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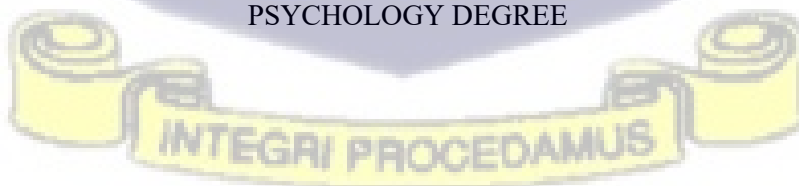
SCHOOL OF SOCIAL SCIENCES

EXPLORING THE PERCEPTIONS AND ATTITUDES TOWARD WOMEN IN SCIENCE,
TECHNOLOGY, ENGINEERING, AND MATHEMATICS (STEM) LEADERSHIP
POSITIONS: A STUDY IN GHANA

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THIS THESIS/DISSERTATION IS SUBMITTED TO THE UNIVERSITY OF GHANA, LEGON
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PSYCHOLOGY DEGREE



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DECLARATION

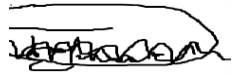
I, Emmanuel Abrokwah, hereby declare that this research work is my original work which was carried out in the Department of Psychology of the University of Ghana under the supervision of Dr. John Enoch Kwasi Dotse and Prof. Kwaku Oppong Asante. All references used in the work have been duly acknowledged.



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ABSTRACT

Globally, gender disparity in STEM is apparent despite the increasing attention and intervention to bridge the gap. The numerous studies available have not yet exhausted the entire scope of the subject matter. In Ghana, while several studies have investigated STEM and STEM-driven initiatives, there is still a paucity of research on women's representation in STEM fields in general and STEM leadership in particular. This study therefore explores STEM educators and students' perceptions and attitudes toward females' involvement in STEM and STEM leadership positions in Ghana. Using an explorative qualitative approach, purposive and snowball sampling techniques were used to select thirty (30) respondents from two public universities in Ghana. Semi-structured interviews were conducted, and the data was analyzed thematically. The major themes that emerged from the study are: favorable perception and attitude toward females' involvement in STEM, persistent personal and social factors or challenges, favorable evaluation of female leadership capacity and non-gendered view of leadership, and non-gendered preference and cordial relationship with female STEM leaders. The study concludes that the respondents have favorable perceptions and attitudes toward females' involvement in STEM and STEM leadership positions. The study also highlights the fact that changing people's perceptions and attitudes about females in STEM and STEM leadership is the key to building a sustainable intervention to bridge the gender gap. This can be done through increasing education and enlightenment on the relevance of female inclusion in STEM and STEM leadership positions.

Keywords: STEM, Gender disparity, Perception, Attitude, Leadership

INTEGRI PROCEDAMUS

DEDICATION

I dedicate this work to my mum, Beatrice Asantewaa, and all the stakeholders in my life who keep inspiring me to higher heights. In addition, I dedicate this to Mr. Barnor Bernard and Mr. Owusu Appiah Ranford for believing in me and pushing me to aim higher. I also dedicate it to the many individuals and organizations who are working effectively to bridge the gender gap in STEM and STEM leadership positions.



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LIST OF ABBREVIATIONS

Biochem	Biochemistry
BioNTech	Biopharmaceutical New Technology
Econs	Economics
mRNA	Messenger Ribonucleic Acid
STEM	Science, Technology, Engineering, and Mathematics
UNESCO	United Nations Educational, Scientific, and Cultural Organization
USA	United States of America



CHAPTER ONE

INTRODUCTION

1.1 Background of Study

In a world of increasing advancement in science and technology, there has been a global interest in Science, Technology, and Mathematics (STEM) fields (Delaney & Devereux, 2019; Freeman & Tytler, 2014). As a driving force for development and globalization, STEM fields offer creativity and innovation opportunities. However, studies have revealed a gender disparity in STEM fields (Quansah et al., 2020; Saah et al., 2023). Studies (e.g., Roberts, 2014) have indicated that males are more likely to choose STEM-related subjects and pursue a career in them than females. This phenomenon is evident across various countries, including Ghana. For example, in the United States, the proportion of women working in science and engineering is just 28% (STEM Women, 2021). According to Norwood (2024), the "Gender Equality Paradox" is frequently seen in developed nations. This paradox implies that countries with higher levels of overall gender equality may also have more acute gender gaps in STEM fields. For instance, women continue to be underrepresented in STEM areas even in developed countries like Sweden and Norway, which score highly on gender equality. In developing countries, the gender gap in STEM is usually worsened by restricted access to resources and education. Economic and cultural obstacles also have a big impact (Singh, 2020). For example, in many African and Asian countries, girls are less likely to seek STEM education because of societal expectations and financial limitations (Singh, 2020)

1.2 Gender Disparity in STEM Fields

1.2.1 Historical Context

Women have historically been underrepresented in STEM fields. In ancient times, the idea of a woman in STEM was almost non-existent to many; however, women like Hypatia of Alexandria

who was a philosopher, and a mathematician made great contributions to the field (Minardi, 2011). Due to their almost negligible presence, the contributions of such women were often attributed to other men or not given the needed recognition. Despite this unfair treatment, women's involvement in STEM did not cease. In the 19th century, women like Ada Lovelace, a computer programmer, made substantial contributions to the field of computer science (Charman-Anderson, 2015). She built the foundation of the computer world we have today. The 20th century also witnessed the wave of the impact of women like Marie Curie, who made groundbreaking discoveries in chemistry and physics leading to her winning the Nobel Prize in both fields (Shanbhag et al., 2024). All these did neither clear the face of women in the field nor increase their representation therein. However, since the 1950s, there have been conscious efforts to increase women's representation in STEM. On that basis, there has been the establishment of various institutions and policies such as the United States National Science Foundation and the Girls Who Code initiative (Bozeman & Youtie, 2017; Palid et al., 2023). These initiatives and establishments have contributed significantly to the gradual increase of women in STEM. In recent times, women have continued to contribute significantly to the field of STEM through their involvement and leadership. The likes of Katalin Karikó, a pioneer in mRNA vaccine technology at BioNTech, and Sarah Gilbert, a lead researcher on the AstraZeneca vaccine at the University of Oxford, contributed significantly to developing the COVID-19 vaccine (Sahin et al., 2020; Dodgson, 2023).

1.2.2 Current Statistics

The world continues to witness a gradual increase in the percentage of females in STEM. Even though the change has not been astronomical, it is noteworthy. According to a report by STEM Women (2023), in the United Kingdom, the proportion of female STEM graduates has increased from 25% in 2015 to 27% in 2022. Also, women in the STEM workforce increased from 21% in 2016 to 26% in 2023. According to the Gender Gap Report by the World Economic Forum (2023),

the percentage of women in the STEM workforce in 146 nations has increased from 27.6% in 2015 to 29.2%. Other reports such as the one by UNESCO (2023) indicate that globally, women constitute 35% of STEM students, and another by Sangeeta (2022) also pointed out that women make up only 26% of STEM professionals across the world. In Africa, women constitute 25% of STEM students according to the African Development Bank (African Institute for Mathematical Science, n.d.), and in Ghana, women make up only 23% of STEM students (Davies, 2023). In terms of workforce, women make up 30% of the STEM workforce in Africa as reported by the African Development Bank (2022) and only 22% hold senior STEM roles (McKinsey & Company, 2022).

1.3 Barriers to Women's Advancement in STEM Leadership

Females' involvement in STEM has been a challenge, but their advancement to leadership positions in STEM has been far more challenging. From stereotypes about their ability to perform in math and science to a perception of their leadership inability, women face numerous challenges in their progression to leadership positions in STEM (O'Connell & McKinnon, 2021). Boateng and Gaulee (2019) in their study highlighted factors such as masculine working environment, gender discrimination, and the challenge of balancing family duties with the demands of STEM leadership as influencing female progression in STEM. The two profound challenges that women face in their advancement in STEM leadership is implicit bias and workplace culture.

1.3.1 Implicit Bias

In the wake of gender equality and women empowerment, people are likely to indicate their lack of prejudice against females and affirm their belief in gender equality or equity. This is because, as Basford et al. (2014) pointed out, overt negative stereotypes and perceptions against women have been reduced; however, it has taken a more latent form. According to Staat (2016), implicit bias is the unconscious attitudes and stereotypes that influence people's understanding, decision-

making, and actions. Pritlove et al. (2019) expand that people internalize schemas that they are not aware of. These internalized schemas predisposed them to act or enact discriminatory behaviors with no conscious intent. This means that people can explicitly report on or evaluate themselves as not being prejudiced and yet act in a prejudicial manner without being consciously aware. The existence of implicit bias is predominant in STEM fields. This is evident in the masculine environment characterized by men's career styles, work practices, and preferences (hierarchical and competitive) with very little or no regard for women's career styles, work practices, and preferences (egalitarian and collaborative) (Pritlove et al., 2019). Implicit bias in the form of latent stereotypes and discrimination, is one basic challenge in STEM occupations face. This has been pointed out as one of the reasons why most women leave STEM occupations to other fields.

1.3.2 Workplace Culture

Workplace culture can be referred to as a set of beliefs, values, expectations, customs, and practices within an organization (Chalmers & Brannan, 2020). This culture specifies appropriate behavior and defines the nature of relationships that exist among workers. According to Chalmers and Brannan (2020), workplace culture could be built on cooperation, competition, innovation, or control. Each of these have varying effects on employees' motivation, productivity, and job satisfaction. According to Su and Rounds (2015), people prefer and thrive in environments or cultures that align with their individual motives and traits. Thus, people who are personally oriented to be innovative and competitive would prefer a culture that allows employees to be creative and competitive. On the other hand, people who are oriented to be cooperative would prefer a culture that allows employees to work together, because they would thrive in such a culture. Su and Rounds (2015) also distinguished between a people-oriented (where workers interact more with other workers) and things-oriented (where workers interact more with things than other workers) cultures as characterizing STEM fields. From their review, males prefer and

thrive in a thing-oriented culture whereas females prefer and thrive in a people-oriented culture. Since STEM fields often adopt a things-oriented culture, this explains why females hardly thrive in STEM and are more likely to seek opportunities in workplaces where the culture is people-oriented, hence the gender disparity.

1.4 The Concept of Perception

Perception is the process by which individuals interpret and organize sensory information from their environment (Sarmadi et al., 2020). The theories that explain perception are numerous; however, the three common theories often used are the constructivist theory, the ecological theory, and the Gestalt theory. The constructivist theory which was proposed by Piaget (2013) asserts that perception is an active process through which people construct their own reality on the basis of anterior or prior experiences and expectations. From this viewpoint, perception is a construction of a person's mind and not a direct reflection of the external world. Also, perception is an active process as opposed to a passive taking in of sensory information. Therefore, people use perception to create their own world. This theory also adds that prior experience and expectations have a strong influence on perception. According to this theoretical standpoint, perceptions are stored in schemas: flexible memory structures that are automatically acquired and updated from the patterned activity and are composed of multimodal neural associations (Wood et al., 2018). Perception is also characterized by the assimilation of new information into preexisting schema and the adaptation of schema to accommodate new information.

In contrast with the constructivist theory, the ecological theory suggests that perception is a direct and automatic process whereby individuals perceive the environment in a more objective and absolute sense (Gibson, 2014). This theory lays emphasis on the role of the environment in shaping perception. It also explains that perception is a direct process that does not any inferences or

interpretations. This theory holds that is functional for the individual because it determines how he or she interacts with the environment.

The Gestalt theoretical perspective also proposed that perception is organized around patterns and relationships rather than individual elements (Hamlyn, 2017). The basic assumptions of this theory are that: 1. perception is a holistic process where the whole is more than the sum of its parts, 2. perception focuses on patterns and relationships between elements rather than individual elements themselves, 3. perception is an organized process where the brain groups similar elements together, 4. similar elements are perceived as related, 5. perception seeks continuity and smoothness rather than abrupt changes, and 6. past experiences influence perception and learning.

Several factors have been uncovered as affecting how a person perceives the world. Some of such factors include attention, motivation, biases and heuristics, and cultural background (Tajfel, 2015). Attention is crucial in perception formation because it determines what information is selected and processed (Kahneman & Henik, 2017; Jaegle et al., 2021). Motivation also plays a key role in perception as people tend to view the environment in a way that is consistent with their objectives and preferences (Schunk & DiBenedetto, 2020). Due to the diverse nature of cultural expectations and conventions, cultural backgrounds might influence how people perceive things (Berry & Dasen, 2019; Hallowell, 2017). A working definition for perception in the study would be a mental framework that describes how people select, organize, and interpret information in order to make sense of the world around them.

1.5 The Concept of Attitude

Attitude can be defined as a relatively enduring organization of beliefs, feelings, and behavioral tendencies toward a person, an object, or an idea (Albarracin et al., 2018; Vogel & Wanke, 2016).

Despite the wide scope of the definition of the concept, the consensus view is that an attitude is a

condition of mind, a collection of ideas, or a set of views about a certain person, object, or idea (attitude object) that have an evaluative component (positive, negative, or neutral character).

Attitudes are made up of three (3) components, namely, affective component, cognitive component, and behavioral component. The affective component of attitude refers to the feelings and emotions a person has about an attitude object. This component focuses on people's values and feelings (Elliot et al., 2016). This component is based on a person's emotional response to an attitude object which can range from positive to negative (Van Harreveld et al., 2015). The affective component is birthed from people's religious convictions, morals, and other values. For example, a person's attitude toward death penalty is based on their religious or personal values. The cognitive component of attitude highlights the thoughts and beliefs a person has toward an attitude object. This kind of attitude is based on the characteristics or relevant facts about the attitude object. This component is developed from a person's personal experiences, cultural values, and social norms (Jain, 2014). For example, a person's attitude toward a car based on its brand and model is cognitively based. The behavioral component of attitude refers to how a person acts toward an attitude object. This is based on the person's intentions and actions toward the attitude object which can range from very supportive to very oppositional (Vogel & Wanke, 2016).

Attitudes exist at two levels, the explicit level and the implicit level. The explicit attitudes are the ones we acknowledge, consciously endorse, and can report on. Assessing such attitudes can be done through self-report measures such as using a questionnaire (Vogel & Wanke, 2016). Implicit attitudes, on the other hand, are the attitudes that are uncontrollable, involuntary, and unconscious. Due to how subtle nature, implicit attitudes are difficult to report on.

Attitudes can be formed through classical conditioning, which is the process of pairing a neutral stimulus with an emotionally charged stimulus (Eelen, 2018). Attitudes can also be through

operant conditioning, which is the process of learning through the positive or negative consequences of behavior (Akpan, 2020). They can also be formed through social learning, which is the process of learning by observation and imitation (Allan, 2017). Several researchers have studied people's attitudes in relation to various general and sensitive topics. For instance, Brown et al. (2018) studied the attitude of mental health practitioners toward transgender people. Thapa et al. (2021) also studied nursing students' attitudes on the practice of e-learning. Azlan et al. (2020) also studied public knowledge, attitudes, and perceptions toward COVID-19.

1.6 Problem Statement

Despite the unique contributions of women like Marie Curie, Ada Lovelace, Katalin Kariko, and Sarah Gilbert to STEM through their involvement and leadership, women are often marginalized and not given the needed recognition in the field due to gender bias and patriarchal culture (Bird & Rhoton, 2021). Various studies have established the gender disparity in STEM fields (Kahn & Ginther, 2017; Noonan, 2017; Quansah et al., 2020; Saah et al., 2023; Su & Rounds, 2015; Zhang & Chen, 2022). Available literature identified factors such as societal influence and stereotype, parental influence on STEM majors, and interest in math and science (Quansah et al., 2020; Saah et al., 2023) as being the cause of such disparity. Despite the low representation of women in STEM, other studies have also established that the percentage of females decreases as they climb the academic ladder in STEM and enter various STEM careers (Arredondo et al., 2022; Wolverton et al., 2023). Some reasons that have been identified as being responsible for such phenomenon include lack or inadequate representation of role models (Davidovitz et al., 2024), stereotype threat and implicit bias (Collins et al., 2020), unconscious bias and microaggressions (Kim & Meister, 2023), lack or inadequate support from men and other women, and inadequate resources (Swafford & Anderson, 2020).

Among the numerous studies, Basford et al. (2014) and Kim and Meister (2023) explained how people's negative stereotypes and perceptions affect women in the workplace and the career progression and financial rewards of women in STEM, respectively. Focusing on the United States, Basford et al. (2014) indicated that even though overt negative stereotypes and perceptions toward women in the workplace are decreasing over time, such stereotypes and perceptions have taken a more subtle form and continue to affect women in the workplace. Kim and Meister (2023) also discovered that people's perceptions and evaluations have a greater influence on women's career progression and financial reward in STEM. This study also sampled respondents from the United States and Canada. The available studies fall short of covering the entire scope of the subject matter; the studies either focused on European or Asian countries (Basford et al., 2014; Kim & Meister, 2023) or focused more on the perspectives of the women in STEM (Boateng, 2017; Davidovitz & Cinamon, 2024; Moyal, 2023). This leaves people's views about females' involvement in STEM and STEM leadership positions as a grey area, particularly within the Ghanaian context. Unlike the Asian and European contexts, the Ghanaian context has a unique cultural landscape which makes it challenging to infer findings from other contexts into the Ghanaian context. Therefore, even though perception about women in STEM has been studied in certain contexts, the need to study it within the Ghanaian context remains crucial. Even though people's perceptions about women in STEM sometimes contrast with reality (Moyal, 2023), they are powerful determinants of how people interact and relate to women in STEM and those in STEM leadership positions. It is essential, therefore, to fully understand people's perceptions and attitudes toward women in STEM and STEM leadership positions. This study is thus designed to contribute to filling this gap by exploring STEM educators' and students' perceptions and attitudes toward women in STEM leadership positions with a focus on Ghana.

1.7 Research Objectives

This study aims to explore people's perceptions and attitudes toward women in STEM leadership positions. This is guided by the following objectives:

1. To explore STEM educator' and students' perceptions and attitudes toward females' involvement in STEM fields.
2. To explore the factors affecting female representation in STEM.
3. To explore STEM educator' and students' perceptions and attitudes toward female leadership in general.
4. To explore STEM educator' and students' perceptions and attitudes toward females in STEM leadership positions.

1.8 Research Questions

This study is designed to answer the following questions:

1. What are STEM educators' and students' perceptions and attitudes toward women's involvement in STEM fields?
2. What are the factors affecting females' representation in STEM fields?
3. What are STEM educator' and students' perceptions and attitudes toward female leadership in general?
4. What are STEM educator' and students' perceptions and attitudes toward females in STEM leadership positions?

1.9 Significance of Study

This study is of great value to the available body of knowledge on the subject matter. Its significance can be viewed from three perspectives; research, theory, and policy making. With regard to the study's significance to research, the study sheds more light on the dynamics of female representation in STEM fields by unearthing certain factors not covered in previous studies. This

goes to enrich the discourse on the gender disparity in STEM fields and the challenge of women climbing to the higher echelons of leadership. It highlights an important aspect of tackling the gender disparity in STEM fields and STEM leadership by focusing on people's perceptions and attitudes toward females' involvement in STEM and their perceptions and attitudes toward women in STEM leadership positions. The study also serves as a beacon that aims to indicate an area in the discourse on women in STEM leadership by highlighting the need for more attention and focus on people's perceptions and attitudes.

In terms of theory, this study provides evidence to substantiate the propositions of the role congruity theory of prejudice toward female leaders developed by Eagly and Karau (2002). It supports the theory's claim that the perception of incongruity between the female gender role and the leadership role does incite a form of prejudice toward female leaders by evaluating females less favorably as potential occupants of leadership positions and evaluating behaviors that fulfill the leadership role less favorably when it is enacted by a female. The study found that the respondents who saw a congruence between the female gender role and leadership role by indicating that females are capable leaders or highlighting the non-gendered nature of leadership, showed a favorable preference for female leadership and had a cordial or friendly relationship with female leaders.

1.10 Thesis Outline

This thesis is structured in five (5) chapters. Chapter one (1) consists of the study background, objectives of the study, the problem statement, research objectives, research questions, and the organization of the study. Chapter two (2) outlines the theory and concepts guiding the study. It also contains a review of various literature that has touched on various aspects of the discourse on gender and STEM. Chapter three (3) consists of the methodology and procedure for carrying out the study. It defines the population, the sample and sampling techniques, data collection, and data

analysis. Chapter four (4) contains a presentation of results from the analysis. It presents and expands on the various themes developed from the dataset. Chapter five (5) presents a discussion of the study's findings. It compares the findings of the study with existing literature and highlights areas of consensus or contradiction. It also presents a summary of the study, conclusion, recommendations, and suggestions for further research.



CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

This chapter presents the theoretical framework and conceptual framework that undergirds this study. It also contains a review of existing literature on gender and STEM, gender and leadership, and female leadership in STEM fields.

2.2 Theoretical Framework

This section covers the theoretical and conceptual basis upon which the study is built, which also serves as a reference point for discussing the findings of the study. The theory underpinning the study is the Role Congruity Theory of Prejudice toward Female Leaders (Eagly and Karau, 2002). This theory fits the study because it explains how people's perceptions of the congruence between gender roles and roles that are regarded as masculine, like leadership, are influenced by gender roles. The theory posits that a perceived incongruity between the female gender role and leadership role will induce the prejudice of (a) perceiving women less favorably as potential occupants of leadership roles and (b) evaluating behavior that fulfills the prescription of a leader role less favorable when a woman enacts it. The consequence of this is a difficulty for women to ascend into leadership positions and to achieve success in leadership roles.

2.2.1 Role Congruity Theory of Prejudice toward Female Leaders

2.2.1.1 Gender Roles

The proponents of this theory adopted the definition of gender roles from Eagly's (1987) social role theory which defines gender roles as consensual beliefs about the attributes of women and men. Since men and women occupy different social positions, there are normative expectations that delineate qualities and behavioral tendencies desirable for each sex. These expectations take the form of descriptive norms; consensual expectations about what members of a group actually do, and injunctive norms; consensual norms about what members of a group ought to do or ideally

would do. On this premise, gender roles can be defined as the combination of both descriptive and injunctive expectations related to men and women. People deduce that the actions of a person correspond with his or her internal dispositions. Therefore, the descriptive component of the expectations people have of others is based on the correspondent inferences from the behaviors men and women perform in their typical social roles.

Inferring from the social role theory, Eagly and Karau (2002) pointed out that the expectations and beliefs held about males and females pertain to communal and agentic attributes. Communal attributes or characteristics encapsulate concern for others; affectionate, helpful, kind, gentle, sympathetic, and nurturant. These attributes are ascribed strongly to women. The agentic characteristics which include aggression, dominance, forcefulness, independence, self-sufficiency, self-confidence, and a tendency to act as a leader, are also ascribed strongly to men. It is these ascribed attributes to men and women that instigate prejudice since people come to hold the belief that men and women ought to differ in conduct according to these socially defined lines.

2.2.1.2 Congruity of Gender Roles and Leadership Roles

According to Eagly and Karau (2002), prejudice against female leaders is a result of the disconnect between the female gender role and typical expectations about leaders. Since leadership is defined in agentic terms, perceivers are more likely to evaluate women as not qualified for leadership roles because the female gender role which is defined with communal traits runs counter to the qualities of leaders. Various literature reviewed in their theory have established that people on average perceive successful middle managers or holders of political offices more similar to men than women on a wide array of agentic characteristics, reflecting the masculine definition of leadership. The influence of gender on leadership is so profound because gender is salient in most if not all social situations which makes it an easily and frequently accessible component for evaluating appropriate behavior. In terms of leadership, women who fulfill the leader role incite positive

evaluations for fulfilling the agentic qualities of the leadership role and negative evaluations for violating the communal qualities of the female gender role. However, the distribution of evaluation; whether a positive evaluation will be made more than a negative evaluation, largely depends on the context within which the evaluation is done.

