

DDP Research Paper:

"Shattering the Glass Ceiling: Exposing and Addressing Racial and Gender Biases in STEM
Careers for Women of Color in Higher Education"

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Abstract

This research investigates the intersectionality of gender and race in STEM careers among women of color in higher education. The goal is to clarify these women's unique experiences and challenges while developing strategies to advance diversity and inclusion within STEM fields.

Reflecting on the journey as a Black woman, daughter of migrant workers, wife, mother, grandmother, and scholar, a profound understanding of how racial and gender biases manifest in various facets of life has been gained. It has been observed that women of color often encounter significant exclusion from essential networks and are subjected to policies that undermine their contributions and expertise in the STEM disciplines. This realization has inspired the research, aiming to uncover and confront these barriers, paving the way for more equitable opportunities for women of color in STEM careers.

This research examines how the interplay of gender and race affects the professional journeys of women of color in STEM, particularly in collegiate settings. The goal is to raise awareness about these individuals' obstacles and biases while exploring ways to amplify their voices and contributions.

Through qualitative methods, the research aims to uncover specific challenges and identify effective strategies for fostering inclusivity and equity in STEM environments. Ultimately, this work aspires to contribute to creating supportive educational spaces that empower women of color to thrive in STEM disciplines, ensuring their diverse perspectives are valued and included in shaping the future of these fields.

Dedication

This dissertation is dedicated to the husband, Raymond, whose unwavering support and belief in aspirations have been a source of strength and motivation throughout the pursuit of a doctorate, particularly in addressing the challenges faced by women of color in STEM.

Additionally, this work is dedicated to the beloved mother, Ethie Threats-Hogan, and the daughters, Angel, Aerial, Nina, and Jessica, along with the granddaughters, Imari, Zariah, Jadasia, Jada, and Kaylah. Constant encouragement, love, and resilience have been key to accomplishments. Deep gratitude is felt for the presence of each individual and recognition of the significant role played in shaping purpose and mission.

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Reflecting on the journey of writing this dissertation, “Shattering the Glass Ceiling: Exposing and Addressing Racial and Gender Biases for Women of Color in STEM in Higher Education,” tremendous gratitude is felt for the many individuals who have supported and inspired this work.

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Heartfelt gratitude is expressed to the amazing women of color in STEM who have generously shared their stories and experiences. Your voices are vital to this dissertation, and your courage in overcoming challenges serves as great inspiration. It is hoped that this work acts as a platform to encourage others to advocate for the changes that are necessary regarding women of color.

To fellow colleagues and friends in the academic community, appreciation is given for walking this path together. Late-night study sessions, brainstorming ideas, and sharing feedback and insights have made this journey worthwhile. Shared experiences and mutual support are truly cherished.

Most importantly, a heartfelt thank you is dedicated to family. Your love, encouragement, and unwavering belief have been the greatest source of strength. Every challenge has been

weathered together, and there is deep gratitude for your sacrifices and support. This achievement belongs as much to you as it does to the researcher.

Introduction

The persistent underrepresentation of women, particularly those from minority backgrounds, in STEM careers has increasingly raised concerns in recent years (Smith & Lee, 2020). Female students from diverse backgrounds often encounter significant barriers due to both overt discrimination and subtle forms of exclusion, which impede their progression in these fields. In this research, the focus is on addressing these pressing issues by investigating the intersections of gender and race within STEM.

To facilitate a better understanding of the complexities involved, a poster was created to visually summarize the key objectives, methodology, and anticipated outcomes of this study. This visual representation condenses data into an easily digestible format and enhances audience engagement, effectively bridging the gap between complex concepts and public understanding. The poster was disseminated at a CPED conference on the topic: “Shattering the Glass Ceiling by Addressing Racial and Gender Biases in STEM Careers for Women of Color in Higher Education,” and it will also be utilized through various digital channels to pave the way for impactful discussions within the community. The following sections will delve into the research methodology, findings, and implications of this study. See Appendix A for a Poster of the topic.

This research confronts the challenges women of color face in STEM by employing a qualitative approach that includes surveys, interviews, and focus groups with individuals currently working in these fields. The primary objective is to unearth their unique challenges and develop effective strategies that genuinely promote diversity and inclusion in STEM. By disseminating these findings, this research aims to equip educational institutions, employers, and policymakers with actionable insights to cultivate environments where all students—regardless of gender or racial background—can flourish.

Particular emphasis is placed on qualitative research, utilizing in-depth interviews and focus groups to capture the lived experiences of women of color in higher education, while surveys provide a broader context for understanding the issues at hand. A comprehensive literature review will also lay the groundwork by examining existing research on racial and gender biases in STEM. This dual approach aims to identify effective strategies for promoting equity and inclusion for women of color in these fields.

The significance of this research lies in its capacity to initiate transformative change by advancing diversity and inclusiveness in STEM. By recognizing and addressing the specific obstacles faced by women of color, it strives for a more equitable environment where they, along with other underrepresented groups, are empowered to succeed. Ultimately, insights garnered from this research are intended to guide institutions, employers, and policymakers in creating a more inclusive environment that benefits all students.

This research will explore several critical areas. The initial step involves contextualization, focusing on the historical and current landscape for women and minorities in STEM, with a particular emphasis on the unique challenges experienced by women of color (Collins, 2000; Ong et al., 2011). By highlighting these perspectives, the research situates the experiences of women of color within broader social and structural contexts.

Next, a theoretical framing will establish a foundation for analyzing the intersections of gender, race, and STEM. This framework aligns with intersectionality theory, which emphasizes how overlapping identities shape individual experiences and access to resources (Crenshaw, 1989). Such a lens allows for a nuanced understanding of the compounded barriers women of color encounter in the STEM landscape (Settles et al., 2019).

A comprehensive literature review of current research on racial and gender biases in STEM will inform our understanding of existing gaps and help formulate pertinent research questions. Previous studies have highlighted how explicit and implicit biases contribute to the underrepresentation and stunted career advancement of women of color in STEM fields (Johnson et al., 2011; Malone & Barabino, 2009). Clearly defining the research problem is paramount. This study addresses the pressing need for inclusive STEM environments that are attuned to racial and gendered experiences—a requirement often overlooked in traditional diversity initiatives (Museus & Liverman, 2010).

Based on the literature and theoretical framing, this research will develop focused questions that delve into the specific experiences and barriers faced by women of color in STEM. These questions will probe deeper into the intersections of race, gender, and professional identity (Ong et al., 2011). The methodology employed in this research will detail participant selection, data collection, and analysis methods. This mixed-methods approach, utilizing surveys alongside qualitative techniques such as interviews and focus groups, enables a comprehensive view of participants' lived experiences while providing robust quantitative data for a richer understanding of the issues (Creswell & Poth, 2018).

Finally, this dissertation will discuss key findings and their implications for the field. By examining these results through the lens of structural and cultural factors, this research contributes to a deeper understanding of the barriers to diversity in STEM. It will also consider the broader impact on academia, industry, and policy, as promoting equity in STEM fields can yield benefits for the entire workforce (McGee, 2020; Smith et al., 2019). By integrating rigorous research with innovative strategies, this dissertation aspires to create a significant impact in fostering a more inclusive and equitable environment in STEM.

Chapter 1 Contextualization of the Topic

The underrepresentation of women, especially those from racial and ethnic minorities, in Science, Technology, Engineering, and Mathematics (STEM) careers is not just a long-standing concern, but an urgent issue that demands immediate attention from educators, policymakers, and gender equality advocates (Ceci & Williams, 2011). Despite advancements in gender equity over the past few decades, women continue to be disproportionately absent from STEM fields, reflecting a failure to harness the full potential of our society's talent and perpetuating systemic inequalities that have far-reaching social and economic consequences. STEM disciplines are critical to advancing medicine, technology, infrastructure, and numerous other sectors. A diverse and inclusive STEM workforce is a matter of fairness and a strategic imperative for addressing complex global challenges (National Science Foundation, 2018).

Gender bias operates in intricate ways, often intersecting with racial biases, creating unique barriers for female students from diverse backgrounds (Crenshaw, 1989; Moss-Racusin et al., 2012). Such biases manifest in overt discrimination and subtle forms, such as stereotype threat, implicit bias, and limited access to opportunities and mentorship (Stout et al., 2011; Williams et al., 2016). Female students of color are stereotyped in STEM education or STEM careers and considered less intelligent or less capable than their male peers. They may also face microaggressions such as being told, "Anyone can succeed if they work hard," "You speak excellent English," "All lives matter," or "Where are you really from?" "She's pretty for a Black girl," or telling racist jokes (Moss-Racusin et al., 2012).

These biases have a profound impact on the interest and pursuit of STEM careers by female students of color, with studies indicating that they are less likely to pursue STEM majors in college and more likely to leave STEM careers after graduation (Cheryan et al., 2009). The

unique challenges faced by female students of color due to the intersectionality of gender and race are significant. For instance, Black and Hispanic women are more likely to come from low-income families and attend underfunded schools, which can limit their access to high-quality STEM education and resources. They may lack role models in STEM fields and experience microaggressions and discrimination in academic and professional settings.

The lack of representation of women and students of color in STEM careers deprives the economy of a talented and diverse workforce. It prevents women and students of color from reaping the benefits of high-paying and rewarding STEM careers. Additionally, the lack of diversity in STEM fields can lead to biases in developing and implementing new technologies, negatively affecting society.

To address this pressing issue, research that delves into the intersectionality of gender and race in the context of STEM careers is essential. Such research can provide a comprehensive understanding of the distinct challenges female students of color face and shed light on potential strategies and interventions to overcome these obstacles. Moreover, such research can inform educational institutions, employers, and policymakers on how to create more inclusive environments that foster the participation and success of all students, regardless of their gender or racial background.

This study seeks to grant knowledge of gender and race biases in STEM by taking a holistic approach focusing on all developmental areas. It recognizes that the experiences of female students in STEM are shaped not only by their gender but also by their racial identities. Therefore, meaningful solutions must acknowledge and address this intersectionality (Crenshaw, 1989; King et al., 2018). By thoroughly examining the various barriers and biases and proposing

evidence-based recommendations, this research contributes substantially to the ongoing efforts to achieve gender and racial equity in STEM.

STEM Education and Its Historical Context

STEM, an abbreviation for science, technology, engineering, and mathematics, has its roots in the late 19th century, distinct from its association with home economics. It encompasses many disciplines that necessitate a strong foundation in these domains. It promotes innovation, drives economic growth, and enhances national competitiveness (National Academies of Sciences, Engineering, and Medicine, 2018). The interconnectedness of these STEM disciplines is a unifying factor, highlighting their shared goal of advancing knowledge and solving real-world problems. Stemming from the emergence of STEM education as a distinct curriculum and focus in the 1990s, the term "STEM" gained prominence in the early 2000s, mainly due to the efforts of the National Science Foundation. These disciplines have been acknowledged for their interconnectedness and fundamental role in preparing students for the challenges of the modern workforce, including advancements in medicine, technology, infrastructure, and other sectors.

Furthermore, establishing a diverse and inclusive STEM workforce is both a matter of fairness and a strategic imperative for addressing complex global challenges (National Science Foundation, 2018). The Department of Education has integrated STEM education into K-12 curriculums, recognizing its significance in developing and preparing school-age students for the future workforce (U.S. Department of Education, 2020). Many universities and colleges have also acknowledged the importance of STEM disciplines in preparing students for the future workforce. Given the rapid advancement of technology, there is an expected increase in demand for individuals with strong STEM skills. As a result, higher education institutions are placing greater emphasis on STEM education to ensure that graduates are well-prepared to meet the

demands of the job market. Additionally, research in STEM fields has the potential to drive innovation and contribute to advancements in various industries, making it a vital component of higher education.

Understanding the evolution of STEM education is fundamental to appreciating its significance. Although the acronym "STEM" emerged in the early 2000s, highlighting the interconnectedness of science, technology, engineering, and mathematics in preparing students for the modern workforce (Sanders, 2009), the underlying disciplines have a much longer history (Bybee, 2010). Notably, this history is intertwined with the challenges faced by women in accessing STEM education. Before the late 19th century, women had limited access to higher education and professional development programs (Adams, 2019). Academic paths for women were often restricted by educational institutions, thereby limiting career options in STEM fields that were traditionally dominated by men (Wilson, 2016; Miller, 2014). Despite these obstacles, women have shown remarkable resilience and determination, carving out their place in STEM fields. Additionally, vocational training programs in that era reinforced gender roles by focusing on domestic and caregiving professions, providing limited opportunities for women to pursue careers in STEM fields (Thompson, 2020). This historical context underscores the enduring challenges women of color face in STEM today.

In this discussion, the findings from this research on "Shattering the Glass Ceiling: Exposing and Addressing Racial and Gender Biases in STEM Careers for Women of Color in Higher Education" will be discussed. Having been identified were six emerging themes from this research that warrant further exploration in future studies. These themes include:

1. Systemic Biases
2. Challenges in Career Advancement
3. Adverse Workplace Dynamics
4. Importance of Equity and Accountability
5. Impact of Financial Stability
6. Call for Collective Action

These themes align with the overall focus on understanding the complex dynamics that affect women of color in STEM fields, particularly within the sociocultural and sociopolitical contexts previously articulated.

