This theme addresses research question four for

this study. The doctoral experience that the participants described in their stories goes

way beyond conducting laboratory research and classroom learning. They immersed

themselves both into the culture of their disciplines, and into the culture and society of

the nations where they acquired their degrees. They additionally learned the way of life

and how things were done in their new environment. They imported the good elements

into their teaching, mentoring, research, and life. Although all participants viewed

doctoral journey to be tough, they cherish the experience and would not trade it for anything.

Timeliness

Participants mentioned timeliness as a characteristic learned from their professors and from the Western environment. The lack of timeliness on the part of some people in the African society was an issue for participants who dwelled on timeliness. African time is a wide-spread term used among Africans. The *Urban Dictionary* defines African Time to be "when one says they will arrive at a certain time, but arrive much later." Some people use this excuse to be untimely. Adu commented on the norm of timeliness in the European country where she attained her doctoral degree. Her experience in that society trained her to respect time because everything runs on time:

Secondly, to respect time also. I mean there you know that the system runs with time, the bus is moving with the time, the train with the time. So, it made me more time conscious which personally I think is helping me.

Nari stated that she likes things done on time and being time conscious and getting jobs done with few excuses. She believed that her doctoral experience has made her who she is today. She mentioned that "I think what I am today is because of all the experiences from my past even not just the doctoral experience but everything…." She further explained how her experience has shaped her expectations:

I have mentioned and I have talked about professional aspect like getting the work done …. Well I am referring to my supervisors. It was as if I always looked for the toughest and the most difficult ones to work with. I don't know whether I have turned into one of them. I hope not but I did gain certain experiences. So, I have

certain expectations of my own work. I have expectation of the quality of work

produced by my student. I have expectations of even my colleagues. I mean if we

are working together and I realized that they are not typical for our environment

here and I think all of these expectations are shaped by what I went through. So, I

worked in a place where there are high standards and I told you about the time

consciousness, professional behavior, attention to detail, and I have modeled my

life, few excuses, and just get it done.

Esther also reported she learned timeliness through her doctoral experience. She respects

time and tries to finish whatever work she touches in a timely manner. She gets frustrated

when meetings are delayed in her department. When asked what she got from her

doctoral journey she responded:

I have more confidence in whatever I am doing and I don't differ. My personal

life, when I touch a thing, I make sure I finish. And finish on time. Timeliness is

what I got from the PhD journey. So, I get frustrated when we have meetings in

this department and in the university in general and they will say 8:30 and they

will start at 9:00. Yes, up till now I am frustrated.

As stated earlier, Esther held a position in the African Student Union in her university

and she disliked the attitude of the students because they were not time conscious. When

the students were questioned about untimeliness to meetings, their responds were that

"after all, we are Africans." She described the experience disliked about the African

students:

An experience that I had that I didn't like was with the African students' union

there. They didn't come to meetings on time. They breeze into meetings and then

they will say after all we are Africans. So, I was made the…. of the African

Students Union once at…. and I didn't like the attitude at all. I work in the lab I

come over for meetings and have to wait for an hour for them before I go back to

my work. So immediately my term was over, I disappeared from the African

group.

Finally, Ellen described the timeliness learned in North America. She specifically

highlighted on hard work and timeliness when sharing her experience. She explained that

"yeah, it's the way the system is. You work hard, but they have their timelines too, you

know."

Compassion and Respect for Students

Genuinely some students encounter challenges that affect their academic

productivity. Understanding the struggle of students as they battle to achieve higher

education is imperative for the participants. In 1966, *Bob Marley and the Wailer* released

a track titled *He Who Feels it Knows it* and the title of the song explains why the

participants understand their students because they struggled and battled challenges as

they journeyed through their doctoral program. Their experience made them develop

compassion for their students. Nari admitted that she has come to the realization that we

are all humans and at a point, go through struggles. She recounted how she understands

her students:

> …. personally, I also realized that people may be going through things and we are
>
> humans after all…so there is the human element …you see a student you don't
>
> just look at them… there is something behind…so everybody had their struggle
>
> and so I try to understand that part as well.

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Esther has developed sympathy for her students who for reasons beyond their capability are unable to submit their assignments. The sympathetic behavior stems from her experience with her former lecturers, academic staffs, and staffs of an institute where she was affiliated with. Although she has sympathy for students, her experience also made her strict. She explained why she has developed such a stance:

> I think the positive experience I had with my lecturers, academic staffs and staffs at …. institute made me both strict with the students and sympathetic. Now, I would like to explain. I am sympathetic when students are unable to complete their assignments because of circumstances beyond their control. But when students do not complete their assignment for no reason, I am very strict on them because of my training of submitting work on time. So, I don't sympathize unless there are extenuating circumstances that the students couldn't avoid.

Lastly, respect for students permeated through the accounts of Adu. She treats her students with respect because she sees them as her clients. In class, when she advises students on academic and nonacademic issues, she does not dictate it to them or shove it down their throats, rather, she leaves the onus on the students to decide whether to take it or not. When answering the question on how her doctoral experience has affected her practice of profession, she said:

> I deal with my students respectfully but formally, politely as if they're clients. I don't disrespect them. I try to do things as much as possible to the standards that I think are best and I know the standards I can do but I think it we're supposed to do the international accepted standard but I know as much as possible. And then I try to do this ethically and thoroughly also…. So, the way I said earlier, even in

class, when I'm teaching and I want to give an advice, I don't give it as if it's a final way, you have to take it or take the highway. It's an advice, I just teach them, advise my students and hope that they see some good sense in it but I don't force it down their throats.

These three participants were hugely influenced by their doctoral experience to understand the struggles that their students bring to their classes. They understand their struggles and treats them with respect. Also, Participants expressed how earning degrees and going through a rigorous process to attain a doctorate degree has improved their relationship with their students. Adu stated that as a lecturer, she has compared her undergraduate environment and how students were treated by professors. She uncovered that lecturers and her supervisor in Europe were not as intimidating, so with a doctorate degree and as a lecturer, she took the position to respect her students. She described her doctoral encounter with professors in her institution in Europe:

> Okay, personally I realized or later contrasted the doctoral environment and with the undergraduate environment both where I studied most people are started at…. and…. And then I took the positives from the doctoral ones, of course I seen the undergraduate environment already. So, when I look at the doctoral, and took the positives. For example, I realize that there the lecturers and the supervisors are not intimidating. They sit down with you and discuss exactly what you're supposed to do and they don't behave as if they're, how do I put it? They're not intimidating, even with their undergraduate students, that's one thing I learnt that, you don't have to intimidate our student. You can get your point across without insulting them or disrespecting them. That's one thing I learnt there.

Similarly, Ayisi noted that as a Lecturer/Senior Lecturer, she believes it is prudent to be patient with her students. Her journey through the program has made her understand students well. She wants her students to feel happy, comfortable, and does not want to meet any unpleasant experience on her students. She said:

Personally, I feel it opened my eyes and it made me realize that life is not so straight forward. You face challenges, you see problems but you have to tackle them head on…. I mean I feel that through that I understand students well. So as a [Lecturer/Senior Lecturer] I think I am a little patient with my students. I try my best to help them and I try to avoid the things that were done that made me very unhappy and uncomfortable. I try to avoid myself from meting out those same experiences to them, so maybe like discouraging them; I try to avoid all those things. I try to encourage them. Of course, if the need be they are recommended I do so.

Augustina feels as a Lecturer/Senior Lecturer and the only female faculty member with a doctorate degree, she serves as a role model for the female students in her department. She feels encouraged to help students who comes to her for advice:

They look up to you. They want to be like you. So, they come to you to ask for advice and what to do to be like you in future. And I feel very encouraged to be of help to them in their lives. They see you and they know that one day I'll also be like her if I study and do well in my studies.

Owusua believes that in addition to the doctorate degree giving her respect and recognition, it has made her a role model for her students. She posited:

But it's actually given me that recognition, that respect, and served as a role

model for my students. Anytime I enter the class and I introduce myself, they say

wow. You know. It's a quite encouraging and then I see that yes, I have actually

come far.

Participants realized that being positioned to serve students, it is important to

build a relationship with their students by breaking down the power hierarchy where the

faculty member is seen as powerful because she has a doctorate degree and the student

might either be pursuing either a bachelor's, master's, or terminal degree. When a

relationship is established, students can freely approach the lecturers and professors and

seek guidance and counseling.

Ability to Hold Positions, Chair Programs, and Do Research

As stated earlier, the journey through a doctoral experience prepares and trains

students to handle both academic and non-academic challenges. Three of the participants

asserted that their doctoral experience equipped them with the ability to teach, research,

chair programs, and hold academic and student affairs position. Tiwaa revealed that her

doctoral experience has humbled her. She has headed her current departments and a

residence hall. She uses experiences accrued from her Master's and doctoral program to

teach and guide students through the writing of their thesis:

Well, I think it has really helped me. Because I went through thesis preparation

and everything, so now I have lots and lots of postgraduate students. And I think

even though a lot of things have changed, the general trend is the same. So, it

helped me not to read before I teach, because a lot of things are already in my

head. And so even currently I have one PhD student and I have a number of

MPhil students, even though I have retired officially. You see I'm doing part

time. Yes, I have a lot of them and I use my experience at…. and my experience

in.….. The training, had changed my attitude to life in general. It has rather

humbled me. And so, when I speak, they listen…. I became head of department, I

became hall warden, of the hall. Six years, I was the hall warden of… hall. Taking

care of the, everything about it, hall warden. So, it was nice. And here. So, I am

the oldest member here. So, if they have a problem, they call on me. And if they

have disciplinary issues, they ask me to chair function, and when I spoke, many

people respected, at least for my age.

Similar to Tiwaa's benefit in her doctoral experience, Owusua asserted that her doctoral

experience has equipped her to perform roles such as chairing events, taking up executive

positions, and students calling on her to speak on topical issues at their events. She stated:

It has actually affected my practice positively. In a sense that it has actually given

me a lot of experiences and opportunities to perform and even go higher. And I

had opportunity of being called upon to chair some functions and also to take up

certain positions, executive positions. And also, students calling on you most of

the time to come and give talks on topical issues for them. You know, and also,

in the classroom, as well, being able to handle, you know, I've gained a lot of

experience of handling and understanding things better because it was a real

exposure. Yeah.

Afrakomaa and Tiwaa share shared an identical view that the doctoral experience trains

faculty members to personally conduct research and additionally, supervise their students

research:

I think is rather positive, very positive, extremely positive. For one thing, by the time you go through your doctoral course, you will very well know how to carryout research and also you will know how to supervise students to carryout research. You cannot acquire this if you haven't gone through the doctoral courses.

Ultimately, Ayisi also mentioned the ability to collaborate with others to work on a research project. She has learned to approach people who she believes are a good fit for her study:

Well I think it affected it positively. Like I mentioned earlier I think it is quite related to the first question. It sorts of opened my eyes and helped me at work. It also helped me collaborate with people with regards to research so if I need help I ask, if I want to do a work and I feel another person can be involved, I am able to approach and discuss and approach the person, discuss the kind of work and get things done. I think generally it has been positive.

The experience acquired from participants' doctoral journey was varied and at the same time similar Their experiences have equipped them with the knowledge and attitude to hold varied position with the university community. Additionally, they can guide their students through their dissertation and collaborate with others to research.

Advice to Prospective Female Doctoral Students

The era of females playing a second fiddle to men in STEM and society has not been totally eradicated. Although there has been an improvement, it is still prevalent in our societies. The experience of going through the doctoral program has equipped participants to advise and encourage female STEM students who have the desire or wants

to pursue a STEM doctoral degree. They also shared words of wisdom to female STEM students who are already in the field. Each participant shared a piece of advice and words of encouragement for all female student. All participants agreed that it is imperative that any female student nursing the dream of pursing a doctoral degree in STEM must go for it. First, Tiwaa, Afrakomaa, and Priscilla encouraged prospective and current female STEM students to pursue their dreams of attaining a doctoral degree. Tiwaa encouraged female STEM students that they are on the right path and must continue to make a difference in their communities:

> I will tell them they are treading the right path and they should continue. Now we need knowledge. Now first degree is like the O level. You have to move on to make a difference in society. Whether female or male, now life is different, not like before, like our parents. We are all contributing whether we are a female or male. The kitchen is no longer our place. The kitchen is for all of us. So, move on. If you have the talent, move on. I will tell them, I will encourage them to move, and if there's anything I can do to help, I will. Particularly the ladies. And I realized that ladies have something unique. Because we are more careful. You see, we are more careful and we don't take risks. So, when we task something we do it well. That's what I have seen.