2.2.1.3 The Two Forms of Prejudice Toward Female Leaders

Eagly and Karau (2002) established that female leaders experience two forms of prejudice: (a) a less favorable evaluation of women's potential for leadership because leadership qualities are defined stereotypically in masculine terms and (b) a less favorable evaluation of actual leadership behavior of women than men because such behavior is perceived as less desirable in women than men. The first form of prejudice is built on the descriptive norms that classify men and women into distinct categories based on socially defined masculine and feminine traits. Since leadership is defined in masculine terms, it is perceived from a descriptive sense that men exhibit more traits of leadership as opposed to women. The second form of prejudice is founded on the injunctive norms that specify what men and women ought or should do. In terms of leadership, perceivers hold that since men exhibit more agentic (leadership) traits they ought to or should be in leadership positions. As a result, when women assume leadership positions and exhibit agentic traits as a means of measuring up to the demands of the leadership position, they attract less favorable or negative evaluations because their exhibition of agentic traits is in sharp contrast with the expected feminine or communal traits of women.

2.2.1.4 Moderating Conditions of Role Incongruity Prejudice

The theorists stated that there are several conditions that can moderate or influence the two forms of prejudice. Whereas a woman in a leadership position may receive a very negative evaluation for occupying one leadership position, she may receive a neutral or even positive evaluation for occupying another leadership position. For the first form of prejudice, some moderating factors

include the masculinity of the leadership role. Even though leadership is generically defined in masculine terms, the defining terms vary across different domains. For instance, an army officer's leadership role is defined in more agentic terms compared to the leadership role of a principal midwifery officer. Therefore, if a particular leadership role is less masculine, it would be more congruent with the female gender role, and hence, the probability of seeing women as less qualified for such roles will reduce or even disappear. Of equal importance is the level of leadership; the higher levels of leadership are defined more in masculine terms, therefore, the higher the leadership ladder, the higher the incongruity of the leadership role and the female gender role, hence, the higher the likelihood to evaluate women as less qualified for such roles.

Another moderating variable that influences the first form of prejudice is the sex of the perceiver. The theorists established from existing literature that men have a more masculine construal of leadership compared to women who have a more androgynous view of leadership which blends both communal and agentic traits and qualities. Therefore, based on their perception, men are more likely to view women as less qualified for leadership than women. Put differently, male perceivers are more likely to be prejudiced against female leaders. Other moderators include cultural milieu and year of data collection (available literature indicates a decline in unfavorable perceptions of women over time).

The second form of prejudice is built on the injunctive or prescriptive form of female gender role which leads to a less favorable evaluation of the behavior of women who occupy leadership roles. If a particular leadership position is defined in more agentic terms, and women completely fulfill such agentic requirements, they will be evaluated less favorably as a result of the prescriptive or injunctive part of the female gender role. Therefore, if women decide to include or exhibit some communal characteristics or traits that are more consistent with the female gender role expectation while in leadership positions, the level of unfavorable evaluation reduces. The moderating factor

for this form of prejudice is the perceivers' personal endorsement or approval of these norms. If a perceiver approves of the traditional gender arrangement and gender roles, he or she is more likely to evaluate a woman who fulfills the agentic traits demanded by leadership less favorably, whereas someone who disapproves of such traditional gender arrangement is likely to give a favorable evaluation. The baseline, however, is that the perception of incongruity between leadership role and female gender role induces prejudice against female leaders.

The role congruity theory of prejudice toward female leaders has been scrutinized, expanded, and adopted by researchers across the world since its inception. For example, Koburtay et al. (2019) extensively reviewed available literature on the adaptation of this theory and highlighted additional noteworthy parts to consider. From their review, the available literature confirms the existence of an incongruence between the leadership role defined in more agentic terms and the female gender role defined in more communal terms. For instance, Mol (2018) pointed out that even though leaders are expected to possess both masculine and feminine qualities, the masculine qualities are nonetheless overemphasized. Jones and Pal (2022) also affirmed in their study that the devaluing of women as potential and capable leaders continues to persist in many places. However, the review of Koburtay et al. (2019) highlighted additional constructs such as equality practices and leadership development programs specifically tailored toward enhancing females' leadership skills and abilities. These can increase females' self-confidence, aid them in coping with leadership tasks, and reduce negative prejudicial evaluations of female leaders. Furthermore, a shift in cultural attitudes that influence people's schematic cognition in gender stereotyping may help female leaders emerge and succeed. Also, del Carmen et al. (2024) highlighted in their review that certain key areas, such as contextual factors, multilevel role incongruity, and multidimensional role incongruity, should be considered in the discourse on the theory.

Aside from the various recommendations, the role congruity theory of prejudice toward female leaders is viable for studying issues that border on gender and leadership. Several researchers have employed this theory in studying different STEM and non-STEM phenomena and have made profound discoveries. For example, Evans et al. (2024) employed the theory in studying gender patterns in engineering PhD teacher assistant (TA) evaluations and discovered that males TAs had a greater probability of receiving a better rating for all survey question in which students rated performance than female TAs. Fritz and Van Knippenberg (2020) also used this theory in their study on gender and leadership aspirations. Their study highlighted that, unlike males, females receive more support and control and exhibit higher leadership aspiration under female supervisors. In addition, Graves, et al. (2017) studied “gender bias in the physics classroom” with the same theory and revealed that both males and females evaluated female professors’ scientific knowledge and skills less positively than that of male professors. This indicated a stereotype confirmation bias.

2.3 Empirical Literature

2.3.1 Gender Disparity in STEM fields

The gender disparity in STEM has echoed time and again in several studies. However, some studies have indicated that the gap is more profound in certain STEM fields such as mathematics, engineering, and computer science, than the other STEM fields (Sakellariou, & Fang, 2021; Anokye-Poku & Ampadu, 2020). According to Sakellariou and Fang (2021), women are fairly represented and even likely to dominate in medical, health, biological, and biomedical sciences. At the same time, they are underrepresented in math-intensive fields such as engineering and computer sciences.

While some studies (e.g. Sakellariou & Fang, 2021; Quansah et al., 2020) noted that the reason for such an occurrence is variation in the interest of both males and females toward these fields,

particularly in the field of mathematics, Anokye-Poku and Ampadu (2020) pointed out that there is no difference in the attitude of males and females toward mathematics. Thus, even though their study revealed that males perform relatively better than females in mathematics, the reason is not the difference in terms of attitude toward mathematics. Sakellariou and Fang (2021) indicated that boys' choice of STEM subjects is driven by an interest in STEM subjects, whereas for girls it is the early development of confidence in their math abilities (self-efficacy) that determines their choice. They explained self-efficacy as the key factor in a generative system of human competence, which relates to the sort of skills one has and what one believes he or she can do with such skills in different circumstances. Overall, people with high STEM self-efficacy are most likely to choose STEM-related subjects and pursue a career in them. They also acknowledged the fact that factors such as differences in career interests and lifestyle values, school environment, social factors, and cultural norms influence female motivation to choose STEM careers.

Other factors that account for the low involvement of females in STEM include societal influence and stereotypes, parental influence on STEM majors, motivation, and mentorship (Saah et al., 2023; Quansah et al. (2020). Quansah et al. (2020) categorized the various factors under three broad themes; school-related factors (course of study and interest in math and science), home-related factors (educational status of parents and their socioeconomic status), and personal factors (self-confidence, career indecision, and having a role model). Despite the immense contributions of the studies highlighted above, they lack in certain ways. For instance, most studies had females being dominant in the sample. This brings to question the validity of the findings since they most likely reflect a feminine perspective. For example, Amponsah and Mohammed (2019) in their study on the perception of learning science, sampled 328 final-year female STEM major students. This means that the findings are only from female perspectives.

In terms of measuring or assessing attitudes toward STEM-related subjects, there have been some arguments around the accurate means of measurement or the appropriate way of assessing such attitudes. The focus of the debate centers around which of the measures, either explicit or implicit, exerts the most influence on people's behaviors. Recent studies predominantly used self-report measures to assess the attitude of males and females toward STEM (Anokye-Poku & Ampadu, 2020; Sakellariou & Fang, 2021; Amponsah & Mohammed, 2019; Kahn & Ginther, 2017; Schmader, 2019; Zhang et al., 2022). However, other researchers have pointed out the pitfalls in using self-report (explicit measures), noting that a more accurate way to assess the gender-math (gender-STEM) attitude is by using an implicit measure (Nosek, & Smyth, 2011; Kiefer & Sekaquaptewa, 2007a; Kiefer, & Sekaquaptewa, 2007b; Nosek et al., 2002; Smeding, 2012). According to Nosek and Smith (2011), the determinants of a person's behavior are not only his or her self-understanding and intentions. Certain automatic mental processes often escape one's awareness. Therefore, implicit measures are designed such that they can measure the mental processes that people are unable or unwilling to report.

Various studies aimed at assessing the difference in attitudes toward STEM fields by gender mostly use mathematics as a baseline subject because of its relevance in science in general (Nosek & Smith, 2011). These studies which assessed implicit attitudes toward STEM subjects using math as a baseline have indicated that, females who have a stronger implicit stereotype of math as a male-dominated discipline have a more negative attitude toward math, have a weaker implicit identification with math, are more likely to perform poorly, and had a stronger implicit math anxiety (Nosek & Smith, 2011; Kiefer, & Sekaquaptewa, 2007b, Nosek et al., 2002). The underlying discovery, therefore, is that the STEM=male stereotype has a negative influence on female's decision to choose STEM-related subjects and pursue a career in them. However, implicit measures are not complete in themselves; they also fall short in some ways. For instance, they

cannot predict behavior with a hundred percent accuracy. In addition, they do not consider contextual factors that have a greater influence on behavior.

To bridge the gender gap that exists in STEM fields and ensure equal access to participation and contribution, various local and international organizations advocate for policies allowing equal opportunity for both men and women. Some of these advocacies have led to the establishment of various structures to ensure equal gender representation in education and STEM fields. For example, in the United States, there was the establishment of the Girls Who Code initiative with the aim of closing the gender gap in technology by providing free coding clubs and summer immersion programs for girls in grades 3-12 (Palid et al., 2023). In the UK, the Athena SWAN Charter acknowledges and commends positive approaches in higher education and research organizations to promote gender equality. One example is the facilitation of mentorship programs that link female students with accomplished women in STEM fields (Kong et al., 2020). The European Commission has also developed a gender equality strategy with the aim of integrating the gender dimension into research and innovation content, as well as encouraging gender parity in decision-making (Beroíza-Valenzuela, 2024). In Ghana, there was the establishment of the Science, Technology, and Mathematics Education (STME) clinic in 1987 by the Ghana Education Service (GES) which sought to organize special programs for students on innovation in science and technology (Sutherland-Addy, 2002 cited in Wrigley-Asante et al., 2022). Also, in 1997, the Ministry of Education established the Girls' Education Unit (GEU) which was focused on establishing non-discriminatory enrollment in education. At the tertiary level, affirmative action policies were established geared toward increasing female enrollment in STEM (National Gender Policy, 2015 cited in Wrigley-Asante et al., 2022). Despite these interventions, gender gaps remain.

2.3.2 Gender and Leadership

The discourse on gender and leadership has been deliberated for a long while. Its academic attention and scrutiny, however, dates back a little over 80 years ago when scholars like Sandra Bem wrote extensively in theory on gender stereotypes and the variation in various aspects of life, including leadership (Eklund et al., 2017). Even though debate remains concerning the accurate definition of leadership (De la Rey, 2005), the fine line in all the various definitions is that leadership is about having the ability and being in the position to mobilize people to undertake a particular action. Various researchers and academics have raised the concern that leadership has stereotypically been defined as masculine (Bandura et al., 2018; Cha et al., 2023; Eklund et al., 2017; Kark & Eagly, 2010), an incidence which denotes leadership as an exclusive reserve for men. This has made it challenging for women to take up leadership positions even if they possess the very qualities that define a leader.

The discussion concerning gender and leadership so far has focused on several themes, some of which include gender and leadership style, gender and leadership effectiveness (Eklund et al., 2017; Dwiri & Okatan, 2021), and gender and leadership aspirations (Fritz & Van Knippenberg, 2020; Fritz & Van Knippenberg, 2018). The literature on gender and leadership style posits that both men and women can choose any leadership style that fits the organization in question; however, women are more likely to adopt an interpersonally-oriented leadership style compared to men, who are more likely to adopt a task-oriented leadership style. In terms of leadership effectiveness, the available literature indicates that both men and women can be effective leaders. Fritz and Van Knippenberg, (2018; 2020) when commenting on the effect of gender stereotypes on leadership stated that it lowers women's leadership aspirations. The issue of concern with the current literature on gender and leadership is that it does not elucidate enough on people's ability to accept or reject the normative definition of leadership. Very little is known about people's ability

to reject the defined incongruity between leadership roles and gender roles and the reasons that influence such decisions.

2.3.3 Gender and Leadership in STEM

The definition of leadership with masculine traits and the designation of STEM fields as traditionally male fields present a double barrier against women who aspire to rise to leadership positions in STEM. According to McCullough (2019), women's leadership in STEM is “terra incognita”; an exploration in a new territory, considering women’s exclusion from these areas. To begin the journey to leadership positions in STEM and equip themselves with the necessary skill-set for leadership, some women begin by joining departmental groups and organizations in which they take various leadership positions (Boateng, 2017). The journey, however, from studentship to academia (Boateng & Gaulee, 2019) is replete with a host of challenges some of which include masculine working environments, unfair working conditions, and poor or inadequate support from society coupled with a lot of sacrifices, some of which include delaying family life and childbirth. One point consistently raised to explain why women are scarce in STEM leadership positions is that STEM fields and leadership positions are both very demanding areas such that, the sacrifice that must be made to attain that often discourages a lot of women (Acheampong, 2014; Amponsah & Mohammed, 2019; Saah, 2023).

2.3.4 The Leaky Pipeline

Historically, women and minority groups are disproportionately lost along the higher levels of STEM disciplines and careers. This is referred to as the “leaky pipeline” (Resmini, 2016). This has been a recurring problem that has attracted the attention of researchers and policymakers. This concept has roots in the 1980s when researchers and scholars began exploring the various factors responsible for the disproportionate loss of women and minorities in STEM fields and careers. Since then, numerous studies have contributed significantly to uncovering the various holes within

the pipeline where women and minorities are disproportionately lost (Arredondo et al., 2022; Lui et al., 2019; Wang & Degol, 2017; Wolverton et al., 2023). Literature has indicated that even though women earn 57% of all bachelor's degrees, only 35% of such degrees are from STEM fields. In tech companies, women occupy only 4% of CEO positions which clearly indicates their underrepresentation in leadership roles (Ashcraft et al., 2016).

The holes in the pipeline that available studies have discovered include stereotype threat and implicit bias (Collins et al., 2020), unconscious bias and microaggressions (Kim & Meister, 2023), lack or inadequate representation of role models (Davidovitz et al., 2024), lack or inadequate support from men and women, and inadequate resources (Swafford & Anderson, 2020). The patch or remedy for these holes is advocating for the creation of a conducive working environment for females and providing the necessary support for females in STEM careers.

2.4 Chapter Summary

In summary, this chapter presented a comprehensive literary background of the study. It touched on the gender disparity in STEM, the relationship between gender and leadership, the dynamics of gender and leadership in STEM, and the leaky pipeline concept. It also expanded on the theory upon which the study is built, the Role Congruity Theory of Prejudice toward Female Leaders. The next chapter is the methodology section which details how the study was conducted.



CHAPTER THREE

METHODOLOGY

3.1 Introduction

This chapter lays out the methodology adopted for the study. It embodies the research design, the research population, the sample size, and the sampling techniques adopted. It also discusses the research instrument, the method of collecting data, and how the collected data was analyzed. The method used for the study and its rationale are outlined along with the questions that needed to be addressed. This chapter also covers the ethical concerns related to the study. The chapter concludes with a profile of the institutions selected for the study, which are the University of Ghana and the Kwame Nkrumah University of Science and Technology.

3.2 Research Philosophy

The research philosophy underpinning this study is constructivism. As a perspective proposed by Lincoln and Guba (1985), constructivism is a paradigm that highlights the social construction of reality through individual experiences. This philosophy's ontology (ontology is the nature of being an existence) holds that reality is diverse and varies from person to person. This means that a person's perception of reality could, and often does, vary from another person. Regarding the philosophy's epistemology (epistemology is the process of knowledge formation), understanding is cocreated by the nature of interaction between a researcher and a respondent (Lee, 2012). This means that people's interactions with one another play a crucial role in how they formulate a particular body of knowledge. From this standpoint, understanding people's attitudes and ways of life requires an approach that seeks to solicit their individual experiences and the subjective interpretations given to the realities they experience. This would require an in-depth approach to studying various concepts that relate to human behavior. For example, Rose (2023) employed the constructivist approach to highlight a critical aspect of the discourse of racial discrimination which

is often overlooked. Making her argument, she pointed out that racial discrimination is often conceptualized as a social construction with composite biological connections. This conception is narrow because it does not touch on the complex nature of the subjective interpretations that individuals make in their perception of race and the influence of historical and political processes on their perception. From the constructivist perspective, Rose (2023) clarified that race is a subjective construct, changes in time, is influenced by contextual elements, and can be influenced by other non-racial features. This presents a better view of the concept of racial discrimination as it highlights the critical role that people's subjective interpretations play in the process. Also, Newton et al. (2013) found in their study that constructivism holds both theoretical and practical value. In their bid to find a remedy for the difficulty prelicensure nursing students face with medication calculations, they adopted a constructivist-based teaching and learning style and compared it with the traditional teaching and learning style. Their results showed that the students who were taught using the constructivist-based teaching and learning style had greater mean scores than those taught via the traditional teaching and learning style. This proved that the constructivist approach potentially improves student learning outcomes. This has been echoed by other researchers, including Kelpana (2014) and Rout & Behera (2014).

Given the positive evaluation and positive practical results achieved from using this approach, the constructivist philosophy suits this study because the study recognizes the diversity of people's perceptions and attitudes, hence adopting an exploratory approach. This approach allows for a broader view of the concept of focus (perceptions and attitudes) and allows the study to cover a wide range of input in terms of information from the respondents. The study also recognizes peoples' subjective interpretation of various concepts and phenomena, hence using an in-depth data collection strategy. This would also afford the research the unique opportunity of uncovering a deep and rich body of knowledge reflecting the participants' unique voices.

3.3 Research Design

The research design or the methodological framework within which this study is conducted is a qualitative approach, particularly employing an exploratory design or style. A qualitative research approach is an approach that aims to provide a detailed and in-depth understanding of various phenomena. According to Tenny and Brannam (2017), qualitative research has the ability to discover and explain processes and patterns of human behavior that can be difficult to quantify. The qualitative approach is also valuable for its ability to bring richness and depth by offering insight into how individuals interpret and understand the meaning of their experiences (Bleiker et al., 2019). The focus on context, existence, experience, perspective, meaning, and subjectivity in qualitative research provides a distinctive lens for examining and interpreting the intricacies of social phenomena (Lim, 2024). The main goal of open-ended data collection for qualitative researchers is to identify themes or generate theories based on the information gathered. Document analysis, interviews, focus groups, and observations are the most often used approaches with this strategy (Delal & Priya, 2016). A semi-structured interview was deemed fit for collecting data for the study.

Explorative qualitative research design is an aspect of qualitative inquiry that is useful for studying phenomena that are novel or have relatively unexplored aspects (Stewart, 2025). It is used for studying phenomena without predetermined predictions or hypotheses. This allows for the discovery of new insights or information uncovered in previous studies. Explorative qualitative research helps to identify or uncover variables for future research. The underlying focus of this design or approach is to understand people's experiences and perspectives about the subject matter or phenomenon in question (Makri & Neely, 2021). It is designed to uncover a detailed and rich understanding, and therefore, samples only participants who can provide detailed information

about the phenomenon in question (Hjeltnes et al., 2015). An analysis of data gathered through this approach often reveals patterns or themes.

3.4 Justification for choosing the Qualitative method

This study seeks to explore a grey area in the discourse on women in STEM leadership: perceptions and attitudes toward female leadership in STEM. To be able to delve deeper into the rich and diverse experiences and orientations of individuals and highlight the context in question, the qualitative approach was a viable option. People's perceptions and attitudes are such that they are difficult to quantify, hence, to make a meaningful assessment of such concepts would require the inquisitive, rich, and exploratory nature of the qualitative approach. Contextual knowledge is provided by the qualitative approach, which recognizes the influence of culture and environment on the results of the study (Hennink et al., 2020). Considering the hope of the study of being able to adequately inform policymakers to enable them to design a well-fitted intervention to bridge the gender gap that exists in STEM leadership and amend already existing policies, a qualitative approach will showcase the contextual details that must be taken into consideration in the process of policymaking and implementation (Sadovnik, 2017).

3.5 Rigor in Qualitative Study

As a different and slightly contradictory approach to the popular quantitative research method, qualitative studies are often questioned in terms of reliability, validity, objectivity, and generalizability. However, advocates for qualitative methodology such as Guba and Lincoln (1989) have raised valid and substantial arguments to establish the fact that the qualitative approach is a robust methodology that is used for studying phenomena that cannot be quantified.

As a means of establishing the trustworthiness of qualitative research, Guba and Lincoln (1985) elaborated on four (4) principles that must be adhered to. The principles are dependability, credibility, confirmability, and transferability. Dependability as a principle specifies that

qualitative studies should be reported in such a manner that other people can come to similar conclusions or interpretations if they review the same data (Nassaji, 2020). This can be done by detailing all the research processes (inquiry audit) including the data collection and analysis and how various conclusions were drawn (Pandey & Patnaik, 2014). This report can be assessed by other researchers to ascertain the link between the conclusions and the data. Dependability is the equivalent of reliability in quantitative studies. Collingridge and Gantt (2019) highlighted the possibility of arriving at slightly different conclusions when the same research process is used to analyze the same phenomenon. However, they clarified that such an incident is not evidence to discredit the qualitative approach, but rather it indicates the diverse nature of certain phenomena. That is, one researcher can use the same approach to discover a different aspect or deeper meaning of the same phenomenon in the same context.

Credibility as a principle is related to the believability of the findings of qualitative studies. Put differently, it relates to how truthful the findings of the study are and how they accurately reflect the reality of the said phenomenon (Nassaji, 2020). To achieve this, the researcher should have a better understanding of the participants in question and the context of the study and ensure that the research process is accurate with an inclusive interpretation of results. Other techniques of ensuring credibility include prolonged engagement with the research participants to establish trust, triangulation which is using multiple sources of data to enrich the understanding of the concept, and member checking which involves letting the participants double-check the interview transcripts and themes (Birt et al., 2016; Candela, 2019; Pandey & Patnaik, 2014). It is the equivalence of validity in quantitative research.

The principle of confirmability (Nassaji, 2020) or conformability (Pandey & Patnaik, 2014) is the equivalent of objectivity in quantitative research. This principle relates to how others can confirm

the interpretation of the findings and conclusions drawn in the study. According to Nassaji (2020), confirmability is similar to replicability which is the ability of a study to be reproduced. This can be achieved through audit trails whereby a researcher records and justifies the various steps undertaken and how he or she concluded on how to code and analyze the data. It is a transparent elaboration of the research process from the beginning of the study to the report of findings (Pandey & Patnaik, 2014).