Sociocultural Context

Qualitative research methods should be employed to understand the sociocultural aspects influencing women of color in STEM careers. This approach involves conducting in-depth interviews with women of color in STEM fields to explore their experiences with racial and gender biases, strategies for overcoming challenges, and the impact of sociocultural factors on their career trajectories (Collins, 2000; Crenshaw, 1989).

A qualitative study by Johnson, Smith, and Lee (2020) examined the experiences of women of color in engineering professions. It revealed how sociocultural factors, such as stereotype threat (Steele, 1997) and the lack of representation in leadership roles, significantly influence their career development. By adopting a qualitative approach, this research effectively captured the complex and multifaceted ways sociocultural dynamics shape the professional

journeys of women of color in STEM. The findings provide valuable narratives that can help inform strategies to address biases and promote inclusivity within higher education settings.

Sociopolitical Context

From a sociopolitical perspective, women of color have historically been underrepresented in STEM leadership positions within higher education institutions. This underrepresentation is mainly due to systemic policies and practices perpetuating inequalities (Collins, 2000; Crenshaw, 1989; Gasman et al., 2015). For instance, hiring practices may favor candidates from specific demographic groups or exclude women of color from leadership roles due to implicit biases and institutional preferences (Turner et al., 2008; Ong et al., 2011). Research indicates that these biases often exist within recruitment processes and evaluation criteria, where subjective judgments about candidates can disproportionately disadvantage women of color (Bianchi et al., 2020).

Furthermore, the lack of mentorship and career advancement support significantly limits the progress of women of color in academia (Johnson, 2019; Thomas & Hollenshead, 2001). Mentorship is essential for navigating the challenges of STEM fields; however, women of color frequently encounter barriers that restrict their access to mentorship opportunities, leading to isolation and hindered professional development (Roberts, 2019). The absence of diverse role models in leadership positions can perpetuate a cycle of underrepresentation, as aspiring women of color in STEM may lack visible examples of success (Buchanan et al., 2020).

This issue goes beyond governmental policies or institutional practices, as it also affects the broader sociopolitical factors that shape the experiences of women of color in STEM fields within higher education. Socioeconomic status, geographic location, and cultural expectations

can further complicate their educational and career trajectories (Malcom & Malcom, 2011). The structural barriers they face hinder individual career progression and impact representation and inclusivity in the STEM workforce, which is crucial for fostering innovation and equity in these fields (Williams et al., 2014; Malcom & Malcom, 2011). Addressing the intersectionality of race, gender, and class is essential to understanding the unique challenges women of color face and creating equitable environments in STEM education and employment (Crenshaw, 1989; Hancock, 2007).

In summary, while these emerging themes provide a framework for understanding the complex barriers women of color face in STEM, this research primarily focuses on clarifying the sociocultural and sociopolitical contexts that impede their progress and promote systemic change within higher education.

Chapter 2 Theoretical Framing

The underrepresentation of women of color in STEM careers is a complex issue that requires urgent attention. This research aims to provide a comprehensive understanding of the specific barriers that women of color face in STEM fields by exploring theoretical frameworks related to racial and gender biases. By applying this theory, this study aims to clarify the complexities surrounding this important social issue and present my findings.

Intersectionality

Intersectionality refers to the interconnected nature of various identities, including race, gender, social class, sexual orientation, and disability (Crenshaw, 1989; Hancock, 2007). By examining how these overlapping identities shape the experiences of women of color in STEM

fields, we can identify the unique barriers they face. Race classifies individuals based on physical characteristics, while gender encompasses the societal roles and expectations associated with being male or female. Additionally, socioeconomic status, sexual orientation, and disability introduce further complexities that are vital to understanding the experiences of these women in STEM careers.

Intersectionality of Race and Gender

Research shows a significant gap in understanding the unique challenges and opportunities faced by women of color in STEM. Their intersectional experiences, influenced by both race and gender, complicate these dynamics (Crenshaw, 1989; Hill et al., 2010). Deeply embedded societal norms surrounding racial and gender biases can significantly limit opportunities for these women. Stereotypes related to their competence and commitment often impede their career advancement, contributing to ongoing underrepresentation in STEM fields (Hurtado et al., 2009; Ong et al., 2011).

Furthermore, social class creates additional barriers for women of color, particularly those from lower socioeconomic backgrounds. These women frequently encounter restricted access to essential educational resources, mentorship, and professional opportunities. The intersection of race and gender, compounded by social class, leads to greater challenges that can negatively impact their interest in and success within STEM careers (Collins, 2000; Crenshaw, 1989).

Additionally, the intersection of race, gender, and sexual orientation presents unique challenges for women of color in STEM. Their experiences of discrimination are often overlooked in traditional research, highlighting the need to expand our focus on how these intersecting identities influence career paths. Addressing the challenges presented by these

intersections is crucial for fostering inclusive STEM environments that support the diverse experiences of all women (Bowleg, 2008; Crenshaw, 1991).

Consequently, after reviewing various theories, choosing to focus on racial and gender bias theory due to its close connection to my topic. Existing research often fails to adequately consider how these biases shape the unique challenges and opportunities female students of color face in STEM. To address this gap, in-depth studies are required to explore the compounded effects of racial and gender biases on their career trajectories, workplace experiences, and overall well-being within STEM environments. Understanding these biases is critical for tackling the institutional barriers that restrict women's progress in STEM careers (Smith & Johnson, 2020).

In this theoretical exploration, two important appendices further clarify the research approach and framework. The Logic of Inquiry Model (Qualitative Approach) chart illustrates the qualitative methodology used in this study. This model clarifies the process of investigating the complex barriers women of color face in STEM, ensuring that the inquiry is grounded in the rich and contextual realities of their experiences. See Figure 1.

THE LOGIC-OF-INQUIRY MODEL (*Qualitative Approach*)

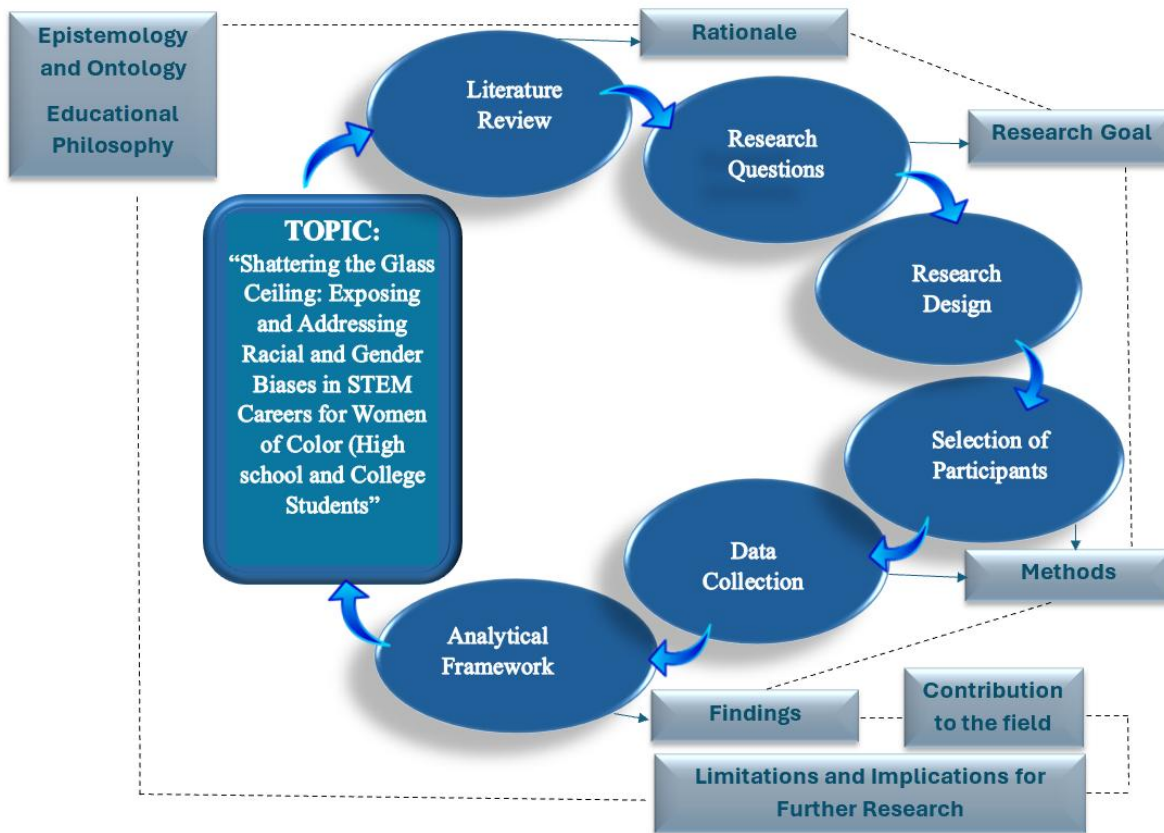


Image created by Ethel Smith

Figure 1: Logic Model for Doctoral Digital Portfolio

The Theoretical Framework Chart provides a visual representation of the various theoretical frameworks discussed in this chapter. This chart synthesizes key theories related to intersectionality, racial and gender biases, and the unique barriers these women encounter. It serves as a useful reference as we delve deeper into the analysis of these intersections in the following chapters. See Figure 2.

Theoretical Framework Chart
EXPOSING RACIAL AND GENDER BIASES IN STEM CAREERS
Thesis Statement: Identifying and addressing the barriers between racial and gender biases preventing female students' representation in STEM careers.

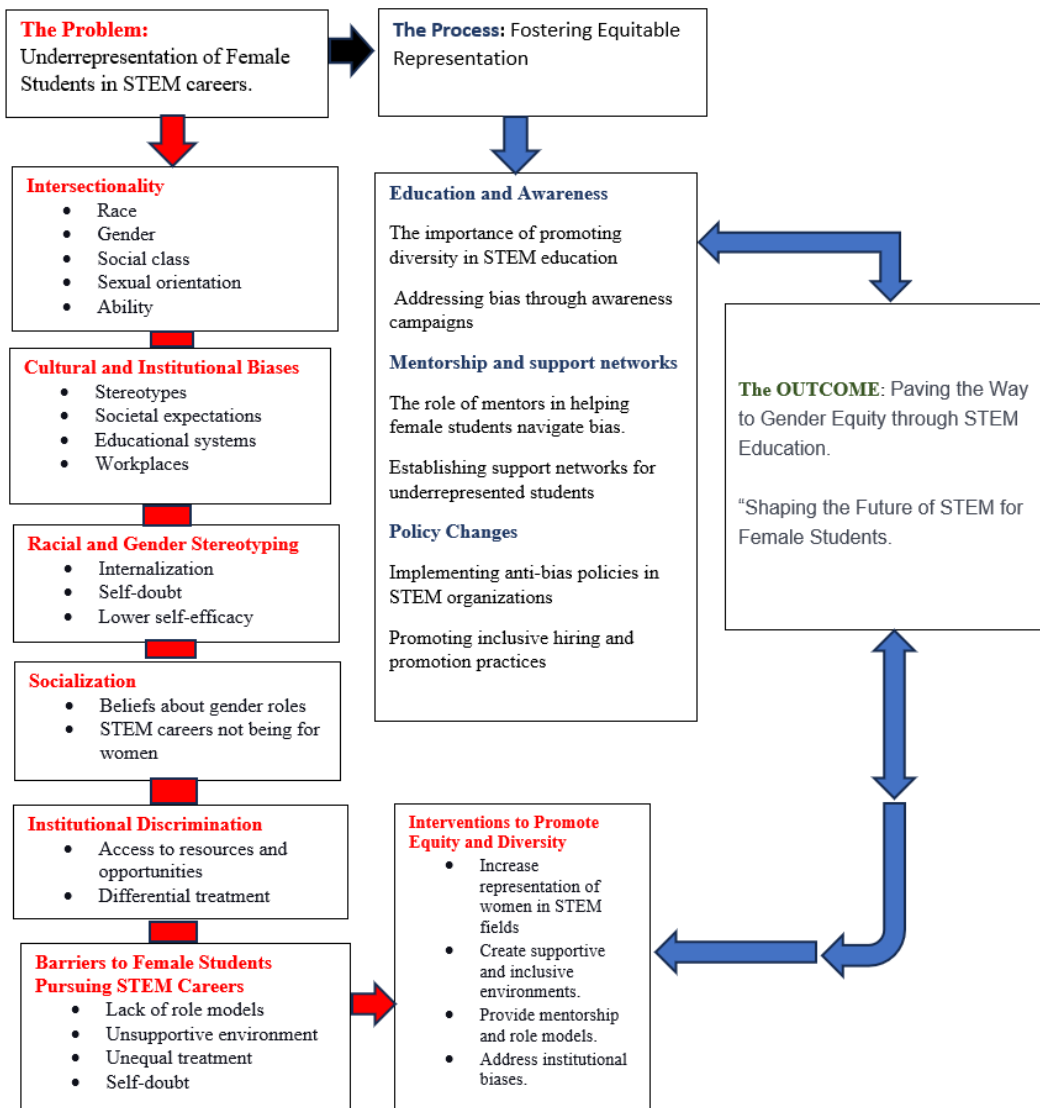


Chart Author: Ethel Smith

Figure 2: Theoretical Framework Chart

Chapter 3 Literature Review

The issue of underrepresentation of women of color in STEM fields persists as a considerable challenge, notwithstanding the advancements made in recent years (Ceglie, 2011; Hill et al., 2010; National Science Foundation, 2017). Women of color encounter multifaceted obstacles in their pursuit of STEM careers, including racial and gender biases, microaggressions, and limited access to mentorship and professional networks within STEM environments (Moss-Racusin et al., 2012; Ong et al., 2011). These systemic barriers contribute to lower recruitment and retention rates, creating a cycle of underrepresentation that perpetuates itself across generations (Estrada et al., 2016; Hurtado et al., 2010). This literature review seeks to comprehensively analyze the specific challenges encountered by women of color in STEM careers by consolidating existing research on racial and gender biases, with a particular emphasis on the unique experiences of women of color. Moreover, it aims to identify critical knowledge gaps and present actionable solutions that could help alleviate these disparities, encouraging more equitable practices within STEM education and workplaces.

