2024

Resilience in the face of sexism: attracting, retaining, and promoting women and girls in STEM

Karin Karakhanian Moore
karin@randkmoore.com

Pepperdine University

Graduate School of Education and Psychology

RESILIENCE IN THE FACE OF SEXISM:
ATTRACTING, RETAINING, AND PROMOTING WOMEN AND GIRLS IN STEM

A dissertation submitted in partial satisfaction

of the requirements for the degree of

Doctor of Philosophy in Global Leadership and Change

by

Karin Karakhanian Moore

June, 2024

Gabriella Miramontes, Ed.D. – Dissertation Chairperson

This dissertation, written by

Karin Karakhanian Moore

under the guidance of a Faculty Committee and approved by its members, has been submitted to and accepted by the Graduate Faculty in partial fulfillment of the requirements for the degree of

DOCTOR OF PHILOSOPHY

Doctoral Committee:

Gabriella Miramontes, Ed.D., Chairperson

Farzin Madjidi, Ed.D., Co-Chair/Committee

Maria Brahme, Ed.D., Co-Chair/Committee

Kelly Sullenberger, Ph.D., Co-Chair/Committee

Theresa Dawson, Ed.D., Co-Chair/Committee

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

DEDICATION

I dedicate this Ph.D. to all of the unsung women in STEM who show up every single day and deliver what is expected of them and more, despite the challenges they face. They keep persisting and choosing STEM. We desperately need their voices to contribute, lead, and innovate in STEM, especially in light of advances being made in artificial intelligence. Our representation in building the future is critical. Eighteen of these women provided insights along with their time, sharing their lived experiences of challenges, and how they persisted. Their honesty and sincere desire to make the world a better place for women in STEM inspired me to continue pushing this passion forward. Here is to the next generation of girls and women in STEM. May they be supported and flourish in their careers.

ACKNOWLEDGMENTS

I would like to thank my parents, Vrouir and Lida Karakhanian, as well as my exceptionally wise and accomplished sister and role model, Dr. Vivian Ekchian. Reaching big dreams is our family's specialty. They have instilled a love of learning, passion for science, and confidence to go after what I believe. It is due to their hard work and support that I stand here.

None of this would have been possible without my incredibly supportive and loving husband, Richard, and our wonderful young adult children, Gregory and Caroline, who inspire me daily with their brilliance, humor, and optimism. You make me hopeful for the future. I am fortunate to have encouraging in-laws, Dr. Richard and Frances Moore, Beth Ann Moore and Dr. Rebecca Kenney, who cheered me on when I started down this path and have continued to do so. In the friends that you make who become your family, two friends have stood the test of time in their kindness and faith in me. On this journey of life, Nazik Muradliyan and Andrea Zadoorian are my truest of friends. I thank you for always being at my side.

I came across many incredible leaders in my STEM career. Their allyship, sponsorship and mentorship, pushed me forward. Within that group, five women stood out as they have stayed vested in the outcomes of my Ph.D. and supported me unconditionally. They are Beth O'Donnell, Staci Pendergress, Alison Conn Shaw, Ali Valdez, and Anna Ward. Much gratitude to the Journey Fellowship. Could not ask for a better crew. I am proud to call you all my friends, Chidimma Abuka, Shawn Herrera, Scott Kissack, Quennette Standford and Thomasina Tafur.

My deep appreciation goes out to our faculty in EIP, under Dr. Gabriella Miramontes' leadership. You created community and camaraderie, with lasting impact on my growth and education. Dr. Miramontes, thank you for making me a scholar. Dr. Farzin Madjidi, true to your word, we received the million-dollar education. Thank you for all of your guidance.

VITA

Education

Pepperdine University – Los Angeles, California
Ph.D. - Doctor of Global Leadership and Change

Pepperdine University – Los Angeles, California
Master's of Business Administration

California State University, Northridge
Bachelor of Science in Engineering

Professional Experiences

Senior Technology Executive who has delivered successful results across world class software companies such as Microsoft, Teradata, and Optum. Extensive experience leading people and programs in data analytics, engineering, business transformations, process consulting, information technology, customer success, and operations. On a mission to improving the outcomes for girls and women in STEM.

ABSTRACT

Women in Science Technology Engineering and Math (STEM) occupations comprise 27% of employees in STEM fields (Martinez & Christnacht, 2021). Their participation continues to drop even when they reach the highest levels of leadership in STEM industries (Chrisler et al., 2012; R. A. Miller et al., 2021; Worthen, 2021). There have been calls by universities and governments to bring women's thought leadership to STEM fields given the massive impact STEM industries have on the economy and innovation (Beede et al., 2011; Fayer et al., 2017). A review of the literature shows that girls and women experience various levels of discrimination at every stage of their STEM pathways (V. E. Johnson et al., 2021; Settles et al, 2006). It begins in childhood, where their self-efficacy and self-confidence are lowered due to societal pressures against girls, and continues on through their academic period and well into their careers (Sadler et al., 2012; Weinhardt, 2017). Without intentional interventions, such as mentoring, female role models, and involved parents, girls and women often lose interest in STEM, even without a difference in skills against their male counterparts (O'Dea et al., 2018). Compounding the issue is that women face harassment and discrimination from the predominately male dominated environments, making for an unpleasant work and study experience (Chrisler et al., 2012; R. A. Miller et al., 2021; Worthen, 2021). The issue is much worse for underrepresented minorities who are often at the intersection of gender and race as well as sexual orientation (Crenshaw, 1989; García-López, 2008; Melaku, 2019). Using phenomenological research methods (Moustakas, 1994), Appreciative Inquiry (Cooperrider & Whitney, 2005), and Feminist Theory (hooks, 2000; Steinem, 1969) this study explores the lived experiences of 18 STEM women, specifically their success strategies and barriers from a young age to college, and through career and leadership.

Keywords: women in STEM, discrimination, persistence, retention, success, barriers

Chapter 1: Introduction

Background/Historical Context

Over the past 50 years, women have entered Science, Technology, Engineering, and Math (STEM) fields in smaller numbers than men worldwide (Martinez & Christnacht, 2021; World Economic Forum, 2017). At the center of this study is developing an understanding of the reasons some women persist in STEM and others drop out at various points, be it during their education or at junctures throughout their careers (Reinking & Martin. 2018). The literature indicates that female STEM majors are less likely than their male peers to participate in STEM fields and remain in them (Glass et al., 2013; Ma & Savas, 2014; Mann & DiPrete, 2013; Sassler et al., 2011). Overall, there has been an increase in STEM workers, with the total number of STEM workers in 2021 at 34.9 million, up from 2011's 29 million (Martinez & Christnacht, 2021). It is estimated that 24% of the U.S. workforce is now engaged in STEM-related fields (Martinez & Christnacht, 2021). To assess how much women have contributed to that growth, one can see that in 1970 only 8% of STEM workers were women, whereas in 2019, 27% of STEM employees were women (Martinez & Christnacht, 2021). However, even though men comprise 52% of all U.S. workers, their numbers are above-average percentage of STEM workers, 73%, (Martinez & Christnacht, 2021). This is where the gender gap lies. Women's talent and aptitude are not questioned, as women perform equally well on standardized tests (Beekman & Ober, 2015). Nevertheless, opportunities for entry and maintaining sustainable careers in STEM continue to be challenging (J. Williams et al., 2016).

There have been a few token women who have broken down barriers in STEM and are known for their ingenuity (Thomas, 2022). Examples are famous female astronauts, physicians, and scientists, such as Sally Ride, Rita Levi-Montalcini, and Barbara McClintock (Thomas, 2022). Ignoring the work of female scientists is so prevalent that there is a term for it, the Matilda Effect (Rossiter, 1993). Only recently, in 2014, the Fields Medal for Mathematics was awarded to a woman, Maryam-Mirzakhani, for the first time (M. L. White, 2023). The story of female scientists and mathematicians from NASA, whose contributions to the Space Race were invaluable and were unknown until Hollywood dramatized their existence in the movie Hidden Figures (Melfi & Schroeder, 2016). Where women were able to shine historically, it was as the partner or wife of famous scientists, such as the case of Marie Curie, the first female winner of the Nobel Prize (Quinn, 1996; Rafalska-Łasocha, 2018). It was not until 1983 before the first Nobel Prize was awarded to a Barabara McClintock by herself (National Library of Medicine, Profiles in Science, n.d.). She was 81 years old.

For generations of women, breaking into STEM fields has been an uphill battle, even as they outperformed men (Bloodhart et al., 2020). There are many contributing factors for this, and it starts early in a young girl’s life, continues in K-12 and college, and eventually leads to challenges in the workforce (Aycock et al., 2019; Bloodhart et al., 2020; E. Cech et al., 2011; Korn et al., 2022; Mattheis et al., 2022; Weir, 2023). This study seeks to understand both barriers and success strategies that women in STEM have experienced to maintain solid and successful careers in STEM fields.

STEM Industry and Occupations

According to the National Science Foundation (NSF; 2023), 34.9 million people work in STEM occupations, representing 24% of the entire U.S. workforce. There are over 100 STEM occupations, with examples such as aerospace engineer, computer scientist, physicist and information security analyst (Fayer et al., 2017). The U.S. Bureau of Labor Statistics (U.S. BLS) considers High Technology a sub-industry within STEM, that primarily employs people in

STEM occupations (Fayer et al., 2017). High Technology employees represent 17 million jobs and 12% of all employment (Fayer et al., 2017). Their output contributes 23% to the overall economy, even though in number of employees, they represent a small percentage (Fayer et al., 2017). High Technology salaries are also higher than average (U.S. BLS, 2017), and competition is stiff for these jobs, especially in light of technology sector layoffs in 2022 and 2023 (J. Parker, 2023). High Technology companies total over 6.625 trillion dollars in market capitalization (Companies Market Cap, n.d.). All U.S. publicly traded companies represent 43 trillion (Companies Market Cap, n.d.). Thus, the top five, also known as MAMAA, companies represent 15% of the market capitalization of 3,547 publicly traded companies in the U.S. (Companies Market Cap, n.d.). The acronym MAMAA represents Microsoft, Amazon, Meta, Apple, and Alphabet. STEM jobs pay twice that of non-STEM jobs (U.S. BLS, 2022). It is critical for women, who are already at a disadvantage, to have access to these jobs to secure their financial futures. As stated by Beede et al. (2011) "Given the high-quality, well-paying jobs in the fields of science, technology, engineering and math, there is great opportunity for growth in STEM in support of American competitiveness, innovation and jobs of the future" (p. 8).