Likewise, Afrakomaa encouraged and motivated female students. She believes they have the capacity to excel in the doctoral program because they have been good students in their undergraduate and master's program. She advised:

> I would encourage them that its good. I will motivate them and most of them who wants to go there would have been very good students at the undergraduate level.

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I will advise them, they are capable of doing it, only if they will focus and when

they do it, and acquire it, they have empowered themselves. You get the personal

confidence and satisfaction to be able to stand head to head with other colleagues

being it males or females. You also know you are capable, so I encourage them.

Next, Priscilla specifically encouraged Ghanaian female students to pursue a doctoral

degree but they should identify a problem within the society, go out to attain a doctoral

degree, and return to help Ghana:

Well, I encourage them that there is so much that one can learn and after that

there is so much that one can offer and that they should look at or identify

problems in our society in Ghana with regards to Science and then go out there

and pursue higher degrees and come back and help

As Tiwaa, Afrakomaa, and Priscilla encouraged female students, Owusua, Nari, Ayisi,

and Augustina alerted them that they will encounter challenges but they must persevere

and conquer them. Owusua advised students not to be afraid or discouraged about the

doctoral journey but rather, they must admit that science is for both gender:

The advice I would give them is to not be discouraged, not to be afraid. Science

is for everybody, it's not only for men. They can do it and they can even do it

better. They can achieve what they want irrespective of the challenges that we

face as females, especially when you want to corporate with your gender roles,

once again gender role has come in.

Nari encouraged female students to pursue STEM doctoral degrees and also advised that

there will be frustrations which will test their limits. She advised students to seek for

education because the knowledge and experience is for the student to keep forever. Finally, she wished them good luck:

> You don't just get into it because you want the title and want to be called a Doctor… so if you have decided to do it, make sure your decision is based on some aspiration you have. It is part of your future goal because things will get hard. There will be days that you would want to quit and if you don't have that goal or the reason why you have decided to put yourself through it in mind, it is not towards any objective…and if it is just for title then please think about it again. I mean everything else, if you make money, your money can be taken from you. If you acquire books, those can go somewhere, but the knowledge you get and the experiences you get, that one is yours forever. So, treasure them and good luck on your journey. And please pay forward…if you are young woman going there are not too many of us …so once you have gotten to a certain place try and bring some other people along with you.

Ayisi advised students to pursue a doctoral degree in STEM but she added that there will be challenges. She stated:

> I will advise them to go for it and pursue, aim higher, face all the challenges head on and finish. The light at the end of the tunnel is quite bright. It's worth working through it…. Generally, they should have a positive outlook to every challenge that they are solvable so depending on the kind of challenge then it will show the kind of advice I give but generally I think every challenge is solvable.

Augustina acknowledged the rigorousness of a doctoral program but would encourage them they can be successful with hard work. She detailed that "it's not an easy task, but if

they put in extra effort they'll be able to complete. All you need is to work hard at your chosen area. And then with determination we'll be able to complete." Other participants gave varied advice to female students. Adu noted that if the participants have the ability to pursue a doctoral degree, then they should go for it. She detailed that "I would say, if you've the flair for it, you've the head for it, you've the time for it, you have the passion for it then go ahead and do it. And of course, if it fits in your future plans, why not?" Ellen advised that students should focus on completion and not wasting time:

What I always tell my colleagues, especially those who are doing their PhD on campus is that they need to focus. I mean when you want to do something, you want to focus on it and get it over with. But you realize that on campus, people are doing galamsey here, they end up taking 10 years, you know, for their PhD. I believe there's time for everything. When you decide to do something, you need to focus on it. You need to make the sacrifices and then get it over with it.

Esther provided three key recommendations for future and current female STEM doctoral students. Her first advice for students was to pursue a doctoral degree from outside Africa so they can learn how things are done from a different perspective. Second advice was for them to take a year off after completion of their Master's degree, and the third recommendation was to work for a year to accumulate experience and build self-confidence. She explained:

I keep telling my students, when you finish the masters, don't do the PHD here. Go and get another experience, how they do things in another country differently not in Africa but how they do things outside Africa, so that you can get the experience of hard work and independent work that you need to succeed.

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Her second and third pieces of advice included:

> Well I would advise that at least they work for one year and pick up so that they become a little more matured. Now maturity helps in building self-confidence early. When you are not confident in yourself and you get into an institution where the lecturers are not firm towards blacks, your self-confidence or image will be destroyed.

She explained the idea of students taking a year off and working:

> Because me, I was matured and nothing they did registered with me. Like I told you my experience with the technician. It didn't register with me. I just ignored it but some younger person may have been hurt. When I look at the younger people now coming, I see they have led a sheltered life. In Ghana, we are sheltered. When they come into contact with discrimination, they would be shocked.

Gyamfuaa also shares the same view with Esther. She admitted that it is essential for students to travel outside African to pursue a doctoral degree. She suggested that students go to a country in North America to pursue a doctoral degree:

> Interesting. In fact, just two weeks ago, one of my past MPhil students who wants to do PhD came to me and wanted to know where to go, and I said, "The best place to get a PhD is in America. But of course, you have to pass GRE and you have to have money to pay your fees." And so, she asked why, and I said, "Let me just use myself as an example." That's was what I was telling the student. I said, "In this school, how many of us have PhDs? And how many of you run to me? That's the difference. There are a lot of us with PhDs here, but every student wants me to see their work. That's because of my background, because of the way

I was trained." So, if we take a PhD from the UK for instance, they go with a proposal, and if your supervisor likes it then you move on and do your research. South Africa, it is the same. In the…. you can't get away with it like that. I sat in a classroom for two years taking courses, making sure I understand what I want to do in my dissertation before I even moved to the field. So, two years, and many of the courses I took were on statistics.

Participant utilized their experiences and especially challenges encountered to advise their fellow females who are nursing the desire to pursue a doctoral degree. These are beneficial statements that must be taken into consideration before and while in the doctoral program.

Mentoring and Advising by Gender

Faculty advisors assume an essential role in the progress and advancement of graduate students (Primé, Bernstein, Wilkins, & Bekki, 2015). A group for which the advising relationship has appeared to be particularly critical is women in science, technology, engineering, and mathematics (Primé, et. al., 2015). All participants affirmed that they mentored and advised students. The mentoring of students was executed differently by participants. Participants who mentored students based on gender and needs developed a mentoring procedure to meet their demands. Other participants mentored without focusing on gender. Ayisi justified reasons for such gender-differentiated method of mentoring. When questioned if she mentors and advises male and female students the same or treats female students differently, she affirmed that there is a little difference and that she is gentler with female students. In explaining her strategies, she detailed:

I think it is a little different. I think I am more gentle with the female students than the male students. Of course, I have been there for a year and a little more so I can't really say. I think it depends on the problems or the challenge, let me put it that way. But in my mind, I feel the female students are more fragile. That's not fair but the female students are more fragile so I am more gentle with them but with the male students I am like "hey be tough, you are a man" which is, should I say, a little gender bias but I find myself doing that.

In the same way, Afrakomaa explained that she advises and mentors students equally when it comes to academics but there are avenues where she sees gender. She mentioned that "When I advise them on academic basis, it will be equal but when it comes to gender, I also share things concerning gender with the ladies." Augustina believes that she mentors and advises students in an unbiased fashion but she thinks females have specials needs. She also agreed that she might be biased in a way because she talks to female students in a special way "as ladies." Her assertion equates the postulation of Ayisi who said females are fragile. Augustina also stated that women are soft. In responding to a fellow-up question as to whether there is no bias in her mentoring and advising process, she said:

No. If there is any bias I talk to the ladies in a special way as ladies, because we have special needs. We are not that hard. We are soft, so I just try to be soft with them and encourage them to know that they can be whatever they want to be…. I tell them all that they need to know in their studies in terms of what to look out for in their thesis write-up. I guide them how to look for information and all that, because I've also gone through the same process.

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Adu shares the same view with Augustina. Adu stated that she mentors students impartially but she would discuss some issues with female and not with male students. She indicated that "So far I think I mentor them the same. It's just that some issues I can discuss with the female, might not discuss with the male. But in general, I deal with them always the same way." Tiwaa concluded that when she is approached by both genders, female students have genuine problems but the male students come for money. She outlined her mentoring and advising of students:

> Oh, it depends upon the problem. The male students, when they come, they all
> need money. And when they take, they wouldn't give it back. They will say oh
> my aunty will… so when you give, take it that is a dash. Don't tell him but you
> don't pursue it. The male students, they come for money. But the females have a
> genuine problem. Somebody come and says oh I am sick; I have white (vaginal
> yeast infection). Are you sure you have white? Have you been to the hospital? If it
> is…. there is drug for it. Why are you sitting here crying? Go to the hospital.
> Now we have NHIS, go with it and get. So, you can't say you cannot come to
> class because you have that. You see? And you depend upon that situation. You
> have to counsel them.

On the other hand, five of the participants posited that they mentor and advise students equally and impartially. They treat their students equally and do not want female students to feel that they need any special treatment. Gyamfuaa articulated that she mentors students without bias and threats them the same. She recounted:

> I will treat female students in the same way I treat male students. There's no
> discrimination, but I mentor based on my teaching philosophy. I believe that

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every student knows something. I don't believe that they don't know anything at all. I believe that every student knows something, so what I need to do as a teacher is to guide them so that they don't fall out of the way. The way I do it at the graduate level is different from at the undergraduate level. In fact, at the graduate level, in Ghana, graduate students see their lecturers as superior, somebody up there, and they are down there.

Nari likewise claimed to mentor and advise women and men equitably. Mentoring and advising students equitably was the assertion of Nari. She chronicled her mentoring and advising of students:

Actually, I don't try to make too big of a difference between the male and the female students. I actually let my mentees, let me know what it is they want from the mentoring experience. So, depending on what the person is looking for I try to adjust my mentoring to the individual support. One person may have different experience with from the other. I don't have a standard way of mentoring people. In terms of my student even right from the beginning we talk about expectation …so we know what we are each doing. There are people who ask me for formal mentoring. I appreciate those people because they know what it is that they are coming in for.

Esther's style of mentoring and advising students is identical to Nari's. Esther's mentoring procedure depends on the seriousness and the demand of the student. Also, she selects hardworking senior students to mentor. She narrated that "See, it depends on how the student pushes. If the student doesn't push, I don't mentor them. So, because I teach a core course, all final year students go through my course. So, I select those who are

hardworking, who I know are going somewhere and mentor them." The follow-up was whether she mentors students impartially and she responded affirmatively "yes, yes." Priscilla also confirmed that she mentors and advise students equally. She mentioned that it is "the same mentoring that I give to them."

Lastly, Owusua has two methods of mentoring and advising of students. First, she advises students in class equally, then she will contact students who need more help. She tries to bridge the gap between male and female students by informing the female students that science is for everyone. She does not discriminate and does not want female students to feel that they must be treated specially. She detailed her mentoring style:

I do the holistic one in class. A few who come to me, I do it, but I also send them out to the females. Why, because I feel they need it. They need it. Because they always assume that it is not for them, it is for the men. So first of all, I must create that awareness that it is for them as well, it's not really for the men. So, the women can do it, the men can also do it. So, once you get them out of that coat and you put them on a platform where I can also do it as the men are also doing it, you have scored points. And now how do you get them to move along with it? Now you must build their interest on.