Empirical studies consistently demonstrate that women of color are underrepresented in STEM fields across academic and professional levels, despite increases in educational attainment and workforce participation. These studies reveal that racial and gender biases are deeply entrenched in STEM environments and often manifest through unequal hiring practices, pay disparities, and exclusion from professional networks (Williams et al., 2014; Dutt et al., 2016; Malcom & Malcom, 2011). For example, Moss-Racusin et al. (2012) conducted an experimental study examining gender and racial biases in hiring decisions, finding that women and people of color are systematically disadvantaged compared to their white male counterparts in terms of both employment and salary. This highlights the need for transformative interventions aimed at

creating inclusive and equitable STEM workplaces that not only promote the career advancement of women of color but also foster a more diverse STEM workforce.

The negative impact of stereotypes on career decisions, confidence, and performance has been well-documented across numerous studies. Martin and Harrison (2012) found that pervasive stereotypes discourage women from pursuing STEM pathways, often leading to diminished self-belief and interest in the field. These effects are compounded for women of color, who face stereotypes associated with both race and gender, adding layers of psychological stress and stereotype threat that can affect performance and retention (Steele & Aronson, 1995; Goff et al., 2014). Cheryan, Master, and Meltzoff (2015) explored how stereotypical images of STEM fields as predominantly white, and male can deter women and minorities from even considering careers in computer science and engineering. They argued that broadening the cultural imagery associated with these fields could significantly increase interest and retention rates, especially among underrepresented groups. These findings underscore the importance of addressing implicit biases and reshaping STEM environments to be more inclusive.

Mentorship and inclusive workplace cultures are also highlighted as crucial to retaining women of color in STEM fields. The National Academies of Sciences, Engineering, and Medicine (2020) provided a comprehensive review of strategies that organizations can implement to address biases and foster supportive environments. Their findings suggest that commitment to diversity must be institutional, with leadership actively promoting inclusion and developing mentorship programs designed to empower women of color (National Science Foundation, 2017). Liu and Martinez (2019) conducted a longitudinal study examining the impact of mentorship on retention rates and found that mentorship was instrumental in helping women of color build confidence, access resources, and navigate the often-hostile environments

of STEM workplaces. Similarly, Gupta and Lee (2017) provided qualitative insights into the career advancement barriers for women of color, underscoring the need for both formal mentorship programs and informal support networks to provide career guidance and psychological support.

In addition to mentorship, other structural barriers such as workplace isolation and lack of support also hinder advancement. Rodriguez and Nguyen (2016) surveyed workplace inclusivity perceptions and found that many women of color feel marginalized, citing microaggressions and lack of advancement opportunities as primary reasons. Such findings align with the work of Ong et al. (2011), who described the "chilly climate" that woman of color face in STEM environments, which often results in decreased job satisfaction and eventual departure from the field. Further, Kim and Patel (2018) examined family support and cultural expectations as influences on career decisions and retention for women of color in STEM, finding that supportive family structures could mitigate some workplace challenges, allowing women of color to maintain resilience and progress in their careers.

In order to better understand the complex interplay of factors contributing to the underrepresentation of women of color in STEM fields, Figure 3 presents a visual mapping of the main arguments discussed throughout this literature review. This figure encapsulates the systemic barriers, mentorship challenges, and the importance of supportive environments that we have explored, offering a comprehensive overview of how these elements interconnect and influence the experiences of women of color in STEM careers. See Figure 3.

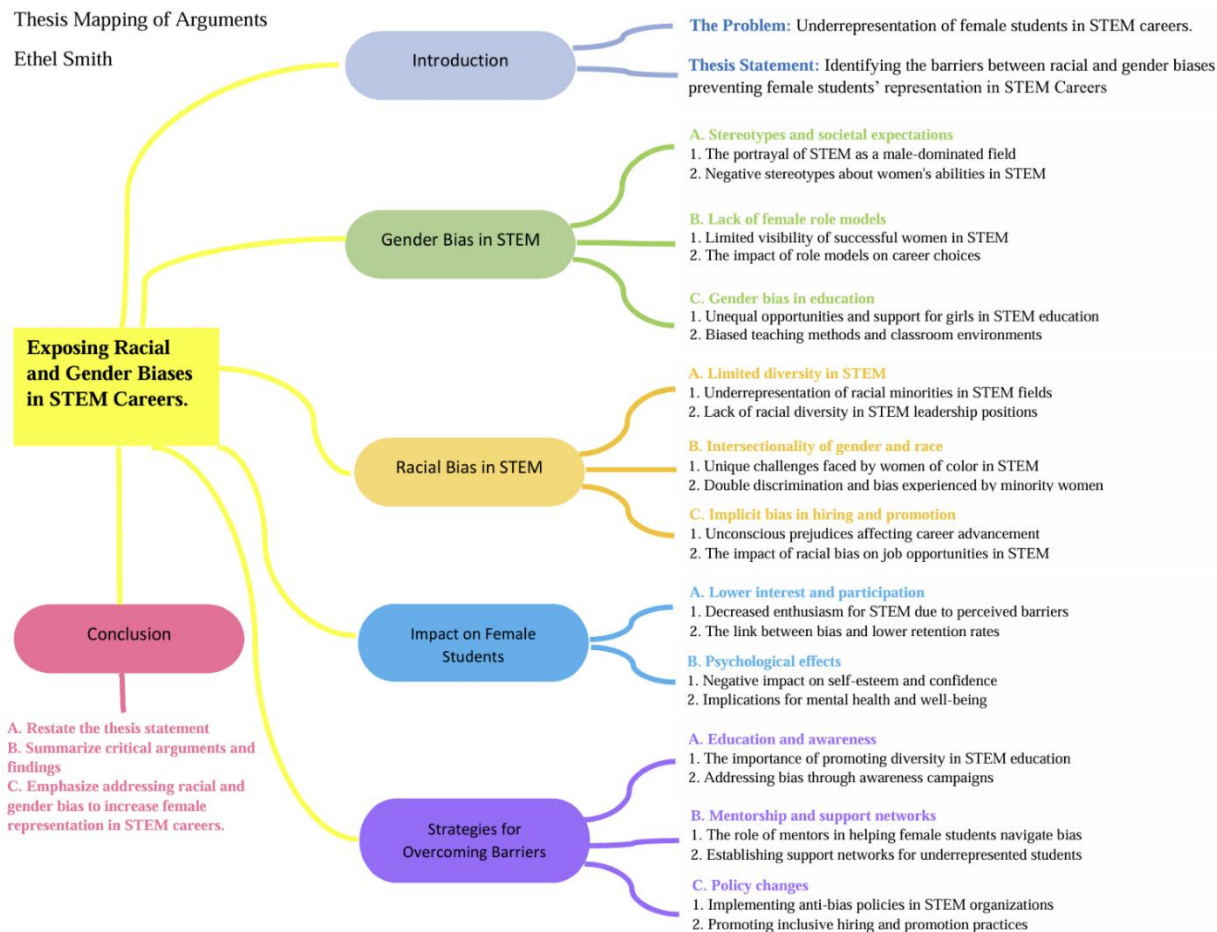


Figure 3: Thesis Mapping of Arguments

Despite these challenges, some progress has been made through targeted policy initiatives and institutional programs designed to promote diversity in STEM. Federal initiatives, such as the CHIPS Act, have been launched to increase the number of underrepresented minorities, including women of color, in STEM fields by investing in research, workforce development, and educational programs that prioritize diversity (Wright et al., 2023). Such policies not only aim to increase representation but also bring attention to the economic and societal benefits of a diverse workforce, which include innovation, creativity, and a broader array of perspectives within STEM industries (Cox & Blake, 1991).

This literature review sheds light on the specific and often complex obstacles faced by women of color in STEM careers. It dives into how institutional change is essential if we're serious about creating workplaces that genuinely support diversity, equity, and inclusion. Alongside advocating for structural changes—like mentorship programs that actually meet the needs of underrepresented groups, bias awareness training, and hiring practices that prioritize inclusivity—the review also brings attention to the crucial roles of family and community. These support systems often serve as the backbone for resilience among women of color navigating STEM fields. What's clear is that addressing these challenges isn't just about one-off programs; it's about rethinking the broader culture within STEM. When institutions commit to targeted strategies that address both the structural and cultural barriers, we don't just make a difference in individual careers. We also strengthen the entire workforce, bringing in diverse perspectives and talents that fuel innovation and growth across the field.

Chapter 4 Statement of Problem of Practice

Women of color in STEM face significant obstacles in advancing their careers due to systemic racial and gender biases. Despite efforts to promote diversity and inclusion, women of color are underrepresented in higher education and often experience discrimination and bias throughout their academic and professional journeys (Kahn, 2017). Research shows that although women outpace men in overall degree attainment across every racial/ethnic group, this trend is not reflected in STEM degrees, where men consistently outpace women (Wright, Gunther, & Bitar, 2023). For instance, the disparity is stark among Black and Latino students, with Black men earning 14.3% of STEM degrees compared to 9.2% for Black women, and Latino men earning 26.3% versus 13.9% for Latina women (Wright et al., 2023). This trend

underscores the urgent need to address the barriers that hinder women of color from entering and succeeding in STEM fields.

Smith and Cheryan (2018) highlighted the cultural factors that contribute to the underrepresentation of women and people of color in STEM fields, suggesting that societal stereotypes and institutional practices must be challenged to foster a more inclusive environment. Furthermore, Hurtado et al. (2012) emphasized gender disparities in undergraduate STEM experiences and advocated for comprehensive institutional actions, such as providing mentorship programs, cultivating inclusive learning environments, and promoting diversity through targeted recruitment efforts in STEM fields. These actions are critical to mitigate the systemic obstacles faced by women of color.

Women of color represent only 12.9% of STEM faculty positions, and data shows that they are significantly less likely to be tenured or promoted compared to their white male counterparts (Colby & Fowler, 2020). This underrepresentation in faculty roles contributes to a lack of diverse perspectives in research and education, which is vital for innovation in STEM disciplines. Furthermore, Black and Latino STEM students and professionals, particularly women, routinely face harassment, workplace discrimination, and unequal pay, which collectively contribute to their underrepresentation in the labor market (Wright et al., 2023).

Colby and Fowler (2020) reported in their Data Snapshot of Salaries that full-time women faculty members earn approximately 81.2% of their male counterparts' salaries. Among tenured or tenure-track faculty members, this figure is slightly higher at 82.4%. These salary disparities reflect broader issues of inequity and contribute to the challenges faced by women of color as they strive for career advancement and recognition in STEM fields.

The barriers faced by women of color are often rooted in microaggressions, implicit bias, and limited access to 6 mentorship and networking opportunities (Sue et al., 2009). These challenges not only hinder the individual advancement of women of color but also limit the diversity of perspectives in STEM research, ultimately affecting the quality and applicability of scientific work (Nielsen et al., 2017).

This research and practice advocate for women of color, who face unique challenges in advancing their careers in STEM. Promoting diversity and inclusivity in STEM fields is crucial for creating a more equitable and innovative academic environment.

Chapter 5 Research Questions

The research aims to present a more in-depth understanding of the various research approaches and their relevance. It is crucial to address the ontological and epistemological variances between quantitative and qualitative research methods.

To effectively examine the ontological and epistemological distinctions between quantitative and qualitative research methods for my research topic, "Shattering the Glass Ceiling: Exposing and Addressing Racial and Gender Biases in STEM Careers for Women of Color in Higher Education," it is essential to firmly grasp the fundamental terms and concepts involved. Ontology delves into the nature of reality and existence, investigating the existence of entities and their modes of being, while epistemology delves into the nature of knowledge and how we acquire what we claim to know (Smith, 2020; Lincoln, Y. S., Lynham, S. A., & Guba, E. G., 2015).