The Disparity Begins Early and Continues Through Women's Careers

Gender disparity in elementary school begins with girls ages six to twelve showing less self-efficacy and higher test-taking anxiety in STEM subjects, especially mathematics (Ayuso et al., 2021). The disparity between genders continues in high school, with less voluntary female participation in STEM subjects (Master et al., 2016). The number of young women in STEM fields in college continues to decline to the point where only 15% of engineers are women, and 26% of computer science employees are women (Society of Women Engineers, 2019). There are more women in STEM fields than in 1970; however, fewer of them than in 1990 in the United States (Martinez & Christnacht, 2021).

There are many reasons for the shrinkage in number of women participating in STEM fields from education to the workforce. Some of the decline is attributed to a lack of women in academia in STEM fields who can act as role models (Rennane et al., 2022). Others suggest that the environment, lack of support, and lack of psychological safety faced by women in school and at their workplace contributes to this gender imbalance, as seen through a study conducted on female physicists who reported experiencing some form of sexual harassment (Aycock et al., 2019).

Gender imbalance contributes to Imposter Syndrome/Phenomenon originally coined as feelings of inadequacy experienced by one's feeling of intellectual inadequacy leading to a drop in confidence (Clance & Imes, 1978). Thought to be the person's shortcoming, current research has challenged that belief (E. McGee et al., 2022). Instead, it is thought to be a byproduct of a psychologically unsafe environment. Left unchecked, Imposter Syndrome increases anxiety, depression, burnout, and other health issues (Huecker et al., 2023). Systemic messaging that girls and women are not good in math or science permeates young girls' and women's lives and perpetuates the belief that STEM is for men (Arredondo et al., 2022). The patriarchal sentiment is found at all levels, including academia, such as when then President of Harvard, Larry Summers, said fewer women participate in STEM because of "issues of intrinsic aptitude" (Barreto et al., 2008, p. 165). Fortunately, MIT, Princeton, and Stanford presidents quickly released statements rebuffing Summer's comments (Jaschik, 2005).

STEM Women Face Discrimination in the Workplace

The discrimination does not stop in academia (V. E. Johnson et al., 2021). The problem persists once women enter their respective STEM industries (V. E. Johnson et al., 2021). As an example, when he is recounting his early days at Microsoft the then newly minted CEO of Microsoft Corporation, Satya Nadella, was asked about women negotiating their raises and promotions. His reply at the prestigious Grace Hopper women's conference was "Knowing and having faith that the system will actually give you the right raises as you go along…good karma" (Nadella, 2014, p. 112). At best Nadella was blind to his own unconscious bias (Shonk, 2014; Suveren, 2022). At worst, it was a microaggression, which is a type of discrimination that will be discussed in depth in Chapter 2 (Alonso-Villar & del Río, 2023; Markovic & Plickert, 2023). Recent research from Berkeley urges a change in the narrative, that the gender pay gap is not in part to women not asking for raises and promotions (Kray et al., 2023). Women do ask for raises and negotiate even more than men (Kray et al., 2023)

Working women in STEM find themselves subject to a host of challenges once in the workplace, such as experiencing discrimination, lack of promotion, and absence of mentors and sponsors (Kesar, 2017, 2018). These types of experiences contribute to women's numbers dwindling further in STEM, especially in engineering and computer science, as evidenced by only 30% of women with engineering degrees still practicing 20 years later, showing the lack of persistence by STEM women (Corbett & Hill, 2015). Studies further show that women who are exposed to more significant gender bias are more disengaged from STEM (Moss-Racusin et al., 2018). This disengagement occurs when women are exposed to highly masculine cultures that impact a woman's sense of belonging (Cheryan et al., 2009).

Studies show that the on-ramps and off-ramps for women are determined by the opportunities provided to them through mentors and sponsors and include hospitable environments free of ageism, sexism, racism, and the overarching culture of patriarchy (Hewlett, 2007; M. J. Lee et al., 2020; Malinen & Johnston, 2013; National Academies of Sciences, Engineering, and Medicine, 2018; M. Williams, 2020). Environmental factors, such as benefits provided by STEM industry employers, are vital in keeping women and girls in STEM interested and participating (Das & Baruah, 2013; Holtzblatt & Marsden, 2022). Other factors include working in a team where they feel valued, a scope that stimulates and challenges them in a supportive environment, role models, and flexibility to manage work-life integration (González-Pérez et al., 2020; Holtzblatt & Marsden, 2022).

Working Mothers in STEM

Women who choose to start families experience an additional burden called the “motherhood wage penalty” (Budig & England, 2001, p. 219). Budig and England found that for every child under age five, there was a 15% decrease in wages for the mother. For indigenous women and Black women, that number rises to 20% per child. More recent research corroborates this finding (Kahn et al., 2014). Once a woman begins having children, she cannot continue accumulating wealth at the same rate (Aisenbrey et al., 2009). Often, she needs to work part-time to be available for her family, leaving her education incomplete and passing up on promotions which may require more of her time (C. Baum, 2002). At some point in her 40s and 50s, she might be able to catch up unless she chooses to have a third child, in which case the disparity continues (Gangl & Ziefle, 2009; Glauber, 2018; Jacobsen & Levin, 1995).

The current climate of technology layoffs and threat of revoking remote work privileges hurt women who are often responsible for caring for children and elders (Dias, 2021; Mussida &

Patimo, 2021). More egalitarian and evolved companies recognize the need to foster female talent and listen to their unique needs. Some companies, as the aforementioned MAMAA, (Quiroz-Guitierrez, 2021), have been able to make marginal improvements in the gender gap by focusing on recruiting, retention, hiring, and promotion practices (Luhr, 2023). For example, they partner with National Hispanic Association of MBAs and National Black MBA Association to host joint events for recruitment. Their glossy annual Diversity Equity Inclusion reports are sometimes seen as virtue signaling (Gurchiek, 2021), especially as women still have double the male turnover rate (J. Moss, 2019). MAMAA are industry leaders in High Technology and are a subset of STEM; however, their policies carry much weight as they model the way for other High Technology companies. For example, when one company lays off employees, others companies follow suit (De Witt, 2022b). When one company calls employees back to the office, the others follow suit. Remote work will be discussed as one of the positive impacts of COVID-19 and one of the critical policies which support women staying in the workforce (Mussida & Patimo, 2021).

Data Accuracy in Reporting

Companies, policymakers, and educators depend on the available data to make data-driven decisions to attract, recruit and retain women in STEM fields. As such, data accuracy is a critical component of assessing the scope of the attrition and persistence problem (Federal Committee on Statistical Methodology, 2020). Within this study, every effort has been made to ensure a careful review of data sources and supporting inputs; however, it is essential to understand that data professionals must make assumptions in creating detailed views --whether historical, current, or projected data. The list below is derived from an email correspondence with U.S. BLS economist Audrey Watson. She was a critical advisor in reviewing publicly available data for this study (A. Watson, personal communication, July 6, 2023). The following considerations should be made when reviewing STEM women's data:

- Different government departments include/exclude specific occupations in their definition of STEM. The definition used in this study is from the U.S. BLS's Standard Occupational Classification (SOC; 2022).
- Every effort will be made to leverage the most recent data available. The most recent data from the U.S. BLS is from May of 2022, as confirmed by U.S. BLS economist Audrey Watson (A. Watson, personal communication, July 6, 2023).
- Even if more detailed data is available, the altitude of the data analysis will be reported at the aggregate level of the United States, without diving into State/County level information. When other country data is available, as much as possible, their data will be normalized against U.S. BLS data.
- Where possible, perspectives from other countries will be included to ensure a global viewpoint, as some countries are ahead or behind the United States in the future of women's rights (National Intelligence Council's Strategic Futures Group, 2021).
- Entry-level education is used in projecting future workforce needs. The study will leverage Occupational Employment and Wage Statistics (OEWS) data, for which the most current information is from May 2022 (U.S. BLS, 2024b).
- Caution will be used when comparing time over-time data. Ms. Watson has noted that using U.S. BLS data may produce inaccurate insights as data-gathering methods and SOCs change. For example, STEM-related management occupations or postsecondary teachers are included or excluded in specific reports (A. Watson, personal communication, July 6, 2023). Further, Employment Projections (EP) for 2021-2031

(U.S. BLS, 2024a) have built-in assumptions which cannot be compared to actuals for OEWS data.

- One should not compare OEWS data, which is gathered from employers and has no demographic metadata, to Current Population Survey (CPS), which does have some demographic metadata and is based on self-reported household information.
- The association that OEWS makes with industry in the data field called ‘industry classification’ is derived from the main product or service that the company produces. This may differ from the ‘detailed occupation’ field, which is derived from job duties performed at the individual level.
- The U.S. BLS reporting creates a broader or narrower definition of occupation when necessary. An example would be nursing and healthcare post the COVID-19 pandemic, when it was critical to understanding attrition and shortages in the workforce.