She further explained:

So first of all, you must take them from where they are and bring them to that platform and now help them out..… So, the holistic one I do in class, I take my time to let them know that it is possible and at least some in the class get it. Some females get it, so I don't have any problem. So, once they get it, I see their performance and I say they are excelling. But those who come to me or those that

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I single out and I see that they have problems because as I mark their work, I identify and I just indicate that see me..... But when I write see me, whoever comes, I look at your issues. So, I treat all of them equally, actually. I treat them equally. The females will come to me, I treat them equally, but when I see that you still need more, then I go beyond. Because I don't want them to, in class, I don't, let me say, I'm not partial. I don't do partiality. I don't discriminate in the class. Because when I do that, then the females are expected to be treated special. No. I let them know that everything is equal for everybody. They must also strive and get it. You know, so, but when they come to me, then I work further with them.

Based on the participants believes, she identified strategies to mentor and advise students in her class. Whether holistically, biasedly, or impartially, they all believed that the end goal was to mentor both male and female students to academic success.

Recommended Changes in Laboratory and Classroom

Based on participants experience as students and faculty members, they were questioned to recommend anything they think should be changed or improved in their former department and laboratories that can improve the experience of female students. Additionally, the current situation in their laboratory and other general issues were addressed. Recommendations raised ranged from equipping laboratories, providing access to laboratories in different departments, instituting mentorship programs, financial support, inter group research, and women taking breaks for child birth and having flexible working hours. Priscilla prayed for access to other departmental laboratories for students use. She noted:

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In the lab, what can be changed is the access, access to the lab, to various labs. So, with my supervisor's lab, there is no problem, I could go there anytime but we had to access certain labs in other departments and that was sometimes disturbing because you know to enter your building you needed… sometimes your ID wouldn't work, no it wouldn't, and during weekends too some of them lock automatically after some hours.

Tiwaa's issue was with inadequate laboratory equipment for the increasing number of students admitted s into the department. Her desire is for students to be exposed to the practical aspect of the program. Another issue raised was her dislike for allowing students to narrow their scope as they journey through their program. She explained:

Yes. When we were students, we were few. So, whatever facilities were there, microscopes or whatever, was sufficient. Now, we have lots and lots of them. And so now the practical aspect is like nothing, zero. To me, it doesn't work well at all for the science student, whether male or female. I have been telling the students that we must devise a way of giving them the practical exposure. One of the reasons why they don't apply, because we give them the concepts, theoretical background, yes, and then that's all they have, they are not able to do the application of what they have because they have no hands except Biomedical science. Biomedical science they do a lot of practical. They even cut dead bodies and what have you. And then I think Molecular Biology, Biotechnology, I think…. too we have not. Things must change. We must have good laboratory for students to really work. That is one thing. One thing if I have authority to change is that it's good to have a broad background and as you are going up, you narrow

them. We had broad background. I did the whole of…., I did the whole of …. I

did the whole of education. So, wherever you are, you don't, you have the

confidence to face anywhere, in any direction. Because I was made head of

department of… it was then…. But because of my general…. background, it was

not a problem. I fitted in very well for the three years before I handed over to

another person. So, you need, when they come in, they need a broader

background because at that time the brain was sharp as young people.

Similarly, Ayisi advised that the faculty and institution must provide the needed

equipment for the laboratory. She added that there should be an institution of mentorship

programs for students. She said:

I think the faculty and the institution should invest in equipping the labs properly

because most of the work we do is lab work so I think they should invest in that.

And then maybe they can even set up mentorship systems or programs for the

students. So aside your supervisors you probably have an academic tutor or a

mentor who you can talk to, share your challenges with and who will encourage

you move on or make proper progress.

Augustina also recommended that there should be an improvement of facilities in the

laboratories. She asserted that without furnished laboratories, students cannot carry out a

meaningful research. Also, she stated that a well-equipped laboratory will not delay

students research progress:

What I would recommend is not to change, but to improve upon the laboratory

facilities, because without laboratories you will not be able to carry out any

meaningful practical to come out with results. And so sometimes you are stuck

with no place to carry out a specific experiment and even if you get a place, the chemicals needed are not available. And so, you end up being delayed or not being able to carry out a specific objective because of that. If that could improve. You know in Ghana we don't give much attention to science and technology. All that we know is our politicians and all those things. The facilities to build up world class laboratories or experiments to go on to come out with results and innovations are not there. I think that can improve.

Esther recommended that the department must promote group work and presentation of seminars by students:

As I said, because I was in …. institute most of the time, I didn't have the same experience that other students had who were in the department. But I think the department should encourage more presentation of seminars by students. And they should encourage group work. See, most of the time we were working on our own but I think group work, theme work would be better, preparing us better for the employment or work market because you have to work in a team.

Nari rooted for intergroup research which will serve as an opportunity for students to learn from their colleagues in other groups:

Maybe more collaboration with other lab… I don't know how things have changed now. But when I was there, like I said, you did everything in the lab. Your supervisor is there. If another supervisor or professor is talking to you, completely, is not in the formal or an encouraged setting is just because you want to …but if there was more of an opened opportunity for more interaction across

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groups…research groups, that would help because then you learn what happens

elsewhere making you get too wise.

Owusua advocated for women to be given time to take breaks for child birth and be given

lesser and flexible working hours. To entice women into the STEM domain, these

conditions should be met. She said:

Oh, there, I think I said it earlier on, that females are given equal opportunities.

So, I don't see any distant there. Probably in a general sense, where they have to,

somewhere along the line, break, go and make families, give birth and come back

where they have to be given more or less hours to work, so they can make time

for bringing up their children. You know, it's also very, very important. If they

have supportive husbands or fathers who are ready to help, then they will be

available to do their work. But we should be given flexible working hours. That

flexible working hours is very, very important. So, I want that to also be, if it's

not there, it should be there. If it's there, it should be improved so that women

can be comfortable. Because that's one thing that holds them back, that if I go

there, it means I cannot make time for the family, I cannot give birth, I cannot do

this and I cannot do that. But when they see those facilities in place, then they

can conveniently come. Because some of it is not that they cannot do it.

Finally, Gyamfuaa advocated for jobs to help curb financial problems for international

students. She told her story of having inadequate funds to support her daughter and the

high cost of rent.

Well, the biggest challenge I had was financial. Financial in the sense that I had a

scholarship that was paying my fees, but I also needed to work to be able to

support my daughter, and in [North America], international students are not allowed to work outside campus, and then the on-campus jobs were, the pay was small. At the time, it was $7 an hour. And then for many of them, you even apply and they tell you the job is for undergraduate students. So, it was very difficult as an international student to find a job to support my finances. So that's something that I wish they could do for international students, and I wasn't the only one suffering that. A lot of us international students had that problem….

She also touched on the issue of racism and accommodation for international students:

Race, it was kind of concealed. Some people were doing, but the problem was there. Another thing that I wish they could change was the accommodation for international students. What they claimed at the time was manageable for students was expensive, especially for we African students. I remember before I left, my rent was $850.

Whether a negative or positive experience, the participants appreciated their doctoral experience. The experience has shaped them to give back to society whether through serving on academic and nonacademic position, or through advising of students. They learned from the positive aspects of Western world such as timeliness, respect of students, and improvement of student faculty relationship. The experience has encouraged them to be hard working. Furthermore, participants understand their students because of their personal encounters and challenges in the journey. Despite the challenges and barriers in their pursuit for a doctoral degree, there is consensus that, it was worth enduring the pain and persisting to graduate.

Chapter Summary

The findings of the study addressed the four-primary research question postured for this study, and explained themes and subthemes, and bolstered with participants' stories, along pertinent research findings. The findings uncovered sociocultural expectation in Ghanaian society which placed a burden on women seeking doctoral education. The expectation ranged from cooking for the family, being a caretaker of the house and children, and additionally focusing on their doctoral education. Having a strong supportive system such as a husband or parents help reduce the stress of joggling multiple role. Six of the participants had their husbands concurrently pursing doctoral degrees. Some supportive husbands supported with traditional female duties such as cocking and taking care of the child(ren). Mothers of participants played an essential role by taking up the role as nannies to divert some of the traditional motherly responsibilities of the participants who had child(ren). Departmental and institutional support also played a key role in the success of women in higher education. In addition, the issue of racism and gender discrimination in higher education was known to affect the emotions and academic success of female Black African students. Mentoring in doctoral programs is a platform to create success for students in general. The finding uncovered inadequate institutionalization of mentoring structures for the success of the women in their doctoral program.

The experience of participants' doctoral journey had an impact and effect on how participants advise and mentor their students. Additionally, their experiences have affected their relationships with their students. Participants adopted the positive elements and characteristics from their supervisors/chairs/advisors and countries where they were

educated. The plethora of challenges essentially influenced the participants' experiences in their doctoral programs, yet, substantially, the fear of being called a failure or disgrace to the family, the desire to return to Ghana with a doctoral degree and fulfilling the requirement by their employees and scholarships was a strong motivation to spur them on to graduate. Also, the women possessed the resiliency strategies such as inviting their mothers over to help care for their child(ren) whiles they pursue education, adaptation of supervisors as mentors, taking a break to have children, and the zeal to fight gender and racial discrimination helped them to persist and graduate.

VI. DISCUSSION AND CONCLUSION

What are the lived experiences of Ghanaian female STEM lecturers'/professors' doctoral journey? Reviewing the literature uncovered the positive and negative experiences that women encountered in STEM fields which tend to be male dominated. The historical backdrop revealed how men or boys were given preferences in getting education and how colonial rule has contributed to the underrepresentation of women of color in STEM education (Bardley, 2000; Espinosa, 2008). Women of color navigating higher education experience barriers such as juggling multiple roles, race and gender stereotypes, and financial concerns and access to resources (Snyder, 2014). Women in Africa are also expected to perform numerous tasks for the family in the house than their male colleagues (Dolphyne, 1991).

The review of literature additionally clarified how women/women of color encounter gender bias and encounter racial biases in higher education. Women of color are expected to participate in certain gender stereotyped careers such as teaching and are stereotyped based on gender when accessing education (Biraimah, 1987; Snyder, 2014). Additionally, socio-psychological and cultural issues were identified in the review of literature as potentially posing barriers for women. Postcolonial African women traditionally encounter exploitation and oppression (Tyagi, 2014). They also encounter exploitation intellectually, politically, socially, economically, sexually, and religiously (Wachege, 1992).

Exploring and examining the lived experiences of Ghanaian female STEM lecturers'/professors' doctoral journey was the purpose of this study. Through this examination, the lived experiences of Ghanaian female STEM lecturers/professors could

be analyzed critically. 11 participants were recruited for this study and they shared their journey in pursuance of a STEM doctoral degrees.

Chapter 6 presents the exploration of the research findings in five sections. The first section examines the discussion of key findings. Section two details the conclusion of the findings. Section three offers the recommendation for policies and practice for stakeholders. Section four offers recommendations for future research. The last category focuses on the reflection on the research.

Discussion of Key Findings

This study centered on lecturers and professors who described themselves to have attained a doctoral degree and have at least a year of teaching experience in a public university in Ghana. The study examined their lived experience in their respective STEM doctoral degree in three separate continents; Africa, Europe, and North America. In addition, it explored how participants' experiences, whether negative or positive, has had on their practice of profession. The lived experiences of the participants are what Bronfrenbrenner calls the chronosystem. These encompasses all of the experiences that participants had during their doctoral journey, including environmental events, major life transitions such as marriage, pregnancy, child birth, dissertation/proposal defense, and historical events (Roundy, n. d.).