Quantitative research methods involve gathering and analyzing numerical data, often through experiments and surveys, to comprehend relationships and patterns. In contrast, qualitative research methods focus on collecting and interpreting non-numerical data, such as words, images, and observations, to gain insights into people's experiences, beliefs, and behaviors (Smith, 2020).

After examining the ontological and epistemological variances between quantitative and qualitative research methods, my research adopts a qualitative phenomenological research design, aligning with an interpretive epistemological standpoint. The goal of my research is to delve into the lived experiences, perceptions, and beliefs of women of color in STEM fields, necessitating a subjective interpretation of their experiences and perspectives. Ontologically, my dissertation takes a social constructionist stance, recognizing the significant influence of social and cultural factors on the decisions of women of color to pursue STEM majors or careers.

Qualitative research methods will be utilized, including conducting interviews and focus groups with female STEM students from diverse racial backgrounds, to gain insight into their experiences and perceptions of barriers within STEM fields. In research, triangulation involves the use of multiple datasets, methods, theories, and/or investigators to address a research question, thereby enhancing the validity and credibility of findings. This approach can be valuable in qualitative and mixed methods research. The triangulation in this research will be applied to explore the following three research questions. See below:

RQ1. What are the personal experiences of women of color in STEM careers regarding gender and racial biases?

RQ2. How do gender and racial biases affect the professional growth and opportunities of women of color in STEM?

RQ3. What support systems and institutional changes are necessary to address and overcome biases in STEM careers for women of color?

One approach to achieving this is by conducting interviews with students, faculty, and career advisors to gain diverse perspectives on the barriers faced by women of color in STEM. Additionally, analyzing documents such as course materials, recruitment materials, and campus climate surveys can provide context for the experiences shared in interviews and focus groups.

In qualitative research, themes represent recurring elements in the data that are significant for understanding the research phenomenon. Reflexivity is the capacity for individuals to introspectively examine their feelings, reactions, and motives. It is essential for acknowledging researchers' biases and understanding how these biases might influence the interpretation of data.

The research design in this study adopts a qualitative approach with a social constructionist ontology and an interpretive epistemology. The use of qualitative methods, including interviews and focus groups, will allow for an in-depth exploration of the lived experiences of women of color in STEM fields. To enhance the credibility and trustworthiness of the research findings, triangulation and reflexivity will be utilized. The goal is to contribute to a deeper understanding of the challenges encountered by women of color in STEM and to put forward solutions to enhance their representation in these fields. Additionally, the research questions guiding this research will focus on the experiences of women of color in STEM careers, particularly in college settings; the specific racial and gender biases that women of color

face in STEM careers and how these biases manifest; and potential strategies for addressing these biases and promoting equity and inclusion in STEM for women of color.

Chapter 6 Methodology

This research aims to address the racial and gender biases faced by women of color in STEM careers within higher education. As approved by the IRB (see Appendix B), all ethical guidelines were followed during the research process. To effectively achieve the goals of this study, qualitative research methods including open-ended surveys, semi-structured interviews, and focus groups were used to gather comprehensive and diverse data that clarify the challenges encountered by this demographic group (Lincoln & Guba, 1985).

The insights gained through these methods will provide a deeper understanding of the personal experiences of women of color in STEM, the impact of biases on their professional growth and opportunities, and the necessary support systems and institutional changes needed to address and overcome these challenges.

Population and Sample

The target audience for this study consists of women of color who are currently engaged in STEM careers or enrolled in higher education at North Westville Career College in a STEM major. To recruit participants, nonprobability sampling techniques were employed, specifically purposive and snowball sampling, which involved collaboration with faculty teaching STEM subjects and direct interactions with students. A total of thirty individuals participated in this study, representing a diverse range of backgrounds. For a comprehensive overview of the

demographics and characteristics of the participants, please refer to Appendix D. This information is crucial for understanding the context of the research findings.

An overview of the ethnic makeup of the 30 survey participants reveals a total of 30 students who participated in the survey, representing a diverse array of ethnic backgrounds. The ethnic breakdown of the participants included 10 African American students, one participant each from African American/Arabian, Asian, Cuban/Italian, Mexican, and Nigerian backgrounds, seven Haitian students, two Hispanic/Latina students, three Jamaican students, and three Trinidadian students. This diversity within the sample provides a richer understanding of the various perspectives and experiences present in the student population. See Figure 4.

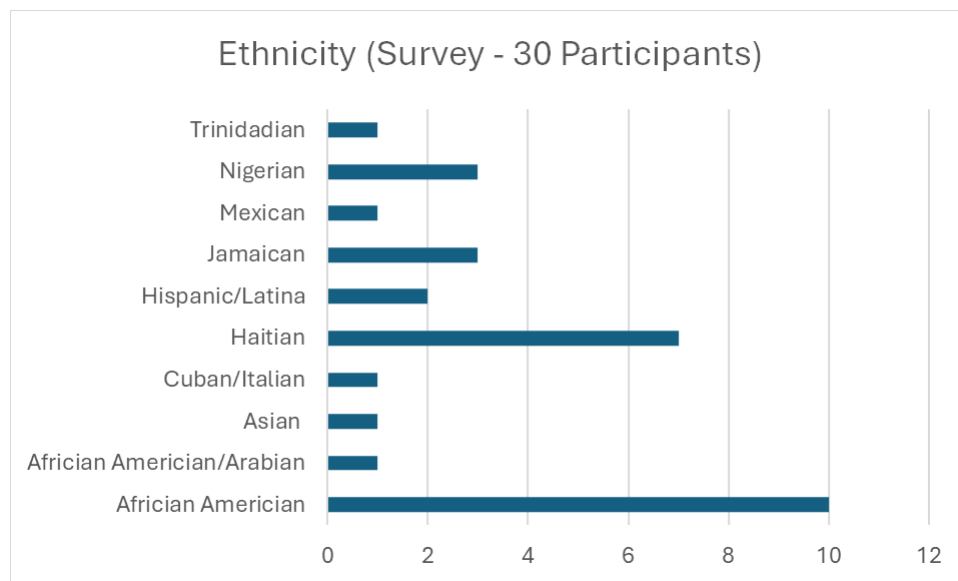


Figure 4. Ethnicity Distribution of 30 Survey Participants

Interviews and focus groups were conducted with the same group of 30 survey participants, ensuring a diverse representation of ethnic backgrounds across both methodologies. Ten (out of the thirty in the survey) agreed to participate in the interviews and the focus groups. The demographic composition for the interviews and focus groups included a wide range of

ethnicities, as detailed in the accompanying chart. Specifically, the sample consisted of 3 African American participants, 2 Haitian participants, 4 Jamaican participants, and 1 Mexican participant. This composition aims to capture a broad spectrum of perspectives from the targeted communities. These interviews and focus groups build upon the insights gathered from the survey, allowing for a deeper exploration of the themes identified in the survey responses.

This approach provides a clearer and more comprehensive understanding of the engaged groups.

See Figure 5.

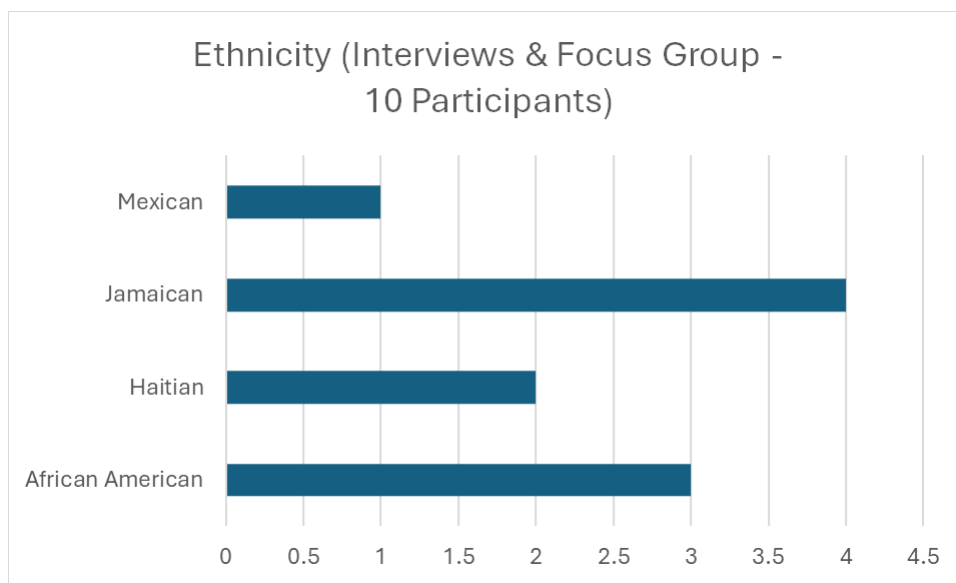


Figure 5. Interviews and Focus Group Participants Ethnicity

Complete demographic data are available for those in the interview and focus groups. Specifically, age information was missing in the survey data, but available in the interview and focus groups. The diverse age representation among these participants can provide valuable insights into the experiences of women of color in STEM, thereby enhancing our understanding of their perspectives. In our interview and focus group participants, there was an average age of 36 years, ranging from 19 to 40 years. This variation in age not only contributes to an average

age but also facilitates a broad spectrum of perspectives to be represented in the findings. Such diversity enriches the overall analysis and enhances the understanding of the subject matter explored in this research. See Figure 6.

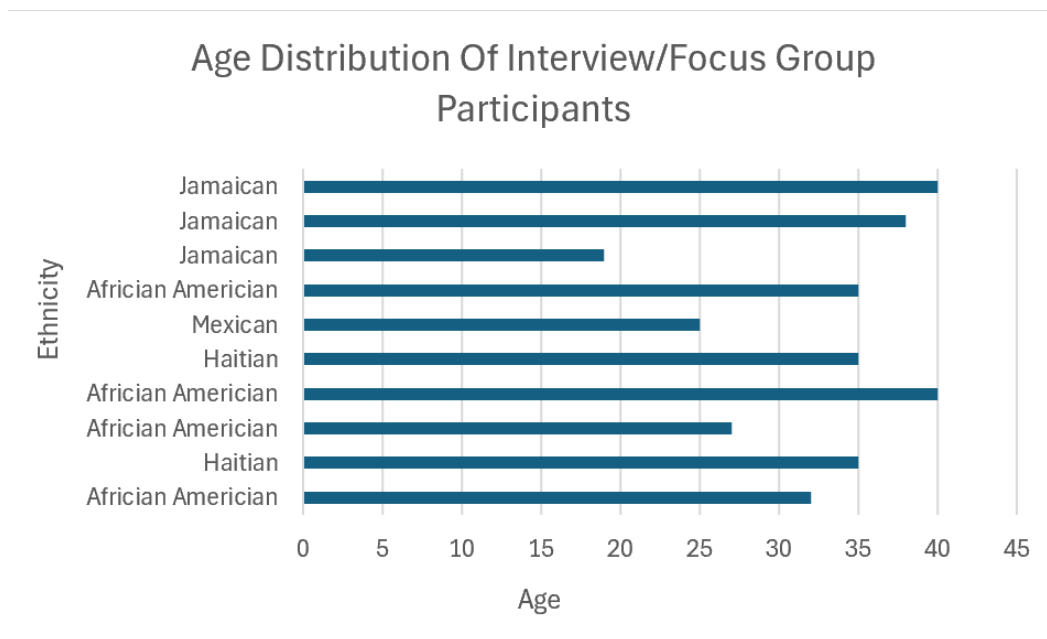


Figure 6. Age Distribution of Interview/Focus Group Participants

Instrument Design

The instrument design for this study includes three main components. First, the surveys are structured to explore participants' experiences with institutional biases, cultural expectations, and unspoken barriers in STEM fields. As a token of appreciation for their participation, each respondent received a rose gold ink pen inscribed with the phrase, “Glass Ceilings are Meant to Be Broken.”

The second component involved one-on-one interviews with ten volunteers selected from the survey participants. Each interview lasted approximately 30 minutes and took place in a comfortable lab environment to encourage open sharing. The specific interview questions used to

guide these discussions can be found in Appendix E. As a further expression of gratitude, each interview participant received a notepad inscribed with the same inspirational phrase.

Lastly, focus groups were formed with the same participants from the interviews to facilitate richer dialogue and deeper discussions about their shared experiences. The questions posed during these focus group sessions are also included in Appendix F. To show appreciation for their participation, each focus group respondent received a tote bag featuring the phrase, “Glass Ceilings are Meant to Be Broken.” See Figure 7.



Figure 7. Appreciation Gifts for Participants (rose gold ink pen, notepad & tote bag) inscribed with the phrase, “Glass Ceilings are Meant to Be Broken.”