Statement of the Problem

The lack of women’s participation in STEM and its negative impacts is even worse for Black, Latina, and indigenous women (Lafortune et al., 2022). At the individual level, STEM jobs are some of the highest paid in society (U.S. BLS, 2017), providing a financial safety net and taking away the dependency a woman has on another to support her (Conner, 2014). By being financially independent, a woman has agency and autonomy. She can choose her lifestyle, partner, and vocation (Fassinger & Asay, 2006). Women need financial independence as they are currently at risk of poverty, mainly due to the post-COVID-19 pandemic’s fallout, which placed the responsibility for childcare and eldercare on women (Power, 2020). Millions of women left the workforce during the COVID-19 pandemic (Clapp, 2023). Following the Great Resignation (Klotz, 2021) and job losses due to the COVID-19 pandemic, women’s participation in the workforce reached its lowest rate since 1948 (Machovec, 2023). Eighteen percent of the United States female population, 13.6 million, lost their jobs during the COVID-19 pandemic (U.S. BLS, 2023c). Much more significant than 14% of the male population with 11.9 million job losses (U.S. BLS, 2023b). For High Technology companies that employ women in STEM, the impact has been more remarkable due to significant layoffs at the end of 2022 and the start of 2023 (De Witt, 2022a). Layoffs disproportionately impact women as they are already a smaller subset of the overall employee base in STEM (Dias, 2021; Kalev, 2014).

At the societal level, STEM industries need women and diverse perspectives to drive better product design and services (Beede et al., 2011). Boards with diverse leadership and product teams with diverse representation, including gender diversity, perform better financially (Amin et al., 2022). By not being fully represented in STEM fields and industries, women are less likely to be in leadership positions where role models are already scarce (Gladstone & Andrei, 2021; D. M. Young et al., 2013). Compounding the problem is the lack of gender equity in pay (Rotman & Mandel, 2023). The United Nations has noted that pay has not improved for women in the past 20 years (2023). The General Accounting Office (GAO) confirms this fact with their data; white women earned 82 cents for every dollar a white man earned, whereas Latina and Black women earned 58 and 63 cents, respectively (2022). Female managers, on average, earn 77 cents to the male dollar (GAO, 2022). It is critical for women to have the same opportunities as men when it comes to pay since women live longer (F. Baum et al., 2021) and often take time off for childbearing and childcare, as well as elder care (Mussida & Patimo, 2021). Financial security, autonomy and agency are important as women initiate 70% of divorces (Rosenfeld, 2017) and then are left with a significant drop in their standard of living, down 45%, and sometimes to the point of poverty. This amount doubles if divorce occurs after age 50 (Lin &

Brown, 2021). High paying STEM fields, which pay almost twice as non-STEM fields, are another insurance strategy towards financial freedom (Okrent & Burke, 2021).

Purpose Statement

This study aims to illuminate success strategies deployed by seasoned women in STEM to persist in their careers, and expose barriers they have faced as they navigate their careers in STEM industries. Some barriers may be well-known and researched, for which decades of knowledge exist in scholarly literature. Other barriers and success strategies may be more nuanced and teased out only in interviews with those who have collectively experienced the phenomenon of working as women in STEM (Creswell & Creswell, 2018). For the younger generation of STEM women early in their careers, this study can serve as a guide for what to expect and how to leverage the experience of the study participants. For mid-career women, this study can validate and provide comfort in knowing that they are not alone. Systemic forces greater than them, such as racism, ageism, and sexism, are at play (NASEM, 2018). In addition to teasing out success strategies and barriers, the study aims to provide tangible recommendations on how to persist and thrive as a woman in STEM whether in their academic pursuits or in her career.

Research Questions

The following research questions (RQ) are addressed in this study:

RQ1: What are the challenges faced by women in STEM in ascending to leadership positions?

RQ2: What strategies/best practices are used by women in STEM to overcome the challenges they face?

RQ3: How do women in STEM define, measure, and track their career success?

RQ4: What recommendations do women leaders in STEM have for aspiring female leaders?

Theoretical Frameworks

The researcher will leverage two frameworks in this study. Evaluating and analyzing through the lens of theoretical frameworks allows for a more consistent and informed set of conclusions (Lederman & Lederman, 2015). Theoretical frameworks are based on studies related to one or many parts of theories that make generalizations about a population to help support findings (Lederman & Lederman, 2015). In this study, the overarching framework is Appreciative Inquiry (AI), where interview questions are framed positively and are asked of female participants who have lived experiences working in STEM fields (Barrett & Fry, 2005; Cooperrider & Whitney, 2005; Watkins et al., 2011).

Appreciative Inquiry assumes a positive perspective on managing change in an organization or at a societal level (Cooperrider & Whitney, 2005). By inquiring about a person's positive experiences, new ideas emerge that can benefit the whole. Within the inquiry, negative information may also surface; however, it is the positive questions whose answers help create a strength-based analysis (Bushe, 2011). At its core, AI has four elements: define, discover, dream, and design (Barrett & Fry, 2005). Later, a fifth element was added called destiny (Barrett & Fry, 2005; Cooperrider & Whitney, 2005).

Starting with *Define*, the researchers establish the change they are embarking upon. This study aims to increase the participation and retention of women in STEM while maintaining positive well-being in all of the spaces they occupy, whether in academia or the workplace (Geldenhuys, 2020). The second principle of AI is *Discover*, whereby positive questions which *appreciate* the experience of the participant are asked in a manner in which to discover strengths or best practices within the realm of their lived experiences (Barrett & Fry, 2005). Open-ended, positive questions may also lead the researcher to challenges, which is the second part of this study, the identification of barriers to women in STEM. In the third principle of AI, the participants are asked to *Dream* about the ideal state (Cooperrider & Whitney, 2005). Every woman in STEM at some point has experienced the "flow state" where all systems are humming at optimal speeds with little to no effort (Gold & Ciorciari, 2020, p. 137). Flow state dates back to almost all religions; even Maslow called it 'peak performance' (Maslow, 1964). Studies have found that those in a flow state operate at 500% higher productivity (Cranston & Keller, 2013). For women in STEM, this could translate to managing their work and family while maintaining self-care and feeling psychologically safe at work.

The fourth principle of AI is *Design* (Barrett & Fry, 2005; Cooperrider & Whitney, 2005). In the *Design* phase, the researcher has gathered all of the best practices from participants and begins to envision what could be if system barriers were removed and supportive policies and procedures were implemented. An example of this would be companies designing favorable remote work policies, which are overwhelmingly the preference of parents of young children to balance home and work responsibilities (Fisher & Kingson, 2022). Remote work will be discussed extensively in Chapter 2. The final principle of Appreciative Inquiry is *Destiny* (Barrett & Fry, 2005; Cooperrider & Whitney, 2005). In Destiny, the knowledge of how to improve the organization is well-known and embraced by the organization. The ideal *Destiny* state for women in STEM would be welcoming environments where they are supported and can grow in their schooling, careers and as partners in their families while thriving in STEM fields.

In addition to Appreciative Inquiry, Feminist Theory (FT) will support the study as a second theoretical framework through which the researcher will construct the questions and analyze the data. The origin of Feminist Theory is over 200 years old and begins with Mary Wollstonecraft's *A Vindication of the Rights of Woman* (1792). Other early champions of feminist theory are Sojourner Truth (1851), with her *Ain't I a Woman* speech at the Women's National Convention, and Susan B. Anthony, whose stance on voting for women (Hayward, 2018) picked up the momentum for the eventual right for women to vote in the United States (Porter & Munn, 2019; U.S. Const. amend, XIX). Modern Feminist Theory has roots in the 1960s with champions of feminist beliefs who aimed to understand gender inequality, sexism, systems of oppression, and discrimination (Friedan, 1963; Steinem, 1969). Much of history has missed the impact of Black women's contributions which paralleled the Civil Rights movement (Giardina, 2018). Black women sought their place in society as early as post-World War II (Giardina, 2018). Feminism is credited for much of the equality movements that have moved women forward in voting rights, reproductive freedoms, and protections within the workplace. Black feminist legislators such as Shirley Chisolm led feminist legislation in the U.S. congress in the 1970s (Mayeri, 2023). Feminist scholars such as bell hooks (2000) have challenged patriarchal belief systems which hold women back in society. There are many noteworthy leaders of the feminist movement, such as Gloria Steinem (1969) and Betty Friedan (1963), who have each contributed in significant ways to igniting the first wave and second wave of feminism, respectively. Since then, there have been many intersectional interpretations of feminism (Kubala, 2020), which will be discussed in Chapter 2. As the body of knowledge is examined, feminist theory will be highlighted in presenting evidence contributing to the lack of persistence by women in STEM.

Significance of the Study

For women entering or contemplating a STEM field and subsequent careers in a STEM industry, this study will provide current experiences and strategies faced by seasoned women in STEM. It may validate the experiences of current women in STEM and provide a helpful guide as to what challenges to expect and how to mitigate them for new entrants into the STEM fields. This study can serve as a manual for organizational leaders, educators, human resources professionals, and people managers to know where to invest their resources in developing training, creating supportive policies and benefits, and recognizing discriminatory behaviors against women in STEM. Discriminatory practices create turnover and attrition, leading to women leaving STEM fields (Y. J. Xu, 2017). This study can be leveraged and repeated for women on Wall Street, in the trades, and academia, among many disciplines where the female-to-male ratios are low and discrimination, especially sexual harassment, is high (Cortina & Areguin, 2021).

Assumptions of the Study

- There has been a multi-decade focus on increasing the number of women in STEM fields without much success.
- It is assumed that systemic forces are acting against women entering successful STEM fields and staying in STEM careers. The study discusses these in extensive detail in Chapter 2.
- The study also assumes that seasoned STEM women are ready and willing to discuss their experiences in sincerity so that the next generation of women entering STEM fields can fare better.