During the interview, participants detailed why they decided to pursue a doctoral degree. Participants reported having decided to return to seek a doctoral degree for a host of reasons. The reasons were job requirements to have a doctoral degree to become a lecturer, desire to accumulate knowledge in their chosen field of study, love for research and teaching, provision of scholarships by government and independent institutions, and

conversion of the Master's degree into a PhD. In their quest to attain a doctoral degree, ten of the participants described numerous challenges that they encountered such as being having to juggle multiple roles, financial issues, male chauvinism, cultural expectations, racial and gender discrimination, and stereotypical perception of Blacks/Africans. Additional challenges mentioned during the dissertation phase were writing, pregnancy and childcare, data analysis, and extensive questions from professors at the dissertation defense. Despite all these challenges, participants persisted and graduated as a result of diverse motivational factors and building of resiliency strategies that facilitated their success in their programs.

The findings were presented through the voices pertaining to participants' experiences through quotes. Utilizing the voices of the participants' aids to comprehend the journey and real experiences of the lecturers and professors. Several key findings based on a further analysis of the themes generated from the data include a) sociocultural expectation of women in higher education, b) gender and racial issues inequity in education, c) importance of support systems, d) timeliness and building strong faculty-students relationship, and e) the role of participants' mothers in their academic success.

Sociocultural Expectations of Women in Higher Education

Historically, women endured oppression and control by the male centric culture in Ghana even though Ghana is considered a matrilineal society (Sossou, 2006). Gender roles socialization and designation plays an exceptionally crucial component in the various ethnic societies in Ghana. In the pre-modern society, there were specific roles or duties that were exclusively protected or played by women and men (Department of the

National Commission for Civic Education, 2011). Many of these practices are as yet discovered today in some places in the nation (Sossou, 2006).

The gender roles and expectations of women range from cleaning, cooking, becoming mothers, and acting as caretaker for children or elders or other family members in need of care (Eagly, 1987). These expectations do not change when women enroll in doctoral programs. All these cultural expectations were evident through the voices of most of the participants. Although participants mostly experienced sociocultural expectations such as getting married, having children, cooking for their husbands, some did not. This is in alignment with Williams (2007) research which surveyed graduate students/mothers negotiating academia and family life. Williams' research revealed that women conform to numerous traditional gender roles such as "they get married, have children, and care for elderly parents and spouses" (p. 74). Parents (especially mothers), faculty members, and colleagues expected participants to be married because they were seen as growing older. These expectations even threaten women entering STEM academia because of the expectations that they will marry and have children. According to the study of Sue and Zachary (2009) which focused on why women are still worried about choosing careers in science, they uncovered that "for both male and female scientists, marriage and family create demands that can cut short a thriving STEM career" (para. 15). Sue and Zachary furthered explained that the biological clocks of women often mean that they cannot delay the decision of marriage and having children until after their careers have been well cemented.

The expectations of participants who were educated in Africa were different from participants educated in the Western world. Participants educated in Africa shared

societal expectations of getting married from faculty members, colleagues or course mates, parents, and fiancé, while participants educated in the Western world experienced these African cultural expectations from mothers and the African community abroad, though not as much from their Western colleagues and faculty members. The research revealed that participants educated in Western nations were asked by African students and people within the African community about when they would be getting married and having children.

Cultural expectation places a role in the mesosystem. As stated above, the cultural expectation revealed in this study was for the participants to be married, have children, provide primary childcare, and cook for the family. Consistent with an article published on *Modern Ghana* (2015) titled *How to be an amazing wife*. Paragraph nine detailed one of the roles of a married woman in the cultural environment; "To take care of the home they share together – this includes cooking, cleaning, running errands, and paying bills; the husband shares this role with his wife but it is mainly her role if the husband is stably working full time." The macrosystem includes the cultural environment, belief systems or ideology in which the participants live and all other systems that influence them (Bronfenbrenner, 1979; Roundy, n. d). Typical examples are the cultural values, and political systems (Roundy, n. d). The effect of the macrosystem on the development of the individual can be either positive or a negative (Roundy, n. d). The negative development on participants' educational journeys were taking a break to marry, having children, and being slowed down in their progress to graduate. Most of the participants had their husbands simultaneously getting doctoral degrees, but none took a break from

their studies upon marriage and childbirth, and participants did not convey that they were expected to do so.

The study revealed that most of women accepted the traditional feminine roles such as cooking, childcare, and taking care of the house. They acknowledge that although some of their husbands performed some of these gender roles such as childcare, cooking, etc. they perceived it as them being supportive to their wives in the house, and not as based in gender equality. Men are viewed as the general leader of the family among all the ethnic groups in Ghana (NCCE, 2011). In spite of these international conventions and constitutional changes, generally, little has changed as far as Ghanaian women's life experiences (Sossou, 2006). Regardless, they still encounter gender-based discrimination (Sossou, 2006). Postcolonial theory disposes the power of male domination and patriarchal tendencies (Akita, 2010). What Postcolonial Feminist theory also tends to do is that-- it addresses issues about women who are oppressed and subordinated (Akita, 2010). It tries to fight back assigned gender roles and cultural expectations in a postcolonial world. Also, it suggests men should be required to share the obligations that they have constantly thought to be the space of women, for example, childrearing and housework (Akita, 2010). Men and also women ought to learn the skills of either sex, insofar as it makes the world a better place for all. Akita (2010) assert that in spite of the fact that this could be very intimidating to a few men, it should in any case be possible.

Gender and Racial Inequity in Education

In Ghana, still, there is a stamped distinction between the enrollment rates among males and females. In spite of the fact that the Ghanaian government has endeavored to beat the gender gap in the formal educational system, much work still needs to be done

(Lambert, Perrino, & Barreras, 2012). The importance of educating girls is the most practical measure for a developing country like Ghana can take to enhance its standard of living (Lambert, Perrino, & Barreras, 2012). Although stakeholders are privy to the importance of women and girl-child education, the issue to equal access to education roots back to the history of colonialization and traditional culture of Ghana. Customary Ghanaian culture does not generally have a positive view on females who progress into higher educational levels, particularly in the rustic northern Islamic regions (Grzybowshi, 2010).

The study revealed that women encountered male chauvinism as well as racism as they accessed higher education. Most of the participants were the only female, Black, or/and African in their departments. The male chauvinist believed that science is not for women and women should rather be content with a bachelor's degree and marriage, not Master's or doctoral degrees. Experiences of male chauvinism by participants was encountered in Africa and the Western education system. This behavior stems from the early colonial influence of the British which built a concept that the only assured way to keep a country of individuals reliant, stagnant, and subservient was to deny girls, the sheer spine of society, formal education (Bardley, 2000). Tamale and Olako-Onyango (2000) said it best that in Africa "a systematic and deliberate colonial policy ensured that African women were excluded from the various 'ivory towers' that dotted the continent" (p. 2). While men were educated to be scientists and civil service workers, women were trained to be needle workers (Bardley, 2000).

Similarly, in a typical traditional setting, customary beliefs influences parents to place more value on sons as compared to girls (Bardley, 2000). If parents need to pick

between educating their girl or son, they will more than likely pick their son who will have admittance to civil service work compared with the farming and informal economy work of his sister (Bardley, 2000). Evidence of male chauvinism in the 21st century can be traced back to both colonial influence and traditional influence of patriarchy system which favored male education over females. The colonialist influence and submergence of female educational empowerment was continued after the colonialist left the shores of Ghana. The findings mean that women face double colonialization; fighting against colonial role, chauvinist in Western locations, and from her brother who was also colonialized. This is summed up by Tyagi (2014) views of what postcolonial feminist encounter:

> Postcolonial feminist theory is primarily concerned with the representation of women in once colonized countries and in western locations. While postcolonial theorist struggles against the maiden colonial discourse that aims at misrepresenting him as inferior, the task of a postcolonial feminist is far more complicated. She suffers from "double colonization" as she simultaneously experiences the oppression of colonialism and patriarchy. She has to resist the control of colonial power not only as a colonized subject, but also as a woman. In this oppression, her colonized brother is no longer her accomplice, but her oppressor. (p. 45).

Name calling of women in STEM has been researched. In this study a participant told her story of being called "a man" by her male colleagues. They also teased her because she grew a beard. They questioned if she was "really a female" and asked if she was going to be married. Her colleagues gossiped that she was from a tribe which breeds

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prostitutes. She admitted that inwardly she was suffering from the name calling and abuse. This affirms Kouassi (2016) and Tamele & Onyango-Oloka's study, (1997) studies where women in STEM and faculty positions were called "half men" and "bitches." There is clearly a need to develop a less oppressive climate for women to thrive in STEM.

The issue of race and racism also permeated the experiences of women in this study who were educated outside Africa. The study reported incidents of racism within student-faculty and student-student encounters in their departments. The women encountered racial discrimination whereby White faculty members chose not to supervise their research, which made them feel racially discriminated against as compared to their non-Black colleagues. Postcolonial theory and Postcolonial feminism seeks to overcome the issues of racism affecting Third world women in developed countries. One of the aims of postcolonial theory in this study is to question the thought of racial discrimination and "challenges the superiority of the dominant Western perspective and seeks to re-position and empower the marginalized and subordinated 'Other'" (Smith, 2007, p. 12). Postcolonial feminism theory does not focus only on Third world women living in Third world countries but rather includes women living in the developing and developed world (Mishra, 2013; Weedon, 2002).

Furthermore, participant's experiences of racial microaggressions and macroagressions over which they had no control align with the exosystem in the Bronfenbrenner's Ecological Systems theory. In the exosystem, the White faculty members, staff, and students have a significant influence on the participants. Their actions have an intense effect on the academic performance but the participants have no

control over the situation. Roundy (n. d) explains the exosystem as a "setting that does not involve the person as an active participant, but still affects them. This includes decisions that have bearing on the person, but in which they have no participation in the decision-making process." This includes policies and practices in the realm of admissions, assistantships, etc. The White faculty members, staff, and students are the closest to the participants in their doctoral journey. This is the most influential level of the ecological systems theory (Tahir, 2018, para 3).

The study also revealed how White faculty members in some cases questioned the intelligence of the Black African women in this study. One participant revealed how faculty members undermined their education in Africa and another revealed her perception of low academic abilities of Black students. These stories affirmed Beoku-Betts" (2004) assertion that White faculty in the UK questioned female African graduate students' scholarly capacities, assumed that they must be situated in remedial classes and criticized their accents and language skills, which led these students to feel unsupported, racially stereotyped, and marginalized (Beoku-Betts, 2004). Another issue in the study relating to race was the isolation of Black female students. Smith's (2014) study about the lived experience of Black African nurses educated within the United States shed light of the experiences of participants' in this study. The study indicate that African students experienced isolation in the classroom which brought about feelings of segregation and discrimination. The relationship between international students and their teaching staff and academic advisors has a compelling effect on international students' learning (Tseng & Newton, 2002). If international students can have a great relationship with their

teachers, it will help their learning, encourage them to accomplish their goal, and obtain

familiarity with their desired profession (Umbach & Wawrzynski, 2005).

Importance of Support Systems

Generally, the faculty members experienced decent departmental and institutional

support systems. The support systems varied based on geographical location. The

Departmental and institutional support system was an essential aspect for students'

progress, development, and success within the program. For the faculty members to learn

the skills to become a lecturer or professor, they had to be abreast with both theoretical

and laboratory work. Faculty members who were educated in Europe and North America

were more typically exposed to quality resources such as ultramodern laboratory and

libraries as compared to students who were educated in Africa. The African graduates

complained mainly of faulty or damaged lab equipment. Also, they complained of delay

of ordered laboratory supplies which mostly arrived late. These problems delayed their

progress to conduct research and help write their dissertation. The shipment of chemicals

or resources arrived late because they were shipped from Europe and North America.

Boateng's (2015) affirm the findings by asserting that "laboratories in Ghana lack

scientific apparatuses and equipment, the few ones are obsolete, and are in derelict

shape" (p. 165). Apart from financial resources, students educated in Western nations had

access to extra assistance from postdoctoral students and administrative assistants.

Students who obtained their doctoral degrees in Africa did not mention extra help from

postdoctoral students. Ginsberg, Davies, and Smith's (2004) study affirms the importance

of departmental and institutional support for students of color in doctoral programs. They

posit that students of color in doctoral programs face various experiences that drive them

out of doctoral programs, an important element is the absence of departmental and institutional support.