Transferability is the last principle established by the advocates of qualitative research methodology. This is related to the concept of generalizability in quantitative research, but its concern is with how the conclusions and interpretations of a study can be transferable to similar contexts (Nassaji, 2020). Since the focus of qualitative research is to develop detailed and rich information about a particular phenomenon, it often has a small sample size and cannot generalize the findings. However, the transferability principle specifies that the researcher should provide adequate information that allows others to transfer the findings and interpretations of the study to other similar contexts. According to Pandey and Patnaik (2014), the basic technique for ensuring transferability is a thick description. This involves detailing the field experience and making the patterns of social and cultural relationships explicit and contextual.

This study therefore adhered to these laid down principles to ensure its trustworthiness. The researcher outlined all the processes employed in the study; from data collection to analysis and interpretation of findings (dependability). Also, the researcher has a profound understanding of the participants and the context of the research, had a prolonged engagement with the respondents during the interviews, and employed the technique of member checking in order to ensure credibility. In addition, the various steps undertaken in the research process have been well-documented and justified with a clear description of how the data was coded and analyzed. This

was done in adherence to the principle of confirmability. Lastly, as a means of ensuring transferability, the researcher highlighted the field experience and indicated the influence of cultural and social relationships on the patterns that were discovered in the study.

3.6 Pilot Study

The pilot study was intentionally designed to assess the acceptability of the interview procedure with reference to the interview guide as well as the assessment of the researcher's capacity to undertake the study (Lowe, 2019). As an exploratory study, the pilot study preceded the main study and was aimed at determining the feasibility of the interview guide and questions. The pilot study helped to highlight specific participants to purposively select, the possible challenges that could arise, and the time each interview in the main study is likely to take. It also served as an opportunity for the researcher to enhance his interviewing skills as he had limited experience in conducting interviews. The interview guide was piloted with three respondents: two male graduates who were employed in non-STEM institutions and a female nursing student. The interview was conducted in English and lasted an average of 26 minutes and 34 seconds. The interview was recorded and transcribed but was excluded from the main findings presented herewith. The feedback from the pilot study informed some modifications in phrasing the questions, adjusting the sequence, and adding additional prompts. For example, it was realized that some questions were double-barreled, and others were not structured in a way that would allow adequate probing. The double-barreled questions were rephrased, and the narrow questions were adjusted to allow for further probing. The pilot study also gave an idea of the average time the interviews would take. This helped to communicate the expected duration of the interview to enable prospective participants to schedule their time after indicating their availability to participate in the study.

The study obtained ethical clearance from the University of Ghana Ethics Committee for Humanities (ECH). Prospective participants were given a consent form that contained brief information about the overview of the research so they could abreast themselves with the scope of the research before indicating consent with their signature. For the interviews that were conducted over the telephone, verbal consent was sought after a brief verbal exposition of the overview of the study. The researcher also kept field notes in addition to a reflexive journal. The reflexive journal captured the researcher's ideas, feelings, and impressions during the research process (Annik, 2017). A review of the reflexive journal helped to improve the interview process. The interview was conducted in English and lasted between 13 to 42 minutes. It was recorded with a voice recorder app on a Samsung tablet and later transcribed for analysis.

3.7 Participants selection and inclusion criteria

The purposive sampling technique and snowball sampling technique were employed in selecting the participants in the study. Purposive sampling is the deliberate selection of respondents according to their capacity to illuminate a particular phenomenon, idea, or theme (Robinson, 2014). Majority of the respondents in this study were selected through purposive sampling; participants were selected based on their ability to elucidate on the gender disparity that exists in STEM. On the other hand, snowball sampling is a sampling technique that relies on referrals from respondents who were first sampled, who refer other people they think might have the feature of interest (Johnson, 2014). In this study, snowball sampling was employed to sample participants who were difficult to reach through other means. The only means of contacting them was through the referral or recommendation of some initial participants. These two sampling techniques helped the researcher to be effective in selecting respondents who met the criteria for inclusion in the study.

According to Mthuli et al. (2022) and Boddy (2016), saturation is a commonly used basis for determining sample size in qualitative research. From their review, researchers reach saturation around the sixth or twelfth in-depth interview among a homogeneous population. That is, from a homogeneous population, more than thirty in-depth interviews would be considered large (Boddy, 2016). Following their recommendations, the study sampled a total of thirty (30) respondents from the University of Ghana and the Kwame Nkrumah University of Science and Technology. The participants had to have an appreciable knowledge of the gender disparity in STEM. To assess this, the researcher, upon contact with potential participants, had a brief discussion on the subject matter after which a decision was made to either include or exclude such individuals from the research process. Participants who met this criterion and were accessible and available were requested to participate in this study.

The sample size of thirty (30) respondents was determined based on saturation; a point in qualitative research where no new information or insight is coming from respondents (Hossain et al., 2024). Since the focus of the qualitative study is to present rich and detailed information on a particular phenomenon reflecting the subjective experiences of participants, the sample is often not large (Malterud et al., 2016). On this basis, researchers agree that the ideal method for determining the sample size in qualitative research is saturation; where respondents are not introducing any new ideas. (Mthuli et al., 2022; Boddy, 2016). In this study, data saturation was reached after the thirtieth (30th) interview. This was evident in the fact that no new themes were emerging, and also later themes overlapped with the previously identified themes (Lowe et al., 2018). As a result, there were no further interviews.

3.8 Summary of Sample Characteristics

A total of thirty (30) respondents were sampled for this study. The sample included eight (8) faculty members, four (4) graduate students, three (3) graduates, and fifteen (15) undergraduate

students. There were fifteen (15) males and fifteen (15) females. The participants are specialized or specializing in fields such as biochemistry, mathematics, chemistry, physics, agricultural engineering, statistics, earth science, veterinary medicine, civil culture and forest management, pharmacy, and cyber security and digital forensics. The participants were identified with pseudonyms for the purpose of anonymity. The demographic information of the participants is presented in **Table 1** below.

Table 1: Demographic characteristics of participants

Pseudonym	Sex	Profession
PF1	Female	Senior Lecturer
PF2	Female	Assistant Lecturer
PF3	Female	Associate professor
PF4	Female	Associate professor
PS5	Female	Undergraduate student
PF6	Female	Associate professor
PS7	Female	Assistant sales manager
PS8	Female	Undergraduate student
PF9	Male	Lecturer
PF10	Male	Lecturer
PS11	Male	Undergraduate student
PS12	Female	Undergraduate student
PS13	Male	Undergraduate student
PS14	Male	Undergraduate student
PS15	Female	Graduate student

PS16	Male	Undergraduate student
PF17	Female	Research Assistant
PS18	Male	Graduate student
PS19	Female	Graduate student
PS20	Male	Undergraduate student
PS21	Male	Undergraduate student
PS22	Male	Undergraduate student
PS23	Female	Undergraduate student
PS24	Male	Undergraduate student
PS25	Female	Operations Manager
PS26	Male	Unemployed
PS27	Male	Undergraduate student
PS28	Male	Graduate student
PS29	Female	Undergraduate student
PS30	Male	Undergraduate student

Source: Field data, 2024

3.9 Data Collection

Data was collected using in-depth semi-structured interviews in addition to field notes (reflexive diaries). An in-depth semi-structured interview is a data collection approach in qualitative studies. In this approach, detailed one-on-one interviews are conducted using a set of open-ended questions known as an interview guide (Adeoye-Olatunde & Olenik, 2021; Eppich et al., 2019; Ruslin et al., 2022). For the majority of the respondents, the interviews were conducted mainly through face-to-face interaction. However, due to geographical dispersion and scheduling difficulties, a

few of the interviews were conducted over the telephone. This allowed participants who were unavailable for face-to-face interviews to still participate in the study. The interview was conducted with an interview guide to ensure that the researcher and the respondent stayed within the scope of the subject matter. The questions were designed in an open-ended fashion without any hint or mention of pre-determined themes. This was done to afford the participants the flexibility to discuss factors they saw as relevant or crucial. The interview guide (see Appendix A) contained an open-ended set of questions together with follow-up probes exploring their perceptions and attitudes toward females' involvement in STEM and females in STEM leadership positions. The interview guide consists of two sections; the first section covers people's perceptions and attitudes toward females' involvement in STEM and the second section covers people's perceptions and attitudes toward females in STEM leadership positions. Some of the questions in the interview guide include: 1. what do you think about females' involvement in STEM? 2. Do you think females belong in STEM fields? 3. What do you think about women in leadership positions? 4. What do you think about women in STEM leadership positions? 5. Whose leadership would you prefer to be under in your field and why?

The researcher conducted the interviews with the help of a research assistant who assisted with speaking with prospective respondents to secure their availability to participate in the study. As an exploratory study, participants were urged to share their perceptions, attitudes, and experiences freely. It is from their narratives that all the themes are developed. The interviews were conducted in English since all the participants were proficient in the English language.

3.10 Ethical Consideration

This study obtained ethical clearance from the Ethics Committee for Humanities at the University of Ghana with reference number ECH 187/ 23-24. The study therefore adhered to the ethical guidelines laid out by the committee. For the face-to-face interviews, upon contact, respondents

were given a consent form that contained a brief overview of the study, its focus, and objectives. It clarified the benefits or risks associated with the study and clearly stated that participants' information would be treated with confidentiality and participants kept anonymous. It also indicated that participation in the study is a freewill decision and that participants will not be compensated in any form except a verbal appreciation for their time and responses. If at any point in the study the participants decided to withdraw, it was stated that they had the free will to do so and that it would not attract any form of penalty from the researcher. Section C of the consent form provided a space for participants to sign their consent before the interview began. For the interviews which were conducted over the phone, a verbal consent was sought after the researcher briefly touched on all the pertinent areas in the consent form. The researcher ensured that no participant was forced, lured, or coerced to participate in the study. The researcher interviewed the participants strictly by the interview guide and probed adequately without veering off the subject matter.

The face-to-face interviews were conducted in offices and areas where the privacy of the respondents was ensured. The recorded interviews were saved with codes to keep the respondents anonymous and are in the safe keep of the researcher. Extracts of the transcripts are herewith employed in presenting the results of the study. However, participants were de-identified for the purpose of keeping them anonymous. The recorded audio and transcripts are safely stored on a password-protected personal computer. The outcome of the study will be shared with the University of Ghana graduate school and the SISTARS project team, however, participants' anonymity was ensured.

3.11 Data Analysis

The interview transcripts and field notes (reflexive diary) produced a large body of data. This data was then analyzed from the standpoint of reflexive thematic analysis. Reflexive thematic analysis

is an inductive approach to thematic analysis introduced by Braun and Clarke (2006; 2019). According to Joy et al. (2023), a reflexive thematic analysis is an accessible and robust method for exploring and developing an understanding of patterned meaning across a qualitative dataset. According to Braun and Clarke (2006; 2019), reflexive thematic analysis is composed of six steps or stages: 1. Familiarizing yourself with the dataset 2. Coding 3. Generating initial theme 4. Developing and reviewing themes 5. Refining, defining, and naming themes, and 6. Writing up. With the initial step of being familiar with the dataset, the researcher read over the interview transcripts several times to become acquainted with them. After being familiar with the data, the researcher proceeded to code the data. This involved creating labels that highlight the important characteristics of the data that have the potential to answer the research questions. The codes in addition to the key data extracts were assembled for the succeeding steps. Some codes that were generated were ignorance, fear, culture, inadequate support, and stigmatization. The third stage was characterized by generating initial themes. This involved carefully scrutinizing the codes with the focus of developing extensive patterns of meaning that may serve as potential themes. In this stage, the aforementioned codes were carefully inspected with the focus of pinpointing the patterns that underlie them. The fourth phase included finding links between various codes and grouping them under common themes. In this stage, using the example above, the researcher found a link between ignorance and fear and grouped them under ‘personal factors’ as a theme. Similar links were found among culture, inadequate support, and stigmatization, hence they were categorized under ‘social factors’ as a theme. The themes that were similar were combined and those that were not relevant to answering the research questions were excluded. For example, the themes ‘social support’ and ‘family support’ were combined as ‘support’. Also, the theme ‘wickedness’ was discarded because it was not relevant to answering the research questions. In the fifth stage, the themes were refined, defined, and named. This involved spelling out the scope of each theme,

establishing the story underlying them, and the name that best fits or describes the themes. Citing the same example, the theme ‘personal factors’ was defined as factors related to the individual but have roots in or are related to society. The theme ‘social factors’ was also defined as factors that originate from the society influencing females from being enrolled in STEM. Both themes were then named as ‘factors influencing female representation in STEM’. The final stage was crafting an analytical narrative from the themes and situating it within existing literature for the purpose of comparison. The result of this stage is detailed in chapters four (4) and five (5). The NVivo software v.20 was used for coding and the development of themes.

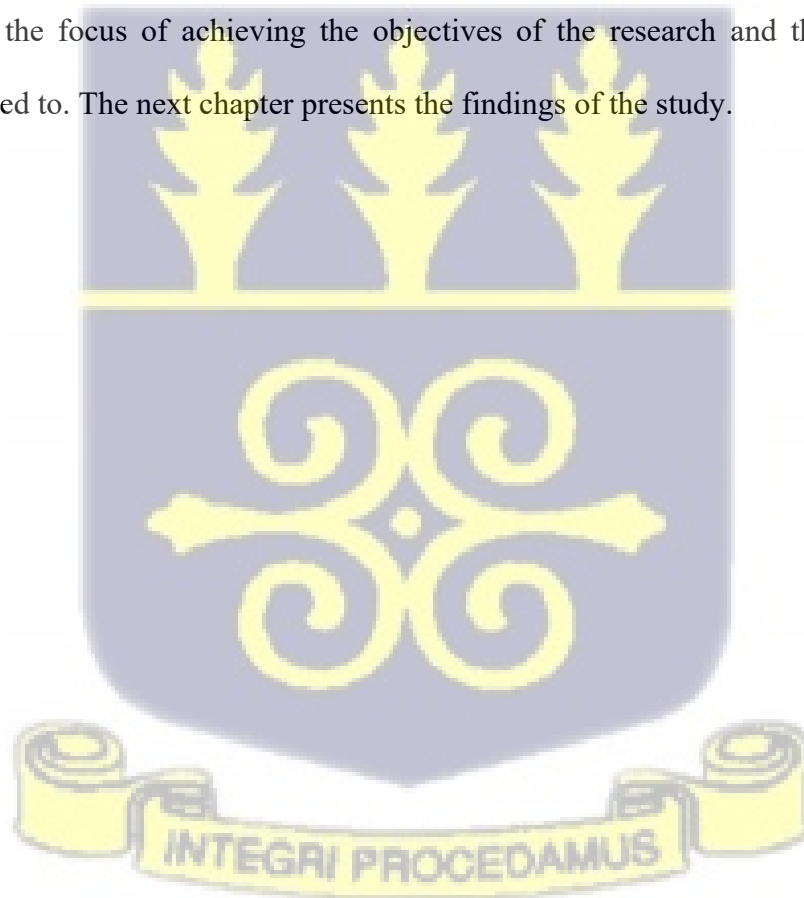
Since qualitative data analysis is an iterative process as pointed out by Ningi (2022), it allows the researcher to reflect and make necessary adjustments in the subsequent data collection. Therefore, it is strongly recommended that data analysis begins almost immediately. This will help the researcher to know areas that need further probing. To produce the first codes, units were defined, the data was segmented, and pertinent points were connected based on important correlations, patterns, and themes that represented the interviewee's opinions. The researcher employed an inductive approach, allowing the researcher to spot the emerging themes from the dataset carefully. From the data, themes and subthemes were finally developed. Coding units were defined as individual statements, often consisting of linked sentences relevant to the research purpose. The consistency and agreement among themes demonstrated a high level of reliability for qualitative data produced from thematic analysis.

As a value-laden approach, the trustworthiness of qualitative research is often questioned. However, as a means of ensuring methodological rigor and enhancing credibility, the study adopted a member-checking strategy (Birt et al., 2016). This involved returning the interview transcripts to the participants to verify if there has been any omissions or additions. Also, the initially developed thematic framework was discussed with four (4) participants selected at

random. This was to ensure that the participants' points of view and meanings are not diminished but accurately represented. Also, intercoder reliability was ensured. Intercoder reliability is a statistical measure of the consensus between different coders concerning the appropriate way of coding the same data (O'Connor & Joffe, 2020). The data from the study was coded by the researcher and an independent coder. The intercoder agreement was 95%. The differences in coding were successively resolved through discussion. For qualitative studies, agreement and consistency across themes is proof of reliability.

3.12 Conclusion

This chapter presented the methodological approach of the study. It detailed how the study was conducted with the focus of achieving the objectives of the research and the various ethical guidelines adhered to. The next chapter presents the findings of the study.



CHAPTER FOUR

FINDINGS

4.1 Introduction

This chapter contains the analyzed results of the data collected from the study. As clearly stated at the beginning, this study was designed to explore the perceptions and attitudes toward women's involvement in STEM and toward women in STEM leadership positions. The research questions serve as a guide for the analysis. The chapter also details the twelve (12) main themes and the sub-themes developed in the course of the analysis.

4.2 Themes and Sub-themes from the Analysis

The main themes that emerged from the study include 1. female representation in STEM, 2. factors affecting female representation in STEM, 3. perceptions about females' place in STEM, 4. perception about females' ability to do STEM, 5. female representation in leadership, 6. factors affecting female representation in leadership, 7. perception about female leadership capacity, 8. female representation in STEM leadership, 9. factors influencing female representation in STEM leadership, 10. perception and attitude toward females in STEM leadership positions, 11. factors to bridge the gender gap in STEM involvement, and 12. factors to bridge the gender gap in STEM leadership. The sub-themes from the main themes include (1) increasing female involvement, equal representation at the basic level, declining representation at higher levels, few females in STEM, (2) personal factors, social factors, (3) females belong in STEM fields, STEM is not gender specific, (4) females have the ability to do STEM, females excel in STEM, (5) low percentage of female leaders, increasing percentage of female leaders, (6) culture, (7) evaluation of female leadership ability, non-gendered nature of leadership, (8) few females in STEM leadership, increasing female leaders in STEM, (9) few females in STEM, inadequate support from female STEM leaders, (10) preference, relationship, (11) early exposure and encouragement, making

STEM attractive, support, and (12) encourage female leadership in STEM, leadership training, support, and increasing female representation in STEM. **Table 2** in the appendix section gives a graphical representation of the themes and sub-themes on the perceptions and attitudes toward females' involvement in STEM and the perceptions and attitudes toward females in STEM leadership positions.

4.2.1 Female Representation in STEM

This theme captures the perception of the respondents concerning the percentage of female representation in STEM. Their views were gathered around four (4) sub-themes: increasing female representation, equal representation at the basic levels, declining representation at the higher levels, and few representation.

4.2.1.1 Increasing female representation

According to the perspectives of some of the respondents, female representation in STEM has been increasing in recent years due to the various advocacies and policies implemented over the past decade. Their views indicated that some barriers that restricted females' entry into STEM fields such as financial constraints are being addressed. For example, the respondents indicated that provisions such as scholarships and affirmative action policies in various institutions have contributed significantly to increasing female representation in STEM. Commenting on the gradual increase of females in STEM, one respondent said:

“I think females' participation in STEM is low, but it's encouraging because looking at the past and now, it's really encouraging. In the past, it was only the men who were going to that field, especially in engineering and then technology, like the IT aspects. But now, there are lots of females who are into engineering, who are into technology, and even science and mathematics. I've come across a lot of women in those fields, so I think it's encouraging.” (Associate Professor, Chemistry)

She highlighted that, if you look at the female representation in STEM fifteen (15) years ago, the percentage was around 18%, but now the percentage is between 36% to 40% which to her is very encouraging. Other respondents shared the same view by stating that:

“Emm, yes, I would say that the avenue for women to pursue subjects in the STEM field is increasing, and I think from the statistics I’ve seen I think the percentages have risen over the years, yes. So I think we will eventually get there. We haven’t gotten there yet but we’ll eventually get there. Women are interested in STEM and they are taking the steps to be in STEM.” (Senior lecturer, Chemistry)

According to the respondents who shared this view, female representation in most STEM fields has not reached the point where it can rub shoulders with the male representation, however, the changes observed are significant and noteworthy.

4.2.1.2 Equal representation at the basic levels

Another view shared by the respondents is that female representation is equal at the basic levels, which are Junior High School and Senior High school, and even at the undergraduate level in most institutions. This view indicates the fact that the gender disparity in STEM is prevalent at higher levels such as Masters and PhD. The respondents shared that one key factor responsible for this is the affirmative action policy in place. The affirmative action policy is a policy that is focused on addressing gender inequality and promoting women's empowerment by tackling systemic barriers against women. According to the respondents, various institutions have lowered the cut-off point for females entering the university to pursue various STEM programs due to the affirmative action policy. This has given females, who hitherto could not secure admission into various STEM institutions due to not meeting the cutoff point to now be able to enroll. The extract below highlights this view.

“Okay, so I think at the lower level a lot more women are involved in STEM. I can say like it is like a 50/50 thing because for instance, I know that in the University of Ghana, there is an equal intake of students in the STEM fields for both male and female.” (Assistant lecturer, Mathematics)

4.2.1.3 Declining representation at higher levels

The third subtheme that emerged under the theme of female representation in STEM is declining female representation. Some respondents shared the view that female representation continues to decrease at higher levels of the academic ladder. According to them, even though female representation is fair from the beginning stages or levels, as they progress, their representation decreases. The higher levels of STEM education as the respondents indicated, are often challenging and require a lot of time, effort, and financial resources. As one respondent put it: *“...pursuing anything in STEM requires a lot of time attention to detail and time, and so if the person is not built to be resilient, then they give up...”* (Associate Professor, Biochemistry). Unfortunately, females tend to have difficulty in finding adequate time to dedicate to higher STEM education due to their added roles as wives, mothers, and homekeepers. Performing such roles together with the demands of the higher levels of STEM courses discourages most females from pursuing such higher degrees. As one respondent indicated, women who are able to combine the workload of higher levels of STEM courses with the roles of a wife, mother, or caretaker do with a considerable amount of social support from their families, friends, or colleagues. Aside from the cumbersome nature of combining the demands of higher STEM with their gender roles, the respondents also pointed out that securing financial assistance in terms of scholarships and grants sometimes tends to be difficult for females. This, as some respondents explained is because there are a very limited number of scholarship schemes or grants that make provisions to accommodate women who have families. The few available opportunities are project-based grants with schedules

that women who have families can adequately work within. This discourages women who have an interest in such opportunities but do not have the kind of support that will enable them to take on such tasks. The extract below gives an accurate description of the loss of females at the higher levels of STEM courses.

“But after the first level, like after the first degree, it is the higher level that the women drop off and then you have very few of them going up. So I think it is dependent on the level. At the lower level, when I mean lower level I mean undergraduate level, you have more like a balance thing, but getting to the end of it, for example, when you look at students who are majoring at the final year, students who are majoring in the STEM fields, then you will see the disparity. You will see very few females finishing with the STEM program. And then also even at the graduate level it is even worse, very very few of them go into still the STEM fields, yes. So depending on the level, the disparities are different. At the lower level they are similar, like equal numbers, but at the higher level is not so, very few people [females] go into it.” (Assistant lecturer, Mathematics)

4.2.1.4 Few representation

The last sub-theme that emerged under the theme of female representation in STEM is few representation. This sub-theme reflects the idea that female representation in STEM is generally low despite the gradual increase in representation. According to the respondents who shared this view, female representation overall is low in most STEM fields. However, they acknowledge the fact that female representation is almost the same or even greater in some STEM disciplines such as the medical sciences, yet when you take a broader look, males still dominate. Citing an example from his class, one respondent said:

“Okay, so women's involvement in STEM is quite low. So, for example, my department, I am in agricultural engineering, we are about 33 in the class, 34, and we just have 6, 6 females in the class, so that's less than half. So, not just my department, we have computer engineering, there are just about 6 girls or so.” (Student, Agricultural engineering)

Another respondent indicated the same incidence in his department. He said:

“No, I don't think so because from what I've observed, and I'm a student too, so I've seen that there are only few students in my field, especially in STEM. In physics especially, mostly especially, there are very few ladies or women in physics departments, yeah.”