Ethical Considerations

The research conducted was characterized by a strong adherence to ethical standards, evident in multiple facets of the study. First, the Institutional Review Board (IRB) approval was acquired before the initiation of the research, underscoring the importance of ethical compliance

to safeguard participants' rights and welfare. The informed consent process was thoroughly outlined, ensuring that participants were fully briefed on the study's objectives and potential risks, thereby respecting their autonomy and right to make well-informed decisions. Additionally, a firm commitment to participant anonymity and confidentiality was demonstrated through the employment of pseudonyms and secure data storage practices, which are fundamental to ethical research methodologies. The sensitive nature of the research topics was properly acknowledged, with careful measures implemented to cultivate a respectful environment that prioritizes emotional well-being.

Additionally, the inclusion of open-ended surveys question, interviews, and focus groups, along with the provision of support resources after participation, demonstrated a proactive and responsible approach to lessen any potential distress from discussing sensitive subjects. Expressing appreciation for participants' contributions through tokens not only underscored their significance but also fostered a sense of empowerment, thereby introducing an important ethical dimension to their engagement in the research.

Data Collection Procedure

The data collection procedure for this research commenced with obtaining approval from the Institutional Review Board (IRB) to ensure adherence to ethical standards and responsible research practices. Various strategies were employed to recruit participants, including posting flyers at North Westville Career College, emailing faculty members, and directly engaging with students. This proactive approach successfully resulted in 30 completed surveys from women of color currently working in STEM careers or enrolled in higher education. The specific survey used in this research is detailed in Appendix C. This instrument was designed to gather pertinent data related to the research topic.

The survey included multiple-choice questions based on a Likert scale, as well as an open-ended question at the end. Although the Likert scale questions will be utilized in future studies, this research primarily focused on the open-ended question to facilitate ease of completion while effectively capturing quantitative data regarding the participants' experiences. The questions aimed to explore institutional biases, cultural expectations, and unspoken obstacles within STEM fields, providing a nuanced understanding of the participants' experiences.

To illustrate the types of questions explored in the survey, participants responded to items such as: "Please indicate your level of agreement with the following statement by selecting one of the options: Strongly Disagree, Disagree, Neutral, Agree, Strongly Agree." For example, one question asked, "I have personally experienced racial or gender biases in my STEM career as a woman of color." Another question inquired, "To what extent do you believe that racial and gender biases have hindered your career progression in STEM?" These questions aimed to investigate institutional biases, cultural expectations, and unspoken obstacles within STEM fields, thereby enhancing our understanding of the participants' experiences. The specific survey used in this research can be found in Appendix C. This instrument was designed to gather relevant data regarding the research topic.

A flow chart was developed to visually represent the steps involved in recruiting participants and administering the survey. This chart serves as a guide to understanding the systematic approach taken throughout the research process, outlining the sequential stages from obtaining IRB approval to collecting completed surveys. It illustrates the various recruitment strategies employed, participant demographics, and the methodology used to gather and analyze data. See Figure 8 for a detailed flow chart illustrating these steps.

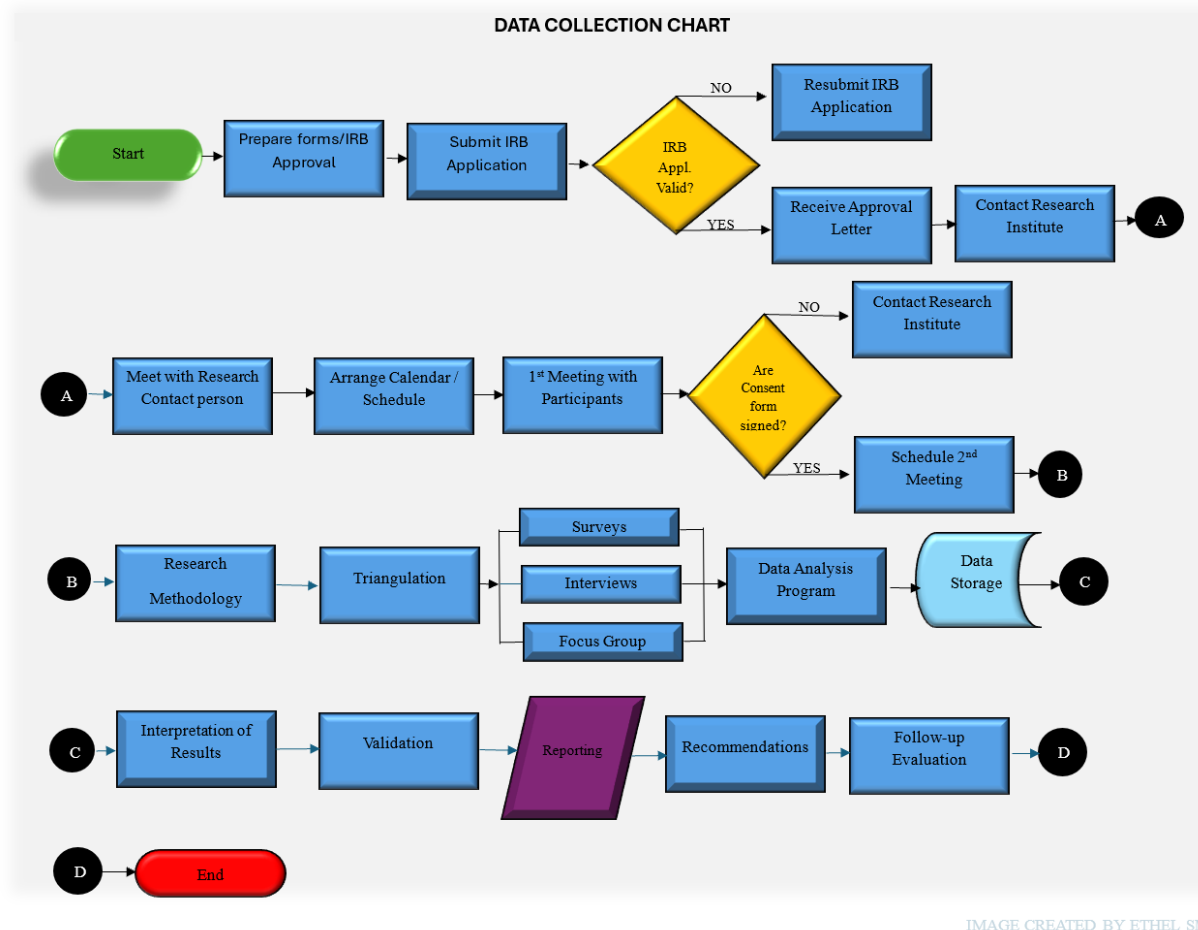


Figure 8. Data Collection Chart

Data Analysis

In this research, a qualitative approach is implemented, focusing on data collected through the surveys open-ended question at the end, interviews, and focus groups. This diverse method aims to highlight the unique experiences and challenges faced by women of color in STEM fields. The open-ended survey questions allow for in-depth responses, capturing the nuances of the participants' experiences. Thematic analysis is used to identify and analyze patterns within these narratives. By exploring these insights, we can gain a better understanding of the broader context in which women of color navigate their careers in STEM.

The qualitative data collected from interviews and focus groups were analyzed using thematic analysis. This involved a systematic coding process to identify recurring themes that reflect the participants' experiences. Key challenges such as discrimination, lack of mentorship, and institutional barriers were documented, along with positive experiences that highlight resilience and support. Together, these analytical methods will provide a comprehensive understanding of the experiences of women of color in STEM and inform strategies to enhance equity and support in these fields.

Trustworthiness, Validity, and Reliability

Efforts to ensure the research findings' trustworthiness, validity, and reliability were implemented through a comprehensive set of strategies based on established qualitative research practices (Lincoln & Guba, 1985). These strategies included triangulation of data sources and a rigorous coding process, both essential for enhancing credibility in qualitative studies (Creswell & Poth, 2018).

Triangulation was achieved by integrating diverse data sources, such as interviews and focus groups—each contributing unique insights. Interviews provided in-depth narratives, while focus groups facilitated discussions that emphasized shared experiences. This integrative approach allowed for identifying consistencies and discrepancies, thereby enriching the overall understanding of the topic (Denzin, 1978).

Furthermore, a thorough coding process was applied during data analysis. Thematic analysis was employed to uncover significant themes and patterns within participant responses, adhering to the guidelines established by Braun and Clarke (2006). This coding process involved multiple rounds of review to ensure that the identified themes accurately captured the variations

in participants' experiences. Systematic reviews of these themes enhanced the study's credibility, as collaborative discussions with peers and research team members facilitated the validation of interpretations and helped mitigate potential biases (Guba, 1981).

By executing these strategies, the research aimed to enhance the overall trustworthiness, validity, and reliability of its findings, ultimately contributing to a meaningful exploration of the racial and gender biases faced by women of color in STEM and ensuring their voices were authentically captured and represented (Taylor, 2016).

Triangulation of Data

In this research, the triangulation of data serves as a pivotal methodological approach to comprehensively understanding the complexities surrounding the racial and gender biases experienced by women of color in STEM careers. Triangulation, as defined by Denzin (1978), involves the use of multiple methods or data sources to enhance the credibility and validity of research findings. Utilizing a qualitative framework, this research integrates diverse data sources, surveys, interviews, and focus groups—to validate findings and enrich the narrative concerning the challenges faced by this demographic.

The surveys, designed with multiple-choice and Likert scale questions, collected quantitative data from 30 women of color engaged in STEM careers or enrolled in relevant academic programs at North Westville Career College (a pseudonym). These responses facilitated the identification of overarching themes related to institutional biases and cultural expectations, aligning with findings from previous studies that highlight the systemic barriers faced by marginalized groups in educational settings (Crenshaw, 1989; Ong et al., 2018).

In-depth semi-structured interviews with ten participants provided qualitative insights into individual experiences, revealing how biases impact professional growth and opportunities while uncovering emotional and contextual factors beyond the scope of quantitative data. This qualitative approach echoes the work of Smith (2005), who emphasizes the need for personal narratives in understanding the nuanced experiences of underrepresented minorities in STEM.

Additionally, focus group discussions conducted with the interview participants fostered collaborative dialogue about shared experiences, barriers to career advancement, and potential institutional changes to support women of color in STEM. Thematic analysis will be employed across the various data sources to identify key patterns, illuminating both challenges and resilience factors within the STEM landscape (Braun & Clarke, 2006). By synthesizing insights from these methodologies, the research aims to enhance credibility and yield informed recommendations for policy and structural changes that promote equity for women of color in STEM. Ultimately, this study seeks to amplify their voices and contribute to a more inclusive environment.

Chapter 7 Findings

A qualitative approach was utilized, employing triangulation methods that included open-ended survey questions, interviews, and focus groups. The findings from the data reveal critical insights related to the personal experiences of women of color in STEM careers, particularly concerning the gender and racial biases they encounter.

The analysis highlights how these biases significantly impact the professional growth and opportunities available to women of color in STEM fields. Participants shared personal

narratives that illustrate the multifaceted nature of these challenges, emphasizing the unique barriers they face that differ from their male or white counterparts.

Moreover, the findings underscore the necessity for effective support systems and institutional changes to address and overcome these biases. Participants identified specific strategies and resources that could facilitate a more inclusive environment, including mentorship programs, diversity training, and policy reforms aimed at fostering equity in STEM workplaces.

In summary, the qualitative data gathered provides a comprehensive understanding of the experiences of women of color in STEM, the implications of bias on their professional trajectories, and the essential measures needed to create a more equitable and supportive landscape in the field.

Surveys

Qualitative insights were gathered through open-ended responses, allowing students to share their personal experiences and suggest ways to address biases. These narratives emphasize the urgent need for concrete actions to create a more inclusive environment for women of color in STEM fields. Several comments from the open-ended survey question are shown in Figure 9. Pseudonyms have been used to protect the identities of students from North Westville Career College. Figure 9 compiles responses from participants regarding effective actions and changes needed to combat racial and gender biases in STEM careers for women of color. The quotes reflect diverse perspectives and highlight the importance of awareness, education, leadership development, and supportive environments. Each response outlines specific strategies that can contribute to a more equitable workplace in the STEM field. See Figure 9.

What specific actions or changes do you believe would be most effective in addressing racial and gender biases in STEM careers for women of color?

Stacy	“Awareness, Educating & bringing awareness would be very effective.”
Brenda	“Racial biases can be addressed by treating everyone the same irrespective of their racial background. If a job position is open it should be about one’s educational background or work experiences and your ability to get the job done.”
Allison	“Leadership Development programs, Mentorship programs, Flexible work arrangement.”
Joanne	“I think that education is the key, it has always been the catalyst. I believe as a woman of color that minorities or women of color should try or attempt to complete the highest degree possible. Education is the most effective tool regarding this matter.”
Mary	“Not let Race/Color be the deciding factor for career advancement. Truly choose according to one’s skillset and knowledge.”
Lotile	“Taking these allegations seriously the moment they are mentioned and appropriately appoint someone to handle these allegations. Stop trying to cover things up when it comes to this topic and properly protect those who do decide to come forward.”
Grace	“Support groups on the jobs that speak up for their employees, women of color. Allow women of color to express their concerns to the support groups & really be heard to allow change to occur. Also, do not let employers punish you for speaking up about things that need to be addressed.”
Alana	“Safe spaces for women of color to share experiences and advocate changes. Early exposure to the STEM community, along with implementing unconscious bias for educators.”