Mentoring, as part of institutional and developmental support system also plays a crucial part in students' development and success in their chosen field of study. Most of the participants lacked role models in their early educational journey. Also, most of the participants were not assigned mentors in their doctoral programs, but rather adopted their assigned advisors or supervisors as mentors. Based on their study of women in STEM, Bernstein, Jacobson, and Russo's (2010) asserts that the role of the advisor as mentor might be especially essential in STEM fields where the conventional progressive and dyadic mentoring model is most pervasive. As stated earlier, among the participants for the study, only one had a female mentor and she described that her mentor was like her mother. Aside from that exception, participants only had access to male mentors to guide them through their academic success. Women who were mentored by their advisor or supervisors admitted that they developed skills such as research and teaching. The mentors additionally helped fund their travels to attend both domestic and international conferences. This finding aligns with a study by Primé, Bernstein, Wilkins, and Bekki (2014) of female science and engineering doctoral students, which asserts that the idea of mentoring and the significance of a mentor is encouraging in the advancement and professional growth of graduate students. The guidance and acquisition of skills and ideas was relevant for the faculty members to transition them to their current profession. The study revealed that the supervisors or advisors who served as mentor to the faculty members in their doctoral journey represented in their list of influential people in their academic journeys.

Fathers and husbands played some vital role in supporting the participants in their STEM doctoral programs to success. In a patriarchal culture, for example, Ghana, women are required to accomplish their wifely and motherly responsibilities with next to zero assistance from their husbands (Adusah-Karikari, 2008) but there was an improvement of support for this study. The husbands served as a mutual primary care provider for their child(ren) with their wives (Etzkowitz et al., 1994). One other traditionally feminine role that husbands assisted periodically or occasionally was cooking. An essential element noted from the accounts of the married participants were that the majority of their husbands were also pursuing a doctoral degree concurrently. The husbands' educational level and experience might have been an influential factor in supporting their wives to academic success. Some participants detailed the supportiveness of their husbands to pursue a doctoral degree. This confirms Adusah-Karikari's (2008) studies which affirm that in many cases, a married woman, regardless of her level of education, would need her husband to support her decision to seek after her doctoral degree. Although participants did not state the educational level or careers of their fathers, it can be noted that they supported their daughters to academic success.

None of the married participants mentioned their educational level as a threat to their marriage nor their husbands expressing reservations about participating in group work with male colleagues. Rather, a few of their husbands' sometimes assisted in traditional or cultural roles which has been primarily assigned as feminine. Kwapong (2007) study of women seeking higher education uncovered that husbands who may not trust their wives pose a threat to the woman's engagement in meetings with their study partners and colleagues (p. 73). Participants talked about financial and motivational

support from their fathers. The financial and motivational support started right from childhood. For women to succeed and climb to higher educational heights, we cannot eliminate certain factors such as parental support--whether financial, motivational--or early developmental bonding with fathers. According to Nielsen (2014), daughters whose fathers have been effectively connected with them all through childhood in advancing their scholarly or athletic accomplishments and empowering their independence and confidence will probably move on from college to enter the higher paying, more demanding employment generally held by men.

Timeliness and Building Strong Faculty-Students Relationship

Timeliness in Ghanaian business culture is not viewed as a primary need. In general, the idea of time in Ghana is taken a gander at in a casual and flexible way (Communicaid, 2017). However, when *vital* business is scheduled, time is important and people are required to be punctual (King, MacLaughlin, & Thomas, n. d). The study revealed that timeliness was an essentially element learned by participants. As they journeyed through their respective programs in the Western world, they transformed from the untimeliness culture acclimatized in the Ghanaian society and adopted timeliness as a norm. After their years in their programs, participants acknowledged respecting time to a greater degree, and becoming more time conscious. They have transitioned timeliness into their practice of profession. King, MacLaughlin, and Thomas affirmed the untimeliness in Ghanaian culture by contending that the concept of time in Ghana is different depending on the context. In casual meetings with others from the village, time is not important (King, MacLaughlin, & Thomas, n. d). In fact, for the most part,

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Ghanaians are very polychromic--meaning that schedules are flexible and plans are barely concrete (King, MacLaughlin, & Thomas, n. d).

It is important to note that timeliness and time consciousness were-specifically referred to by participants who were educated in Europe and North America. Participants educated in Africa never made mention of timeliness. This might be translated into the culture of untimeliness that participants are used to as stated by Communicaid (2017) and King, MacLaughlin, and Thomas (n. d). The effect of the timeliness in the Western culture can be assessed through the lens of macrosystem. The cultural value of timeliness is a positive effect on participants from the cultural environment which Bronfrebrenner (1979) and Roundy (n. d) termed the macrosystem in the Bronfenbrenner's Ecological Systems theory.

It is interesting to note that some female professors acknowledged that they have learned to develop a respectful relationship with students. They tend to listen to their students and the struggles they present. Boateng's (2010) discusses the cultural power dynamics present in the student-faculty relationship. Boateng's study asserts that students felt that their interactions with their lecturers were commenced on an uneven plane where they had no chance to part take in a free discourse, yet more or less indirectly constrained to acknowledge whatever lecturers say as the only "truth".   This exuded primarily from the Ghanaian culture, which frowns on dynamic engagement with authorities, but instead hails passive engagements with them. This falls in accordance with a famous aphorism in Ghana that says that "a child must be seen, but must not be heard" (Boateng, 2012, p. 28).

Additionally, participants for this study tend to see their students as human beings and have developed sympathy for them. This stems from their experiences in their

doctoral journey which makes them understand their students' behaviors. A few participants admitted the power hierarchy between faculty members and students in Ghana and how they tend to bridge the gap. They tend to be lenient on students who submit a genuine reason to substantiate their reason for submitting an assignment late. A participant who pursued her undergraduate education in Ghana affirmed that she has learned not to be intimidating, disrespectful, and insulting towards her students but rather has learned through her doctoral experience to be unintimidating and get her points across to students without insulting or disrespecting her students. This is in congruent with Appiah and Agbelevor's (2015) study on the impact of lecturer's gender on learning, which targeted a population consisting of undergraduate students of the University of Ghana. They assert that students who were in favor of teaching by female lecturers justified their preference on the basis that female lecturers were more professional and diplomatic, more understanding, patient, more fascinating, more intuitive and taught better. Some likewise believed that female lecturers were encouraging and more demanding which kept them on task (Appiah & Agbelevor, 2015).

The study revealed that female faculty members exhibited some forms of bias in their relationship and mentoring of students. A few female faculty members admitted that there are gender biases in their mentoring and advising of students. Participants described that they see female students as having special needs, talk to female students in a special way, share things concerning gender with the women, and believe females are "fragile." Participants continued, describing female students as having genuine challenges within STEM programs, and advising female students that STEM is for both genders. This affirms Appiah and Agbelevor (2015) study findings which asserts that female lecturers

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are too sentimental and that male lecturers were not biased. Looking at participants'

actions can be assessed through postcolonial feminist theory, whereby the faculty

members make special effort to encourage women, promoting gender equality in STEM,

and battling the cultural and colonial thinking that promoted STEM for men, and

(Ahmad, 2010; Dangarembga, Desai, & Markandaya, 2010; George, 1976; Jyoti, 2015,

Tyagi 2014).

The Role of Participants' Mothers in their Academic Success

Listening to the participants throughout the interview and going through the

transcripts, the importance of having a supportive mother was critical to foster academic

success. Both single and married participants in one way or the other mentioned the roles

that their mothers played in their doctoral journey. Their roles cannot be underestimated.

The role of participants as family caretakers did not change when they enroll as doctoral

students. They are still expected to be housewives, babysitters, cooks, and problem

solvers. This is consistent with Adusah-Karikari's (2008) study findings which argue that

women in academia are encumbered with primary responsibilities in the home such as

childcare, performing house duties, and for instilling cultural values in the next

generation. Participants are still expected by tradition to maintain all these responsibilities

and combine them with academic work. According to the study of Sue and Zachary

(2009) which focused on why women are still worried about careers in science, they

uncovered that "for both male and female scientists, marriage and family create demands

that can cut short a thriving STEM career" (para. 15). Sue and Zachary furthered

explained that the biological clocks of women often mean that they cannot delay the

decision of marriage and having children until after their careers have been well

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cemented. When pregnancy and childcare come into the picture, it tends to affect the progress and academic success of women. When they focus on their academics more than their traditional roles, there is often a sense of guiltiness.

In Africa, Asia, Latin America, and the Pacific, grandmothers often serve as essential advisers to women of reproductive age and their spouses, in that they oversee all maternal and child health practices within the family, and that they have significant duty for directly caring for young children on a daily basis (Judi, Ibrahima, Diagne, Lazin, Sène, Faye & Tandia, 2001). Judi et. al's (2001) research in Senegal (West Africa) additionally revealed that family members typically respect grandmothers and believe in them because of their age, their tremendous knowledge and experience, and their honest commitment to teach and care for the younger generations. One particular role that mothers of participants played in participants' doctoral journeys was taking up the motherly responsibility from the participants to care for their grandchild(ren). In four cases participant's mothers traveled to Europe, North America, and within Africa to care for their grandchildren so as to ease the huge burden of combining academics with child care. There are two specific duties of the grandmothers in this study. They either arrived before child birth or after child birth. They typically stayed for months to years to serve as childcare providers. Other grandmothers also provided care for their grown children whiles participants' continued their education. In instances another role taken on by the STEM doctoral student's mother was to find a maid to provide the needed assistance to lessen the duties of participants. Although childcare by mothers was widely attributed to participants' success, mothers additionally provided inspiration and in some cases payment of tuition fees for participants.

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The Bronfenbrenner's Ecological Systems can be examined in this context. Here, the role of the grandmother can be identified in the microsystem and the mesosystem. A microsystem is a pattern of activities, roles, and interpersonal relations experienced by the developing person in a given setting with particular physical and material characteristics" (Bronfenbrenner, 1979, p. 22). The microsystem is the framework closest to the participant and the one in which they have direct contact (Roundy, n. d). A microsystem mostly incorporates family, caregivers, and peers (Roundy, n. d). In the microsystem, the grandmother or mother of the participant serves as the family member who has developed an interpersonal relationship with the participants and she also performs social roles for the participant. The mesosystem comprises of the interactions between the distinctive parts of an individual's microsystem. In the mesosystem, the person's individual microsystems do not operate independently, yet are interconnected and maintain influence upon each other; for an adult, among family, work, social life, and peers) (Bronfenbrenner, 1979; Roundy, n. d). An aspect of participants' mesosystem is the relationship between their mothers and their spouses. Their mothers take an active role in their educational success, by traveling to stay with them and cater for their grandchild(ren) while participants, and in several cases their husbands, pursued doctoral degree or postgraduate education.

In the study, it could be noted that participants' mothers were the ones traveling to cater for their grandchildren and not grandfathers. Although some of participants' husbands supported their wives in one fashion or another, there was no mention of grandfathers or fathers of participants taking up the role of caregivers. The traditional role of women as caregivers is pervasive in this context. The postcolonial mentality of gender

roles is visible in this study, particularly as related to males in the family beyond the spouse. This is consistent with Nfah-Abbenyi's (2005) study on gender, feminist theory, and Post-Colonial (Women's) Writing which asserts that "gender has also been seen as a play of power relations that offers men's and women's activities as public and domestic respectively. This opposition rigidly controls the organization of production and manipulates the division of labor into "male" and "female" categories" (p. 260). The omission of the father from what postcolonial communities has assigned as female gender roles and the patriarchal system is what postcolonial feminism tries to fight. Although participants in several cases talked about the supportiveness of their fathers, none talked about fathers supporting them in what are considered traditional women's roles. The Third World women suffer from the dominance of the patriarchy system (Tyagi, 2014).