- The final assumption is that women are equally capable and intellectually matched as men (Halpern & LaMay, 2000), and even in the chance where men perform better on math tests, one could argue it was a lack of opportunity and support provided in formative years for the women (Ganley, 2018). Where there are differences, boys are about 0.1 to 0.3 standard deviations from girls better, but only on math tests. There are no differences in intellect between infants and elementary school children (Ganley, 2018). However, differences in attitude about math, more significant test-taking anxiety, and lower confidence exist (Ellis et al., 2016; Moakler & Kim, 2014) and do not favor girls, suggesting environmental causes (Else-Quest et al., 2010). Perhaps male hubris and female humility have created this false narrative (Reilly et al., 2022). Nevertheless, given the chance and provided equal opportunities, the assumption is women should be able to flourish in STEM careers.

Limitations of the Study

- Where possible, the latest available data has been used which may be post-COVID-19, and not fully representative of the pre-pandemic state of women in STEM. However, post-COVID-19 data is consistent with studies that state the recovery of women's standing in the workplace may take a generation to recover (Kashen et al., 2020).
- Many of the resources related to women in STEM comingle the data related to women in healthcare with data related to engineering, math, and science. Women in healthcare have less of a representation issue, with women being 37.1% of all doctors (Kalter, 2018). An exciting pipeline of female medical students tipped the scale in favor of women in 2018, whereby over half of women applicants and those who

enrolled totaled 51.6 % female (Kalter, 2018). The number grows to 85% of nurses being female (Joelle, 2023), and as such, STEM women's data can falsely mask participation challenges by identifying women in engineering, math, and science populations. Some Unites States government organizations, such as the United States Department of Commerce and Department of Homeland Security, do not consider nursing as a STEM discipline. In contrast, U.S. BLS does consider nursing as a part of STEM (A. Watson, personal communication, July 6, 2023). Nursing is a field that is sometimes included in STEM occupations, and other times it is not (Dreisbach et al., 2022). This impacts nursing from being included in funding and policy decisions, including immigration.

- Another limitation of this study could be that it over or under-represents specific demographics. Every effort will be made to cast the survey wide, but the willingness of participants to share their experiences will drive responses (E. Green et al., 2018). Those between the ages of 48 and 57 are more likely to participate in studies (E. Green et al., 2018).
- Minority women in STEM may be more difficult to find as participants since they are already a lower percentage of the population of STEM Women (NSF, 2021). Thus, this study might not have enough Black and Latina representation as they make up 14.58% and 3% of overall women in STEM, respectively (Hispanic Heritage Foundation, 2020).
- Disabled (3% of all STEM employees), Asian American Pacific Islander (10% of all employees), and American Indian and Alaskan Native (.28%) are subset demographics that may be challenging to represent by this study.

- Other limitations to this study could be over- or underrepresentation of women in a specific subset of STEM, such as High Technology companies clustered around the people in the researcher’s network.
- Every effort will be made to ensure a balanced global perspective; however, interview participants might lean more toward a United-States-centric viewpoint by residing in the U.S. or working for U.S. companies.
- A final limitation is that there could be over or under-representation of specific disciplines such as project management, program management, software development, etc.

Definition of Terms

- **Ageism**. Based on the definition provided by the World Health Organization (WHO), “ageism refers to the stereotypes (how we think), prejudice (how we feel) and discrimination (how we act) towards others or oneself based on age” (2021). The term “ageism”, coined by Robert Butler in 1968 (p. 243), has been under legal protection in by the Age Discrimination in Employment Act 29 U.S.C. § 621 to 29 U.S.C. § 634 (1967).
- **Discrimination**. As defined by the Civil Rights Act of 1964 (Pub. L. 88-352) (Title VII). Discrimination appears in volume 42 of the United States Code, section 2000e, and prohibits discrimination based on race, color, religion, sex, or national origin (US Civil Rights Act, 1964). In this study’s context, the definition is widening to include ageism, which is discrimination based on age.
- **Employee Resource Group (ERG)**. According to the definition of National Institute of Health (NIH) “ERGs as non-union voluntary employee organizations led and comprised of members of the organization, formed around common interests” (2022). Their focus is

to improve employees' careers, company culture, build a sense of community, and advance commerce (Rodriguez, 2021).

- **Flexitime/ Flextime / Hybrid Work / Remote Work**. All of these terms are used interchangeably. They refer to type of remote work where the employer has expectations of their employee's presence in the office at least part of the time or at the employer's will (Rubin, 1979). Work is often conducted at home or in another location that is not the office.
- **High Technology (High Tech).** The collective industry of companies who make software, hardware, Cloud, Artificial Intelligence, Mobile applications, and generally those leading in developing cutting-edge technology (Wolf & Terrell, 2016).
- **Intersectionality.** Coined by Kimberle Crenshaw, it was connected to feminism, which for a long time was a white-privileged push for equality for white women (Crenshaw, 1989, p. 139). Intersectionality is now used to note that the discrimination and lack of equality faced by women who are Black, Latina, disabled, or members of LGBTQIA++ communities is amplified.
- **Metadata.** This is data that provides additional information regarding other data (Bagley, 1968, p. 26).
- **Microaggression**. Everyday verbal, nonverbal, and environmental slights, snubs, or insults, whether intentional or unintentional, communicate hostile, derogatory, or harmful messages to target persons based solely on their marginalized group membership (Pierce, 1970, pp. 265–282; Wright et al., 2022).
- **Overrepresented groups (ORG)**. In the case of STEM women, ORGs are considered the sum of white and Asian women, at 66% and 10%, respectively (NSF, 2021). Groups

are considered to be ORG if the percentage of their population in STEM is equal to or greater than the percentage of their total population. White women represent 66% of women in STEM and 50.6 % of the total population (United States Census Bureau, 2023); therefore, they are an overrepresented group within women in STEM. Similarly, Asian women represent 9.76% of the STEM women's population, whereas Asians as an overall population are 6.6% of the U.S. population (Budiman & Ruiz, 2021), thus they too are overrepresented by the definition of ORG.

- **Racism**. When one party, who has more power and is considered the elite group, can invoke systemic discrimination by their institution's policies, processes, and practices. In this process, they can also shape societal and cultural beliefs, supporting racist policies (Braveman et al., 2022; McLeod, 2021).
- **Sexual Orientation and Gender Identity (SOGI)**. As defined by U.S. Census Bureau (2021), this study will follow the same language in the interview questions as the Current Population Survey (CPS). For sexual orientation, the choices will be male, female, transgender, or none of these. For gender identity, the choices will be gay or lesbian, straight, that is not gay or lesbian, bisexual, something else, and I don't know. The CPS started asking participants about their SOGI in July of 2021 (File & Lee, 2021). The language of SOGI is continually evolving as is science about identity and gender. The most current language, as defined by US Census Bureau (USCB, 2021) will be used.
- **Sexism.** Discrimination based on sex can be overt or subtle. To the person on the receiving end, it is very real. In this study, the definition used is from Klonoff and Landrine (1995), who stated, "Sexist events are inherently demeaning, degrading, and highly personal; they are attacks upon and negative responses to something essential

about the self that cannot be changed: being a woman" (Klonoff & Landrine, 1995, p. 442). They refer to these experiences as "sexist events" (p. 441).

- **Standard Occupational Classification (SOC).** The SOC Policy Committee provided a recommendation to the Office of Management and Budget (OMB) for a classification system based on the breakdown across the following professions and domains: a) Science, Engineering, Mathematics, and Information Technology Domain, under which Life and Physical Science, Engineering, Mathematics, and Information Technology Occupations and Social Science Occupations reside and b) Science and Engineering-Related domain where Architecture Occupations and Health Occupations reside (U.S. BLS, 2018).
- **STEM**. An acronym which describes Science, Technology, Engineering, and Math disciplines. It was coined in 2001 by Judith Ramaley from the NSF (Teaching Institute for Excellence in STEM, 2010). This study leverages U.S. BLS's STEM occupations, and they are "computer and mathematical, architecture and engineering, and life and physical science occupations, as well as managerial and postsecondary teaching occupations related to these functional areas and sales occupations requiring scientific or technical knowledge at the postsecondary level" (U.S. BLS, 2022, Table 1.1, footnote 2).
- **Underrepresented Minorities.** Underrepresented minorities include individuals of races or ethnicities whose representation in STEM employment and Science and Engineering education is smaller than their representation in the U.S. population (NSF, 2021). This includes Blacks or African Americans, Hispanics or Latinos, and American Indians or Alaska Natives (NSF, 2021).

Chapter 1 Summary

Chapter 1 introduced the topic of this study, Women in STEM Success Strategies and Barriers. The background and historical context section provided data showing that the participation rate for women in STEM is still relatively low and has remained flat over decades, impacting societal and economic growth for women. The lack of participation by women can be attributed to many factors, which begin in a girl's early education and flow through to college. Once in the workforce, they experience a lack of support, lack of role models and sponsors, and continued discrimination and harassment in STEM fields (Zheng & Weeden, 2023). Those women who persevere through academia with STEM majors attrit at double the men's rates and leave the workforce prematurely (J. Moss, 2019). Attrition from high-paying STEM jobs (U.S. BLS, 2022) robs women of the opportunity to secure their financial future and independence. This study examines success strategies despite the noted challenges and teases out additional barriers from seasoned STEM women. The off-ramps at various points deplete the STEM field of talent and diversity, proven to be accelerators for the economy (Fayer et al., 2017). This study aims to enlighten the next generation of women based on the lived experiences of women in STEM.

There are four research question, two of which focus on challenges and success strategies. Research Question 1 seeks to understand challenges, from which barriers are expected. Research Question 2 explores how the participants overcame them, suggesting success strategies. Research Question 3 seeks to understand how women in STEM measure their career success and Research Question 4 provides the participants an opportunity to share their lessons learned with the next generation of women in STEM.

An outline of the Literature review was introduced in Chapter 1 and will be enumerated in Chapter 2 to support the building of the interview questions. The leading research topics for the Literature Review are harassment and discrimination experienced by women in STEM, the lack of role models and sponsors, the gender pay gap, the motherhood penalty, the cost of providing free labor for childcare and eldercare, and the impact to companies with benefits which support women in STEM, resulting in their retention.