(Graduate student, Physics)

The respondents added that females often shy away from a course like agricultural engineering because it involves an aspect of farming that most females do not like. They would also shy away from a course like physics because it is more mathematical and abstract in nature. This makes females opt for reading-intensive STEM courses such as biology or the health sciences or even choose a course from the social sciences.

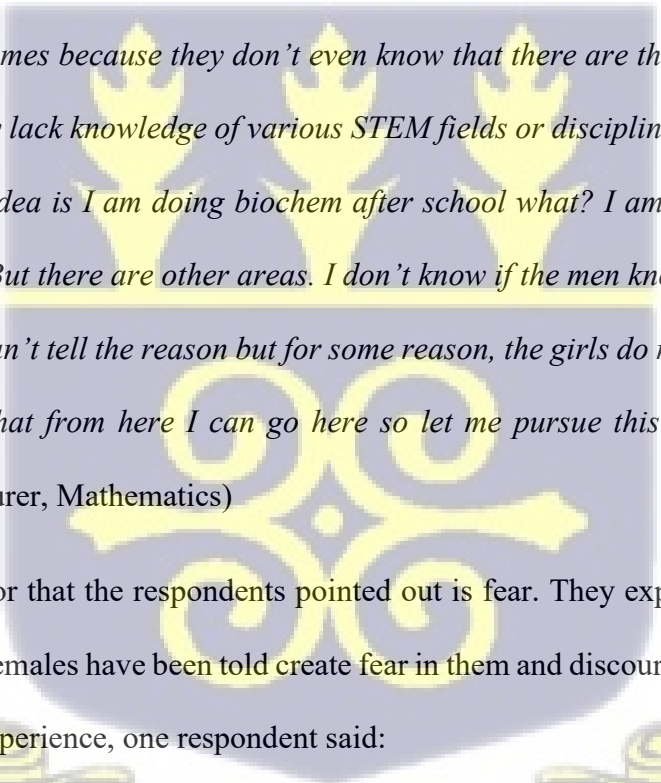
4.2.2 Factors Influencing Female Representation in STEM

The second theme developed from the analysis of the responses gathered during the study highlights the various factors that are responsible for the gender disparity observed in STEM. According to the respondents, several factors account for the overall low representation of females in STEM. The various factors mentioned can be categorized under two sub-themes: personal factors and social factors.

4.2.2.1 Personal factors

The personal factors constitute individual-based factors. These factors are predominantly psychological. Even though they are restricted to the individual, the respondents indicated that the personal factors often have roots in the social factors. The various factors captured under personal

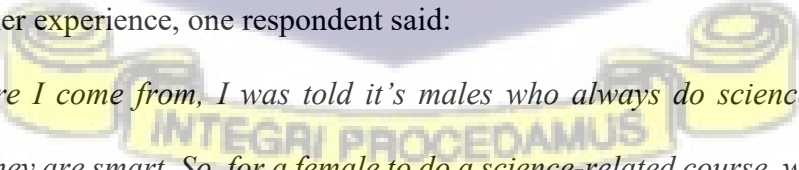
factors are; ignorance, fear, perception, and lack of willingness. According to the respondents, some females are not entering various STEM disciplines because they are ignorant of the diverse nature of STEM and the various career opportunities within most if not all the disciplines. In Ghana, most people when they hear of STEM only hear pure or medical science, computer science, mechanical engineering, and pure mathematics. They do not know other aspects of for example engineering such as industrial engineering and chemical engineering. In addition, most females do not know the career prospects available in Ghana for STEM courses such as mathematics, physics, and chemistry. This limited knowledge prevents most females from considering careers in STEM. One respondent put it this way:



“I think sometimes because they don’t even know that there are these areas that they can go into, so they lack knowledge of various STEM fields or disciplines that they can branch into. So their idea is I am doing biochem after school what? I am doing chemistry, after school what? But there are other areas. I don’t know if the men know it, like I can’t really tell if...I just can’t tell the reason but for some reason, the girls do not know. Some of them do not know that from here I can go here so let me pursue this to the topmost level.”

(Assistant lecturer, Mathematics)

Another personal factor that the respondents pointed out is fear. They explained that the various ‘wrong things’ some females have been told create fear in them and discourage them from entering STEM. Sharing her experience, one respondent said:



“So, where I come from, I was told it’s males who always do science-related courses because they are smart. So, for a female to do a science-related course, we think she’s kind of going to compete, like that’s not her level because she should stay in the den, do the home econs stuff and all this stuff. And then some ladies too, they fear that what if I do the

STEM and I end up not getting good grades, my parents will be disappointed and all this stuff. So, it's just fear and intimidation. So, the fear of failure. Because initially before they go into the system, they are being told it's for guys because guys are smart and they attempt to go in there. When they go in there and they find a little bit of challenge, they be like, 'so, I was told and I'm afraid I'll fail'. So, before they would enter, they would, some ladies... so, me for instance, before I entered, I had to put all these things into consideration. What if I fail? What should become of me? Will I be a disappointment? And all that stuff because I've been told already that it's for guys and guys are smarter than ladies. So, that kind of fear and all this stuff comes in” (Student, Chemistry)

Their views also highlighted the fact that even though some females have an interest in STEM and can excel when they enroll, they choose not to enroll because they fear that they may fail and disappoint themselves and their families. Females who are able to overcome this fear are the ones who are passionate, determined, and inspired enough to make a difference.

The kind of perception some females have about their abilities and STEM courses is another personal factor that prevents them from entering into STEM. According to the respondents who expanded on this perspective, some females think STEM is a difficult field and hence only males have what it takes to read such courses. They see themselves as lacking the intellectual capacity that STEM fields require, therefore, they choose to pursue careers in other fields outside of STEM. The extracts below confirm this view.

“There's this mindset that these STEM programs are difficult and then it's only the men that can pick them up. So I think that's what is causing the disparity.” (Graduate student, Cyber security and digital forensics)

“Okay, I think from what I know, I think they think the sciences are very difficult. The sciences are very difficult courses. For instance, when some of them hear about quantum physics, they run away. So I think it's the difficulty of the course that makes them not to try to step in that field.” (Graduate student, Physics)

As one respondent indicated, this perception is built early on at the basic levels. It is often carved from hearsay or comments from people who generally have an unfavorable view of STEM. She said:

“I think, basically, it starts from SHS when you're like, oh, it's too difficult. Because people are like, ah, I'm doing physics, it's too difficult. They just put this notion of, it's too difficult. And since it's too difficult, that means a girl can't do it. So, that's why most people don't prefer these pure science courses.” (Student, Physics)

The last factor raised under personal factors is the lack of willingness from females to pursue STEM courses. Some of the respondents pointed out that despite the various policies such as the affirmative action policy and the various scholarship opportunities available which aim at encouraging female participation in STEM, some females choose not to take advantage of such opportunities because they are generally not interested in STEM or believe the other non-STEM disciplines have more and better career prospects. Even though these opportunities are not as many as could be, the respondents are of the view that they are adequate to some degree to accommodate a lot more females. Put differently, the combined effect of ignorance about the various opportunities in STEM and the perception some females have about STEM creates fear in most females, thereby killing their desire and willingness to pursue STEM. One respondent simplified it this way:

“So, sometimes, I feel that there are opportunities there, but the women are actually not making good use of it.” (Graduate, Chemistry)

Whether it is ignorance, fear, the kind of perception, or a cumulative effect of lack of willingness, these personal factors function to restrict females from being enrolled in STEM.

4.2.2.2 Social factors

The social factors, according to how the respondents elaborated on it, are the various factors that are embedded in the very structure of the society. These factors exert a powerful influence on females' choice of reading STEM courses and pursuing a career in STEM. The social factors include culture, inadequate support, and stigmatization. Culture was the dominant point raised by the respondents with 22 references across 14 files in the dataset. The component of culture that was highlighted as affecting people the most is the descriptive and prescriptive roles assigned to both males and females in society. According to these roles, men are supposed to perform productive roles such as taking care of the family whereas women are supposed to perform reproductive roles such as taking care of the family. These assigned roles determine whether a person, either male or female will be deemed as fit to pursue a particular profession or not. So, women mostly pursue careers that mirror the reproductive roles society expects them to perform or careers that give them enough time to take care of their families. One of the respondents stated that:

“But, or should I say and some of the things that affect female participation if you ask me, one of the very first things is our cultural system. You know in Ghana or maybe in most of Africa, you'd realize that women are, they have some cultural role assigned to them as in they should be homekeepers, they should be mothers, they should be the people who just support their husbands, okay? And you don't really find a lot of women who have full-time careers like bankers, engineers, and what nots. In the sciences, it's even worse because you don't really see a lot of people who have done science from JHS to SHS, have finished university and are even in a graduate program. So as you go higher up the academic

ladder, you'd find less and less female being enrolled in those positions, and most of the times it's because of our cultural expectations.” (Associate Professor, Biochemistry)

These descriptive and prescriptive gender roles in the Ghanaian society go further to even affect the nature of education given to males and females. Males are more likely to be educated and encouraged to pursue education at higher levels than females. This is to prepare them for the productive roles they have to perform. Since females do not necessarily need formal education to perform the reproductive roles assigned to them, they are not as encouraged as males to be educated. Another respondent said:

“I think it's just cultural, from the grassroots and the general perception that certain professions are for men, and so when a woman tries to go there, then they are either discouraged or they themselves will give up because of the challenges they might face. Yeah, it requires a lot of work to achieve these things. And the traditional roles of women sometimes hamper the pursuit of such careers. The traditional role of a mother and a wife and a daughter, your parents, sometimes can be very overwhelming. As you go higher, the majority stop and do something else, either they start their own business, or they get a job with their first degrees and never go back to school. When they go back to school, they will do something not STEM-related, management or something else.” (Associate Professor, Chemistry)

Because gender roles form the basis of every culture, they tend to be enforced either explicitly or in a latent form. The enforcement is done in ways such as defining certain professions in masculine terms with masculine demands that females can hardly meet. The other way is discouraging females who decide to challenge the status quo and pursue careers in masculine-defined fields or professions. The extract below from the response of one respondent substantiates this view.

“Yes, we have a lot of people who have this perception that if you are a lady or if you are a woman then they belong to the kitchen. Then also, some people make the course or the field look very difficult for women. Some people believe that STEM is for only men and so if you're a lady and you are trying to engage in to STEM field you don't really get the encouragement from people, either your surroundings or your neighborhood or even sometimes our own people tend to um tell them that “oh come on, you see this field is not for you, electrical is not for you, engineering is not for you. Yours is to be on TV, yours is to dress. Yours is to sit behind a desk and not to be on a field working” and all that. And so I think that is also a factor that is hindering them from jumping into the STEM field.”

(Student, Mathematics)

Another social factor that the respondents indicated as hindering females from choosing STEM courses and pursuing a career in STEM is the lack of or inadequate support. Because STEM has been tagged as a masculine discipline, it contrasts with the gender roles assigned to females, therefore, females are less likely to receive the necessary support and encouragement if they decide to enroll in and pursue a career in STEM. One respondent said:

“So I think that in terms of even the education from the onset, most of the time we tend to push the men because again we know that at some point we won't get this much from the females because again you will have all these; the females we get married and all this. So even from the beginning, the push is not that much over there.”

(Associate Professor, Biochemistry)

Another respondent added that the support does not even come from other females who have been able to enroll in STEM and are employed in various STEM institutions. Ideally, such women should be the ones encouraging other females to come into the field, but it turns out that some of them even work to hinder the progress of other females coming into the field. The respondent said:

“And also one other factor I think is very important is women already up there, at the high positions, they do not try to encourage the ones coming into the industry, the other females coming into the industry. This has been a very thriving issue. I don't know if people are seeing it, but it's really happening. Whether they feel as if the lady coming in there is trying to compete with them or they like the attention of being the only woman in the industry.

It's just really bad how they do not encourage other women coming in.” (Student, Agricultural engineering)

Another social factor that some respondents highlighted is stigmatization. Again, because STEM fields have been tagged as an exclusive domain for males, females who choose to break the status quo by entering into various STEM disciplines are sometimes stigmatized. This stigma makes it difficult for females to choose STEM and uncomfortable for them to stay in STEM. The respondents also highlighted that, even though the stigma has been reduced in recent times, it persists more in latent forms. One respondent said:

“Some of them face some stigmatization, maybe if you're a lady and you're taking maybe engineering, they face some sort of stigmatization. Not often but in some cases, they do face those stigmatizations. You'll hear a lady doing engineering def eeeiii, it's some way. That kind of thing.” (Student, Biochemistry)

Another respondent added that:

“You know, the perception is that, as the first, from the question that you asked me, STEM is a field for men. So you know, when you go there the stigmatization as a woman, when you go into such fields, the stigmatization and everything...” (Senior lecturer, Chemistry)

The nature of the Ghanaian culture, the inadequate support, and the stigma attached to females in STEM are social factors responsible for the low representation of females in STEM in Ghana.

4.2.3 Perceptions and Attitudes Toward Females' Involvement in STEM

As the second objective, the study explored people's perceptions and attitudes toward females' involvement in STEM. The perceptions and attitudes reflect the subjective concepts and views together with the cognitive, affective, and behavioral dispositions that the respondents have concerning females' involvement in STEM. The sub-themes that emerged from their responses were: perception about females' place in STEM and perception about females' ability to undertake STEM programs.

4.2.3.1 Females' Place in STEM

This sub-theme captures the respondents' perceptions about whether STEM is a field where females should be. From their responses, all the respondents indicated that STEM is a field where females should be. As opposed to the popular notion of STEM being a masculine discipline, gender has very little or no influence on whether or not a person can excel in STEM fields. As one respondent pointed out, females just as males belong in STEM fields. She said:

“Of course!! Why would females not be expected to be in STEM? STEM is not beyond any person regardless of gender. STEM has nothing to do with gender because whether you're a male or female you have a brain and you can think. Throughout basic education school all the way till the end of university, both boys and girls and men and women sit in the same class and they are taught the same material. They are capable of grasping the same concepts. And even if you take performances in high schools in STEM programs, girls are doing equally, heck, sometimes even better than boys. So they definitely belong. If a woman can drive a car, why can't she be in a STEM career? The same intellectual or should I say thinking faculties that you need to do these things, so men are in no way superior to females when it comes to STEM.” (Associate Professor, Biochemistry)

As the respondents explained, the basic qualities that make a person excel in STEM fields: a genuine interest, passion, ‘right’ cognitive skills, determination, and resilience, are evident in and can be developed by both males and females. As one respondent said,

“STEM has nothing to do with your physiological appearance or your anatomy. It's about your ability, your capability, and then your interest. Whether male or female, if you have the right IQ, and you also have the interest to pursue that field, then it has nothing to do with your sex.” (Associate Professor, Chemistry)

She went further to explicate that woman naturally have the qualities that set one apart in the STEM field: attention to detail, patience, and endurance. One has to pay attention to the finest detail in conducting experiments or following certain procedures. One must also be patient enough to wait during most if not all experiments. And one must be able to endure the high demands in STEM. Women tend to be naturally equipped with these virtues and hence, make them qualified just as men to be in STEM fields. The extracts below support this view.

“I think STEM is an area that really allows you to think, be innovative, try to bring out solutions that would make the world better. And women have a lot of creative abilities. So, if you want to employ your creative abilities, I think STEM is one of the best areas for a woman to be in.” (Student, Biochemistry)

“Definitely yes, they belong, they should be. Because the main motive of STEM is to help solve problems, and it's not related to only, the problems are not related to only the guys, and we are not the only ones who have the knowledge to also solve this problem. So I think everyone should be able to work this out and be able to contribute to STEM.”

(Lecturer, Mathematics)

The other view pointed out is the non-gendered nature of STEM. Under this view, the respondents rejected the popular masculine tag of STEM by indicating that even though men have dominated

the field for a long period, they are not the only ones what the abilities and capacities to excel in such fields. They added that the masculine tag on STEM is a social construct that has very little or no empirical basis. For instance, some of the respondents said:

“I mean, STEM isn't a gender-biased field, so anybody at all could be involved in STEM. STEM is not for males. STEM is not for females only. It's for everyone. So, if you feel you have the capabilities, abilities, the strength, and everything to run in a particular STEM field, I think everyone belongs, yeah.” (Operations Manager, Statistics)

“STEM is not a field that is gender specific, anyone with the interest can be in STEM. Is not a field that is reserved for one specific gender, yes.” (Senior lecturer, Chemistry)

The respondents indicated that tagging STEM as masculine is an indirect way of saying men are the only one with ‘right’ and the unique ability to conceive the bright ideas that have developed in the field. However, the evidence of the profound impact made by women in the field will contrast this idea. As one respondent put it:

“In as much as we say that, oh, we can't just say men have all the ideas, men have the resources to push STEM or whatsoever. Women equally have the power to do that. So we can't just limit it or just narrow the scope and then assume if it's not coming from a man, then it's trash or something, nah. I've seen some wonderful females who are doing some powerful projects in STEM and then they are going far.” (Student, Engineering)

4.2.3.2 Females’ ability to read STEM courses

Aside from sharing their view about females’ place in STEM, the respondents also shared their views about females’ ability to undertake STEM courses and excel. Their views centered around the idea that females have the ability and capacity to do STEM, and the few women who have been enrolled in STEM have done great stuff. Some of these females were able to rub shoulders with certain notable male figures in STEM by making new discoveries and blazing a trail for other

scientists either males or females to follow. The following are some notable extracts from the respondents' responses:

“Okay, so, I mean, like how I said earlier, look at how, you know, countless women are winning, you know, the Nobel Prizes, science, and leading, you know, the research, you know, groundbreaking research and all of these things. I think they are proving their brilliance every day, every single moment that, I mean, yeah. So, the whole thing is that if you are smart, you are smart. If you are good, you are good, whether you are a male or a female. And I've seen very smart, you know, females. So, yeah. Yeah, so that's just my opinion...Okay, yeah, I mean, I've mentioned a couple of female names; Marie Curie, Katherine Johnson, and all of these things. I mean, we've had quite a number of females, you know, some, you know, excelling, you know, having, you know, the doctorate, having, you know, I mean, having like quite a number of females who are professors, you know, professor, you know, emeritus and all of these things. They are actually, you know, like, they are very, I mean, they are doing very well. The thing is that if you are given the right, you know, opportunities and support, there is no barrier that you cannot actually break. So, they are doing very well, yeah.” (Graduate, Chemistry)

“Yes, they are smart. And even if way back in history, you could see that there are certain things that they brought into the limelight before the men had to I mean, improve on it. For instance, we have some people that they started programming, some women started programming and then the guys took over. Like Ada Lovelace like this, she was a computer programmer and you know now where we are heading toward everything is about programming. So it was for almost a decade ago a woman started this and we the guys, no she didn't start the whole thing but I mean she made a huge contribution. And then if you look at someone like Sally Ride; Sally Ride, she's an American woman and she was the first

woman to land in space, and if you're talking about space then we are talking about something serious here. And if a woman has been able to go to space I mean, you can tell her capability.” (Student, Mathematics)

Aside pointing to females’ ability to read STEM courses, majority of women who have enrolled in the field or are enrolled in the field are actually excelling. This is noteworthy considering the many challenges women in STEM fields face. One respondent highlighted that despite the many things women have to attend to in their daily lives, they still find a way to excel, sometimes, even better than their male colleagues. She said:

“They excel even more, because women pay attention to details, women are capable of multitasking. You give a woman everything she needs to work with and you’ll see that she’d outperform her male colleagues. I can assure you, one hundred percent. ...Because in spite of everything that I described that I have to go through on a...and I have three kids, and I told you my age, I’m 43, I am an associate professor, which means I have gone up the rank twice. I started teaching here in 2010. I have male colleagues who started teaching here way before me and they just got promoted from lecturer to senior lecturer. So personally, oh yeah!” (Associate Professor, Biochemistry)

Other respondents highlighted from their responses that, the reason why some females end up doing better than some males in STEM is because of their hard work, dedication, and desire to prove people wrong. One of them said:

“Yes! They really excel. I feel like females even do better in STEM than guys. Because there's always this thing too, when a female gets into STEM, she's always working twice as hard to prove the point that, yes, she can do it. So, usually, the females who enter STEM do way better than the guys because they are trying to prove, yes, they can do it.” (Student, Physics)

Another respondent also said:

“You see, one thing about giving a female a major role is usually they want to prove that they are better, they can do it. So, when you give them an opportunity like that, whatever it takes for them to excel, they do. Yes. So, they really excel in any role, any STEM role you give them.” (Operations Manager, Statistics)

All these responses indicate that the respondents have a favorable perception and attitude toward females in STEM. By highlighting that STEM is not gender specific, females belong in STEM, females have the ability to undertake STEM courses, and females excel when enrolled in STEM, the respondents perceive females' involvement in STEM favorably and have a favorable attitude toward females' involvement in STEM.

4.2.4 Female Representation in Leadership

Female representation in leadership as a theme captures the respondents' perspective on the gender distribution in leadership. The sub-themes that emerged were increasing representation and low representation.

4.2.4.1 Low representation

This sub-theme contains the cumulative idea that female representation in leadership is low relative to males. Even though females are more than males in most populations, it does not reflect their representation in political, social, educational, and career leadership. Expanding on this view, one respondent said:

“So I think in Africa, you'll probably find in – any institution that you go – you'll probably find about 15% to 20% of them being female. And as you go higher up the leadership echelons, it's actually less. You'll probably find maybe, if you're lucky and you get anywhere between 5% and 10% in leadership positions, then it is miraculous. Emm, times have changed now, but in the beginning I think you wouldn't really find a lot of women in

leadership positions. And it's mainly because of some of the things that I've told you. We don't progress high enough as fast to get to a point of leadership" (Associate Professor, Biochemistry)

Drawing on a similar statistic, another respondent noted that:

"Maybe percentage as compared to men, I don't know. Maybe, say, about, let's say, 20 to 80 percent. So, 20 for women, 80 for men. So, I think more women should actually be encouraged to also pick up, you know, some positions too as well. So, yeah." (Graduate, Chemistry)

One respondent expanded that, even though female representation in leadership is low, the few women in leadership are doing exceptionally well despite the many challenges they are confronted with. She said:

"Yeah, it's the same issue, you normally don't find too many females in leadership positions. But of course, the ones that you find are also very excellent, yeah, if you ask me. And it's the same thing, you start off with a large number, and then in time it sort of drizzles up, and then you have very few of them up there. And I believe it is again the same issues, because of time, and family, and all those extra things that come with it." (Associate Professor, Biochemistry)

4.2.4.2 Increasing representation

Aside from pointing to the low representation of females in leadership, some of the respondents stated in acknowledgment of the gradual increase of females in leadership positions. This increase was attributed to factors such as the increasing level of education among women, women empowerment policies and programs, and the initiative and courage of women to go for leadership positions, and support. Some respondents stated that:

“More women are going in for leadership positions. That's because now they've been enlightened. Now they know that as long as they have the capacity to fit there, they can do it. They can go there and they will be supported. Yes, compared to previous years, I think women are taking more leadership positions in the country and even worldwide.”

(Research assistant, Civil culture and forest management).