Elements for Success

The findings from the study point to essential elements that needs to be present for Ghanaian female doctoral students, before and during their pursuance of a STEM doctoral degree. The model of success (See fig. 6) incorporates these significant elements needed to facilitate a successful completion of a STEM doctoral degree.

According to the findings of this study, one of the major challenges encountered by Ghanaian female doctoral students' STEM fields is finances to pay tuition and to sustain one's self and the family. For the Ghanaian female doctoral student to be successful, there should be a provision of scholarships or fellowships to fully cater for their tuition and an assistantship that will provide stipends to cater for her personal and family needs. Provision of scholarships or tuition waivers and assistantship, will reduce stress and help create a free state of mind to study.

Black female STEM
Doctoral Student

Financial Support

Healthy Learning
Environment & Faculty-
Student-Administrative
Staff Relationship

Strong Support Systems

International Student
Office & African
Students Union
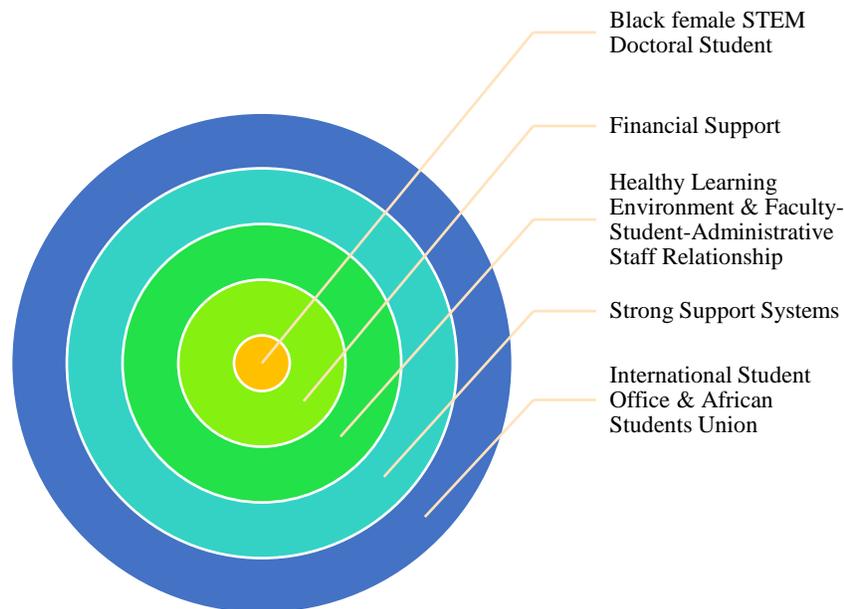
Figure 6. Model of Success

Secondly, the findings from the study revealed that participants encountered male

chauvinism and racism in their learning environment (classroom and laboratory). A

positive learning climate (classroom and laboratory) is essential to promote success.

Also, it is extremely imperative for faculty and students to build a healthy professional

relationship that is free from sexism, racism, harassment, and intimidation. A positive

relationship promotes a positive learning climate for the female Ghanaian doctoral

student to adopt essential skills such as teaching, conducting of research, and the

professional way of interacting with their future students from their professor/mentors.

The finding uncovered that participants who had a rough relationship with their faculty

members and administrative staff suffered an emotional effect due to such incidents.

Also, there is a need to for faculty members and policy makers to implement positive

measures or policies to curtail racist incidents and sexism from students, faculty

members, administrative and university staffs. The learning environment should and must

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be free from racism, gender bias, and negative preconceived ideologies about students of color or Africans. They need to be treated equally so they can feel welcomed in their classrooms and laboratory. This requires a cultural shift within these universities.

Again, the Ghanaian female doctoral students need strong support systems from people and sectors such as their mothers, husbands, International Student Office, faculty members, department and the university. Traditionally, Ghanaians and most African cultures requires grandmothers to be caretakers of their newly born grandchild(ren) and a guide to train their daughters on how to bath, feed, clean, and entertain the newborn child. Parents are required to provide assistance in paying of tuition fees and other related educational expenditure. The International Student Office must provide immigration lawyers to help all international students including Ghanaian female doctoral students file to bring their families over. Such help will reduce stress, homesickness, and provide female students the needed attention to focus solely on their academics. Additionally, the International Student Office should continue to provide scholarships, and help connect Ghanaian female doctoral students to current enrolled African students. Provision of adequate information for the international students before their arrival is beneficial for the Ghanaian female doctoral students to know what the do's and don'ts which will speed the process to settle and focus on their academics.

STEM departments and institutions must endeavor to provide the needed laboratory equipment/resources and financial help. Especially, African institutions and STEM departments must be proactive and ensure the continuous stocking of STEM laboratories with needed equipment/resources necessary to promote scientific research, learning, and accelerate students' graduation. In the United States Historically Black

Colleges and Universities (HBCU) also face similar challenges of resource limitations that is hindering student and staff effectiveness (Hodge-Clark, Daniels, & Association of Governing Boards of Universities, 2014), a typical example of a college in Ghana is the Kwame Nkrumah University of Science and Technology College of Engineering which is taking steps to replace obsolete training equipment in their laboratories (Tawiah, 2017). Provost, Professor Mark Adom-Asamoah at KNUST admitted "We needed laboratory equipment to the tune of over €20 million. We've been able to use €5.6 million of our Internally Generated Funds to acquire part of the equipment which means that only a quarter of our needs have been catered for" (Tawiah, 2017, para 4).

With these elements in place, Ghanaian female doctoral students will thrive and be successful academically in a positive learning climate free from racism, sexism, and harassment. A strong support network will provide all the necessary resources to ginger Ghanaian female doctoral students to learn, conduct research, and focus solely on academics and be free from distractions.

Recommendation of Policies for Practice

The emerging findings from this research provide an understanding into the detailed experiences of STEM lecturers' and professors' doctoral journey and how their experiences have affected their practice of profession. Also, the findings from the study suggest recommendations of policies to serve as a practical guidance to promote a safe climate for women, encourage and enhance the number of African women enrolled, retain, and graduate from STEM doctoral degrees. The recommendations of policies for practice was influenced by the lived experiences and voices of the female faculty members in this study. According to Sossou's (2006) research, to understand experiences

of women in the Ghanaian society is necessary to take a look at gender inequality, viewing mothers as working donkeys of the family, and at women's position in the community, cultural, educational, and financial barriers encountered. Truly, the study unearthed several factors affecting women in STEM doctoral education in African and the Western world such as the patriarchy system, juggling multiple roles, gender and racial discrimination, sociocultural expectations, and the support systems for women in higher education.

The recommendations are influenced by the findings from this research suggesting avenues that colleges and universities and policy makers can utilize to enhance the experiences of Ghanaian or women of color in doctoral programs and entice women into faculty positions. The recommended policies are suggested to these bodies: (1) International Students' Offices (2) Universities, more generally, and (3) Government and other policy makers.

International Students Office

The number of international students entering the U.S. higher education increased by 7.1 percent to 1,043,839 students in 2015/16, with 69,000 more students than the previous year at colleges and universities over the United States (Open Doors Executive Summary, 2016). This denotes the tenth consecutive year that *Open Doors* revealed expansion in the aggregate number of international students in U.S. higher education (Open Doors Executive Summary, 2016). There are currently 85 percent more international students pursuing education at U.S. colleges and universities than were accounted for a decade ago (Open Doors Executive Summary, 2016). There has been a strong increase among students in STEM fields in both directions (Open Doors Executive

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Summary, 2016). The *Open Doors* report indicated that the top senders of students from West Africa are Nigeria, Ghana, and Ivory Coast. In 2015/2016 they reported that Ghana sent 1,323 graduate students as compared to 1,400 the previous year. That represent a decrease of -5.5% of graduate students. In Canada, international students' enrolment in postsecondary programs have risen by 11 percent between 2013-14 and 2014-15 academic year (Bothwell, 2016). Also, the top European destination for African international students are France 95, 759, U.K 34, 919, Germany 22,402, and Italy 10,985 (Schulmann, 2017).

Kauffmann, Martin, and Weaver (1992) posit that education is no longer restricted to the borders of a person's home country and that education is in fact an important global service that can be accomplished from anywhere in the world. To increase the number of brilliant Ghanaian women into STEM fields in the Western and African colleges and universities, there must be a proper institution of programs to cater to the needs of students. There is an urgency for financial related help for African international students (Karamoko, Casey, & Griffin, 2017). First, there should be provision of scholarships and assistantship to reduce financial struggles which may affect international female students' academics. Findings from this study indicated that the number one challenge encountered by the faculty members in their doctoral journey was finances. Although some of the faculty members had scholarships, not all of them were fully funded or had research assistantship positions. To attract women into STEM fields, the International Students' Office should seek external funds or direct female students to external funds to help fund female students into STEM doctoral fields.

Since participants struggled with finances to cater for themselves, family, and pay tuition fees, the International Student Office and the Graduate Students Office can help female African students and other international students seek for external and internal scholarships and aid. This can be achieved by organizing funding workshops each semester that will provide in-depth knowledge to seek funding to help support international students financially. Again, the International Students' Office can suggest to influential stakeholders in the universities to set funding and loans for the brilliant and needy female African STEM doctoral students. Students can repay loans through monthly deductions from their monthly or weekly stipends. Karamoko, Casey, and Griffin (2017) agree that the International Engagement office can also offer financial management and funding programs and workshops whereby international students will be educated on ways to obtain financial assistance from diverse associations, university departments, and off-campus and on-campus job opportunities so they could gain some additional money to help themselves.

The support of fellow African students to their colleagues was reported as an asset by participants who were educated in the Western world. Fellow African students served as emotional and financial support system for one another. The International Students' Office should help bridge the isolation gap by introducing African students who are either already in STEM programs or in the institution to newly admitted female Ghanaian or African international students. This will serve as an avenue for the incoming or newly admitted female international students to ask questions, feel welcomed, reduce homesickness, and feel belonged before and after entering the university. International Students office can merge with the African Students' Union to organize events such as

balls, gala, or auctions to raise money for themselves. Mostly, big institutions have an African Students Union to create a safe space for African students. Through their yearly African Students Week, the International Students' Office can partner with the African Students Union to sell African artifacts and merchandize across campus and at the African Students' Dinner Dance to raise funds for the needy female students. This will help the African international students to help themselves, rather than remaining heavily or entirely depending on the limited external and internal resources.

Also, the International Students' Office can again partner with the African Students Union to send letters to request funds from African Student Alumni from their universities and the African community outside the university. Karamoko, Casey, and Griffin (2017) also propose that the African students' association, with the support of the International Engagement could establish an African Students' Alumni Association. This association could encourage a spirit of steadfastness and advance the general welfare of all African students. They also state that such an African Alumni office can help raise funds from past students to help African international students.

Universities

Many authors have written extensively on closing the gender gap in STEM higher education (Horting, 2016; Jung, Clark, Patterson, & Pence, 2017; Krämer, Karacora, Lucas, Dehghani, Rüther, & Gratch, 2016). As recommended by these authors, to increase, retain, graduate, and promote participation of women or Ghanaian female international students in STEM doctoral programs, the onus lies on universities, departments, and faculty members to take proactive measures. It was earlier stated that most of the participants identified as being either the only Black, African, female, or

international student in their departments. To promote women's interest in STEM higher education, universities and colleges both in Africa and Western nations must first develop a female-friendly climate that seeks to welcome and retain Black African women or women in general. Documents were sought directly from both participants and all four universities where participants taught to ascertain the laid down policies that promotes gender equality, equity, and positive climates in classroom/laboratory but only two of the universities provided me with policies relating to female students. Both policies only centered on protecting female students from sexual abuses. None focused on policies preventing female students from verbal abuse, admission discrimination in STEM fields, gender and racial abuse, or abuse/discrimination in the classroom/laboratory.