Chapter 1 also focused on the data analytics challenges which must be overcome by researchers due to variations in reporting of STEM demographic, household, and industry data (A. Watson, personal communication, July 6, 2023). By having a baseline understanding of the data, critical errors and false assumptions can be avoided. The assumptions and limitations of the study were listed, as were the commonly used terms with their definitions.

Several frameworks will support this study. They are Appreciative Inquiry, which follows the five principles of Define, Discover, Dream, Design, and Destiny (Barrett & Fry, 2005; Cooperrider & Whitney, 2005). In addition to Appreciative Inquiry, Feminist Theory will be leveraged, which will guide the researcher (Friedan, 1963; hooks, 2000; Steinem, 1969). Feminist theory ensures systemic sexist biases are noted and overtly stated within the lens with which the study is conducted.

Chapter 2: Literature Review

Introduction

Chapter 2 is organized in the chronological order that a woman experiences STEM fields: from a young girl in elementary school, through high school, to college, to becoming a seasoned STEM professional. Not all experiences are universal for all girls and women. However, Chapter 2 highlights the challenges some face at these junctures based on the available scholarly data. The goal in Chapter 2 is to share the contributing factors to persistence and attrition for young girls to mature women from experiences in STEM academia to STEM fields. Chapter 2 also highlights successful best practices where women have been able to find their voices and confidence working in STEM fields. The financial and intrinsic rewards of staying in STEM professions are clear (E. Cech et al., 2011). Chapter 2 is an opportunity to canvas the body of knowledge related to the retention of girls' interests in STEM topics and mitigation strategies deployed by educators to maintain girls' interests in giving STEM classes a try and staying with STEM majors.

As young women enter college, Chapter 2 highlights the additional challenges they face when exposed to discrimination and harassment by male students and teachers (Aycock et al., 2019). Further, there is a lack of female academics to act as role models (Krebsbach, 2022), and a drop in confidence is experienced by feeling a lack of psychological safety (E. Cech et al., 2011). If they commit to STEM majors, as often many women do not (Corbett & Hill, 2015), they find themselves in the workforce facing further challenges such as the gender pay gap (Korn et al., 2022), sexual harassment (Mattheis et al., 2022), discrimination (Funk & Parker, 2018), absence of mentors and sponsors (Marshall, 2022), and Imposter Syndrome (Clance & Imes, 1978). Chapter 2 discusses what corporations can do to support their female employees, strategies such as designing for flexible and remote work (de Laat, 2023), strong ERGs (W. M. Green, 2018; Welbourne et al., 2015), and generous maternity leave, as almost half of women do not return to their STEM jobs after having or adopting a baby (E. Cech & Loy, 2019). Leadership characteristics and leadership challenges will also be enumerated in Chapter 2. These challenges include being sidelined for promotions (Bloodhart et al., 2020) and experiencing ageism (Weir, 2023).

Chapter 2 will review the past 50 years of STEM education in the United States as other countries continue to dominate in STEM education while some slip further behind (Herman, 2019). One of the primary education pivots in the United States, Common Core, will be reviewed with a critical lens to see if it has been effective as a strategy to make American youth college-ready (Common Core State Standards Initiative, 2010).

Finally, the post-COVID-19 impact on women in the workforce is discussed along with United Nations Sustainable Development Goals #5 and #8 (2015), which target gender equality and decent work and economic growth. Without women thriving in their workplaces and homes, society's ability to innovate is shortchanged by half its population living below their full potential. Diverse companies and organizations that focus on diversity outperform companies without fully representative leadership of their populations (V. Hunt et al., 2015). As a society, we need all of our human resources deployed on the significant challenges faced by the planet.

Review of Education Systems in Support of Improving STEM Outcomes

America's interest in doing well in STEM fields and academia originates from realizing that its students needed to catch up to the U.S.S.R in math and science (Flesch, 1955, 1981). This enlightenment arrived in the late 1950s following the post-Cold War period and the Space Race (Steeves et al., 2009). From then on, American educators, politicians, parents, and scientists have been concerned about college students' poor performance and lack of preparedness, especially the underserved (Conley, 2010; Lane et al., 2020; Pew Research Center, 2015). Data shows that American youth often end up in college not ready for math and science subjects (Frischmann & Moor, 2017; Varlejs & Stec, 2014; Venezia & Jaeger, 2013). Paradoxically American universities offer some of the best STEM educations in the world (Herman, 2019). Researchers have been looking into this gap for decades, knowing that a large part of the latest technology, such as Artificial Intelligence and Quantum Mechanics will require a firm grasp of mathematics (Colletti, 2023; Ersozlu et al., 2023; Kuenzi, 2008; J. Piaget, 1964; Xu & Ouyang, 2022). Policymakers have been advising US leadership on guidelines and principles to overcome this critical exposure that some say is a national security risk (Herman, 2019; President's Council of Advisors on Science and Technology, 2012).

In comparing math and science students' performance across the 35 Organization for Economic Cooperation and Development (OECD) countries, the US ranked 30th in math and 19th in science (Desilver, 2017). Meanwhile, a large proportion of top American universities continue to operate with budgets in large part funded by international students, especially in STEM fields (Cantwell, 2015; Herman, 2019). For example, Harvard, MIT, Princeton, and others typically have 70-80% non-U.S. residents as their students in most STEM fields, such as electrical engineering (National Science Board, 2018). Many of these graduates take their knowledge back to their home countries, sometimes due to convoluted immigration policies in the United States, which deprives the United States of their talents (X. Han et al., 2015). Foreign universities have been improving their education to keep their human capital within their countries (Freedman, 2010). Most science and engineering (S&E) degrees awarded worldwide come from China and India, who produce almost 50% of science and engineering degrees worldwide (Committee on STEM Education, 2018). According to the Committee on STEM Education (2018), the United States produces only 10% of S&E degrees which has been the trend from 2003-2018.

As policymakers look for the root cause of lower US degrees conferred, researchers reflect on several pivotal changes in the American systems of teaching STEM, specifically math (Holmlund et al., 2018). New Math was introduced in 1965 as a brainchild of accomplished math minds of the time and was funded by the NSF (Loveless, 2021a). It was a complete rewrite of how math had been taught in reaction to concerns about the United States falling behind in innovation and technology post World War II. New Math baffled parents and teachers alike due to its complexity and abstractness, as it focused more on theory and less on application (Klein, 2003; Loveless, 2021a; Philips, 2014). Subsequent attempts like the "New New Math" also fell short of their aspirations for revamping math education (Herrera & Owens, 2001).

Scholars have been dissecting how one learns math most effectively for decades to no avail, with the most recent data from National Center for Education Statistics (2023) reporting that 13-year-olds have the lowest math scores since 1990 (Z. Yang et al., 2021). Experimental integration of STEM into non-STEM fields such as architecture, art, history, and other humanities fields has also been tested with mixed results (Carrell et al., 2020; El Bedewy et al., 2022; Hughes et al., 2022; Pratama et al., 2022; Simpson et al., 2023). Education systems such as the Montessori Method have been studied to see if they achieve better STEM results (Archer et al., 2010; Çakir & Altun-Yalçin, 2021; Montessori, 1912). The outcome of these focused studies on the Montessori Method and its impact on STEM performance shows that there is a slight improvement for kids before sixth grade in math and science scores, but the effect wears off by high school (Lillard, 2018; Ruijs, 2017). More recently, student-centered teaching techniques such as project-based learning have caught the interest of education researchers (Drobnic, 2023). Project based learning and inquiry-based learning methods have offered hope to educators by resulting in better learning particularly for underperforming students (S. Han et al., 2015).

Common Core

The most recent evolution of improving math and English outcomes has been the roll-out of Common Core (Common Core State Standards Initiative, 2010). It is intended to clarify, for each grade, what success looks like for English language arts and mathematics. Common Core was supposed to align parents and teachers in expectations, leading to students who could compete and contribute to the global economy (Common Core State Standards Initiative, 2010). Though brilliantly constructed, the execution and adoption of Common Core created confusion and pushback by the states (Greer, 2018). Common Core's success has come under scrutiny (Loveless, 2021b). Critics say that it is challenging to dictate standards from the top which have thwarted the teacher's discretion to teach according to the class they have. Proponents say Common Core sets high standards, and children will catch up (Loveless, 2021a). Ultimately, forty-one states adopted Common Core, while some decided to challenge it in court (Herman, 2019). Critics of Common Core have deemed it confusing and hard to implement; some have said it needs more time, and others believe it has failed (Loveless, 2021b; Polikoff et al., 2020). Hodge et al. (2020) have scrutinized the references used to argue for the Common Core and have discovered that one-third of the 59 claims in Common Core do not marry with their citations. Since Common Core only covered English language arts and mathematics, a similar set of science standards, Next Generation Science Standards, was released in 2011.

As to their effectiveness, the data needs to be more conclusive regarding Common Core or its predecessor, No Child Left Behind (No Child Left Behind [NCLB], 2001). Every Student

Succeeds Act (ESSA) also went into effect in 2015. It calls out the importance of engineering and technology education, including computer science, for pursuing STEM degrees (Every Student Succeeds Act, 2015; National Science Board, 2018). These legislative acts are well-intentioned, but compliance by teachers must improve if they are going to have the intended impact of increasing children's learning (Opfer et al., 2018). In a teacher's survey conducted by the Rand Corporation, only 16% of elementary math teachers were using Common Core Standards (Opfer et al., 2018). In secondary math, just five percent of the teachers surveyed used Common Core Standards (Opfer et al., 2018). The positive outcome from that survey is that the students performed better on their tests if their teachers did adopt Common Core. Some practitioners say to stay with it and enhance it (Walker & Sherman, 2017).