Figure 9: Specific Actions to Address Racial and Gender Biases in STEM Careers for Women of Color.

The findings from the survey highlight that biases significantly hinder professional growth and opportunities, revealing not only individual experiences but also the systemic nature of these biases. Participants in interviews and focus groups frequently discuss how these biases limit access to promotions, mentorship, and leadership roles, illustrating their manifestation in career trajectories and underscoring the broader implications of these barriers in the workplace.

These insights reinforce the relevance of the research questions and emphasize the urgent need for further investigation. In light of this, personal interviews and focus groups are likely to uncover additional layers of complexity and nuance.

While the survey provides a solid foundation, it is evident that more in-depth research is essential to effectively address the challenges faced by women of color in STEM. This comprehensive approach will better inform solutions that can promote equity and enhance professional opportunities in the field.

Personal Interviews

The one-on-one interviews took place in a lab at North Westville Career College. Each of the ten participants was asked five questions and encouraged to elaborate on their responses. The researcher collected firsthand accounts and insights from individuals relevant to the topic. This section offered a deeper understanding through direct engagement, showcasing diverse perspectives and experiences. By incorporating personal narratives, the overall analysis was enhanced, linking theoretical concepts with real-world implications based on the three research questions.

Results for Research Question 1

The findings from the NVivo analysis regarding Research Question 1—which explores the personal experiences of women of color in STEM careers concerning gender and racial biases—are summarized as follows. Based on ten personal interviews, the analysis identified four main themes: Equity, Accountability, Discrimination, and Injustice in Employment Practices. Each of these themes captures specific elements that effectively reflect the participants' shared experiences. See Figure 10.

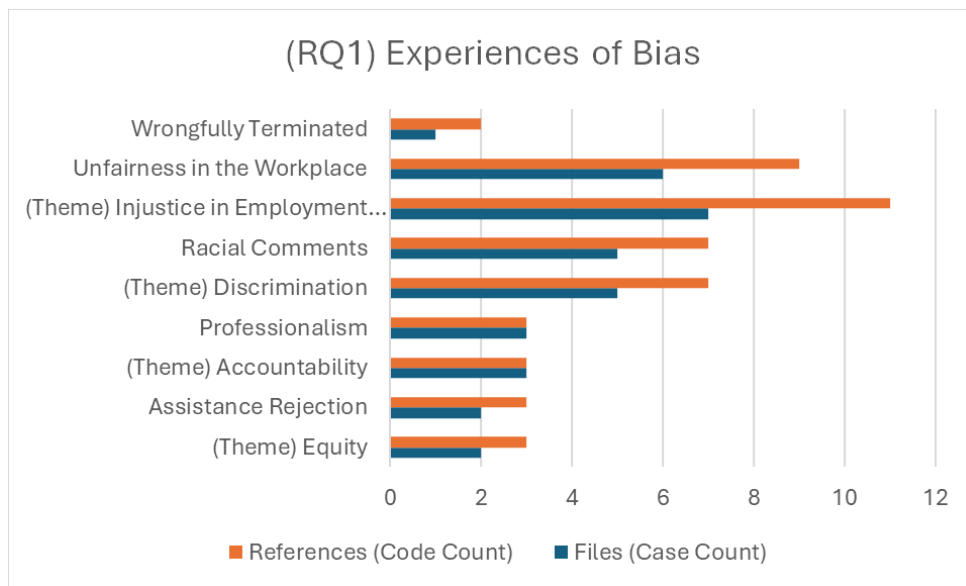


Figure 10: Theme - Experiences of Bias

The theme of equity is highlighted by the code "Assistance Rejection," which refers to cases where requests for help are frequently denied. This finding points to systemic inequities in the support systems within workplace environments. When requests for assistance are often turned down, it reveals a lack of equitable resources and support for women of color in STEM fields.

The theme of Accountability includes the concept of "Professionalism," indicating that a perceived lack of accountability in professional standards may have contributed to experiences of bias and inequity in the workplace. This lack of accountability can intensify feelings of bias and inequity among employees.

The theme of discrimination is reflected in the code "Racial Comments," which highlights participants' direct experiences with racially charged remarks. This finding underscores a significant area of concern in professional interactions, as it can negatively affect the work environment and personal well-being.

The theme of Injustice in Employment Practices encompassed two codes: The phrases "Unfairness in the Workplace" and "Wrongfully Terminated" highlight general patterns of unfair treatment and specific cases of wrongful termination, respectively. Together, these terms reveal significant issues related to discriminatory practices in employment and point to broader systemic problems within hiring and termination practices.

In summary, the research demonstrates that gender and racial biases have a significant impact on women of color in STEM careers. The identified themes—Equity, Accountability, Discrimination, and Injustice in Employment Practices—highlight significant challenges faced in professional environments. Evidence of denied assistance, a perceived lack of accountability, experiences with racial comments, and issues of unfair treatment and wrongful termination emphasize the urgent need for systemic change in support structures and workplace policies. Addressing these issues is crucial for creating an equitable and inclusive environment in STEM fields, where all individuals can thrive without the barriers of bias and discrimination.

Results for Research Question 2

The overall findings from the NVivo analysis relate to Research Question 2: How do gender and racial biases affect the professional growth and opportunities of women of color in STEM? The analysis, based on ten personal interviews, identified four main themes: Financial Support, Empowerment Through Growth, Harassment, and Identity. Each of these themes encompasses specific codes that effectively reflect the experiences shared by the participants.

See Figure: 11.

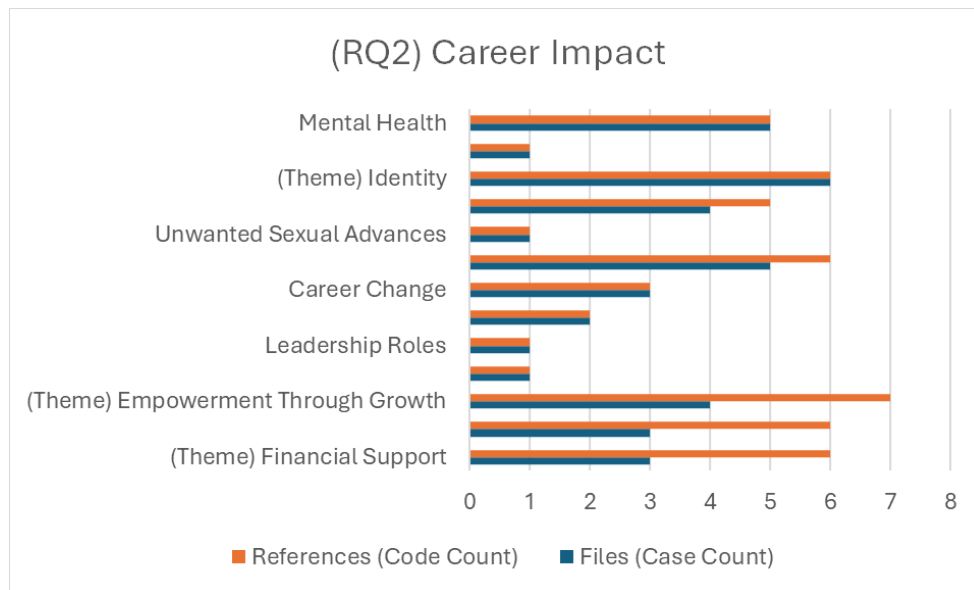


Figure 11: Theme – Career Impact

The theme of Financial Support was underscored by the code "Financial Stability," which identified three files and six references. The analysis reveals a prevalent concern among participants regarding their financial situations and the pursuit of stability, indicating a clear need for additional resources and programs to improve financial well-being. This finding emphasizes that addressing financial stability is crucial for enhancing the support systems available to women of color in STEM.

The theme of empowerment Through growth highlights how individuals can gain strength and confidence by developing skills or assuming new roles. Specific codes under this theme include "Become an Advocate," which suggests individuals can empower themselves by speaking out on important issues, though a limited number of references represented it. Furthermore, "Leadership Roles" and "Invest in Education" emerged as vital factors, pointing to the significance of leadership experiences and educational pursuits in fostering personal growth. The code of "Career Change," identified through three files and references, underscores the

importance of transitioning careers as a pathway to personal and professional development, illustrating participants' aspirations for growth and fulfilling opportunities.

The theme of Harassment addressed various codes, including "unwanted sexual advances" and "being profiled." The latter code, appearing in four files with five references, indicates that profiling experiences are more prevalent among participants, reflecting systemic biases that contribute to feelings of being unjustly categorized. Conversely, reports of unwanted sexual advances, while noted, were singular, indicating a less widespread concern relative to profiling.

The theme of Identity encompasses two codes, "Imposter Syndrome" and "mental health." While reports of Imposter Syndrome were sparse, indicating limited instances of such feelings among participants, discussions around mental health were much more frequent, appearing in five separate files. This highlights the importance of mental well-being among participants and suggests a need for supportive frameworks to address these issues.

In summary, the research illustrates that gender, and racial biases significantly impact the professional growth and opportunities of women of color in STEM. Financial stability remains a critical concern, urging the necessity for enhanced resources and support systems. Empowerment through growth is recognized as vital, emphasizing the importance of education, advocacy, and leadership. The theme of Harassment, particularly profiling, illustrates systemic challenges that can undermine confidence and mental health. Finally, the prominence of identity-related discussions underscores the need for frameworks addressing mental health. To foster an equitable environment in STEM, organizations must take concrete actions to address financial barriers, promote empowerment, combat harassment, and prioritize mental health. These insights provide

a foundation for developing strategies that support the professional growth of women of color in these fields.

Results for Research Question 3

The overall findings from the NVivo analysis relate to Research Question 3: What support systems and institutional changes are necessary to address and overcome biases in STEM careers for women of color? The analysis, based on ten personal interviews, identified four main themes: Support Systems, Continuous Education, Mentorship and Role Modeling, and Fostering Inclusivity and Engagement. Each of these themes encompasses specific codes that effectively reflects the experiences shared by the participants. See Figure 12.

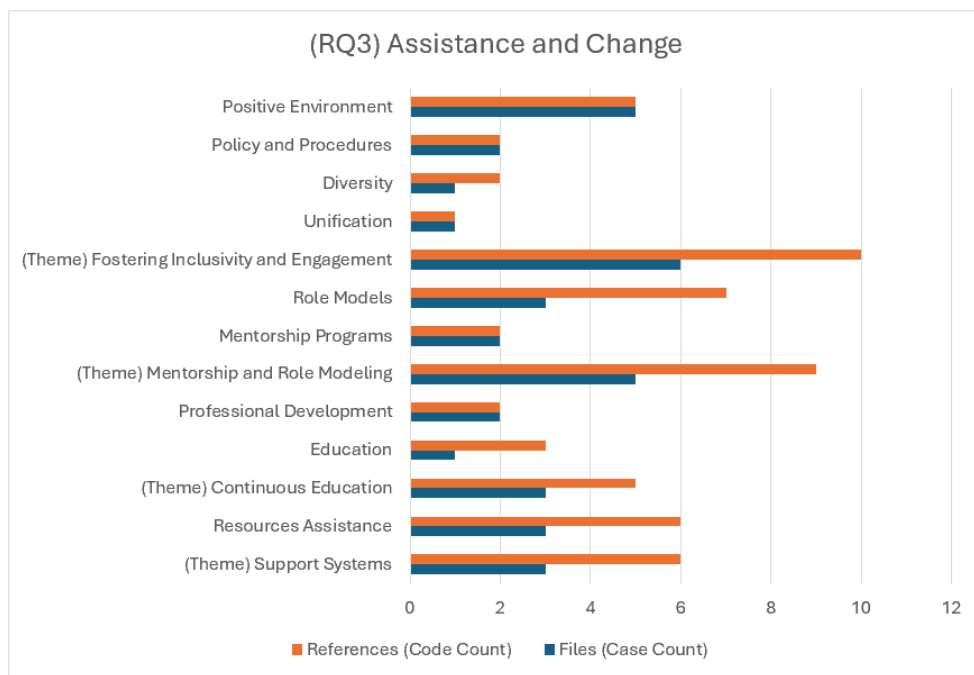


Figure 12: Theme – Assistance and Change

The theme of Support Systems was highlighted through the code "Resource Assistance," which revealed three files and six references. Findings indicate that many participants are

concerned about the accessibility of resources to help navigate personal and professional challenges. There is an emphasized need for stronger support networks and tailored assistance, with reliable access to these resources deemed crucial for well-being and success.

The theme of Continuous Education was emphasized through two codes. The first code, "Education," resulted in one file and three references. The second code, "Professional Development," produced two files and two references. Findings regarding Continuous Education, Education, and Professional Development reveal that many participants need ongoing learning opportunities to enhance their skills and knowledge. There is an expressed desire for structured programs that address current industry trends while promoting personal growth and adaptability. The emphasis on Education indicates that foundational training remains a priority, while Professional Development highlights the importance of lifelong learning and the evolving demands of their professions.