Since the university is a microsystem and the system closest to the students and the one in which they have direct contact with (Bronfenbrenner, 1979; Roundy, n. d.), then it is important that policies that have the effect of gendered or racial discrimination be tightened in universities across the world. Especially, universities in Australia, Europe, North America, and Southern and North Africa must constantly update their policies that promote racial and gender equity. STEM departments must partner with the International Students Office and hold orientations where they can communicate the rights of female students. Also, they must be advised on who and where to report racial and gender abuse. Black female students and women in general must be protected from retaliation after reporting racial and gender discrimination incidents.

After the 2016 election in the United States, the political climate has affected the safety and student living. According to a study conducted by the Chronicle of Higher Education titled *U.S. Political Climate Casts a Cloud over International Enrollment*

uncovered that "they are particularly uneasy higher-education experts say, about the

Trump administration's controversial policies on immigration, including a proposed wall

along the border with Mexico, efforts to deport undocumented residents, calls for tougher

vetting for visas, and two attempts to push through travel bans. Even though the bans

were legally blocked and primarily directed at predominantly Muslim countries, the

efforts are unnerving students from other areas of the world as well, who aren't sure if

they're welcome on the nation's campuses anymore (para., 7)." Dickerson and Saul

(2016) report in *The New York Times* have discussed hostile acts against minorities after

Donald Trump's elections on campuses such as Texas State University, Wellesley

College, York County School of Technology in York, and Canisius College in Buffalo.

United States universities must endeavor to promise female and all international and

minority students of their safety. Students who reports racial issues must be safeguarded

and not penalized or ostracized by authorities. Albrecht (n. d) affirmed that international

students who are victims of racial bias must be assured of their safety and security. Also,

international students must be educated through orientations and other events in the

universities about reporting any act of discrimination, bias, and their rights.

Furthermore, it is imperative to reaffirm and echo the importance of diversity and

female role models and mentors in STEM. The presence of Black faculty member, other

women of color, and female faculty members in general is important to enhance female

students and women of color interest in STEM education. According to a survey on the

interest of Black woman in doctoral fields, role models are indicated as being a main

element that influences the number of Black women entering and leaving doctoral

programs (Borum, & Walker, 2012). Diversity within STEM is fundamental for

developing a flourishing work environment and a learning environment packed with role models, differing methods of thinking, and improved learning that hoist excellence and benefits scientific innovation, public health, and economic development (Smith, Handley, Zale, Rushing, & Potvin, 2015). A few of the participants who had female faculty members in their high schools and undergraduate universities were influenced by their presence as a motivating factor to emulate their role models on their campuses. This showcases the importance for departments and the universities to employ females or women of color as part of the faculty members. The only participant who had a female dissertation chair perceived her like a mother and none of the ten participants viewed their male chairs as a father figure. Their presence can encourage more women to seek doctoral degrees because of the achievements of female and women of color in their various universities. Universities can influence STEM faculty hiring committee to recruit females and women of color in tenure track positions to serve as role models and mentors for female student journeying through STEM higher education. Smith, et. al (2015) confirms that "intervening in the faculty search process is therefore one potential way to enhance the representation of women STEM faculty at an institution" (p. 1085).

Moreover, an essential issue that was unearthed in the study was that most of the female faculty for this study were not assigned mentors when they were admitted into the doctoral program. A positive relationship with their supervisors/advisors as evident resulted in faculty members' retention and graduation from their doctoral program. It is imperative to assign female students with mentors as they enter a male dominated STEM field. Mentorship and support from group members were the prime markers that women in graduate programs accept as being helpful in their journey (Borum, & Walker, 2012).

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Deans and chair of STEM programs must ensure that every female student or women of color who are admitted into STEM doctoral programs must have a mentor that will guide, counsel, develop their skills, and encourage them throughout their journey. At the end of each academic year, students and mentors must evaluate each other and students must be given the opportunity to change mentors without any retaliation or soured relationship between them.

Additionally, STEM faculty members must strive to accept and promote cultural difference by learning from their students who are from different cultures. Each semester, there can be a cultural week whereby students share their culture as part of orientation and classroom project. Faculty will bond with students and gradually understand the way students do things from their cultural perspective. Additionally, faculty must mix students from diverse race and cultures when assigning group projects. As students continue to learn from each other and work together, they celebrate their cultural differences, eliminate conscious and unconscious biases, and promote cultural and religious tolerance. This strategy will reduce racial groupings and feeling of isolation evident in the study findings. The feeling of isolation or exclusion in graduate programs have also been accounted to reason doctoral students leave their programs (Borum, & Walker, 2012).

Lastly, participants with children stressed the challenges of combining childcare with academics. Kwapong (2007) suggests the provision of support systems for women. She stated that for female students to be successfully they must be provided with "both traditional and modernized support systems to enable them to enhance themselves professionally" (p. 75). Based on the experiences of participants with child(ren), there should be provision of day care centers to cater for their children while they focus on

their academics. This will reduce the childcare responsibilities and save time and money of participants' mother who traveled to cater for their grandchild(ren).

Government and Other Policy Makers

Each year many students leave the shores of Ghana to pursue graduate education abroad. Although numerous students travel to seek education, other remain to pursue graduate education in Ghanaian universities. For Ghana to thrive and shift from a developing to a developed country, there is a need to focus attention on STEM education. Much focus must be placed on reducing the gender gap in STEM fields. The essence to develop as a nation rest on the shoulders of promoting STEM education to foster the economic growth of Ghana through agricultural, technology, engineering, science, and mathematics. The findings from the study indicated that to date, numerous laboratories in the nation's public university lack proper resources in their laboratories to carry experiments. Some faculty members discussed issues that they are currently facing in their laboratories. Also, participants educated in African universities had identical issues of lack of resources in their laboratories. Only one participant educated in Africa talked about accessibility of resources. To enhance both females and males' students interest and to remain in STEM fields to develop Africa, there is a strong urgency to fully equip Ghanaian and African university STEM laboratories to Western standards. This will promote continuous research to solve problem facing the African continent. This will help reduce the overreliance on Western research to always tell our stories, experiences, and prescribe antidotes as a remedy for African problems which might not be the truly needed remedy.

Secondly, the Ghana Ministry of Education must partner with universities, vice chancellors, deans, and STEM departments to create laws and policies beyond sexual abuse of women in higher education but rather incorporate policies that will promote suitable environment that prevents male students and faculty members from making women uncomfortable in male dominated programs. Another policy essential to close the gender gap in STEM is an affirmative action to grant women equal enrolment in doctoral programs in Ghanaian universities. To encourage more women to apply, enroll, and remain in STEM programs, policy makers such as the government of Ghana, Ministry of Education, NGO's, universities, and the Ministry of Gender, Children and Social Protection must join forces to provide scholarships for women to seeking to pursue doctoral degrees in STEM. The reason is that financial problem was one of the major challenges that participants pointed as a barriers or obstacle in the doctoral journey.

Lastly, since all or most of students pursuing STEM doctoral degrees are adult, it is imperative for the government to influence departments and colleges to design flexible schedules for female students that will permit them to step in and out to have child(ren) and perform traditional roles that cannot be avoided.

Recommendations for Future Research

The current examined study provides an avenue to expand upon what was researched. The themes from the study gives glimpses and cues as to what is essential to research in the future. The participants for this study were Ghanaian female faculty members who obtained their STEM doctoral degrees in Africa, Europe, and North America. It will be fascinating to examine only the lived experiences of STEM lecturers and professors who were solely educated in Ghana or Africa. It would be interesting to

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know and understand the depth of sociocultural elements and postcolonial ideologies that affect students who are educated in Ghana or Africa.

Another interesting study would be looking at doctoral experiences of Ghanaian male lecturers and professors lived experiences in Europe and North America. It will be noteworthy to ascertain if they had similar encounter as their fellow female faculty members. Since participants mentioned in their interviews that they encountered male chauvinism and other problems in their respective departments, it would also be prudent to investigate how female Ghanaian faculty members in STEM departments navigate their way through tenure track faculty positions in Ghanaian universities.

Third, it would be intriguing to conduct either a mixed method or quantitative research with a similar focus to this study. If a quantitative study would be considered, the number of participants can be increased to gain additional understanding of the lived experiences of Ghanaian female lecturers and professors who either obtained their doctoral degree in Africa, Europe, and North America.

Fourth, the study found that most participants had a good experience working with their supervisors or advisors. A comparative study can be conducted to ascertain the working experiences of male faculty members and female Ghanaian doctoral students. Also, a study can only focus on male STEM faculty members working experiences with Ghanaian female STEM doctoral students. This would help understand their experiences working with female students from a different race and culture and how their practice of profession is challenged as they work with female STEM Ghanaian students.

Finally, it can be noted that participants honed on the importance of the African community and the African Students Union to their success. It would be essential to

research the effectiveness of African Students Union and its essence on Western universities and colleges campuses. Considering the lack of participants in Physics and Mathematics, it will be important to examine the lived experience female lecturers and professors who attained PhD in these fields.

<h2 style="text-align:center">Researcher's Reflection</h2>

As a Black male student, this research was an eye opener and a learning experience as I conducted this study. Listening to the experiences of the female faculty members took me through an emotional rollercoaster. At a point, I was elated and at a certain time of the interview, I almost cried. I had to revisit my experiences in my Master's and doctoral programs and came to the realization that some of their challenges encountered were related to my experience in some ways. My experience makes me reminisce an African proverb which goes like "*a river cannot flow through a forest without bringing down trees.*" I relate this proverb to my life by explaining that I cannot seek higher education in a land far away from my birthplace and family without encountering any obstacles or barriers--obstacles similar to those my participants encountered ranges from isolation, racial discrimination, financial struggles, homesickness, and academic challenges.

My research highlights similar struggles encountered by both female lecturers and professors navigating a doctoral journey, successes achieved, amidst obstacles enough to cause derailment during their doctoral journey, and those resiliency strategies adopted to fight the challenges to succeed. Prior to this study, previous research focused on the experiences of female Ghanaian STEM students in undergraduate and high schools. My study took a step further to delve into the experiences of STEM female lecturers' and

professor's experiences in STEM doctoral programs and linked their experience with the

current practice of profession. The findings revealed that the experiences of the lecturers

and professors had a strong influence not only in their interactions with their students but

with how teaching, research, and how they must conduct themselves professionally and

ethically. This study has opened a new gateway to examine the experiences of current

Ghanaian women in STEM doctoral degrees in Ghana and abroad. These findings of the

study provide a deeper understanding of the struggle Black African female students

encounter in typical male dominated programs.

Support for phenomenological studies which look at giving a voice to participants

can be found in African proverbs. As I reflect on the study and link it to my culture, I

uncovered two great proverbs that talk about telling our own stories so that peoples

would not tell stories and suppress our experiences. The first proverb quoted by the

legendary Nigerian novelist, poet, professor, and critic states that "*Until the lions have*

their own historians, the history of the hunt will always glorify the hunter." The second

quote is from the Ghana Rising blog which states that *"Until the lion tells his side of the*

story, the tale of the hunt will always glorify the hunter." I will go a step further to

rephrase the quote to sound feminine: *Until the lioness tells her side of the story, the*

tales, stories, and history of the hunter will always glorify the hunter. What I want to

project here is that if the female STEM lecturers and professors did not share their stories

and experiences in their own voices, their stories will continue to be told by Western

authors or researchers. It is the lioness that does most of the hunting, so her account and

experiences cannot be overshadowed.

The participants' experiences have humbled me to learn from all the struggles and challenges that I encounter and celebrate my success as I journey to complete my dissertation. They have proven beyond doubt that juggling multiple traditional roles did not derail their dreams and aspirations but it rather pushed them to academic success. Yes, I can also do it. It sends a strong signal to all women dreaming to attain STEM doctoral degrees that it is more than possible to overcome the struggles whether single, divorced or married.