One point that most educators do agree on is that math readiness is a critical skill for STEM success, including studies that analyze the role of anxiety in math performance (Clements & Sarama, 2023; Daker et al., 2023; Hilz et al., 2023; Levitt, 2022). Educators continue to test different methods for teaching students STEM skills, such as partnering with science educators and STEM professionals in STEM industries to create context-based curricula (Kostøl & Remmen, 2022). There are also hopeful formulas, such as STEM charter schools, project-based learning (PBL), and all-girls STEM schools (Hong et al., 2023; Sahin et al., 2017; Siani & Harris, 2023). These methods have shown varied success. Project based learning has shown to be effective (S. Han et al., 2015). All-girls schools have shown mixed results whereby the all-girls attendees do better when they self-select to attend a one-sex school, but do no better when they are randomly placed in an all-girls school (H. Park et al., 2018). The speculation is that without boys distracting the girls and the girls competing for the teacher's attention, the girls should outperform their female peers from mixed gender schools (Doris et al., 2013).

STEM Girls: The Early Years—Kindergarten Through High School

Interest in STEM topics can start at a very young age. With a balance of parental involvement, and positive environmental factors such as highly involved teachers, all students have the potential to be drawn to STEM subjects (Mitchell et al., 2022; Perna & Titus, 2005). However, for young girls, identifying as an engineer has an even greater chance if the curriculum is designed to cultivate their curiosity (McLean et al., 2020). Play problem-solving is just one example of how children are engaged in STEM topics (B. L. MacDonald et al., 2022). In this section, a child's early years through high school are discussed with research that leans towards a variety of factors coming together to maintain the interests of young girls and women. Developing their interest early in life is vital to sustaining it even when challenges arise in their later years (P. K. Hunt et al., 2021).

When it comes to play and electronics as a teaching tool, T. Miller (2018) proved that Kindergarteners can learn math by leveraging technology such as iPads, but use of technology is optional. In her study, the children gravitated towards entertainment-based applications, which also taught math using games to hold their attention (T. Miller, 2018). The use of technology in the classroom has been studied extensively to see whether it enhances or takes away from learning STEM (Baroody et al., 2022; M. Burton et al., 2022; Ward et al., 2022). Once the children learn the technology, it does not significantly impact learning (Bebell et al., 2012). Traditional teaching efficacy, which includes the teacher's disposition, planning for curriculum, choice of play, and the teacher's positive sentiment towards STEM, is still very much necessary (Baroody et al., 2022; M. Burton et al., 2022; Ward et al., 2022).

By the time the child is in middle school, if she has been exposed to STEM role models in her early years, her interest will continue to grow in pursuing a STEM career as her self-efficacy and confidence are higher than peers without role models (Christensen & Knezek, 2017; González-Pérez et al., 2020; Guenaga et al., 2022). Girls as early as 5th grade believe they are inferior in math and science subjects (Weinhardt, 2017). Keeping a girl's interest from middle school to high school in STEM is necessary as that is one of the off-ramps where girls lose interest (Sadler et al., 2012). At this juncture, role models, such as their teachers, continue to positively impact the girls' opinions of STEM (Ekmekci & Serrano, 2022). STEM-based summer camps and tutoring are other methods to keep a girl's interest (Fernández-Martín et al., 2020; Merritt et al., 2021; Roberts et al., 2018). The presence of role models has multiple positive effects whereby not only are gender stereotypes negated, but also positive sentiments about math and careers in STEM are increased (González-Pérez et al., 2020). Of course, the ultimate role models are the parents (Siregar et al., 2023).

Parental Involvement

According to Marcus et al. (2021) parental involvement is significant. Their study showed that a simple STEM-building activity in a museum between parents and their children increased retention of what they had learned by 77% when tested a week later at home. Indeed, this is even more important for underrepresented youth, whose parental involvement significantly differentiates 9th graders who become more confident 11th graders. This milestone predicts a higher grade-point average in STEM (Dotterer, 2022). Amarnani et al. (2018) demonstrated that the child's career choice, STEM persistence, and self-esteem were indirectly a result of parental engagement. Svoboda et al. (2016) related career choice to parental education level, where the higher and closely aligned to STEM, the more likely the child would pursue a career in STEM. Studies show that even viewing movies with lead women in STEM roles encourages young girls to see themselves with futures in STEM (Kool et al., 2022; B. Yildirim et al., 2021).

Parents can support their students in STEM (Epstein et al., 2009). Their support can produce excellent outcomes by putting resources towards their children's education. One such example is tutoring (Batz et al., 2015). Youth are often discouraged early in a class when they feel that they don't understand the content. Peer tutoring can raise grades and student confidence (Batz et al., 2015). Early intervention strategies, such as assigning a tutor after the first poor performance on a test, increases overall performance (Deslauriers et al., 2012). Those who opt-in to tutoring earn a third of a grade better than those who do not (Hockings et al., 2008). Tutoring has also shown to improve student engagement, which drops for middle school girls (Almeda & Baker, 2020; Sheily & McCarthy, 2019). Factors such as chaos at home, poor parenting, and lack of self-regulatory skills are all signs of disengagement (Garrett-Peters et al., 2019).

Another excellent way to bolster and encourage STEM persistence is enrollment in summer programs, where the stakes are low and learning occurs easily with peers (Roberts et al., 2018). A simple robotics summer camp increased career interests, especially in engineering, by the end of the program (Tekbıyık et al., 2022). Summer camp is not just for the younger girls. A study of high school girls attending a 10-day camp at a university increased many dimensions of STEM retention, such as understanding of STEM fields, interest in research, and positive perception of STEM by engaging with role models (Nation & Muller, 2023). These all aggregate to higher confidence for the young women in high school who are highly socially conscious (Harter, 1990).

Belongingness and Environmental Factors

The next factor to consider within the primary education years is the environment of adolescents, where the belongingness they feel within that environment creates better learning outcomes (K. Allen et al., 2022; Arslan, 2021). In a study conducted by Master et al. (2016), researchers identified two classes of high school students; one group was from a private school, and the other was from a public school. Students were placed in various physical environments while researchers measured participants' opinions regarding computer science. In one classroom, dark paint, masculine decoration, and "nerdy" artifacts such as game consoles and electronics comprised the décor. In these classrooms, the girls were disinterested in enrolling in an introductory computer science course even when studies show that boys and girls have little difference in STEM skills (O'Dea et al., 2018). Their interest in enrolling in a computer science class increased when presented with a classroom with colorful posters and neutral artifacts, such as a coffee machine (Master et al., 2016). The researchers then associated this data with the questions they asked about belongingness. Again, the data showed that girls disassociated from computer science if they felt they did not belong in that environment (Master et al., 2016).

Attendance in a single computer science class increases the rate of participation in computer science as a major (Gale et al., 2022; Gottfried & Bozick, 2016). A girl's interest grows by 23% if they have their father's support and 27% if they have their mother's support as parents who actively promote STEM either by working in STEM fields or by showing interest in STEM raises the girls' habitus, sentiment and capital towards STEM (Crossley, 2001; Hite & Spott, 2022; Kesar, 2017, 2018). Related to these findings, the gender of the instructor, if female, further increases a girl's interest in computer science, especially where gender stereotypes are present (Master et al., 2014). Masculine gender stereotypes discourage girls' interest in STEM by decreasing their self-efficacy (Galano et al., 2023).

Black and Latina youth have different experiences in middle and high school regarding STEM, which should be taken into consideration by educators and policymakers to account for their needs (Park-Taylor et al., 2022). Girls are subconsciously choosing their career paths as early as sixth grade by looking at negative science stereotypes which portray STEM careers as boring and void of people, thus less desirable (Luo et al., 2021). As discussed above, many factors contribute to a girl being interested in STEM fields, such as their teachers, parents, other role models, their environment, and opportunities such as having tutors, joining after school clubs or attending summer camp (Batz et al., 2015; Blanchard et al., 2023; Kesar, 2017, 2018; Master et al., 2016; Nation & Muller, 2023). An essential factor is to ensure girls feel a sense of belongingness and inclusion, especially if they are a member of an underrepresented community (Mulvey et al., 2022, 2023).

A significant decline in STEM interests occurs between elementary school and high school in girls. In fourth grade, both sexes reported similar interests in STEM. However, that number reduces to 59% for girls and 70% for boys by the time they graduate high school (Cunningham et al., 2015; Yavuz & Yildiz Duban, 2021). As early as age six, stereotypes have crept in to make girls think less of STEM and less of their intelligence (Bian et al., 2017; Master et al., 2017). As such, it is critical to build STEM capital via positive STEM experiences from kindergarten to high school (S. M. Cohen et al., 2021). Piaget (1971) believed that as early as age eight, children have less flexibility to combat stereotypes. Children still have the capacity to apply a growth mindset to combat these stereotypes if active interventions are deployed (Law et al., 2021).

The College Experience

When a young woman enters college with a STEM major, she can face threatening environments such as discrimination by faculty and male peers (J. Park et al., 2020). The absence of female role models, such as professors and female peers, also creates a threatening environment and lowers self-esteem (Casad et al., 2019; Dajani et al., 2021; Hockings et al., 2008; Smith et al., 2009; Spaulding et al., 2020). Research showed the psychological ripple effect created by unsafe cultural climates. Casad et al. (2019) observed unsafe environments lowered self-esteem and eventually led to attrition from STEM fields. The threat is reinforced when the female student finds herself among the few women in a STEM classroom (M. C. Murphy et al., 2007).

The female college freshman finds herself grossly unprepared for the rigor of STEM fields and discouraged by her lack of academic readiness (American College Test (ACT), 2022; Rask, 2010). Academic rigor in college versus curriculum offered in high school is one of the reasons that 35% of students change STEM fields before they graduate (National Center for Education Statistics, 2017). The rate is even higher for mathematics majors, where 52% of students change majors (Leu, 2017). This may be due to poor performance in an entry-level calculus class, which increases the desire for female students to quit STEM by one and a half times that of men (Ellis et al., 2016). In 2022 only 16% of students met the STEM benchmark requirements, down from 19% in 2021 (ACT, 2022). This indicates that most students need to prepare for a STEM college curriculum.