“I honestly think the ladies or the women are coming to the realization themselves. Because let's say, let's take social media, for instance, when you go there, you see them doing the equality, like, yeah, gender equality and all those things. So I think they are realizing it themselves. Men are not really doing much, but they are realizing it themselves that, oh, they can do better, they can do better. So I think they are trying to improve themselves. And when, whenever they realize it and they come into the field, I think the men allow them to flow in some of the fields.” (Graduate student, Physics)

One respondent stressed the idea that support is a major factor that increases female representation in leadership. Females can be educated, smart, equip themselves with the requisite leadership skill and still not be able to become leader if they do not have support from people, particularly men. The journey to becoming a female leader is saddled with numerous challenges, without financial, social, and moral support, one would easily give up. Citing a clear example, she said:

“I think one factor is also support because if you don't have the support, you can't get there. Taking the current KNUST SLC president for example, when she stood for the first time to be an SLC president, the students were like, oh a female SLC. She was the first person to actually come out to be a SLC president, a female. And even if you look at the students' comments, they were, hey, a female president, what can she come and do? What will she do? And all those things. But when she came back for the second time, their mentality changed because they saw someone who wasn't giving up. They saw someone

who has passion. They saw someone who has interest. And then they were like, why not? Let us give her our support because even the males that have come, we don't even know what they came to do. So let us give this lady our support and see what she can do. One key thing is also support because if you don't have the support, you can't get there. If you are always being criticized, even your own family, your own circle, it will be very difficult to get there. So support also is very, very important.” (Research assistant, Civil culture and forest management)

The respondents also explained that even though female leadership has been increasing a long time, a greater portion of the increase has taken place in recent years, over the past decade. The extracts below substantiate this view.

Oh yeah, yeah, yeah. A lot of improvements. Yes. Five, 10 years ago, it didn't used to be like that. Yes. Not at all. But now, a lot of women have been given the opportunity. Like I said, we are drifting. People are learning, people are advancing. So things are changing. (Operations Manager, Statistics)

“I think there is a difference because we are now seeing our women out. At first I think I don't really hear about female leadership in, you know, leadership roles like now. Now I think leaders and women are already availing themselves of such roles. So we are becoming, we are reaching there, we'll get there. But it's becoming, you know, there's a progress” (Student, Chemistry)

4.2.5 Factors Influencing Female Representation in Leadership

This theme houses the factors that the respondents point to as causing the low representation of females in leadership positions. The only factor pointed out by the respondents is culture. According to them, the prescriptive and descriptive gender roles in the Ghanaian culture make it challenging for women to become leaders. The Ghanaian culture is one that is patriarchal in nature,

hence, female subordination is a norm. The power structure in the family that situates man as the head extends to the larger society. One respondent rightly stated that:

“Yes, in a way it's our culture because in our home we already have the mind-set that men are to lead. They are the head of the family which is not fair. They are the ones, but they are not the ones who do everything in the house. But as a woman tells, you know, in a way a woman tells us what to eat, what we should wear, where we should place things, where we should put that. So in a way women are leading in such places. So I think it's our culture, our cultural stuff that's making me look like that.” (Student, Chemistry)

Even though there are various initiatives to change or amend the gender dynamics in Ghana by encouraging female leadership, some men, as one respondent stated, have remained unchanged and still hold on to and enforce patriarchy. She said:

“There are still culturally some men who cannot accept the fact that the woman is leading them. And men form the majority of people in the public space. So before a woman can succeed in leadership, you will need men on your side, some men at least. And that is what a woman needs to know if she wants to go far in leadership, that you will need the men who dominate the space, a good number of them to be supportive of you. And I think what some women in the past have failed to recognize was that they saw male colleagues as their enemies to be fought and not potential allies and collaborators. Of course, some men are very hostile, I've said that already, extremely hostile. They cannot wrap their heads around the fact that a woman wants to lead, maybe because culturally their background, their mother was always at the back stage, had no opinion, so it's difficult for them.” (Associate Professor, Biochemistry)

The prescriptive gender roles create a negative impression about women's ability to lead. Since the communal nature of the female gender roles conflict with the agentic nature of leadership,

people tend to see women as not competent and capable to lead and hence do not give them the opportunities to lead. Speaking to this challenge, one respondent said:

“No, it's not. It's not, because one, of the way, I mean, culturally, no. I mean, that is very difficult. It's now that things are changing a bit. But it seems to take years. Yeah, I think it takes so many years for a complete change. But again, it's not difficult because they have to battle a lot of things, you know. People seeing them as weak, people seeing them as not capable, people seeing them as, you know, they being easily manipulated and stuff, especially if the person is married. Even if the person is not married, the person may be going out, let's say, in a relationship, and thinking that the males can easily influence their decisions and stuff. I think that poses a very big challenge to them, especially, yeah, if they want to occupy such positions. So, it's not easy. There are so many things to actually contend with, yeah.” (Lecturer, Mathematics)

4.2.6 Perception and Attitude Toward Female Leadership

Another theme that emerged from the responses is the perception and attitude toward female leadership. This entails the respondents' concepts, cognitive and affective orientation, and behavioral tendencies toward the idea of female leadership. There were two sub-themes that emerged under this theme: evaluation of female leadership ability and the non-gendered nature of leadership.

4.2.6.1 Evaluation of female leadership capacity

The evaluation of female leadership ability is an assessment of whether females are able to lead. Concerning their evaluation or assessment, all the respondents indicated that women are capable leaders. Even though some of the respondents expressed the idea that it is not laudable to compare female leadership to male leadership because men do better in some leadership positions than

females and females also do better than men in some positions, they all agreed with the idea that women have what it takes to become leaders. Below are some of the extracts from their responses.

“Yeah, they are very, very capable. Some are even better than the men. They are very, very capable. I know that most people compare men to men based on sympathy and empathy and the rest. They've been saying women have sympathy and they are too caring and because of that their emotions are soft and you can't believe there's an all and all. Who said males are not emotional? And who said males are not, they can't sympathize with people? We all have those emotional characteristics. So you can't judge someone based on, because we are female so we are emotional and we can't be leaders. That's very, very wrong. Women are capable. Some are even more capable than the males. They can be leaders. They can lead. Being a leader is about quality. It's about what you can do. It's about your capacity. It's not about comparing emotions. So women are very, very capable. They can be compared to men when it comes to leadership and they can stand, work hard, and be victorious wherever they find themselves.” (Research assistant, Civil culture and forest management)

“Yes, women are capable leaders. Because some women are still in leadership and they are doing extremely well, yes, and the organizations are thriving for so many years. There are women CEOs, there are women founders and things are still in operations. Vodafone has a CEO, a woman CEO, and it's still in operation. So yeah.” (Operations manager, Statistics)

It was indicated from their responses that the communal nature of female is a compliment and not a deficit to their leadership. Contrary to the popular conception, the respondents explained that women's feminine traits rather make their leadership unique. One respondent summed it up this way:

“In fact, women make better leaders looking at all the problems they have to go through. If a woman still emerges, then she is resilient, she is tough, and she can deliver. And a woman does not only lead with her head and logic, she leads with her heart, and you need that when you're leading human beings.” (Associate Professor, Chemistry)

4.2.6.2 Non-gendered Nature of Leadership

A unique sub-theme that emerged from the responses of the respondents is the idea of the non-gendered nature of leadership. Contrary to the masculine definition of leadership, some of the respondents indicated that gender has very little or no influence on a person's ability to lead. They indicated that what makes someone a leader is the person's personality and competence. Those who subscribe to the idea that leadership is determined by a person's personality explained that the qualities of leadership and the ability to lead is an inherent trait that some people have regardless of their gender. Because it is an inherent nature, some people possess the qualities that predispose them and make them more likely than others to emerge as leaders. Below are some of the extracts that highlight this view.

“I have had both women and men leaders and I have had both good and bad women and men leaders so I cannot tell who is better and who is not. So it is more of personality than gender, yes. I think in terms of leadership it is more about personality than gender... I said the type of leadership is based on the personality, not gender. So you can go to an institution you can have a man leading the institution, everything runs well. You can go to another institution a woman is running the institution and everything is going well. The same way you can go to an institution, another institution a man is running things are falling apart. The same way a woman will be running and things can be falling apart. That is what I mean. So it is based more on a person's character and leadership skills than a person's gender.” (Senior lecturer, Chemistry)

But when it comes to leadership, it just depends on the individual, not the person's gender. I think it's actually about the individual's personality; how the person sees things, how the person understands. Because you can understand something differently from the way I understand it.” (Student, Physics)

“I think leadership is all about qualities. I mean, to be honest. Earlier I said that women, you know, they have this kind of qualities. They are, I mean, equally too, some men also have the same, you know, qualities. So, I think the comparison maybe should actually be ditched in the first place. But it's all about qualities, not even about gender.” (Graduate, Chemistry)

The others whose views directed toward the idea that leadership is non-gendered pointed out that, what makes a person likely to emerge as a leader and be able to lead is his or her competence; the leadership skills he or she has built over the years, and the results he or she has produced with such skills and not about the person's gender. Their responses indicated that people mostly if not always emerge as leaders because they are competent. They emerge leaders because they show a track record that qualifies them for various leadership positions. Put differently, if a person builds the required qualities for leadership and shows a credible track record, he or she will emerge and perform effectively as a leader regardless of gender. Below are some of their responses:

“I think for leadership, it depends on who is leading. It's an individual thing rather than a broader sense. So, if whoever it is, whichever woman that is leading has trained herself to be able to take on the task, she can lead effectively. That's the same way with a male counterpart. So, I don't think leadership should be gender-based in the first place.” -PS15

“Gender has nothing to do with it. If gender had something to do with it then I wonder how leadership would be chosen in the US where they have over 137 genders right now. Gender

has absolutely nothing to do with it. It's all pure hardcore ability to do the things and demonstrating a track record that if you've been given an opportunity, you have delivered and delivered excellently at it." (Associate Professor, Biochemistry)

"But apart from that, in terms of competencies, I mean that one I think it's individual. If the person is a good leader, regardless of whether the person is a man or a woman, the person is good at it, finished. So they will still deliver and do what they need to do."

(Assistant lecturer, Mathematics)

The views of the respondents expressed as a positive evaluation of female leadership ability and highlighting the idea of the non-gendered nature of leadership indicates the favorable perception and attitude of the respondents toward female leadership.

4.2.7 Female Representation in STEM Leadership

The study also sought to explore the perceptions of the respondents concerning female representation in STEM leadership. The views of the respondents cumulated around two sub-themes; low representation and increasing representation.

4.2.7.1 Low representation

As a view shared by 64% (14 out of 22) of the respondents, it highlighted the idea that there are few females in STEM leadership positions. The respondents confirmed this in the extracts below.

"When it comes to the STEM leadership positions, I don't think there are too many. Maybe if you take a percentage, I don't think there are more than 30%. I don't know, but from what I've seen, I don't think there are more than 30%. Especially in Ghana here or in the African countries." (Student, Earth science)

“But then in reality, you don’t even have enough women in leadership positions in STEM to even help to hold the hand of the younger woman to come up. So that is the biggest challenge, that you don’t have enough.” (Associate Professor, Biochemistry)

“No. For instance minister for um, let's say health is a man this is a company like GNPC that is a petroleum company is headed by a man. GNPC is a STEM field, it's headed by a man. Look at ECG for instance, it's a STEM is decided by a man. In Ghana to be precise, all the institutions that connect the various STEM fields are all added by men. When you go to a place like atomic, atomic is headed by a man. So I think if you want to give women the opportunity to also come in the STEM field, then give them the opportunity to also head such fields. But if you check all our STEM fields in Ghana, they are all headed by men and their vices are all men and the women tend to be they are secretaries sometimes not all of them but some.” (Student, Mathematics)

The low percentage of females in STEM leadership is alarming because, as the respondents discussed, when women get into leadership positions in STEM, they can initiate or enforce various policies that will increase participation in the field and also aid in their ascension into the higher levels of STEM. In addition, women in STEM leadership positions serve as mentors for younger females by inspiring and motivating them to stay in STEM and aim for higher heights. Their limited number therefore implies that the younger generation would struggle for lack of mentorship which would discourage most of them to pursue careers in other fields.

The reasons the respondents gave for the low representation of females in STEM leadership positions are; few females in STEM and inadequate support from females. Commenting on the inadequate percentage of females in STEM as contributing to the inadequate percentage of females in STEM leadership, one respondent said:

“Because we don't have a lot of them in the field. So we don't have a lot. We need a lot of them so that they can enter into STEM, but most of them run to the social sciences and all the business and all the other fields, yeah. So I think that's the cause. If we have a lot of them coming to the field, I think they will fight for the positions because generally looking in the world, what is happening in the world, as I said, they are learning themselves to be trying to fight for their rights, which some of the men are allowing them to do. So I think if they tend to come into the field, they will fight for that position as well.” (Graduate student, Physics)

Another respondent added that:

“Yes, it is more about the numbers, yes, that we have than the skill or anything. If a lady is skilled enough or has the experience to be a leader and she is available, I think yeah, from what I know, they are given the opportunity, yes, from my experience.” (Senior lecturer, Chemistry)

Also, other respondents pointed out that another factor responsible for the low representation of females in STEM leadership positions is the lack or inadequate support from people, particularly other females in STEM leadership positions. Mentals in STEM leadership should ideally serve as mentors to younger females, but in the cases highlighted by the respondents, most of them take up such roles. However, the respondents pointed specifically to the inadequate support from females in STEM leadership positions. One respondent elaborated on this idea in the extract below.

“We women in leadership positions are our worst enemies because some women – especially some of the older generation who really struggled and had a tough time, not necessarily competing but even just cohabiting with their male counterparts – when they eventually pulled through all of that murkiness and became leaders, when they see another

younger female academic coming and who doesn't have too much of the struggles that they had going up and in a short time they've risen, their relationship with those women is not really good because, why should you have had it so easy when I struggled so long and so hard to get here? I find that a lot. So you don't have too much support from some women who are in higher positions for women who are rising in the scenario, okay? So for instance, if I, let me give you a classical example. Let's say I'm a female leader, older, maybe in my late 50s, 60s, or even 60s going, I have struggled to get to where I am and there is a younger colleague who has come, she's doing well and she has a child but maybe she needs a few extra days to stay at home to look after her child or what, you'll be very surprised that the higher woman will say why, what makes you so special? I have seen it like, it's not like I'm telling you a story, okay? I've seen older women, and this is not just necessarily for STEM, it cuts across.” (Associate Professor, Biochemistry)

In support of this view, another respondent added:

“And women in leadership right now, most of the women in leadership I look at from a distance, they might seem good, but when you get closer or you try to climb the ladder to where they are, they try to push you down. Yes, and it is really, really bad.” (Student, Agricultural engineering)

4.2.7.1 Increasing representation

Aside from noting that female representation in STEM leadership is low, the respondents also indicated that female representation has been gradually increasing over the past decade. Pointing to the various policies initiated by various organizations, 36% (8 out of 22) of the respondents indicated that they have observed an increasing representation of females in STEM leadership.

Their leadership includes positions such as lead researchers, unit heads, departmental heads, and deans. One respondent said:

“When it comes down to STEM, okay, I think now definitely things are really changing. I think it has been realized that their representation in the STEM industry and all is low so there's been some policies to make them really get some spot in the STEM. Currently, Elsie Kaufmann is the dean for the school of engineering so I mean that's a great feat, I don't know if it has really happened. And now too physics department, the HOD is a female. So even in Legon you can see there are some females chairing the STEM field and all. And here you have many professors, females professors at WACCBIP, at biochem department so it's actually improving and it can also be getting better and better and better.” (Student, Biochemistry)

Other respondents added that:

“We don't have enough, but I think we are close to having enough. We are close to having enough because most of the STEM programs or the STEM projects that are going on are initiated and led by women. It's because you want to change the narrative that a woman must be a follower. A woman can be a leader, right?” (Student, Engineering)

“I feel like it's a gradual process, because we're not yet there, but it's better than it was yesterday. So it's a gradual process, let's see how it goes in the future.” (Student, Agricultural engineering)

Naming factors such as female empowerment and the conscious effort of retaining women in STEM in terms of policy and intervention, a lot more females are now able to secure various leadership positions in STEM fields.

The few percentage of females in STEM and the inadequate support from the few females in STEM leadership positions contribute significantly to the low representation of females in STEM leadership positions. However, female representation is increasing in recent years due to female empowerment and the conscious effort to increase female representation in STEM leadership positions.

4.2.8 Perception and Attitude Toward Females in STEM Leadership

This theme captures the respondents' perceptions and attitudes toward females in STEM leadership. Their various responses cumulated into two sub-themes; preference and relationship. The preference embodies the kind of leader the respondent would prefer to be under in their field, either male or female.

4.2.8.1 Preference

In terms of preference, the various responses were categorized under three preferences: gender neutral, male leadership, and female leadership. A greater number of the respondents indicated that gender is not a basis for choosing a leader. According to them, leadership is not about gender, it is about who has the qualities and competencies to lead, whether the person is male or female. One of them is presented below:

"I would not prefer to be under somebody's leadership just because they are males or females. I would rather prefer to look at how capable they are, regardless of their gender. If they can perform the roles that the position they are in, how should I say it? If they are capable of performing those roles, I think that person is okay to be my leader or to lead me. I don't really, I won't really say, oh, because she's a female, or because he's a male, let's put him or let's put her. Once the person can perform, that's okay for me." (Graduate, Physics)

“Mine is to be under someone who is capable of training me enough to be who I want to be. So regardless of the sex, so far as the person is performing, I like the person. So whether a male or a female, once you are performing your duties as my senior or my manager or as my superior or whatever that you may be, I just want you to be able to make me the person that I want to be thereby you doing your job well. If the man is not doing the job well and the woman can do the job better, I'll prefer the woman to be my leader. And also, if the woman is not doing the job well and the man is also performing, I'll prefer the man to be my leader. So that's it for me, I don't know for others.” (Student, Mathematics)

The main reason why the respondents indicated their preference for a competent leader rather than being gender biased is that according to them, both males and females possess and can develop the qualities of leadership. However, some of the respondents added that there are certain leadership positions that males will do better in than females. These are usually roles that require more agentic traits. An example is a military officer. In the same vein, there are some leadership positions that females will be better in than males. These are leadership positions that require more communal traits in which women dominate. An example is a healthcare administrator. This however does not make one gender any better than the other. Therefore, having both male and female leadership will be ideal for any institution or organization, particularly STEM institutions. One respondent put it this way:

“By the way, I think every individual has different capabilities. If possible, it should be a board of both men and females, so that we can balance the whole gender stuff, and then we can incorporate different skills, because everyone is different, basically.” (Student, Agricultural engineering)

The other respondents who preferred either male or female leaders gave reasons other than leadership ability or competence for having such a preference. One respondent who indicated his

preference for a male leader stated that his reason for such preference is his exposure and experience with only male leaders. He said:

“Yeah, I’ve been under male leaders and all and I’ve seen how they do their things but I haven’t really been under female that’s why I’m choosing the male side. But if I get the chance to be under females and also like observe how they do their leading things and, I think that can change my perspective. So the experiences that I’ve been opened to that’s making me choose that, yeah. But if I get a lot of experience from females too, I can make a logical conclusion. But now it’s only one side, the male.” (Student, Biochemistry)

Another respondent stated that his reason for preferring a male leader is availability and the freedom to express himself without the fear of attachment. According to him:

“Obviously, looking at the factors like the time that the person will have for us, right? Because as a leader, you have to have some time for your subjects, so that when they have issues, they can share with you. When it’s a guy, and I’m sharing it with him, no matter the venue, I’m safe. There’s no issue of any attachment kind of thing. But if it’s a female, there’ll be a lot of eyes. So I’ll go with the male because of issues like that.” (Student, Chemistry)

The other respondent pointed out that, his reason for preferring a male leader to a female leader is that males exemplify leadership more than females. He said:

“Emm, because I think a leader should be a strong-minded person, and I see a male should be able to, like is able to give that. You understand? Yes. And I know, for my department, the males are really smart, that’s what I’m talking. So I’m talking from my...so, if today, right now, I was going to pick someone, and there’s a really smart person, but I don’t know whether if he can talk, he has the qualities a leader should have. But I know with smartness, he has the intelligence, the natural intelligence to be able to decide stuff. Yeah. Yes. So, I

think a male, I would prefer a male. Yes. But I wouldn't mind a female, but I would prefer a male there. If there's a female there, I don't have a problem. But if you ask me, who would I put there? I'll put a male.” (Student, Agricultural engineering)

The other 42% (3 out of 7) indicated their preference for a female leader. The reasons they gave for such preference are that female leaders are inter-personally oriented in their leadership, they think more about the welfare of their subordinates, and are a source of inspiration to them and hence, will be able to understand and nurture them well in their career as compared to male leaders.

Below is an extract from their responses:

“If I'm to choose, if I'm to choose, then I would go in for a woman. But then, if I'm just given anyone, I would just have to, you know, adjust to everything. But I would love to have a woman as a leader. So, she's going to guide me in such a way that, one, she's already encouraging me and I'm looking up to her. So, in a way, she's training me, she's training me. I'm training myself to become like her. Not like her in terms of other ways but in terms of, you know, her smartness, and then all those things and the field that she is in. So she's encouraging me. And then, she will understand me, I wouldn't say she will understand me better to mean like, as in the guys would understand me better. But then, she would also understand me, you know, when things are not really going well, she's going to talk to me, guides me, and all that. So, yeah.” (Student, Chemistry)

4.2.8.2 Relationship

The other sub-theme that emerged under perception and attitude toward females in STEM leadership is relationship. This sub-theme highlights the nature of relationship that exists between the respondents and the female leaders in their institutions. All the respondents pointed out the existence of a positive relationship between themselves and the female leaders in their institutions. They indicated either an equal relationship or a cordial relationship. Those who spoke

to equal relationship explained that they do not see the female leaders in their institution as any less compared to the male leaders. They accord them the needed respect that is due to their respective leadership positions and do not show any form of discrimination towards them. In the extracts below, the respondents elaborated on this stance.

“I mean, they are leaders, we are supposed to respect them. If they give instructions, we are supposed to follow them. So, I mean, people should think about the leadership of women or even men this way; one, they are serving a certain purpose for the common good. It is our best to just support them. So, whether males or females, I think it shouldn't really matter. The same respect one gives to males, one should also give the same respect to females. The same support should also be given to them. So, yes, full respect for them. If you are not happy about something, you just have to let them know. It shouldn't be any sort of discrimination, no. So, I respect her as my HOD. If there is something that I have to do, I just have to do it.” (Lecturer, Mathematics)

“I like my job. Okay, yeah, in terms of, okay, at least the leader is a leader, so I just give them the necessary respect I'm supposed to give as compared to whether it's a male leader or female leader. Yeah, so the main idea is I don't do what I do because of the gender, I do it because of the position. So my focus is on the position, not simply on the gender.”

(Lecturer, Mathematics)

The other 37.5% also indicated that they have a cordial relationship with the female leaders in their institution as well as the male leaders. They pointed out a sort of friendliness that exists between them and the leaders they have whether they are males or females. Below are some extracts from their responses:

“Cordial. I personally see people, I'm not really women women women, men men men, I see people, I see good people, that's about it. So I don't have a special relationship with

women and a special relationship with men, I try to be cordial with the people I work with... Well, because I see people, and I see people and so I look for good people and that person happens to be a woman, fine, if he happens to be a man fine. I'm not particular about I have to be friends with only women, no. It's people, good people. And so I have some very good collaborations with some of my female colleagues and same with some of my male colleagues as well." (Associate Professor, Chemistry)

"So very friendly. I think that of course, if I see somebody that I look up to, you feel that you want to be up like the person, of course, you have to want to know how they ended up there right? So you will try to talk to the people, seek advice on how to go about it. Normally, of course they are more experienced so they can give you one or two tips on how to manage it and how to put everything together." (Associate Professor, Biochemistry)

"Well, so far I haven't really had any challenges at all. But I think it's also because of my personality... But I think so far in Legon in my almost 15 years here, I haven't had any negative interaction with females in STEM. And then another reason is that we are just not many. In my department, it's quite unusual but almost all the female faculty members here currently, we are within the same age range so we have this comradery or rapport which is very comfortable. We don't have any older woman here right now and then even as you go higher in the academic ladder here, we're just not many." (Associate Professor, Biochemistry)

4.2.10 Bridging the Gender Gap in STEM Involvement

The respondents also shared their views on how the gender gap that exists in STEM can be bridged. Their views cumulated around three sub-themes; early exposure and motivation, making STEM attractive, and support.