The theme of Mentorship and Role Modeling was emphasized through two codes: the first, "Mentorship Programs," resulted in two files and two references. In contrast, the second code, "Role Models," produced three files and seven references. Findings indicate that many participants are concerned about the accessibility of adequate mentorship opportunities. There is a highlighted need for structured programs that connect individuals with diverse role models who reflect their backgrounds, underscoring the importance of mentorship in shaping career development and aspirations.

The theme of Fostering Inclusivity and Engagement was emphasized through four codes. The first code, "Unification," resulted in one file and one reference. The second code, "Diversity," produced one file and two references. The third code, "Policy and Procedures," resulted in two files and two references. The fourth code, "Positive Environment," produced five

files and five references. Findings suggest that participants are concerned about creating a more inclusive atmosphere. The Unification code emphasizes the need for a cohesive environment where individuals feel a sense of belonging. Diversity highlights the importance of integrating varied perspectives to enhance decision-making. Concerns over existing protocols are revealed in Policy and Procedures, suggesting a need for transparent practices to support inclusive initiatives. Lastly, the Positive Environment code indicates that a supportive and respectful workplace is crucial for engagement.

In summary, the research demonstrates that gender and racial biases have a significant impact on women of color in STEM careers. To address and overcome these biases, it is essential to implement support systems and institutional changes. The findings indicate that for women of color in STEM, enhanced support systems, continuous education, effective mentorship, and a commitment to fostering inclusivity are critical components in overcoming these challenges.

Focus Group

In this research, the focus group served as a valuable extension of the insights gained from the initial interviews with ten women of color in STEM. By convening these participants for a group discussion, we aimed to delve deeper into their collective experiences, particularly regarding the themes of bias and institutional support within their careers.

The focus group discussion revolved around three primary questions, which are listed in Appendix F:

1. How do common experiences regarding biases differ among women of color in STEM? This question prompted participants to share and reflect on the varying ways biases have manifested in their professional lives, highlighting the complexity of their experiences. The

findings indicated that while many participants encountered similar types of biases, the intensity and impact varied based on their individual backgrounds and circumstances.

2. What barriers do you think gender and racial biases create for women of color pursuing STEM careers? Participants explored the specific obstacles they face due to these biases. The findings revealed that many felt disadvantaged in terms of opportunities for advancement, mentorship access, and recognition, ultimately influencing their career trajectories.

3. Which institutional changes would significantly support women of color in STEM? In this part of the discussion, participants offered insights into the systemic changes they believe could enhance support and create a more equitable environment. The findings highlighted a consensus around the need for more robust mentorship programs, diversity training initiatives, and policy reforms aimed at equitable hiring practices.

The focus group yielded rich discussions that built upon the qualitative findings from the NVivo analysis, illuminating the lived experiences of women of color in STEM. By synthesizing their insights, actionable recommendations were identified that could foster equity and inclusion within these fields, ultimately contributing to a more supportive environment for future generations of women of color in STEM.

Results for Research Question 1

In analyzing the experiences of women of color in STEM regarding biases, several key themes emerged from the focus group discussions, each highlighting the distinct challenges they face.

The theme of Stereotyping and Labels, Participants expressed frustration with the prevalence of pre-judgment based on their identities, noting that they often feel labeled without

anyone taking the time to understand them as individuals. For instance, some described how the "angry black woman" stereotype negatively impacts their interactions in the workplace, where their assertiveness is frequently misinterpreted as aggression. One participant stated, "'Black women often face the 'angry black woman' stereotype, which can result in their assertiveness being labeled as 'aggressive' and another participant stated that 'Women of color are often labeled as uneducated or not good enough.'" Furthermore, negative labels suggesting that they are uneducated or inadequate create barriers to recognition and advancement in their fields.

The theme of Microaggressions and Workplace Dynamics, the focus group participants shared experiences of microaggressions that specifically questioned their competence and authority. Many highlighted instances of others expressing doubt about their capabilities simply because of their identity as women of color. One participant noted, "Black women may experience microaggressions that question their competence and authority." Additionally, participants reported issues of gender bias in pay, revealing that they often earn less than their male counterparts performing identical roles. As one participant put it, "Earning less than a man doing the same job" has been a recurring challenge. This treatment diminishes their perceived competence and contributes to a broader culture of inequity in workplace dynamics.

The theme of Intersectional Challenges, women of color expressed the unique challenges that arise from the intersection of their racial and gender identities. The group noted that they frequently feel compelled to work twice as hard to gain the visibility and recognition that their contributions deserve. Furthermore, they discussed how social stereotypes about their work ethic often led others to assume they must "prove" their competence, placing undue pressure on them. One participant shared, "For a woman of color they have to do twice the work to be noticed," highlighting the additional burdens they face. Another commented, "Women of color may face

stereotypes about competence and have to work harder," further underscoring the challenges inherent in their experiences.

The theme of Social Perception and Opportunity, participants indicated that they often feel overlooked in professional settings and are subjected to social perceptions that undermine their expertise. Cultural expectations, particularly for Black women, can prioritize family and caregiving roles, adding another layer of challenge in balancing professional aspirations with societal views. Additionally, biases manifest during interview processes, where opportunities can vary significantly based on the interviewer's perceptions and biases related to race.

In exploring the experiences of Black women in the workplace, participants in the focus group shared powerful insights that highlight the intersection of cultural expectations, bias, and challenges faced in professional settings. The following quotes illustrate their perspectives and concerns:

Quotes from Participants:

- Cultural Expectations: "Black women often face cultural expectations to prioritize family and caregiving roles."
- Interview Bias: "Certain women that differ among color have different opportunities sometimes depending on the person conducting an interview."
- Overlooked Expertise: "I've often felt that my qualifications are dismissed because of assumptions about my background."
- Balancing Roles: "It can be really tough to navigate work while also meeting societal expectations around family."

- Perception in Interviews: "I've noticed that I need to prove myself much more than my colleagues to be taken seriously."

These quotes not only reflect the challenges faced by participants but also underscore the broader systemic issues that impact their professional journeys.

The findings from the focus group question 1 highlight that the experiences of women of color in STEM are shaped by a complex interplay of stereotyping, microaggressions, and socio-cultural dynamics. Recognizing and addressing these issues is crucial for creating a more equitable and inclusive environment in STEM fields. The results from the first focus group question reveal a detailed understanding of the experiences of women of color in STEM, effectively addressing all three research questions. Participants articulated both the positive and negative aspects of their experiences, showcasing the resilience and determination that many women demonstrate, even in the face of significant challenges.

On the positive side, the discussions emphasized a shared sense of community and the importance of support networks among women of color, which can empower individuals to navigate biases and advocate for themselves. However, the negative impacts are also clear. Pervasive stereotyping, microaggressions, and the challenges of intersectionality significantly hinder professional growth and opportunities. These biases create a work environment where women of color often feel marginalized, leading to a lack of recognition for their contributions and an ongoing struggle for equal pay.

Collectively, these findings underscore the urgent need for institutional changes. While there are pathways for growth within supportive communities, systemic barriers remain that must be addressed to foster true equity in STEM fields.

Results for Research Question 2

In analyzing the focus group responses regarding the barriers created by gender and racial biases for women of color pursuing careers in STEM, several significant findings emerged:

The theme of Career Advancement Barriers, participants highlighted severe obstacles in advancing their careers, underscoring issues of promotion challenges, double discrimination, and systemic bias. Many expressed frustrations about being unable to progress to higher positions, often feeling excluded from informal networks essential for career growth. One participant remarked, "Not being able to level up to higher positions in their career," illustrating the deep-seated obstacles faced. These systemic biases lead to self-doubt, causing some women to question their capabilities and potential in the field. Another participant recalled, stating, "Double discrimination, and exclusion from informal networks," further emphasizing the pervasive challenges that hinder career advancement for women.

The theme of Stereotypes and Representation, the focus group revealed that negative stereotypes significantly deter women of color from entering STEM fields. Participants noted that these stereotypes perpetuate the harmful belief that they are "less than capable." One participant expressed this sentiment emotionally: "Women of color may be discouraged from pursuing STEM fields due to stereotypes suggesting that they are 'less than capable.'" This stigma creates an environment where doubt looms over their abilities. Additionally, the lack of visible role models in STEM compounds this issue, leaving many women without mentors to inspire them. As another participant pointed out, "The lack of visible representation of women of color in STEM fields means fewer role models to inspire and mentor them." This absence of representation not only affects women of color directly but also reinforces the stereotype that they do not belong in these fields. Stereotypical expectations lead to assumptions about their

capabilities based on appearance or background, which severely impacts their pursuit of careers in STEM. Addressing these stereotypes and increasing visibility within the community is crucial for encouraging women of color to thrive in these vital fields.

The theme of Psychological Barriers, psychological factors emerge as a critical barrier for women of color, prominently featuring issues of self-doubt and low self-esteem. Many participants articulated how external perceptions and reports of discrimination significantly hinder their willingness to apply for jobs or explore opportunities in STEM fields. This pervasive fear of discrimination not only impacts individual confidence but also perpetuates a cycle of underrepresentation, ultimately discouraging women from fully engaging with the career paths available to them. One participant reflected on the struggle with self-doubt, stating, "Self-doubt, because what is seen they just turn away from it because it's not easy, especially for black women." Another shared an emotional insight into the fear instilled by others' experiences: "Knowing/hearing how others were treated, it makes us less willing to do more or apply for specific jobs." These sentiments underscore the psychological barriers that contribute to a lack of participation and representation in STEM for women of color.

The theme of Interpersonal Dynamics. Interpersonal relationships within workplace settings are significantly influenced by biases. Many women reported feeling overlooked due to their race or gender, fostering an environment where unconscious biases can thrive. Participants indicated that they are often labeled as strong or capable, which leads to unrealistic expectations and added pressure, as others assume they can manage overwhelming workloads without distress. One participant shared, "The more an individual consciously agrees with the stereotype that men are more fit for STEM than women, the more they will act with unconscious bias." Another participant added, "Women of color are labeled strong. People perceive us to be capable

of doing all the work without tiring." These reflections underscore the need for greater awareness and sensitivity in addressing biases that affect workplace dynamics.

Overall, the responses from the focus group shed light on the multifaceted barriers that women of color encounter in STEM, ranging from systemic issues and stereotypes to psychological impacts and interpersonal dynamics. Each of these themes illustrates the urgent need for systemic change to create a more inclusive and supportive environment for women of color in these fields.

The personal experiences of women of color in STEM careers reveal significant challenges related to gender and racial biases. Many women report being overlooked in professional settings, facing microaggressions, and encountering stereotypes about their capabilities, which creates feelings of isolation and highlights the unique difficulties they endure in a predominantly male-dominated field. These biases profoundly impact their professional growth and opportunities, often resulting in limited promotional prospects, unequal pay, and reduced access to key projects, ultimately hindering career advancement. The intersection of gender and racial discrimination creates compounded barriers that can lead to lower job satisfaction and higher turnover rates for women of color. To address and overcome these biases, it is essential to establish robust support systems and implement significant institutional changes, such as developing mentorship programs specifically for women of color, providing diversity training for all staff, and instituting equitable hiring and promotion practices. Creating a more inclusive organizational culture is vital for fostering a work environment that values diversity and actively works against biases, thereby enabling women of color in STEM to thrive professionally.

Results for Research Question 3

The study analyzed the responses from focus group discussions regarding institutional changes that could significantly support women of color in STEM. The results revealed four prominent themes, each reflecting key suggestions from participants.

The theme of Diversity and Representation, participants strongly advocated for increasing the representation of diverse faculty within STEM fields. Participants emphasized the importance of hiring more individuals from varied backgrounds for senior positions and implementing hiring quotas for minority groups across all companies to enhance workforce diversity.

The theme of Equal Opportunity and Fair Practices, the need for equal opportunities and fair practices was a recurring theme. Participants emphasized the importance of creating pathways for advancement that are free from bias, ensuring equal pay for equal work, and instituting policies that apply uniformly to everyone, regardless of their appearance.

The theme of Inclusive Environment, the need for an inclusive environment was identified as a crucial theme. Participants emphasized the importance of implementing inclusive recruitment and hiring practices, ensuring equitable access to education and resources, and establishing mentorship programs specifically for women of color in STEM. These measures are essential for supporting the success of women of color in these fields. Key recommendations included prioritizing inclusive recruitment, fair access to educational resources, and targeted mentorship initiatives.

The theme of Policy Changes and Accountability, focused on the need for meaningful policy changes and greater accountability. Participants emphasized the importance of policy changes and enhanced accountability within institutions. They suggested revising pay policies to

rectify existing disparities, removing gatekeeping from hiring processes, and ensuring that evaluations of qualifications and experiences are impartial, free from racial and gender biases.

Chapter 8 Discussions & Impact on the Field

The study on shattering the glass ceiling and addressing racial and gender biases in STEM careers for women of color in higher education has a profound impact on the field. By promoting diversity, the study aligns with existing literature that demonstrates the numerous benefits of diversity in the workplace, including increased creativity, innovation, and productivity (Cox & Blake, 1991). Furthermore, the focus on addressing biases in STEM fields contributes to creating a more equitable and just society by challenging systemic discrimination and inequality that historically marginalizes women of color. This is especially important given the dominance of white men in high-paying and powerful positions within STEM fields (Holmes, 2020). By highlighting these issues, the study motivates us to commit to change and strive for a more equitable future.