According to the US Department of Education, 28% of college students are assigned STEM fields, and 45% change majors or leave STEM before graduation (X. Chen, 2013). Then, there is an attrition of 56% of students in the next six years. Of that 56%, half leave college entirely, and the other half switch to non-STEM majors. Early indications of poor performance in introductory STEM majors show that it might lead to the weeding out of students (Barr et al., 2008). Rather than using introductory classes as a gate for further progression, they should be used to recognize a lack of readiness. Institutions should deploy immediate mitigation strategies such as tutoring and greater faculty support for those students struggling right from the first year (Mervis, 2010).

Some resources, such as women's affinity groups, provide knowledge and support throughout a woman's college experience. Some examples are the American Association of University Women and Black Girls Code. Most colleges have women's support centers and are affiliated with professional organizations. This increases a strong sense of belongingness, supporting persistence in STEM majors (Casad et al., 2018). A more personalized relationship with peer mentors has also been shown to increase women's persistence in STEM by double that of men who receive mentoring (Spaulding et al., 2020). Alongside peer mentoring is tutoring, which has also shown to be a very effective way to support and retain women (Toven-Lindsey et al., 2015). The benefit is not just to the student being mentored but also to the mentor, which might be one of the reasons female mentors outnumber male mentors 58% to 42%, even in majors where men outnumber women (National Academy of Sciences, 2007). Women mentors report that an outcome of their mentoring is to see their confidence being raised (Philipp et al., 2016). Students, male and female, who were mentored by female mentors reported being more prepared for their STEM careers (Moghe et al., 2021). However, male mentors at the highest levels in academia have shown to mentor more male students than female students in the life sciences, leaving another gap in women getting the support they need to persist (Schwartz et al., 2022).

An option to bridging the mentoring gap is Living Learning Communities (LLC). Studies have shown that LLCs are also very effective in immersing female students in a STEM culture (Maltby et al., 2016). These communities offer students a one-year immersive program with other female STEM students and have been shown to improve female STEM persistence. The women’s college environment, just as it did in the aforementioned high school students’ study (Master et al., 2016), plays a huge role in women’s sense of belongingness (McCarty et al., 2022). Even more pronounced is belongingness and intersectionality of representation, where women of color and underrepresented minorities feel a greater sense of connection when intentional belongingness is factored into their STEM education when they see others who look like them in STEM (Rainey et al., 2018). The need for belonging can also be tied to domain-specific majors such as physics, where women’s representation is low (K. L. Lewis et al., 2016). In the case of female physics students, K. L. Lewis et al. (2016) found that feeling a lack of belonging and intention to persist were related; the less the belonging, the more likely to leave the major.

The Role of Female Faculty

The role of female faculty in providing a sense of psychological safety and allyship is critical and can increase the sense of belongingness, hope, and persistence in a female student (Hansen et al., 2023; Solanki & Xu, 2018). It has been a long-held insight that greater female faculty representation and their positive interaction with female students increases STEM retention of female students (J. Park et al., 2020; Robst et al., 1998). Conversely, poor faculty-student relationships, especially of underrepresented minorities, drive more significant attrition from STEM fields (J. Park et al., 2020). Faculty trained in creating inclusive spaces see student success in STEM (O’Leary et al., 2020). A strategy for creating inclusive spaces is to increase empathy in student and teacher interactions (Ghazy et al., 2019). Empathy plays a significant role when students sense it from their faculty and peers, and in women has shown to increase math proficiency (Ghazy et al., 2019; Ortiz-Martínez et al., 2023; Tikkanen et al., 2022).

Female faculty also face retention issues as they are often sidelined for the tenure track and less likely to be published, hold high-level STEM leadership positions, be listed as first authors, be awarded fellowships and grants, or be asked to speak at prestigious STEM events (Beede et al., 2011; Holman et al., 2018; Huang et al., 2020; Isbell et al., 2012; Ledin et al., 2007; O'Dorchai et al., 2009; Wenneras & Wold, 1997). Female faculty are not credited for their work (Ross et al., 2022). Being a female faculty member in STEM mirrors what female students experience; the lower the number of fellow women, the greater the discrimination and the more challenging the colleagues (Gregor et al., 2023). Female faculty members in various positions and levels of tenure experience microaggressions such as sexual objectification or being silenced and demeaned (Y. Yang & Carroll, 2018). Women faculty in STEM comprise a small number of professors: 46 % of assistant professors, 38% of associate professors, and 25% of tenure track professors (National Science Board, 2016). One of the reasons for the low numbers is that female faculty face incivility and leave STEM earlier in their careers (Miner et al., 2019). They also need more support, as only 30% of college and university presidents are female (Melidona et al., 2023).

In a study conducted by McCullough (2020), over 50% of female STEM leaders stated that they had encountered barriers such as gender bias and microaggressions upon entering STEM fields. Twenty-three percent had experienced sexual harassment (McCullough, 2020). Remarkably, people build resilience against the barriers they face, which prepares them to face the same or similar barriers (G. King & Rothstein, 2010). However, the "paradox of power" is the phenomenon where sexual harassment increases as a woman's organizational authority increases. The chance of sexual harassment increases as a woman gains more organizational power, such as earning a place in leadership (Folke et al., 2020). The female leader's power is no match for the informal power that a male subordinate might feel he has (McLaughlin et al., 2012).

Male Allies Needed

Allyship, mentorship and sponsorship are often discussed together for supporting women in the workplace and in academia (Silver, 2023). There is a difference in their definition and the actions of each. According to National Academies of Sciences, Engineering, and Medicine (NASEM), mentors are more seasoned individuals who help hone one's craft (2019). Their role is to teach the woman in STEM the way that a job gets done. A sponsor can be a mentor, but their biggest differentiator is that they advocate for the woman in STEM when she is not in the room. This could be in the form of ensuring she gets the same resources, benefits, and opportunities as those in the dominant group. Allies are people from the dominant group who use their privilege to elevate those from non-dominant groups such as women in STEM (Arif et al., 2022; Bishop, 2002).

Given some of the barriers discussed in academia, female students and faculty need male allies who have a clear understanding of gender issues to step in to support both cohorts (Nash et al., 2021; Shapiro et al., 2022). Active allyship ranges from stopping bullying when one observes it to speaking up and being a sponsor when one sees a woman getting sidelined for promotion, as they tend to in academia after starting their families (M. A. Mason & Goulden, 2002; C. O'Connell & McKinnon, 2021). Allyship is derived from power, which is overwhelmingly possessed by male leaders in academia, as they hold an overwhelming 70% of academic leadership positions, such as the university president's roles (Shapiro et al., 2022).

Male leaders are still the majority in charge of universities (Silbert et al., 2022) with only 22% of women in university leadership positions, it is often male leaders who drive decisions and policies by their sheer number. Thus, men's viewpoints may drive many of the colleges and universities’ policies. An example of an important policy within universities is class size, which is one of the markers of female STEM success. The higher the class size, the lower the outcomes for women (Ballen et al., 2019). Though entry-level classes may to be large, male and female allies in academia can design curricula and structure their classes to allow for small group interactions, which has proven to be more encouraging for asking and answering questions (Smith et al., 2009). Male students do not exhibit this hesitation, as they have a higher perception of their intelligence and confidence in their questions (Cooper et al., 2018). Women’s confidence to ask questions increases when the professor is female, making it critical to staff large classes with female professors (Hoffmann & Oreopoulos, 2007). Confidence rises if the teacher’s assistant is female, even if the professor is male (Cotner et al., 2011).

To increase male allyship, men need to understand that they hold a position of power. The term ‘ally’ is defined as “A person who is a member of the ‘dominant’ or ‘majority’ group who works to end oppression in his or her personal and professional life through support of, and as an advocate with and for, the oppressed population” (J. Washington & Evans, 1991, p. 195). The ally stands to risk their power and privilege: as such, it is essential to understand the risks to their power, teasing out their discomfort with being seen as someone who possesses power (Shapiro et al., 2022). On the positive front, an ally can gain stronger interpersonal relationships across a larger faculty span (Warren et al., 2021). Allyship is an active process whereby the ally does something to support the woman versus just being a listener (Nash et al., 2021). The ally steps in when the woman cannot both advocate for herself and break down systemic barriers put in place by generations of institutional sexism (Sidelil et al., 2023). The ally works from the inside to change the institutional culture, which is necessary for women to succeed (Prasad et al., 2021). Persistence by female students and female faculty is good for the overall student body, as research has shown that the presence of both increases overall academic performance (N. A. Bowman et al., 2022). Institutional sexism does not stop in academia, but if combatted, it can make for a stronger and more focused STEM student body.

College success for students and female faculty depends on a combination of fellow students as peer mentors, allied faculty, solid high school preparation, and a sense of belonging within one's domain subject (Arslan, 2021; Cheryan et al., 2009; Dortch & Patel, 2017; DuBow & Ashcraft, 2016; Freedman et al., 2023). Female faculty need support and interventions, such as peer mentoring, to support their students (Dajani et al., 2021). Mentoring is especially critical for underrepresented minority female faculty, who are likelier to leave academia (Petersen, 2020). Unfortunately, attrition in STEM fields is quite high, ranging from 78% in math majors to 62% for engineering and technology majors (X. Chen, 2013). For non-binary and transgender students, compared to their cis hetero colleagues, a 10% drop in STEM attrition is noted (Maloy et al., 2022; Sansone & Carpenter, 2020). For those who graduate with STEM degrees, such as engineering, and move into their professions, other organizational challenges lay ahead of them; thus, the more allies one can line up, the better (Fouad et al., 2012; Li et al., 2023).