4.2.10.1 Early exposure and motivation

Concerning early exposure and motivation, the respondents highlighted the idea that exposing females to STEM courses and the opportunities available in STEM at the early ages is key to creating a sustainable interest in them to pursue STEM courses. They explained that exposing females to the discipline early would help to clear some of the misconceptions that cause them to opt out of STEM. It would also help females to realize their hidden potentials which they can develop and utilize effectively in STEM. Some of the respondents said:

“If we educate young females, especially those who are coming up, like me, I had the opportunity to be educated by my teachers because they liked me in school. They educated me about going to school and reading engineering or being a doctor or even becoming a computer engineer or going into learning mathematics in the university and all because they saw I was good in those fields. They helped me and then they educated me. So, I think there should be policies that would help educate young females who are coming up, especially those in their primary, and secondary school. Because when they are coming to university, most of them think, even up to now, some females think engineering is a male course. Mathematics is a male course. Some kind of courses, if you want to be a doctor, it's a male's course. So, we the females should look for communication and other things. But that's not the case. If they are really educated, if there are policies there that back them and then educate them, then they'll be able to venture into those fields. Maybe that's even their field. That's what they can do best. But because they don't have the knowledge about it, then they are not going into it. So, I'll just encourage maybe governments or the private sector or anyone who can help educate these young people so that they will know that there is much, much more in store for them in their STEM field.” (Research assistant, Civil culture and forest management)

“Like I said earlier, some of them think the science courses are difficult. It's not to say the science courses are not difficult, even though everyone can do it. So most of them have the perception that the courses are difficult, they can't read. So I think educating them at a young age will encourage them to read the sciences.” (Graduate student, Physics)

One respondent remarked that for it to be effective, the early exposure should be coupled with motivation. Motivating them from the onset would create the resilience they need to tackle the challenges are in STEM fields. She said:

“And with motivation, I think more women should be encouraged right from their childhood that they can do more. Science is not only medicine, nursing, or professional med lab, science is more than that. But right from childhood, maybe because of the area we find ourselves, right from childhood, it's put into your head that you be a doctor. So you grow up wanting to be a doctor no matter what. If you don't get to be a doctor, maybe you settle to be a nurse or a med lab or a pharmacist. But me, science goes beyond that. But it starts from childhood, career orientation and all that. If we can orient more women about science, about engineering, maybe if I was told I would become a physicist as a child, maybe I would have grown up with that notion to become a physicist. I wouldn't have seen physics as my downfall and all that.” (Student, Biochemistry)

4.2.10.2 Making STEM attractive

Another point some of the participants raised as having the potential to bridge the gender gap that exists in STEM is making STEM attractive. This entails advertising STEM on various media platforms, demonstrating the practical nature of various STEM courses, and having various STEM fun clubs that engage in various interesting activities related to STEM. Some extracts from their respondents are presented below.

“We should have policies that have nice and special packages that will attract females so that they can go to STEM easily and without thinking of any issues... Yeah, I think if we make STEM, it's not really practical in a way, but if we make so many things practical, you know, some people are good when they are practical, so if we make it that way, it's going to make them understand that when they do it practically, they can really understand it although there's a theory side. Okay. And then we can have maybe fan clubs that are interested to, you know, do innovations, try to create new things, that is also going to attract.” (Student, Chemistry)

“Okay, so there's this society at my department, I don't know, like WeSTEM. So, they are more into female attaining higher education, entering into the STEM environment and doing more. So, with that society, they have meetings, they go out there, do some workshops for females and all the ladies across the country from junior high school to senior high school, telling them about what some ladies like me are doing up here and then letting them know that there's nothing to be afraid of. So, I remember some time ago, I spoke with some first-year students and they were like, oh, these people came to my school and then they did some projects. It was all ladies. When she saw that, she saw that she also has the potential and it's not what she has been hearing that chemistry is for brilliant students, this is for guys, ladies are dumb, so they should do that. So, that was her reason for coming.”
(Graduate student, Cyber security and digital forensics)

“Make it more attractive. Just make it more beneficial, like, show what they can get out of it. Because mostly, if like the agriculture engineering like this, they should make it more officy, like they should make it, they shouldn't make a farm. Because, me myself, I don't really like the farm. Yes, but I'm managing it. So, I understand why females will not be in it. So, they should make it more attractive. They should brand it. Yes. Make it appetizing,*

like they should organize workshops, people that, women that are already in the field, they should talk to the new generation, like senior high school girls, all those kinds of things. Yes, there should be an outreach to make it look like it's not all dirty work, there are benefits of being in the field. Yes. So, just make it more attractive to get more people. Yes, that's what I think.” (Student, Agricultural engineering)

4.2.10.3 Support

Support was another key point some of the respondents raised. According to them, because the journey of STEM is saddled with many challenges the support in terms of financial, social, emotional, and physical comes in handy. According to those who highlighted financial support, STEM fields are expensive so it tends to discourage people, mostly females from coming in. However, they mentioned if there are scholarship opportunities for females, it would encourage them to come into the field. Some of the respondents stated:

“Well, a scholarship would do. So if there's a policy where based on maybe your performance in a particular class, then they give you a scholarship to do a program in STEM that you wish you want to do. So from senior high, let's say you top your class in physics, then that scholarship will be given. Or you do a particular project in a science club, and the females in a group which participated so well, could be given such a scholarship to do maybe engineering or something. So a policy where it's geared towards scholarship for females doing excellently in their small field of study.” (Student, Chemistry)

“So funding in terms of scholarship, in terms of projects. So for example, for the females, there need to be more like a conscious effort to have specific fellowships, select specific females or a specific number of females in order to sort of bridge this gap a little bit because in most cases, if you leave it open then we will have less females applying then if

you have less females applying, there will be less number of people that they can actually select from the fewer that have already applied. In terms of research also it's the same thing. You will have fewer people in the cohort anyway, and you'll have fewer people applying, so if you don't make a conscious effort to selectively push this group, then going along the ladder you'll still have a lower number of them.” (Associate Professor, Biochemistry)

Touching on social support, one respondent mentioned that usually, the females who are able to climb into higher level of STEM are those who have support from their families, friends, and colleagues. He said:

“Well, I mean, so, one, it depends. If the person is married, the person will need support from the husband. If the person is not married, the person will need maybe support and encouragement from the parents. Because at times things get very tough and one might want to give up, you know. But if the parents, you know, they understand your vision, they understand how far you want to go, I think they'll just push you. The same goes with the person who is married. If the husband also understands that the husband is supposed to push the woman, yeah.” (Lecturer, Mathematics)

One other respondent added that emotional and psychological support is very helpful in stirring the interest of females to pursue STEM courses. She said:

“You know, the perception is that, as the first...from the question that you asked me, STEM is a field for men, so you know when you go there the stigmatization as a women when you go into such fields, the stigmatization and everything, so if a women is in that field and she gets the encouragement, like everybody is cheering her on, it kinda boosts her moral to continue, and you have this sense of like you can't fail this people, you have to put in your best, yes.” (Senior Lecturer, Chemistry)

Factors such as early exposure and motivation, making STEM attractive, and support hold the key to increasing and sustaining female representation in STEM fields.

4.2.11 Bridging the Gender Gap in STEM Leadership

The final theme that emerged was bridging the gender gap in STEM leadership. This captures the respondents' views on how the gender gap in STEM leadership can be appropriately addressed.

The sub-themes that emerged were; encouraging female leadership, leadership training for females, support, and increasing female representation in STEM.

4.2.11.1 Encouraging female leadership

Some of the respondents were of the view that females in STEM should be encouraged to take up various leadership positions in STEM and also climb to higher levels of leadership. They highlighted that due to the prevailing concept about female leadership in STEM, if females are not encouraged to take up leadership positions, they would most likely lay back and not take the initiative. Enlightening them about the need for their leadership and holding their hands along the path would push most females to take up various leadership positions in the field. The extracts below provide evidence for this view.

“I think we should encourage women to apply for leadership positions. When they deserve it, it should be given to them. We shouldn't compare it to oh, this one is a lady, this one is a woman, this one is a man. A man and a woman are fighting for the same position, then automatically, we think the man will do better, so we give it to the [man]. But sometimes, ideally, the woman deserves it, the woman qualifies more. But then they might be saying gender, gender, gender things then they'll give it to the man.” (Student, Biochemistry)

“But I would encourage women to take part in leadership schools, encourage women to put themselves out there. Go for, if there is a vacancy for leadership, they should put themselves out there to take, like to fight for that position. Yes. Most often we stay back and

are like “this is for men and I don’t want to be scrutinized and all those things. So we need to put those things behind and go for it.” (Senior lecturer, Chemistry)

“So more like I would push my female counterparts who I’ve seen potential in them, that they’re able to do well or bring so much progress in that area. So encourage the females or young achieving individuals who have that kind of drive or initiative or who have innovative ideas to bring on board. That would push or make the STEM project in whatever society or whatever area we find ourselves in to become well-noticed or maybe to become globally recognized. So that’s what I would do.” (Student, Pharmacy)

4.2.11.2 Leadership training

Aside from encouraging females to pick up various leadership opportunities in STEM, other respondents said organizing special leadership training for females in STEM will help equip them with the required leadership skills. One respondent said:

“So, creation of programs to train and support women in STEM to take up leadership roles. Not just setting up STEM projects and asking them to lead. They need training. You need to be trained to become a leader. You can’t just wake up and become a leader. Even if you have it as God-given, you still have to be trained because you’ll be a bad leader. You get it? So if I had the power, I’ll encourage, I’ll create more leadership development programs to encourage and train, and support women to take up leadership roles. You get it? Yeah.”- (Student, Engineering)

Another respondent added that:

“You have to create, you know, training programs specifically just to help women with the skills that they actually need in their leadership role. If I had the power, I would work very well to promote it in a way. And then just to create, you know, like, the awareness also for them to actually lead, yeah.” (Graduate, Chemistry)

One respondent also indicated that:

“I would actually make sure that they are like, okay, women are much more enrolled in leadership training courses or workshops. I think that would greatly help because that way you get to see your personality, what you can take. You realize your strengths and your weaknesses. And you'll be taken through practical ways of using that in your field. So that would really help. Other than just picking someone and just giving them the role to play without any proper training. I think that would make a lot of difference. For the males, it might be easier because it's something they are demanded to do right from the onset...But for the women, there's an emotional point of view. So there's a need for some level of training so that you can balance what you know emotionally and what should be done as someone in leadership. And that can drive more women into leadership, I guess.” (Student, Biochemistry)

4.2.11.3 Support

Support was another key factor for increasing female representation in STEM leadership positions. According to those who share this view, because leadership has been relegated to males and males have occupied leadership positions for a long time, it will take some push for females to take the initiative to enter into leadership positions. According to them, the support should come in the form of mentoring, fellowships, and other forms of social support. Some extracts that highlight this view are shared below.

“I think I already talked about the support, support in terms of the fellowships, research money, family support, departmental support from head of department being flexible with working hours and things like that. I think even now with Covid, online teaching and those extra things have even yeah, added a little bit to the flexibility but of course we have to

implement and accept some of these things and I think that should help a little bit to move the female in STEM up the ladder.” (Associate Professor, Biochemistry)

“With that, you provide mentoring and networking, what do you call it, sessions. So you establish networks and mentorship opportunities that will connect emerging female leaders with established ones. That's the only way... I mean, that's one of the ways that can be pushed forward and then advanced to the next level. Yeah, because there are some women in STEM who have done exceedingly well. And then when they are able to provide some mentorship to the up-and-coming ones, it will be very beneficial to all of us. So a scheme or a forum where these female leaders who have already done their bit and have been appreciated by all can also relay some information and some tips to those who are coming up so they can also inspire other people so it goes across. Yeah, so that's it.” (Student, Engineering)

“So I'll say some ladies, they are not really, you know, they don't have the confidence in them. They feel like when they go, they are not going to, you know, get it. So the support and encouragement that is given to them in helps them such ways.” (Student, Chemistry)

4.2.11.4 Increasing female representation in STEM

Lastly, some of the respondents also pointed out that increasing female representation in STEM is the key to increasing female representation in STEM leadership. According to them, if there are enough females in STEM, eventually they will enter into various leadership positions. One respondent said:

“Well, I would first increase the number of women in the field, so in STEM, because if I increase the number, and so let's say the ratio of male to female is equal, then when we are voting, it becomes a fair game, right? So that the whole ideology of, oh, let's try here and see, it's gone out of the equation, because equal numbers of the females are going to vote,

equal numbers of the males are going to vote. So based on her political ability, then the people will be like, okay, here we have equal numbers, let's all vote in favor of her, or let's vote against that kind of issue. So my first thing was to increase the number, so that there's no bias. Then, again, putting structures where when they become mothers, there will be that opportunity for them to still hold their leadership roles.” (Student, Chemistry)

Another respondent also said:

“I would encourage female participation in STEM...So I would encourage participation in STEM again. Like before I even come and think of leadership in STEM because leadership in on its own is even bogus, but you are coming to encourage women who are not in STEM to go into leadership. So first I will encourage participation in STEM before I even think of leadership.” (Student, Chemistry)

Put together, the respondents in the study pointed out that factors such as encouraging female leadership in STEM, leadership training for females, support, and increasing female representation in STEM will contribute significantly to bridging the gender gap that exists in STEM leaders.

4.3 Conclusion

This chapter presented the findings of the study. It elaborated on the twelve (12) themes developed during data analysis and the sub-themes under each main theme. It also highlighted how they contribute to our understanding of the discourse on gender disparity in STEM and in STEM leadership. The next chapter is a discussion of the findings.



CHAPT FIVE

DISCUSSION OF FINDINGS

5.1 Introduction

The main aim of this study was to explore perceptions and attitudes that STEM educators and students have toward females in STEM and STEM leadership positions. The study was structured using an explorative qualitative research approach. This chapter contains a discussion of the findings of this study presented in the previous chapter four (4). The discussion situates the findings of the study within existing literature and indicates the relationships between the findings of the study and the findings of other studies reviewed. It also highlights the points of connection and areas of contradiction to existing literature.

5.2 Female Representation in STEM

This study set out to explore the nature of female representation in STEM fields. The views of the respondents on female representation in STEM were gathered under four (4) sub-themes; increasing representation, equal representation at the basic levels, declining representation at higher levels, and few representation. The idea of the increasing percentage of females in STEM is discovered in the study confirms Kahn and Ginther's (2017) assertion that female representation in STEM has been steadily increasing since the 1970s. This highlights the results of the various national and international attention directed at bridging the gender gap that exists in STEM as pointed out by the respondents in this study. Intervention strategies such as the Girls Who Code initiative in the United States (Palid et al., 2023), the Athena SWAN Charter in the UK (Kong et al., 2020), and the establishment of the Science, Technology, and Mathematics Education (STME) clinic in Ghana (Wrigley-Asante et al., 2022) have all contributed to increasing female participation in STEM. These initiatives and policies raise awareness about STEM programs,

provide financial support for females, and incite interest in STEM in females by encouraging them to enroll in the various STEM disciplines to contribute their quota.

The gradual increase of females in STEM has contributed to an equal representation of males and females in various STEM courses at the basic levels. As evident from the study, one is likely to observe equal percentages of males and females reading STEM courses in the Junior Higher and Senior High levels. Despite the increase in female representation in STEM, female representation continues to decline or decrease at higher levels. As highlighted in the study, the demands of time, effort, and resources at the higher levels of STEM discourage most females from persisting in STEM. This confirms the leaky pipeline phenomenon pointed out by Arrendondo et al. (2022), Liu et al. (2019), and Wang and Degol (2017). As expanded by previous studies, factors such as stereotype threat and implicit bias (Collins et al., 2020) where females are tagged as not belonging in STEM fields, unconscious bias, and microaggressions in the form of discrimination (Kim & Meister, 2023), lack or inadequate representation and role models who would encourage and direct females to climb higher in STEM (Davidovitz et al., 2024), and lack or inadequate support (social) and resources (Swafford & Anderson, 2020) hinder female involvement in STEM. These factors make other non-STEM disciplines a favorable option for most females.

It was also found in this study that the overall percentage of females in STEM is low relative to males despite the gradual increase over the past decade. As indicated by the 2022 statistics from the African Development Bank, in Africa, women constitute only 26% of STEM students. In Ghana, according to the 2020 report by the Ghana National Accreditation Board, women make up only 23.4% of STEM students.

5.3 Factors Influencing Female Representation in STEM

The study also aimed at exploring the factors influencing female representation in STEM. The various factors discovered in the study were grouped under personal factors and social factors. The

personal factors highlighted in the study are ignorance, fear, perception, and lack of willingness. These personal factors complement and expand the personal factors bracket identified by Quansah et al. (2020). Quansah et al. (2020) stated self-confidence, career indecision, and having a role model, as personal factors influencing females' entry into STEM. The complementary nature of these factors is such that, for instance, career indecision as pointed out by Quansah et al. (2020) can be explained by the factor of ignorance identified in this study. Due to the lack or inadequate information, some females have about the diverse nature of STEM and the numerous career opportunities available therein, it tends to make those who have an interest in STEM indecisive about the careers to pursue. This was confirmed by O'Brien, (2022) who indicated that young people most likely associate STEM with conducting research, wearing a white coat, and working in a lab. Also, the factor of fear identified in this study could explain the self-confidence factors pointed out by Quansah et al. (2020). If females are afraid that they may not excel in STEM and may end up disappointing their families and friends, it would dampen their self-confidence to enter STEM fields. However, this study introduces the factor of lack of willingness which explains that some females do not make good use of various advantages created for them to enter into STEM fields because they generally do not have an interest in STEM fields.

The social factors identified in this study are culture, stigmatization, and lack of or inadequate support. These factors are in sync with other factors identified in previous studies. For instance, culture as a social factor is captured as societal expectations by Singh (2020) and societal influence by Saah et al. (2023). This emphasizes the significant role that society or culture plays in influencing females' choice of STEM disciplines. A culture that stresses gender roles would have very little or no females entering into fields with a masculine tag such as STEM. This is what is evident in most countries including Ghana. The study also identified lack or inadequate support as a social factor influencing female representation in STEM. This is in line with already identified

factors such as inadequate mentorship (Saah et al., 2023) and not having a role model (Quansah et al., 2020). Whether personal or social, the factors highlighted in this study influence females' choice to read STEM courses and pursue a career in STEM.

5.4 Perception and Attitude toward Females' Involvement in STEM

The study explored people's perceptions and attitudes towards females' involvement in STEM. The respondents' views touched on whether females belong in STEM and whether they have what it takes to excel in STEM. The study found out that as opposed to the preconceived notion of STEM being a masculine discipline, gender has very little or no influence on whether a person chooses STEM or not. This gives a hint about the assertion made by Sakellariou and Fang (2021) that the dominance of males in STEM is due generally to their being more interested in STEM subjects, whereas for females, it is the early development of confidence in their math abilities that determines their choice. The findings of the study by Anokye-Poku and Ampadu (2020) also clarified that gender has very little or no influence on males' and females' attitudes toward STEM (mathematics) and their choice to pursue STEM programs. This contrast between the popular notion and the reality on the ground, as discovered in this study and as pointed out by other researchers strongly establishes the tendency for a particular perception to deviate from reality. Put differently, what people think about females' place in STEM fields, which has been a key factor working against the enrollment of females in STEM fields, is unfounded because research consistently proves the opposite. The study also found that females have the intellectual abilities to excel in STEM fields just as males. Pointing to successful female scientists such as Maria Curie (Shanbhag et al., 2024), Ada Lovelace (Charman-Anderson, 2015), and Sarah Gilbert (Sahin et al., 2020), researchers have consistently highlighted the unique achievements and contributions of women to the field of STEM. Even though only a few women have been given the needed recognition in the spotlight, the value of these women makes it nearly impossible to doubt or

disregard the intellectual capacity of females to excel in STEM. This does not mean every female who enters into STEM excels, but it means that discrediting all females as unfit for STEM is problematic. As pointed out in the study, most females enrolled in STEM do exceedingly well, sometimes even better than some male colleagues. This is in line with the review by Kahn and Ginther (2017), which pointed to the fact the difference in the performance of males and females in STEM is attributed to other factors such as competitive environments rather than gender.

5.5 Female Representation in Leadership

The study found two perspectives on female representation: low representation and increasing representation. It was discovered that female representation in most aspects of the society is low. This supports the argument by Bandura et al., (2018), Cha et al., (2023), and Eklund et al. (2017) that female leadership is lacking in areas such as politics, career, and education. According to a report by the World Economic Forum (2022), globally, women occupy 31% of leadership positions. Osagie (2024) on the other hand reported that in 2023, women occupied 32.2% of senior leadership positions worldwide. Also, the Women in Business report (2024) from 28 countries indicated that women represent only 33.5% of top management across the world. In Africa, women occupy about 25% of seats in parliament and hold 8.5% of CEO positions (Monarch, 2024). In Ghana, Sasu (2023) reported that as of 2021, women occupied only 14.5% of national parliamentary seats. Despite the low representation, it was found in the study that female representation in leadership has increased. In agreement with these findings, Sasu (2023) indicated that the 14.5% representation of females occupying parliamentary seats in Ghana was a 1.4% increase from 2019. The World Economic Forum (2022) also pointed to the fact that the percentage of women hired into leadership positions globally increased from 33.3% in 2016 to 36.9% in 2022. The study found that the increasing representation of women in leadership is a result of increasing female education, women empowerment, and the creation of opportunities for female leadership.

This sides with the discovery by other studies pointing to the increase of female leadership in executive positions (Berger et al., 2014) and in the health sector (Rakestraw et al., 2022); Wells & Fleshman, 2020)

5.6 Factors Influencing Female Representation in Leadership

The one factor discovered in this study as being the cause of the underrepresentation of females in leadership positions is culture. Culture is the collective norms, values, and role expectations of the people in a society. The culture of a society specifies appropriate behavior and the normative duties of both males and females. Existing studies highlighted factors such as intimidation and harassment, (Howe-Walsh & Turnbull, 2016) and gender stereotypes (Fritz & Van Knippenberg, 2018; 2020). Gender stereotypes, which are oversimplified beliefs about men and women, set the tone for prejudice and discrimination against women. However, the highlight of culture as the factor influencing female representation in leadership in this study gives a deeper understanding of the broader context within which most of the already identified factors play. As Eagly and Karau (2002) theorized, the descriptive and prescriptive roles assigned to women in most cultures contrast sharply with the agentic roles that characterize leadership, hence, women are by definition inhibited from taking up leadership roles. The patriarchal nature of most, if not all cultures also makes it difficult for women to attain autonomy and occupy certain positions that have been tagged as masculine. According to Ademiluka (2018), the patriarchal aspect of culture sets the tone for many unfair treatments against women including abuse.

5.7 Perceptions and Attitudes toward Female leaders

The study assessed people's perceptions and attitudes towards female leadership. The study found a favorable perception and attitude towards female leadership. This was expressed in the respondents' favorable evaluation of female leadership ability and highlighting the non-gendered nature of leadership. The respondents evaluated females as having the ability and capacity to

become leaders. This agrees with the assertion made by Eklund et al. (2017) and Dwiri and Okatan (2021) that both males and females have what it takes to be effective leaders. They may differ in leadership style: men are more likely to adopt a task-oriented leadership style whereas women are more likely to adopt a communal leadership style (Eklund et al., 2017), however, they can all become effective leaders. Another interesting finding from the study is the idea of the non-gendered nature of leadership. Available literature has expanded the fact that leadership is defined in stereotypically masculine terms (Eklund et al., 2017; Bandura et al., 2018; Cha et al., 2023). However, the respondents in the study reject this social construct by arguing that the key determinants of leadership are a person's personality and competence, not gender. Their rejection of the social conception of incongruity between the female gender role and leadership role supports Eagly and Karau's (2002) theoretical assertion that people can choose to see a congruity between the female gender role and leadership role by rejecting the traditional gender roles and norms.