In terms of transformative education, this study serves as a powerful model for creating more inclusive and equitable learning environments. Transformative education encourages individuals to critically reflect on their experiences and assumptions, leading to personal and social change (Mezirow, 1991). By emphasizing the importance of fostering a sense of belonging for all students, regardless of their race or gender, the study encourages optimism about the future of education and the possibilities for creating more inclusive environments. It also highlights the importance of cultivating educational practices that recognize and value diverse perspectives, which is crucial for promoting equity in learning (Cochran-Smith et al., 2016).

Additionally, the study contributes to the existing literature on the underrepresentation of women of color in STEM careers (Crenshaw, 1989; Fouad et al., 2019) and provides insights into the unique challenges faced by this demographic. This subsequently helps the research community develop more effective strategies to address these issues and benefits the marginalized population by raising awareness about the challenges women of color face in STEM fields (National Science Foundation, 2017).

Incorporating transformative learning theory into the dissertation project "Shattering the Glass Ceiling: Exposing and Addressing Racial and Gender Biases in STEM Careers for Women of Color in Higher Education" involves promoting critical reflection and fostering inclusive perspectives. This is accomplished by empowering individuals to challenge and reassess their assumptions, encouraging critical reflection to question existing beliefs, and fostering personal growth and open-minded perspectives (Taylor, 2009). However, it is essential to note the limitations of an individualistic approach and to incorporate broader social and cultural perspectives into the application of transformative learning in addressing racial and gender biases in STEM careers for women of color in higher education (Crenshaw, 1991).

The application of Mezirow's transformative learning theory also involves organizing workshops and seminars to encourage critical reflection among women of color in STEM. These activities aim to guide participants through reevaluating their assumptions and experiences of bias, aligning with Mezirow's emphasis on fostering an environment conducive to reevaluating assumptions. Furthermore, the theory's emphasis on critical reflection offers the potential to empower women of color in STEM, instills awareness of societal structures, and builds a supportive community for collective empowerment (Chung & Kwan, 2020). However, it is

crucial to consider the emotional labor and intersectionality of identities within these workshops to ensure sustainable impact (Collins, 2000).

The research on shattering the glass ceiling and addressing racial and gender biases in STEM careers for women of color benefits the research community by providing new insights and information that advance existing knowledge. It opens up new areas of research and contributes to the development of innovative solutions and approaches (Buchanan et al., 2020). Additionally, the study's findings serve as a foundation for further investigation and exploration by other researchers, ultimately driving progress and growth within the research community. Moreover, the study benefits marginalized populations by providing valuable insights and data that advocate for policies and programs targeted toward addressing their specific needs, raising awareness about the challenges they face, and contributing to greater social and economic inclusion (Gonzalez et al., 2017).

Conclusion

In conclusion, this study has brought to light the complex challenges faced by women of color in STEM careers, revealing how pervasive gender and racial biases significantly obstruct their professional growth and opportunities. Through a comprehensive approach utilizing surveys, interviews, and focus groups, we have deepened our understanding of their experiences, which exposes the systemic nature of these biases alongside the personal toll they take.

To directly address our research questions:

1. What challenges do women of color face in STEM careers?

The findings reveal that these challenges are deeply rooted in pervasive biases that limit access to promotions, mentorship, and leadership roles. The participants highlighted that such

obstacles not only hinder individual career advancement but reinforce systemic issues that require urgent action. This leads us to the next question.

2. How do these challenges manifest in the workplace?

The biases encountered by women of color manifest in various distressing forms, such as denied assistance, racial comments, unfair treatment, and wrongful termination. The research underscores critical themes of Equity, Accountability, Discrimination, and Injustice in Employment Practices, illustrating the adverse workplace dynamics that need to be confronted.

3. What strategies can be implemented to empower women of color in STEM?

On the positive side, the research emphasizes that empowering women of color is not just feasible but imperative. Strategies that can effect real change include developing mentorship programs specifically designed for women of color, promoting equitable hiring practices, and fostering a workplace culture that prioritizes mental health while addressing harassment. Education, advocacy, and leadership emerge as essential pillars for overcoming these challenges.

While these findings offer a roadmap for improvement, it is also crucial to recognize another area that merits attention: the impact of financial stability on women of color in STEM. The emotional and psychological toll of navigating biases can lead to issues such as low self-esteem and self-doubt, further compounded by financial difficulties. Addressing these financial barriers with dedicated resources and support systems is vital for cultivating an equitable environment.

Ultimately, this research lays a solid foundation for future initiatives aimed at elevating the voices of women of color in STEM. By tackling both individual and systemic barriers head-on, we can create an environment that not only values diversity but also empowers women of

color to reach their fullest potential in STEM fields. It is through our collective effort and commitment to take a practical step that we can build a more equitable, inclusive, and thriving STEM community for everyone.

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Appendices:

Appendix A: Poster of Topic

Shattering the Glass Ceiling: Exposing and Addressing Racial and Gender Biases in S.T.E.M. Careers for Women of Color in Higher Education

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Introduction

The field of science, technology, engineering, and mathematics (STEM) has been growing rapidly in recent years (National Center for Education Statistics, 2022). The research by Ceci & Williams (2011) found evidence against the biological essentialism hypothesis and points towards social and environmental factors contributing to the dominance of men in STEM fields. This perception contributes to the underrepresentation of women, particularly those from underserved communities, in STEM careers, presenting a significant challenge. Women of color face numerous barriers in pursuing STEM careers due to pervasive racial and gender biases (Smith, 2020). Smith (2020) further emphasizes the importance of addressing the intersectionality of gender and race in STEM and highlights the systemic racial and gender biases hindering the advancement of women of color in STEM careers within higher education. Additionally, it has been noted that equity and social justice are important in fostering a more inclusive STEM environment (Johnson, 2018). Through this research study on the intersectionality of gender and race in STEM, the goal is to develop effective strategies to promote diversity and inclusion in STEM, thereby providing insights for creating inclusive environments for all students, regardless of gender or racial background. Furthermore, the underrepresentation of women, mainly from underserved communities, in STEM careers is a substantial challenge. Women of color encounter numerous obstacles in pursuing STEM careers due to widespread racial and gender biases (Smith, 2020).

Research Questions

1. What are the experiences of women of color in STEM careers, particularly in college settings?
2. What are the specific racial and gender biases that women of color face in STEM careers, and how do these biases manifest themselves?
3. What are the potential strategies for addressing these biases and promoting equity and inclusion in STEM for women of color?

Preliminary Findings

Challenges:

- Racial and gender biases in academia and STEM
- Impact of college settings on women of color in STEM

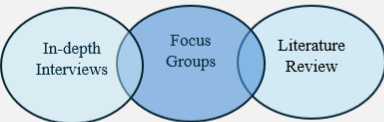
Potential Barriers and Strategies for:

- Addressing biases in recruitment and promotion
- Creating support systems for women of color in STEM

Tools to use:

- Case studies, Personal narratives, Workplace observations, Existing literature, Expert opinions

Methodology- Qualitative Research




Women of Color

Women of color include non-white or non-European women from diverse racial and ethnic backgrounds, such as African American, Hispanic/Latina, Asian American, Native American, and mixed racial heritage.

S.T.E.M GROUP

Lack of Representation



STEM stats: Employment data from 2017-2019 show that Black and Hispanic professionals are underrepresented in STEM, compared with their share of the overall U.S. workforce. Asian and white workers, on the other hand, are overrepresented in STEM.

	White	Other	Asian	Hispanic	Black
All jobs	63%	3%	6%	17%	11%
All STEM jobs	67%	3%	13%	8%	9%
Health related	68%	3%	10%	9%	11%
Life science	65%	3%	19%	8%	6%
Math	64%	3%	16%	8%	9%
Physical science	65%	3%	18%	8%	6%
Computer	62%	3%	20%	8%	7%
Engineering	71%	2%	13%	9%	5%

PEW RESEARCH CENTER, E. OTWELL /

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Acknowledgments

I would like to express my gratitude to Dr. Yin Lam Lee-Johnson, Director of EdD Program, School of Education at Webster University, for her continued support and guidance.

Appendix B: IRB Approval Letter



Office of Academic Affairs

November 11, 2024

TO: Ethel Smith
FROM: Webster University Institutional Review Board
RE: Doctorate Digital Portfolio (DDP). Grade level: College Students, Age: 18+
STATUS: Expedited – Conditionally Approved

NOTES:

- The IRB Proposal Number for this research project is FA24-13.
- If any changes are made to the study, the IRB must be notified.
- You are also required to promptly notify the IRB Chair of any problems that arise during the course of the research.

A handwritten signature in black ink that reads "Vicki Callan". The signature is written in a cursive style with a large initial "V".

Vicki Callan, Associate Professor, Nurse Anesthesia
Chair, Webster University Institutional Review Board, FWA00024297

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Appendix C: Survey

SURVEY

Below you are presented with a list of statements about the topic: "Shattering the Glass Ceiling: Exposing and Addressing Racial and Gender Biases in STEM Careers for Women of Color in Higher Education." Please indicate to what extent you agree or disagree with them by checking the appropriate option next to each statement.

To what extent do you agree with the statement: "I have personally experienced racial or gender biases in my STEM career as a woman of color?"

Strongly Disagree Disagree Neutral Agree Strongly Agree

How often do you feel that your contributions and achievements in your STEM career are overlooked or undervalued due to your race or gender?

Rarely Occasionally Frequently Always

To what extent do you believe that racial and gender biases have hindered your career progression in STEM?

Strongly Disagree Disagree Neutral Agree Strongly Agree

How supported do you feel by your colleagues and supervisors in addressing issues related to racial and gender biases in your STEM workplace?

Strongly Disagree Disagree Neutral Agree Strongly Agree

How confident are you in the fairness of the promotion and advancement processes within your STEM organization?

Strongly Disagree Disagree Neutral Agree Strongly Agree

To what extent do you believe that initiatives to promote diversity and inclusion in STEM have been effective in addressing racial and gender biases?

Strongly Disagree Disagree Neutral Agree Strongly Agree

How often do you engage in discussions or activities aimed at raising awareness about racial and gender biases in STEM within your workplace? (Never, Rarely, Occasionally, Frequently, Always)

Rarely Occasionally Frequently Always

How satisfied are you with the support and resources available to address racial and gender biases in your STEM workplace? (Very Dissatisfied, Dissatisfied, Neutral, Satisfied, Very Satisfied)

Very Dissatisfied Dissatisfied Neutral Satisfied Very Satisfied

Have you ever felt pressured to conform to certain racial or gender stereotypes in your STEM career? (Yes/No)

What specific actions or changes do you believe would be most effective in addressing racial and gender biases in STEM careers for women of color? (Open-ended question)

Appendix D: Survey Demographics Chart

Survey Demographics Chart:

	Gender	Ethnicity	Age
S1	Female	Nigerian	N/A
S2	Female	Nigerian	N/A
S3	Female	Haitian	N/A
S4	Female	African American	32
S5	Female	Haitian	N/A
S6	Female	Hispanic/Latina	N/A
S7	Female	Haitian	35
S8	Female	African American	27
S9	Female	African American	40
S10	Female	Hispanic/Latina	N/A
S11	Female	African American	N/A
S12	Female	Nigerian	N/A
S13	Female	Cuban/Italian	N/A
S14	Female	African American	N/A
S15	Female	Trinidadian	N/A
S16	Female	Asian	N/A
S17	Female	African American	N/A
S18	Female	Haitian	35
S19	Female	Mexican	25
S20	Female	African American	35
S21	Female	African American/ Arabian	N/A
S22	Female	African American	N/A
S23	Female	African American	N/A
S24	Female	Haitian	N/A
S25	Female	Haitian	N/A
S26	Female	Jamaican	19
S27	Female	African American	N/A
S28	Female	Jamaican	38
S29	Female	Jamaican	40
S30	Female	Haitian	N/A

Appendix E: Interview Questions

Dissertation Topic: "Shattering the Glass Ceiling: Exposing and Addressing Racial and Gender Biases in STEM Careers for Women of Color in Higher Education."

Interview Questions:

Interview Questions:

1. Can you describe your experiences with gender and racial biases in your STEM career?
2. In what ways have these biases impacted your professional development and opportunities?
3. What challenges specific to your gender and race have you encountered in advancing your career?
4. What support systems are essential for addressing these biases?
5. What institutional changes would promote a more equitable environment for women of color in STEM?

Appendix F: Focus Group Questions

***Dissertation Topic:** "Shattering the Glass Ceiling: Exposing and Addressing Racial and Gender Biases in STEM Careers for Women of Color in Higher Education."*

Focus Group Questions:

1. How do common experiences regarding biases differ among women of color in STEM?
2. What barriers do you think gender and racial biases create for women of color pursuing STEM careers?
3. Which institutional changes would significantly support women of color in STEM?