I end this reflection with the verses one and two of the Lutheran Hymn 447 "*Fight the Good Fight with All Thy Might*," written by John S Monsell (1811-1875): "1. Fight the good fight with all thy might; Christ is thy Strength and Christ thy Right. Lay hold on life, and it shall be thy joy and crown eternally. 2. Run the straight race Thro' God's good grace; Lift up thine eyes and seek His face. Life with its way before us lies; Christ is the Path and Christ the Prize." My participants and I have fought a good fight to complete this dissertation. I am elated to complete this journey and thankful to God because his word says "I am the vine; you are the branches. If you remain in me and I in you, you will bear much fruit; apart from me you can do nothing" (John 15:5). I believe that I am bearing much fruits and with the completion of a doctoral degree, there is much more fruit to bear.

Conclusion

Each year, a few female Ghanaian STEM students with or without scholarship tend to seek doctoral education in Africa and around the world. Findings from this study affirm that Science, Technology, Engineering, and Mathematics are for both genders and a doctoral degree in these fields is possible to be attained by both gender. Per the

findings, as a Ghanaian woman accessing a doctoral degree in STEM means that you must brace yourself to encounter gender discrimination in undergraduate before the doctoral degree. In undergraduate, male chauvinism is also a possible reality. Some male students view women as not smart or intelligent enough to pursue STEM degrees and an undergraduate degree and marriage is enough for a woman. Black women must try to showcase and exhibit more evidence of competency than their male colleagues before they can be perceived to be equally competent. This is what Williams, Phillips, and Hall (2014) call *prove-it-again*. Second, pursing a doctoral degree in STEM in the West requires that students must build a thick skin and be ready to endure and survive culture shock and racism. Third, journeying through doctoral degree demands that despite all the challenges that might crop up, women must fight to conquer, and understand that there is still light at the end of the tunnel. Fourth, the doctoral experience, whether negative or positive will impact and have an effect on doctoral students personal and professional life, and profession of practice.

To attract more women into STEM domain means reaching out to women at a very younger age. There is a need to hire more female STEM teachers in high schools and female lecturers and professors in higher education. The research evident that a role model impacts a lot of the "*I can do*" spirit in female students. Seeing someone like them at the top motivates and encourages them to go far and achieve the same status or even pursue higher goals. Also, Western universities must strive to hire more women in STEM to close the gender gap in STEM faculty. Women as faculty members in STEM fields can serve as mentors to female undergraduate and doctoral students.

Yes, the kitchen is no longer the place of the woman. In this 21st century, the world and especially Ghana should put women in decision making areas to help change gender inequity laws and policies that prevent women from attaining similar or identical positions as their male counterparts. The patriarchal system is embedded within the sociocultural system and this system needs to be broken down to promote women empowerment and development. As a developing nation, with a higher number of women population there in a huge opportunity to encourage more women to venture into STEM fields to boost the agriculture which is the backbone of the country. Also, Kwagyir Aggrey said that "*If you educate a man, you educate a person but if you educate a woman, you educate a nation.*" This quote symbolizes the need to entice more women into STEM education because an educated woman will ensure that her children, nephews, and nieces are educated. Not only women within the family can see her as a role but men and people within the community and the nation.

APPENDIX SECTION

APPENDIX A: DEFINITION OF TERMS

Bronfenbrenner's Ecological Systems theory – the "ecology of human development involves the scientific study of the progressive, mutual accommodation between an active, growing human being and the changing properties of the immediate settings in which the developing person lives, as this process is affected by relations between these settings, and by the larger contexts in which the settings are embedded" (Bronfenbrenner, 1979, p. 21).

Postcolonialism – as that which includes "studied engagement with the experience of colonialism and its past and present effects, both at the level of local societies, as well as at the level of more general global developments thought to be the after-effects of empire" (Quayson, 2007, p. 93-94).

Postcolonialism Theory— "pushes back to resist paternalistic and patriarchal foreign practices that dismiss local thought, culture and practice as uniformed, "barbarian" and irrational" (Dussel, 2000, p. 472).

Postcolonial Feminist Theory— have routinely called attention to the ways in which the "woman question" powered colonial practices and mediated relations between colonial and native male elites" (Jyoti, 2015, p. 65).

APPENDIX B: SAMPLE INTERVIEW QUESTIONS

First Interview

Thank you for your time and for deciding to share your story in your doctoral journey.

1. Can you tell me about the object (or picture) you brought as a symbol of your experience as a female Ghanaian STEM professor?

2. How did you arrive at the decision to pursue a doctorate degree in STEM?

3. Overall, how would you describe your doctoral experience as a female Ghanaian STEM student?

    a. How was your real/actual experience with your PhD education the same or different than your expectations for the program?

4. What were your interactions like with people in your department like? What challenges did you face, if any? How did you solve them?

    Potential follow-up questions:

    a. Tell me about your interaction with faculty members and administrative staff. Were there any particularly positive or negative experiences that stand out in your mind?

    b. how would you describe your relationships with other doctoral students, and in particular male colleagues?

    c. How would you describe the classroom climate you experienced as a female STEM student?

5. Can you talk to me next about the support systems that you feel helped you complete your doctoral journey?

    Possible follow-up questions:

a. What were the support systems provided by the department to aid student success throughout the program? Did you feel you had equivalent access to these (supports) as your male colleagues? Additional access?

b. Tell me about me the departmental support system provided specifically for your dissertation work?

c. Tell me about the mentoring process in your department. In what ways was it beneficial towards your graduation?

d. Did you call upon other support systems in completing your doctoral degree, such as other students in the program, or individuals or programs outside of the department or university?

6. Tell me about a time when you felt empowered/encouraged/inspired during your PhD education.

7. Recall a period in your doctoral program when you felt there were deterrents/obstacles. First tell me about the nature of these deterrents.

a. What happened?

b. What steps or strategies did you employ to solve these difficulties/challenges?

8. Tell me about how you selected your dissertation committee members?

a. Where there any challenges pertaining to this process?

b. If 'Yes' how did you handle these challenges?

9. Please describe what your dissertation experience was like?

a. Did you encounter any particular challenges during the dissertation phase of your program?

b. How were you able to overcome them?

10. Tell me about your dissertation defense?

      a. Did you encounter any challenges as part of the defense?

      b. If yes, how did you handle them?

11. What, if any, experiences did you encounter during your dissertation journey that affected your time to completion?

12. Is there anything else you would like to add to your doctoral experience that I did not ask?

Second Interview

Is there anything you wish you would have said in your first interview?

1. Looking back at your doctoral journey, what stands out as one of your most significant achievements?

2. During your doctoral journey were there any events or situations that made you think of not completing your degree or transferring to another university?

      a. What motivated you to persist and graduate in this situation?

3. Looking at things from where you are now, how has your doctoral degree impacted your personal and professional life?

4. How do you think your doctoral experience, whether positive or negative has affected your practice as a STEM professor or lecturer?

      a. How do you think it has impacted how you mentoring or advising?

      With male students? With female students?

5. What advice would you give to female students who are thinking about completing a STEM doctoral degree?

6. What was your relationship with your male students in your program? Are there any you keep in touch with now as colleagues? What about fellow female students?

7.What, if anything do you recommend to be changed in your department, lab and the classroom concerning your educational experience? (or that might improve the experience of female STEM students like yourself?

8. Is there anything else you would like to add about your doctoral experience or how it has impacted your career that I did not ask?

I want to share with you some conclusions I started to make from your first interview as I share these tentative conclusions if you think I do not seem to have interpreted something accurately. Also, please let me know if something important seems to be missed

Bailey-Iddrisu's (2010) and **Burnette (2013)** studies helped shape the construction of the interview questions.

APPENDIX C: INFORMED CONSENT

Study Title: TELLING THE LIVED EXPERIENCE OF GHANAIAN STEM

LECTURERS AND PROFESSORS' DOCTORAL JOURNEY

Principal Investigator: Owusu Boakye   Co-Investigator/Faculty Advisor: Dr.
Jovita Ross-Gordon

This consent form will give you the information you will need to understand why this research study is being done and why you are being invited to participate. It will also describe what you will need to do to participate as well as any known risks, inconveniences or discomforts that you may have while participating. We encourage you to ask questions at any time. If you decide to participate, you will be asked to sign this form and it will be a record of your agreement to participate. You will be given a copy of this form to keep.

PURPOSE AND BACKGROUND
You are invited to participate in a research study to learn more about the doctoral education experiences of Ghanaian female lecturers and professors in the Science Technology Engineering and Mathematics fields. You are being asked to participate because you are a Black female, Ghanaian, have completed a STEM PhD degree, and teach in a STEM field in a Ghanaian university. This is a phenomenological qualitative study which seeks to examine the lived experiences of 8-12 Ghanaian female lecturers and professors in the Science Technology Engineering and Mathematics fields. The information gathered will be used as findings for my dissertation and possibly for article publication.

PROCEDURES
If you agree to be in this study, you will participate in the following:

- Two separate interviews, with a possible brief follow up interview in case something needs clarification or further explanation.
- Each interview will last for approximately (1) hour.
- Cultural Artifacts will be collected and its imperativeness to the participants will be discussed

As primary researcher, I will set up a time to meet with you at your office or any place that is comfortable for you. I hope to schedule the first interview during the first two weeks of May. You will first complete the demographic information and then participate in two separate interviews which will last approximately an hour each.
During the interviews, you will be asked to discuss the significance of an artifact of your doctoral studies that you are invited to bring, to provide limited demographic information, and finally to respond to the interview questions. The two interviews will be

audio-recorded; their third interview might take place via SKYPE or on phone. Some notes may be taken as well.

RISKS/DISCOMFORTS
In the unlikely event that some of the survey or interview questions make you uncomfortable or upset, you are always free to decline to answer or to stop your participation at any time. Should you feel discomfort after participating and you are a Texas State University student, you may contact the University Health Services for counseling services at list **(512) 245-2161**. They are located at**: 298 Student Center Dr, San Marcos, TX 78666.**

BENEFITS/ALTERNATIVES
There will be no direct benefit to you from participating in this study. However, the information that you provide will fill a gap in the scholarly literature Findings from this study can also contribute to modifying and creating new policies aimed at ensuring gender equity and increase enrollment, participation, and success of women in STEM graduate programs in Ghana and elsewhere. Additionally, the findings are necessary to inform and retain current and future female students in STEM doctoral fields. The long-term objective is to improve the atmosphere of STEM graduate school for females while the transient objective (Culpepper, 2004) is "to help women now enrolled, survive, and succeed" (Johnsrud, 1995, p. 77).

EXTENT OF CONFIDENTIALITY
Reasonable efforts will be made to keep the personal information in your research record private and confidential. Any identifiable information obtained in connection with this study will remain confidential and will be disclosed only with your permission or as required by law. The members of the research team and the Texas State University Office of Research Compliance (ORC) may access the data. The ORC monitors research studies to protect the rights and welfare of research participants.

Your name will not be used in any written reports or publications which result from this research. Data will be kept for three years (per federal regulations) after the study is completed and then destroyed.

PAYMENT/COMPENSATION
There is no compensation for participants.

PARTICIPATION IS VOLUNTARY
You do not have to be in this study if you do not want to. You may also refuse to answer any questions you do not want to answer. If you volunteer to be in this study, you may withdraw from it at any time without consequences of any kind or loss of benefits to which you are otherwise entitled.

QUESTIONS

If you have any questions or concerns about your participation in this study, you may contact the Principal Investigator, **Owusu Boakye: 001 646 374 7349** or email **o_b36@txstate.edu**.

This project [insert IRB Reference Number or Exemption Number] was approved by the Texas State IRB on [insert IRB approval date or date of Exemption]. Pertinent questions or concerns about the research, research participants' rights, and/or research-related injuries to participants should be directed to the IRB Chair, Dr. Jon Lasser 512-245-3413 – (lasser@txstate.edu) or to Monica Gonzales, IRB Regulatory Manager 512-245-2314 - (meg201@txstate.edu).

DOCUMENTATION OF CONSENT

I have read this form and decided that I will participate in the project described above. Its general purposes, the particulars of involvement and possible risks have been explained to my satisfaction. I understand I can withdraw at any time.

_____   _____   _____
Printed Name of Study Participant   Signature of Study Participant   Date

_____   _____
Signature of Person Obtaining Consent   Date

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