5.8 Female representation in STEM leadership

The study explored the respondents' views on female representation in STEM leadership positions. It was discovered that female representation in STEM leadership is low, but there has been a gradual increase in their representation particularly in recent times. The low representation of females in STEM leadership as pointed out in this study is in line with the report by the World Economic Forum (2022) which stated that women make up only 26% of STEM professionals across the world. McKinsey and Company (2022) also indicated that women hold only 22% of senior STEM roles. It is the recognition of the underrepresentation of females in STEM leadership positions that has inspired various international and local initiatives and studies, including this very study, to understand the phenomenon and help devise various mechanisms to bridge the gap. The reasons discovered as being responsible for this phenomenon are the low percentage of females in STEM and lack of or inadequate support. The low percentage of females in STEM

being a reason for the scarce presence of women in STEM leadership is a logical conclusion because as expanded by some of the respondents in the study, if there is an adequate representation of females in STEM, they would eventually move to occupy various leadership positions in STEM. On the other hand, if they are not so many in the field, only a few will be able to make it to leadership positions. This complements the factor of inadequate mentorship pointed out in existing literature as being responsible for the low representation of women in STEM leadership (McCullough, 2020; Moghe et al., 2021). This means that because few women are enrolled in STEM, relatively few of them ascend to leadership positions to become mentors, and if a relatively few of them become mentors, they would not be enough to mentor upcoming females. Therefore, the many upcoming females who would not get the chance to be mentored would most likely not make it on their own to leadership positions. Inadequate support as a factor is also in line with what Boateng and Gaulee (2019) indicated that the one key challenge females who decide to pursue a career in STEM and take leadership face is inadequate support from society. Due to the masculine tag attached to STEM and leadership, many people do not tend to encourage and support women to climb to higher levels in STEM to leadership positions. However, despite the low representation, the study also found that female leaders in STEM have increased to some degree. This is consistent with the report by McKee (2022) which indicated that women's representation in C-suite roles in STEM appreciated from 17% in 2015 to 21% in 2021. This is an indication that the various efforts targeted at increasing female representation in STEM leadership are yielding some fruits.

5.9 Perception and attitude towards females in STEM leadership

This study explored the perceptions and attitudes towards females in STEM leadership positions. Their perceptions and attitudes were expressed in their preference and relationships. Various studies have touched on the gender of the leaders that people mostly prefer, particularly in STEM.

For example, Comaford (2021) pointed out in her study that even though both men and women have positive attitudes toward women leaders, men are less likely to prefer to work for female managers and are less likely to trust a woman to lead them. Consistent with this assertion, this study discovered that even though all the respondents positively evaluated female leadership ability, four (4) of the respondents indicated their preference for male leadership but cited reasons such as availability rather than leadership competence or ability for making such a preference. However, one interesting finding of the study is the respondents' non-gendered preference for leadership. This finding is intriguing because it runs counter to the assertion by most studies which indicate that people most likely indicate their preference for male leaders as compared to female leaders (Crites et al., 2015; Rosette et al., 2016). This means people can reject the existing social norms and traditional gender roles so as to create a congruity between leadership roles and gender roles.

5.10 Bridging the gap in STEM involvement

The study found various ways by which the gender gap in STEM involvement can be addressed. The factors pointed out in this study are early exposure and motivation, making STEM attractive, and support. Early exposure and motivation as a factor highlight an effective way of creating a sustainable interest in females for STEM disciplines. This aligns with the point by McClure et al. (2017) and Kennedy and Odell (2014) that exposing females to STEM and the career opportunities available at an early stage creates a lasting interest in females to read STEM courses and pursue STEM careers. Making STEM attractive was another point that was found potential to encourage female participation in STEM. Increasing STEM advertisements and introducing various activities that highlight the practical use of STEM would give females enough convincing reasons to choose STEM disciplines. The other point found in the study is support. Support in terms of financial, social, and moral, is noted as being key to bridging the gender gap that exists in STEM. This

finding is consistent with other research findings which indicated that financial support is key to encouraging and retaining females in STEM (Dasgupta & Stout, 2014; Kahn & Ginther, 2017).

5.11 Bridging the gap in STEM leadership

The study in addition found certain factors which can help bridge the gender gap that exists in STEM leadership positions. The factors identified were: encouraging female leadership in STEM, leadership training for females, support, and increasing female representation in STEM. As pointed out by Howe-Walsh and Turnbull (2016) and Botella et al. (2019), encouragement in the form of mentorship helps to sustain females in STEM and inspire them to take up leadership positions. The point of low representation of women in STEM accounting for the low representation of females in STEM leadership positions relates to Boateng and Gaulee's (2019) fact that the females in STEM account for their limited enrollment into STEM occupations. Leadership training highlighted in the study can potentially increase the number of females in STEM leadership. This supports the claim by Main et al. (2022) and Casaucao-Tenllado, et al. (2024) that professional development or leadership training contributes greatly to increasing female representation in STEM leadership positions. Support as discovered by Brue (2019) is very helpful to women in STEM leadership as it enables them to have a better work-life balance. This could potentially encourage other females who dread the burden of combining the demands of STEM leadership with family roles.

5.12 Implications of the Findings of the Study

This study is of great significance to the discourse on gender and STEM both in practice and in theory. It has made profound discoveries that will contribute to broadening the understanding of the gender disparity in STEM and STEM leadership positions. Its practical relevance to policy-making is also noteworthy.

5.12.1 Theoretical Implications

This study presents substantial information in support of the propositions of the role congruity theory of prejudice toward female leaders, developed by Eagly and Karau (2002). This theory proposes that a perception of incongruity between the female gender role and leadership role will incite two forms of prejudice; a less favorable evaluation of females as potential occupants of leadership positions and a less favorable evaluation of behaviors that fulfill the role of a leader if it is enacted by a female. However, such stereotypes will reduce or even disappear in situations where there is a perceived congruity between the female gender role and leadership role. One condition that can moderate the perception of the incongruity between the female gender role and leadership role is a personal rejection of the traditional gender arrangement and gender roles. This indicates that perception as an individual stance or conception can contradict the general perception within society. As was evident from the study, the respondents acknowledged the existence of a general cultural perception that indicates an incongruity between the female gender role and leadership role by pointing out culture as the main reason responsible for the underrepresentation of females in leadership positions. However, they choose to reject this cultural perception by giving a favorable evaluation of female leadership ability and having a favorable attitude toward female leaders, particularly in STEM, in terms of their preferences and relationships.

5.12.2 Practical Implications

This study expands the literature on the gender disparity in STEM and STEM leadership by contributing significantly to a grey area; people's perceptions and attitudes towards women in STEM leadership positions, within the Ghanaian context. It reveals how some people perceive females' involvement in STEM and STEM leadership positions and their attitudes toward women in STEM leadership positions. The study broadens the understanding of the factors that are

responsible for the low representation of females in STEM by highlighting culture as the key social factor and highlighting ignorance, fear, and lack of willingness as personal factors. These factors have hitherto not been pointed out in previous research.

In terms of policymaking, the study sheds light on some profound ways of addressing the gender gap in STEM and STEM leadership. In terms of bridging the gender in STEM involvement, the study reiterates practices such as financial support in terms of scholarships, emotional support in terms of encouragement, and social and institutional support. However, it introduces and emphasizes practices such as making STEM attractive in terms of demonstrating its practical usefulness through advertisement and exposing females to STEM at a very tender age. These when done would incite a sustainable interest in females to pursue a career in STEM. In terms of increasing female representation in STEM leadership, the study again reiterates an existing practice of support in terms of mentorship. It, however, introduces practices such as encouraging female leadership and leadership training for females as having the potency to increase female representation in STEM leadership. This presents policy-makers with valuable information upon which a well-fitted policy intervention can be structured and implemented.

5.13 Limitations of the Study

Aside from the significant discoveries made in this study, it cannot make claims of flawlessness. As a qualitative study, the findings from the research cannot be generalized or inferred to the general population even though they hold valuable information. Also, getting in touch with people who are employed in the various STEM departments at the University of Ghana and in the Kwame Nkrumah University of Science and Technology was challenging because of their busy work schedules. Particularly, the males who were contacted either turned down the request or did not respond at all, hence, the majority of the respondents who are employed in STEM departments

were females. This could have an effect on the perspectives presented during the interview. The study explored a self-report measure for assessing the perceptions and attitudes of the respondents.

5.14 Recommendations for Future Research

The research approach employed in this study raises some pitfalls that have to be addressed in subsequent research. As indicated earlier, this study lacks the quality of generalizability because it adopted a qualitative approach, therefore, it is recommended that a larger study be conducted on the subject. Preferably, such a study should focus on assessing the perceptions and attitudes of people towards women in STEM leadership positions using an implicit measure since that is able to assess latent perceptions and attitudes that people are not willing or able to report on. Also, the study should sample other STEM institutions as well as other predominantly STEM and predominantly non-STEM educational institutions. This will allow for a broader view of the subject matter highlighting various areas which were unintentionally overlooked in this study.

A longitudinal study is also recommended. A longitudinal study will be able to observe how perceptions and attitudes towards women in STEM leadership positions change and the factors responsible for such changes. With a long-term goal of bridging the gender gap that exists in STEM and STEM leadership, a longitudinal study will reveal the factors that contribute significantly to changing people's unfavorable perceptions and attitudes towards women in STEM and STEM leadership positions.

5.15 Conclusion

This study was designed to answer four (4) major questions; (1) what are STEM educators' and students' perceptions and attitudes toward females' involvement in STEM fields? (2) what are the factors influencing females' representation in STEM fields? (3) what are STEM educators' and students' perceptions and attitudes toward female leadership in general? and (4) what are STEM educators' and students' perceptions and attitudes toward females in STEM leadership positions?

The respondents sampled indicated a favorable perception and attitude toward females' involvement in STEM by elaborating that STEM is not an exclusive reserve for males, and that females also possess what it takes to study and excel in STEM courses.

In response to the second question, the respondents identified factors that were categorized into personal and social factors. The personal factors identified were ignorance, fear, unfavorable' perception, and lack of willingness (on the part of some females). The social factors on the other hand were culture, inadequate support, and stigmatization.

The respondents shared their views in addressing the third question by first evaluating females as capable leaders. Even though they clarified that males and females will do relatively better in certain leadership positions, they emphasized that both males and females have what it takes to lead and be good leaders. A greater number of the respondents also pointed out that leadership is non-gendered, and that the gendered nature of leadership is a flawed social construct.

Finally, the perceptions and attitudes that the respondents have toward females in STEM leadership positions were expressed in their preference and relationship. A greater number of the respondents expressed a non-gendered preferences for leaders in STEM and highlighted that what they prefer is a competent leader, whether the person happens to be male or female. The others also indicated that they have an equal or cordial relationship with the female STEM leaders they work with or work under.

In a nutshell, despite the general social conception of the incompatibility of women in STEM fields and the incongruity between the gender roles and leadership roles, some people choose to reject this social or cultural view. Such people choose to rather hold a favorable perception of women in STEM and STEM leadership as it has been carefully elaborated in this study. Based on this realization, much attention should be given to enlightening people about the value of females'

involvement in STEM and STEM leadership in order to nurture a favorable perception and attitude toward females in STEM.



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APPENDICES

APPENDIX A: INTERVIEW GUIDE

EXPLORING PERCEPTIONS AND ATTITUDES TOWARD WOMEN IN STEM

LEADERSHIP POSITIONS

INTERVIEW GUIDE

A. PARTICIPANTS WITH KNOWLEDGE ABOUT STEM AND LEADERSHIP

Personal Information

1. Sex
2. Age
3. Level of education

Perception and Attitude toward Females' involvement in STEM

1. What do you think about females' involvement in STEM?
2. Do you think females belong in STEM fields? Kindly elaborate on your answer.
3. Are females smart enough to excel in STEM fields? If yes or no, why do you think so?
4. Do you think females excel or can excel as well as males in STEM fields? Kindly explain your response.
5. Should there be policies that will encourage female involvement in STEM? What policies would you recommend or suggest?

Perception and Attitude toward Females in STEM Leadership Positions

1. What do you think about women in leadership positions?
2. Do you think women are capable leaders as compared to men? If yes or no, why?
3. What do you think about women in STEM leadership positions?
4. Whose leadership would you prefer to be under in your field, and why?

5. If you had the power, what would you do to advance women's leadership in STEM? What policies would you suggest or recommend?

B. PARTICIPANTS EMPLOYED IN STEM

Personal Information

1. Sex
2. Age
3. Institution of employment
4. Level or rank in organization

Perception and Attitude toward Female involvement in STEM

1. What do you think about females' involvement in STEM?
2. Do you think females belong to STEM fields? If yes or no, why?
3. Do you think females excel as well as males in STEM fields? Kindly elaborate on your answer.
4. Should there be policies that will encourage female involvement in STEM? Which policies would you suggest or recommend?

Perception and Attitude toward Females in STEM Leadership Positions

1. What do you think about women in leadership positions?
2. Do you think women are as capable leaders as compared to men? If yes or no, why?
3. What do you think about women in STEM leadership positions?
4. What is your attitude toward female leaders in your institution? Why do you have such an attitude towards them?
5. If you had the power, what would you do to advance women's leadership in STEM? How do you intend to do what would have done?

APPENDIX B: ETHICAL CLEARANCE



UNIVERSITY OF GHANA
ETHICS COMMITTEE FOR THE HUMANITIES (ECH)

P. O. Box LG 74, Legon, Accra, Ghana

My Ref. No: ECH.187/23-24

April 15, 2024

Emmanuel Abrokwah
Department of Psychology
University of Ghana
Legon

ETHICAL CLEARANCE
(ECH 187/ 23-24)

The Ethics Committee for the Humanities (ECH) conducted a full-board review and approved your protocol titled:

EXPLORING THE PERCEPTIONS AND ATTITUDES TOWARD WOMEN IN STEM LEADERSHIP

PRINCIPAL INVESTIGATOR: **EMMANUEL ABROKWAH**

Please note that the final review report must be submitted to the Committee at the completion of the study. Your research records may be audited at any time during or after the implementation. Any modification of this research project must be submitted to ECH for review and approval prior to implementation.

Please report all serious adverse events related to this study to ECH within seven (7) days verbally and in writing within fourteen (14) days.

This certificate is valid until April 14, 2025. You are required to submit annual reports for continuing review.

Please accept my congratulations.

Yours Sincerely,

Professor Akosua K. Darkwah
ECH Vice-Chair

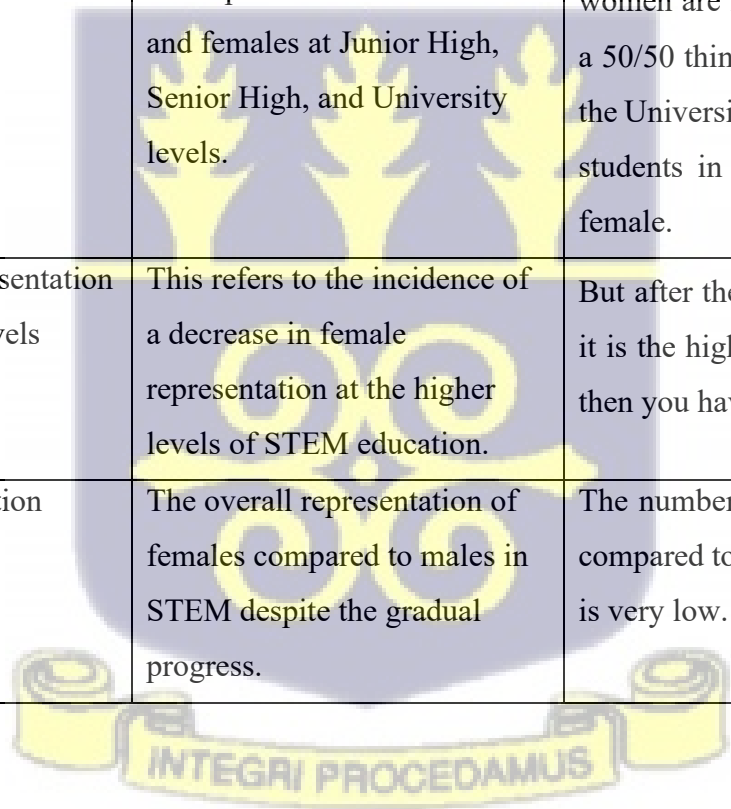
Cc: Professor Adote Anum, Department of Psychology, UG
Dr. John Enoch Kwasi Dotse, Department of Psychology, UG

APPENDIX C: THEMATIC FRAMEWORK AND CODING FREQUENCIES



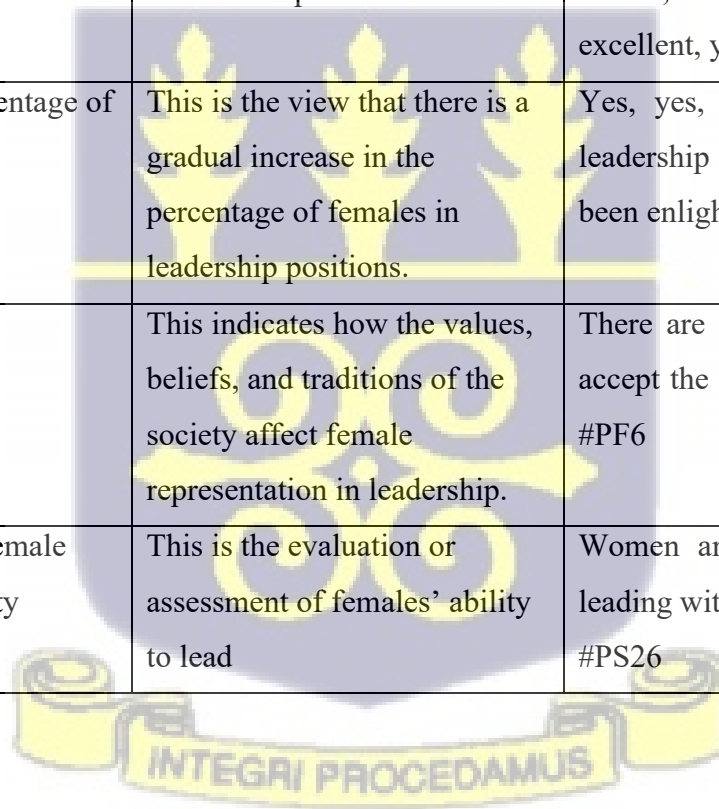
Table 2: Thematic framework for Twelve (12) themes

Main theme	Sub-theme	Definitions	Quotation extracts
Female representation in STEM	Increasing female representation	This highlights the progressive increase in female representation in STEM compared to over 10 years ago.	No, but we've seen a lot of growth and improvement in the past, let's say 15 years, where we were around 18 percent to currently between 36 and 40 percent. #PF6
	Equal representation at the basic level	This points to the equal intake and representation of males and females at Junior High, Senior High, and University levels.	Okay, so I think that at the lower level a lot more women are involved in STEM. I can say like it is a 50/50 thing because for instance, I know that in the University of Ghana, there is an equal intake of students in the STEM fields for both male and female. #PF2
	Declining representation at the higher levels	This refers to the incidence of a decrease in female representation at the higher levels of STEM education.	But after the first level, like after the first degree, it is the higher level that the women drop off and then you have very few of them going up. #PF2
	Few representation	The overall representation of females compared to males in STEM despite the gradual progress.	The number of females in STEM is quite low as compared to the men. So I think the representation is very low. #PS28

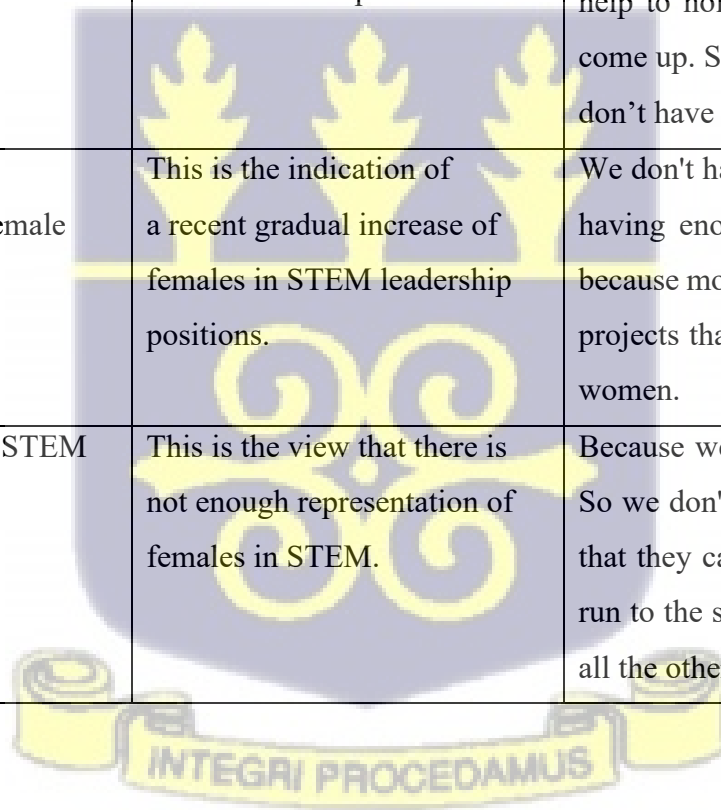


Factors influencing female representation in STEM	Personal factors	These factors are related to the individual but have roots in or are related to society.	I think sometimes because they don't even know that there are these areas that they can go into, so they lack knowledge of various STEM fields or disciplines that they can branch into. #PF2
	Social factors	These are factors that originate from the society influencing females from being enrolled in STEM	Yeah, it's a cultural thing. When you hear people say the women are just supposed to sit in their house and cook, take care of the family, take care of the family, essentially you are not supposed to do anything academic... #PS15
Perception about females place in STEM	Females belong to STEM	This is the perception that females just as males have what it takes to read STEM courses.	Mm-hmm, they really belong. Because one thing I've realized, when it comes to looking at things, especially in STEM, guys are from a different perspective and females bring this touch of creativity to a way that males don't come with it... #PS29
	STEM is not gender specific	This is the idea that STEM is not a designated field for males or females.	STEM is not a field that is gender specific, anyone with the interest can be in STEM. Is not a field that is reserved for one specific gender, yes. #PF1
Perception about females' ability to do STEM	Females have the capacity to do STEM	This is the conception that females have the intellectual	I think females can excel. I mean, if you give men and women the same chance to do science and excel, both can excel. #PS19

		prowess to read STEM courses.	
	Females excel in STEM	This is the view that highlights the evidence of females who have excelled in STEM	I think most of those I know have excelled. Just a few you know, just went their separate ways. But I think most of them have excelled. #PS8
Female representation in leadership	Low percentage of female leaders	This is the view that the overall percentage of females in leadership is low.	Yeah, it's the same issue, you normally don't find too many females in leadership positions. But of course, the ones that you find are also very excellent, yeah, if you ask me. #PF4
	Increasing percentage of female leaders	This is the view that there is a gradual increase in the percentage of females in leadership positions.	Yes, yes, yes. More women are going in for leadership positions. That's because now they've been enlightened. #PF17
Factor influencing female representation in leadership	Culture	This indicates how the values, beliefs, and traditions of the society affect female representation in leadership.	There are still culturally some men who cannot accept the fact that the woman is leading them... #PF6
Perception about female leadership capacity	Evaluation of female leadership ability	This is the evaluation or assessment of females' ability to lead	Women are absolutely, you know, capable of leading with vision, integrity, whatever so as men. #PS26



	Non-gendered nature of leadership	This is a rejection of the masculine definition of leadership.	And I have had both women and men leaders and I have had both good and bad women and men leaders so I cannot tell who is better and who is not. So it is more of personality than gender... #PF1
Female representation in STEM leadership	Few females in STEM leadership	This is the view of the overall few percentage of females in STEM leadership.	But then in reality, you don't even have enough women in leadership positions in STEM to even help to hold the hand of the younger woman to come up. So that is the biggest challenge, that you don't have enough. #PF3
	An increasing percentage of female STEM leaders	This is the indication of a recent gradual increase of females in STEM leadership positions.	We don't have enough, but I think we are close to having enough. We are close to having enough because most of the STEM programs or the STEM projects that are going on are initiated and led by women. #PS21
Factors influencing female representation in STEM leadership	Few females in STEM	This is the view that there is not enough representation of females in STEM.	Because we don't have a lot of them in the field. So we don't have a lot. We need a lot of them so that they can enter into STEM, but most of them run to the social sciences and all the business and all the other fields, yeah. #PS27



	Inadequate support from female STEM leaders	This reflects the insufficient amount of support available to females who may decide to pursue leadership in STEM fields.	And women in leadership right now, most of the women in leadership I look at from a distance, they might seem good, but when you get closer or you try to climb the ladder to where they are, they try to push you down... #PS12
Perceptions and attitudes towards females in STEM leadership	Preference	This is the respondents' choice of the gender of the leader they would want to be under in their field.	Mine is to be under someone who is capable of training me enough to be who I want to be. So regardless of the sex, so far as the person is performing, I like the person... #PS18
	Relationship	This highlights how the respondents relate with the female leaders in their organization.	Oh, everyone is just equal. I relate to them equally. I relate to everyone equally. It doesn't matter who you are. If I'm supposed to call you, I mean, I'll call you. If I'm supposed to text you, I'll text you professionally. #PS25
Bridging the gender gap in STEM involvement	Early exposure and encouragement	Introducing STEM to students from the basic level and giving them the needed encouragement to pursue various programs in the field.	So most of them have the perception that the courses are difficult, they can't read. So I think educating them at a young age will encourage them to read the science. #P27
	Making STEM attractive	Putting things in place to highlight the relevance and practical nature of STEM.	Just TV shows to show more women in STEM, it doesn't have to be a 2hour long movie about somebody, it could be a short snippet posted like

			on tiktok or somewhere to show that women can excel in STEM... #PS5
	Support	This is the moral, social, and economic support that serves as motivation for females to enter STEM.	I think one of it is financial support. I think females should be financially supported. It would encourage them. #PF2
Bridging the gender gap in STEM leadership	Encourage female leadership in STEM	This is the conscious effort to encourage females to take various leadership positions in STEM.	But I would encourage women to take part in leadership schools, encourage women to put themselves out there... #PF1
	Leadership training for females	This is a deliberate effort to equip females with leadership skills.	So creation of programs to train and support women in STEM to take up leadership roles. Not just setting up STEM projects and asking them to lead. They need training. You need to be trained to become a leader. #PS21
	Support	This is the moral, social, and financial support that when given to females will encourage them to take up leadership in STEM	So if policies are there to support females to be leaders, it will help because it will also help in the educational aspect. #PF17
	Increasing female representation in STEM	This is the idea that when female representation increases	So first I will encourage participation in STEM before I even think of leadership. #PS24

		in STEM, it would reflect in their representation in STEM leadership positions.	
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Table 3: Coding frequency for female representation in STEM

	Increasing representation	Equal representation at the basic level	Declining representation at the top	Few females in STEM
PF1	*			
PF2		*	*	
PF3			*	
PF4				*
PS5				*
PF6	*		*	
PS7				*
PS8	*			
PF9				*
PF10		*		
PS11				*
PS12				
PS13	*			*
PS14				*
PS15	*			*
PS16				
PF17	*			
PS18				*
PS19				*
PS20				*
PS21				*
PS22				*
PS23	*			
PS24	*			
PS25				*
PS26	*			
PS27	*			*
PS28				*
PS29				*
PS30				*
<i>Total</i>	10	2	3	18

Source: Field work, 2024

Table 4: Coding frequency for factors influencing female representation in STEM

	Personal factors	Social factors
PF1	*	*
PF2	*	*
PF3		*
PF4		*
PS5		*
PF6		*
PS7		*
PS8		*
PF9	*	*
PF10	*	
PS11		
PS12	*	*
PS13		*
PS14		
PS15		*
PS16		
PF17		
PS18		*
PS19		*
PS20		*
PS21		
PS22	*	*
PS23	*	
PS24		*
PS25		*
PS26	*	*
PS27	*	*
PS28	*	
PS29	*	
PS30		
<i>Total</i>	11	20

Source: Field work, 2024

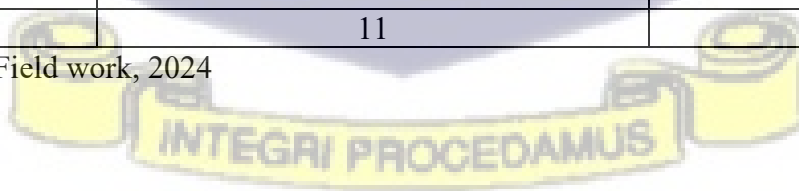


Table 5: Coding frequency for perception about females' place in STEM

	Females belong to STEM	STEM is not gender specific
PF1		*
PF2	*	
PF3	*	
PF4	*	
PS5		
PF6		*
PS7		*
PS8	*	
PF9	*	
PF10	*	
PS11	*	*
PS12	*	
PS13	*	
PS14		*
PS15	*	
PS16		*
PF17	*	
PS18	*	
PS19		*
PS20	*	
PS21	*	
PS22	*	
PS23	*	
PS24	*	
PS25	*	*
PS26	*	
PS27		*
PS28	*	
PS29	*	
PS30	*	
<i>Total</i>	22	9

Source: Field work, 2024



Table 6: Coding frequency for perception about females' ability to do STEM

	Females have the capacity to excel in STEM	Females excel in STEM
PF1	*	*
PF2		*
PF3		*
PF4		*
PS5	*	*
PF6	*	*
PS7	*	*
PS8		*
PF9		*
PF10		*
PS11	*	*
PS12		
PS13	*	*
PS14	*	*
PS15	*	*
PS16	*	*
PF17	*	*
PS18	*	*
PS19	*	
PS20	*	*
PS21	*	*
PS22	*	*
PS23	*	*
PS24	*	*
PS25	*	*
PS26	*	*
PS27	*	*
PS28	*	*
PS29	*	*
PS30	*	
<i>Total</i>	23	27

Source: Field work, 2024



Table 7: Coding frequency for female representation in Leadership

	Increasing representation	Low representation
PF1		*
PF2		*
PF3		*
PF4		*
PS5		
PF6	*	*
PS7		
PS8	*	
PF9		
PF10		*
PS11		
PS12		
PS13	*	
PS14	*	
PS15	*	
PS16	*	
PF17	*	
PS18		*
PS19	*	
PS20	*	
PS21		*
PS22		*
PS23		*
PS24	*	
PS25	*	*
PS26		*
PS27	*	
PS28	*	
PS29	*	
PS30		
<i>Total</i>	14	12

Source: Field work, 2024

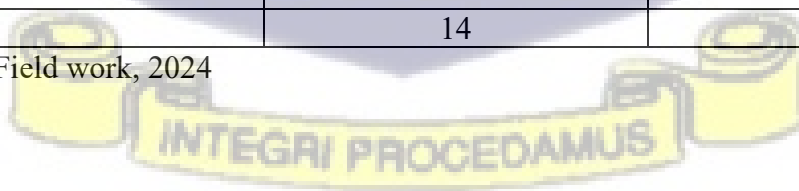


Table 8: Coding frequency for factors affecting female representation in Leadership

	Culture
PF1	*
PF2	
PF3	*
PF4	
PS5	
PF6	*
PS7	
PS8	*
PF9	*
PF10	*
PS11	*
PS12	
PS13	
PS14	
PS15	*
PS16	
PF17	
PS18	
PS19	*
PS20	
PS21	
PS22	*
PS23	*
PS24	*
PS25	
PS26	
PS27	
PS28	
PS29	
PS30	
<i>Total</i>	12

Source: Field work, 2024



Table 9: Coding frequency for perception about females' leadership ability

	Females are capable leaders	Non-gendered
PF1	*	*
PF2	*	*
PF3	*	*
PF4	*	
PS5	*	*
PF6	*	
PS7	*	
PS8	*	
PF9	*	
PF10	*	*
PS11	*	
PS12	*	*
PS13	*	*
PS14	*	
PS15	*	*
PS16	*	
PF17	*	
PS18	*	
PS19	*	*
PS20	*	
PS21	*	
PS22	*	
PS23	*	
PS24	*	
PS25	*	
PS26	*	*
PS27	*	*
PS28	*	
PS29	*	*
PS30	*	
<i>Total</i>	30	12

Source: Field work, 2024

Table 10: Coding frequency for female representation in STEM leadership

	Few percentage	Increasing representation
PF1	*	
PF2		
PF3	*	
PF4	*	
PS5		
PF6	*	
PS7		*
PS8		
PF9		
PF10		
PS11		
PS12		*
PS13	*	
PS14		*
PS15	*	
PS16	*	
PF17		*
PS18	*	
PS19		
PS20	*	
PS21		*
PS22	*	
PS23		
PS24		*
PS25		*
PS26	*	
PS27	*	
PS28	*	
PS29	*	
PS30		*
<i>Total</i>	14	8

Source: Field work, 2024

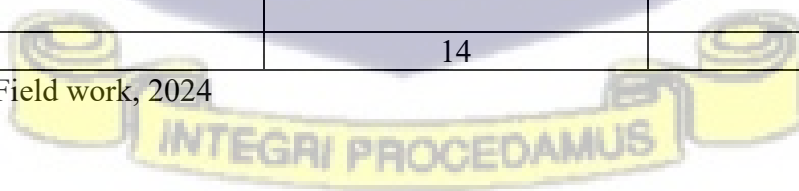


Table 11: Coding frequency for factors influencing female representation in STEM leadership

	Few females in STEM	Inadequate support from female STEM leaders
PF1	*	
PF2		
PF3		*
PF4		
PS5		
PF6		
PS7		
PS8		
PF9		
PF10		
PS11		
PS12		*
PS13		
PS14		
PS15		
PS16		
PF17		
PS18		
PS19		
PS20		
PS21		
PS22		
PS23		
PS24		
PS25		
PS26		
PS27	*	
PS28		
PS29		
PS30		
<i>Total</i>	2	2

Source: Field work, 2024

Table 12: Coding frequency for perceptions and attitudes towards females in STEM Leadership

	Preference	Relationship
PF1		*
PF2		*
PF3		*
PF4		*
PS5	*	
PF6		*
PS7	*	
PS8	*	
PF9		*
PF10		*
PS11	*	
PS12	*	
PS13	*	
PS14	*	
PS15	*	
PS16	*	
PF17		*
PS18	*	
PS19	*	
PS20	*	
PS21	*	
PS22	*	
PS23	*	
PS24	*	
PS25	*	*
PS26	*	
PS27	*	
PS28	*	
PS29	*	
PS30	*	
<i>Total</i>	22	8

Source: Field work, 2024

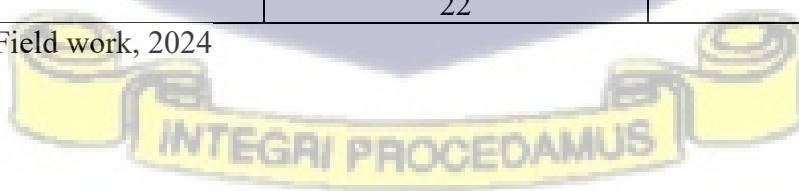


Table 13: Coding frequency for bridging the gap in STEM involvement

	Early exposure and encouragement	Make STEM attractive	Support
PF1			*
PF2			*
PF3		*	
PF4			*
PS5		*	*
PF6	*		
PS7			
PS8	*	*	*
PF9			*
PF10			*
PS11		*	
PS12	*		*
PS13			*
PS14	*	*	
PS15			*
PS16			*
PF17	*		*
PS18			*
PS19	*		*
PS20		*	*
PS21			
PS22			*
PS23	*	*	
PS24			
PS25			
PS26			*
PS27	*		*
PS28			*
PS29	*	*	*
PS30			
<i>Total</i>	9	8	20

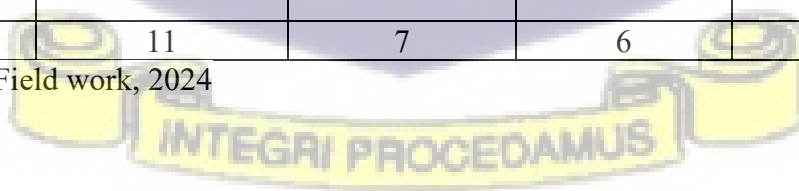
Source: Field work, 2024



Table 14: Coding frequency for bridging the gap in STEM leadership

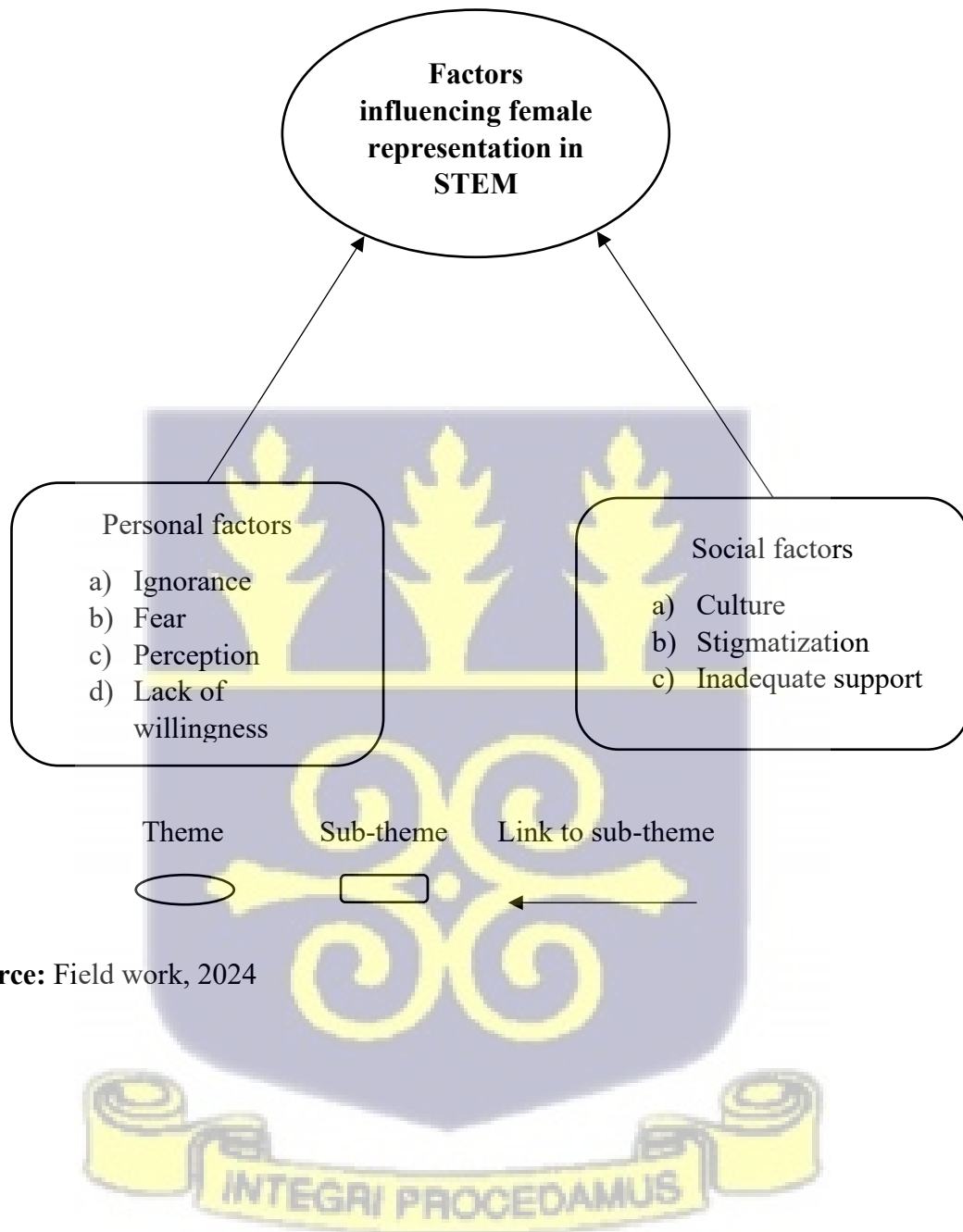
	Encourage female leadership	Leadership training	Support	Increase female representation in STEM
PF1	*	*		
PF2	*			
PF3			*	
PF4			*	
PS5		*		
PF6				
PS7				*
PS8			*	
PF9	*			*
PF10			*	*
PS11				
PS12	*			
PS13	*			
PS14	*			
PS15		*		
PS16	*			
PF17			*	
PS18	*			
PS19	*			
PS20	*			
PS21		*	*	
PS22				*
PS23				
PS24				*
PS25				
PS26		*		
PS27		*		
PS28	*			
PS29		*		
PS30				
<i>Total</i>	11	7	6	5

Source: Field work, 2024



APPENDIX D: THEMATIC MAPS

Figure 1: Thematic map showing one (1) theme



Source: Field work, 2024

Figure 2: Thematic map showing one (1) theme

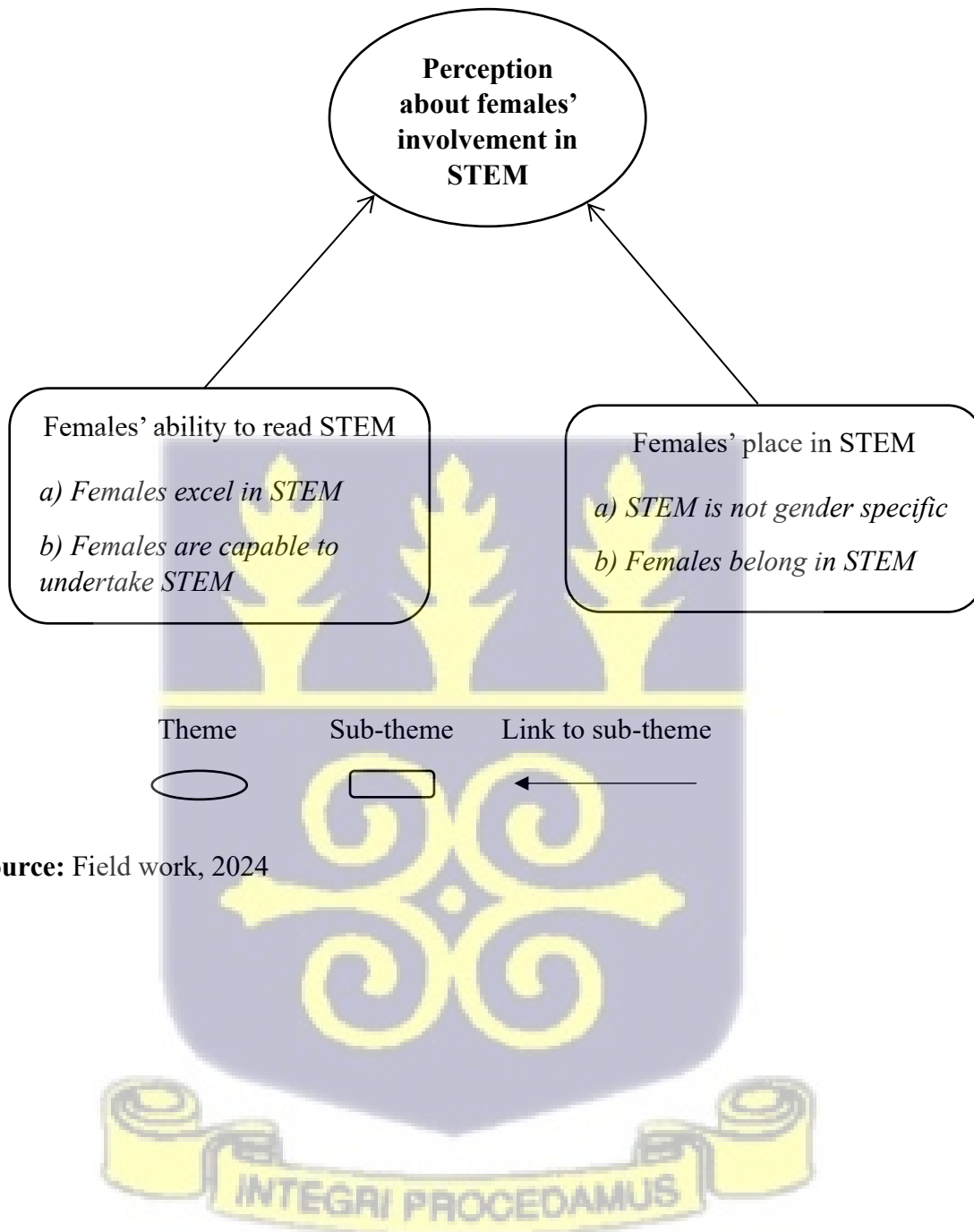
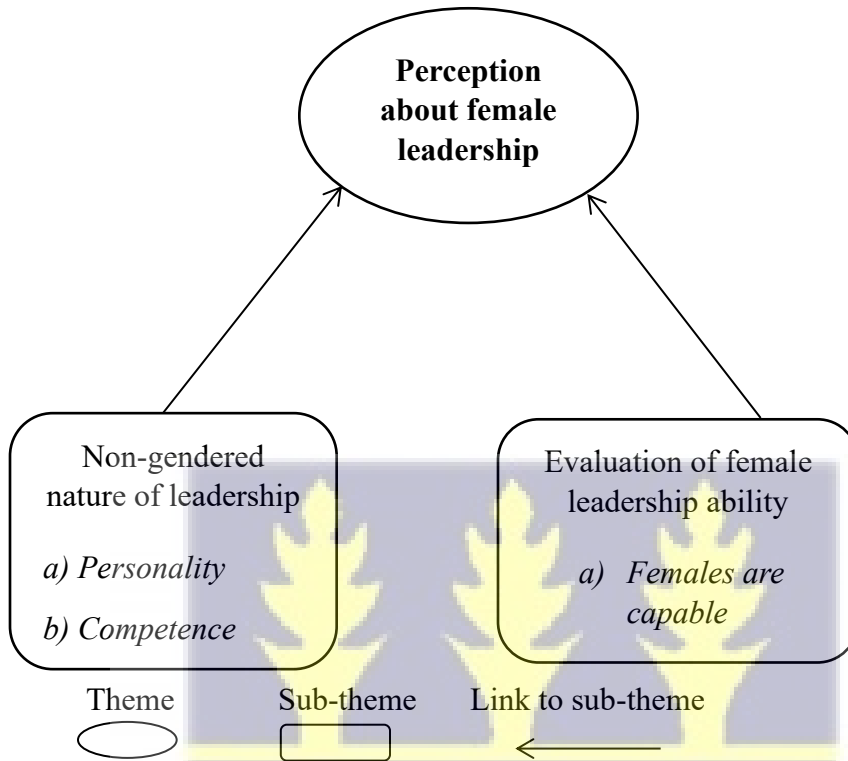


Figure 3: Thematic map showing one (1) theme



Source: Field work, 2024



Figure 4: Thematic map showing one (1) theme