Community Colleges

This section will discuss the pros and cons of attending a community college for two years and then transferring to a four-year university. Community colleges have a unique place in the STEM education system yet are often lumped into the same solutions as four-year universities (Varty, 2022). Community colleges offer certificate programs, associate degrees, and credit toward four-year university majors. According to the NASEM (2016), community colleges often prepare students for the "T" which is the technology segment of STEM occupations that are a feeder into information technology technician roles. Community college students represent one-third of all undergraduates (National Center for Education Statistics, 2019). With their open admissions policies, community colleges are an attractive solution in helping to bridge the learning gap between a student's high school lack of preparedness matched against high expectations of a four-year university (Bottia et al., 2020; Long & Kurlaender, 2009; X. Wang et al., 2019; Xie et al., 2015).

Community colleges provide a bidirectional path to support students by way of reverse transfers if students find a four-year college to be either financially or educationally not right for them (Salzman & Van Noy, 2014; X. Wang et al., 2017). Twenty-five percent of community college students in a STEM major continue to earn their degrees in a four-year college (Van Noy & Zeidenberg, 2014). Community colleges provide accessible and cost-effective means to many students, especially if they did not receive the necessary core education for STEM majors in fields of study such as math and biology (R. Cohen & Kelly, 2020; Cotter et al., 2022). Data from the National Center for Education Statistics (2022) shows that when students see college as affordable, they are more likely to attend college. Community colleges are also a great way to earn units for entry-level STEM classes, which can be counted towards a four-year university degree through a transfer (Fletcher & Carter, 2010; D. L. Jackson et al., 2013).

The study of community colleges has been a topic of interest for scholars for decades (Doyle, 2009; Perez-Felkner et al., 2019; Townsend & Dever, 1999). With over 1038 community colleges costing a fraction of four-year universities in the United States, they have been a staple of education (Community College Research Center, 2021). There are many schools of thought on their usefulness. Some scholars believe that community colleges have unrealized potential to help democratize a college education and are a transfer pathway to four-year universities (Bahr, 2017; Blaney, 2022; Dinh & Zhang, 2021; C. A. Evans et al., 2020; Ghazzawi et al., 2020; Y. L.

Zhang, 2022). Another set of scholars (Brint & Karabel, 1989; Gauthier, 2020) believe that attending community college will derail a student from pursuing their desired degree, given their low completion rates; 11% of the 77% of community college students who started with aspirations for a four-year degree can reach their goal (Working Group on Community College Workforce Education, 2020). Other studies call out community colleges' critical role as safety nets, especially for disadvantaged students who may have dropped out entirely (Kalogrides & Grodsky, 2011). Harvard authors, Fuller and Raman (2022), researched why community colleges produce students who are not ready for middle-skill vocations. Examples of middle-skill vocations are clerical jobs, jobs in construction, and some health tech jobs (Holtzer & Lerman, 2007). Middle-skill vocations need higher than high school level schooling but less than a four-year degree. Fuller and Raman (2022) found that there is a gap between what employers need and what faculty are teaching.

When assessing whether the community college path is the right decision for an individual student, they must consider their income, their emotional and educational preparedness for direct entry into a four-year university, and the level of support they expect to need (Ashcroft et al., 2021; Pechac & Slantcheva-Durst, 2021). For underrepresented minorities and women, the community college path provides an opportunity to develop a STEM identity (S. M. Jackson et al., 2014). At a fraction of the cost per unit, it is also a great way to fund a college degree without the exorbitant prices of four-year college programs (Ginder et al., 2018; Hanson, 2023; Hilmer, 1998; Malcom & Dowd, 2012; Voorhees et al., 2023). According to the NSF (2015), URMs are more likely to belong to families who come from poverty, which makes community colleges an attractive option for persistence. Over 30 states have made community college free or offer students classes at minimal cost for in-state residents (College Board, 2021).

Underrepresented minorities find more support and mentoring in community colleges. They can take preliminary STEM classes to help them shore up their studies, especially in math, which is often the backbone of many STEM degrees (Acevedo et al., 2021). Lack of success in remedial math courses is a factor in dropping out or changing out of STEM majors (R. Cohen & Kelly, 2020).

Achievement gaps exist between community college students and their counterparts in four-year universities (Varty, 2022). However, community colleges seem to do a better job of increasing self-efficacy and are generally attended by more diverse populations (Meza, 2020; Thompson & Verdino, 2019). Self-efficacy is difficult to measure by itself, however it has proven to contribute to girls feeling inadequate in math, and math is often used as a proxy for sentiment towards all STEM subjects (Zander et al., 2020). Zander et al. (2020) state that there are three sources of self-efficacy in mathematics. They measured “mastery, social persuasion in the form of positive feedback and encouragement from others, and exposure to positive vicarious experiences” (p. 2), to discover that girls typically self-report lower self-efficacy even when they have the same competence level as their male peers. Self-efficacy is the measure by which one predicts their ability to do something in the future and when it comes to math, girls operate under the assumption that they will fare worse than they actually do. Social persuasion by parents, peers, and teachers is another way self-efficacy is measured (Ahn et al., 2017; Won et al., 2017). In that case, a student looks to those around them for queues about their ability and then subconsciously decides if they have high or low self-efficacy based on the feedback loop they are receiving. Community colleges provide students the opportunity to see themselves as competent college students, which raises their overall self-confidence and self-efficacy (Bickerstaff et al., 2017).

Community colleges are promising for many immigrant families and first-generation students due to the support systems in place (Samanta, 2018). Finally, community colleges have a generous open admissions policy, which broadens access and allows enrollment to all students if they have a high school diploma (Hanauer et al., 2022).

Women in the Workforce

Despite their hard-earned degrees, of the 50 million STEM-educated workers, 14 million, 28%, are working in a STEM job (American Community Survey, 2023). The numbers are even worse for those with degrees in engineering, who are 14% of those employed in STEM fields but hold STEM degrees (American Community Survey, 2023). When reviewing the data by gender, women’s numbers shrink as they are 34% of those employed in STEM occupations (NSF, 2022). Looking at individual professions such as engineering and computer science, the number of women shrink further to 16% for engineering and 26% for computer science (NSF, 2022).

Women’s first challenge is to pass the bias in hiring practices that exists by the predominant group, male hiring managers, who make it challenging for women to enter STEM careers and move across organizations as they navigate their STEM journeys (Enav & Efrat-Treister, 2023). Women are acutely aware of the role that men, especially white men, play in STEM (Dortch & Patel, 2017; Leath & Chavous, 2018). They have already learned this from their undergraduate days (Dancy et al., 2020). This section is a review of the challenges full-time working women in STEM experience.

Gender Pay Gap

The Census Bureau reports on 70 STEM occupations (United States Census Bureau, 2022). Men earn more than women in all but one profession: computer network architect (Martinez & Christnacht, 2021). The gender pay gap is one of the target areas for the United

Nations Gender Equality Sustainable Development Goal #5 (2015). The most recent World Economic Forum report predicted that it would take over 130 years to close the gender pay gap worldwide (World Economic Forum Gender Gap Report, 2023). The gender pay gap is one of the many reasons 60% of women in the STEM workforce feel disenfranchised and leave their professions, even after their investment in earning a STEM degree (X. Chen, 2013; Moakler & Kim, 2014; Pell, 1996; United States Census Bureau, 2019)

The gender pay gap is pervasive in all male-dominated professions, including law and finance and it persists around the world (Alonso-Villar & del Río, 2023; Markovic & Plickert, 2023; Moyser, 2019). The gender pay gap for all industries across all demographics in the United States shows that women earn 76 cents for every male dollar earned (GAO, 2023). However, these numbers get progressively worse for Black and Latina women and will be discussed in the following section (GAO, 2023). Female managers also fare worse than non-managers by earning 71 cents to the male dollar. Additional demographic characteristics such as being married or having children contribute to the gender pay gap, due to the impact of the stop and starts offramps regarding childcare (Rosse, 2018). Single/widowed/divorced women had the highest earnings at 92.4% of men’s earnings, and married with children under the age of 18 had the lowest earnings at 78.4% (U.S. BLS, 2020).

Research by Sterling et al. (2021) suggests that the gender pay gap starts from a confidence gap and begins from the first job out of college when women, especially in computer science and engineering, put themselves on a lower-paying trajectory, impacting their lifetime earnings. Korn et al. (2022) contradicts this finding by reviewing available tax return data for millennial women who attended the same schools and earned the same degrees as their male counterparts, only to start earning less just three years after college graduation (Korn et al., 2022). Even additional education, such as a Ph.D., does not mitigate the gender pay gap, where women still earn 11% less than their male counterparts with the same degree (Buffington et al., 2016). One of the strongest factors contributing to the wage gap is the woman's marital status and whether she has children (Shen, 2016).

Motherhood Wage Penalty

There is a bias against mothers who work outside the home suffering (Mumporeze, 2020). The assumption is that the children are suffering (Mumporeze, 2020). In addition to that, a phenomenon known as the "motherhood wage penalty" (Budig & England, 2001. p. 219) creates a very real financial dent in women's lifetime earnings, as the female PhD pay gap example above showed (Shen, 2016). Surprisingly, the highest motherhood wage penalty is seen in white women with high skills and high wages (England et al., 2016). This cohort is the most likely to take a career break, but given their high educational investment, even a short break takes them out of their financial trajectory (Wilde et al., 2010). Arora and Kumari (2022) discuss necessary policy interventions such as maternity and paternity leave, flexible work schedules, and childcare support to return women to work. Research on the motherhood wage penalty has prompted conflicting theories to emerge. Budig and England (2001) present findings that more skilled women experience higher penalties as they often have their children late and at the peak of their earnings in their career. This costs high-earning, highly skilled women between 21-35% of their lifetime earnings. Low-skilled women return to the workforce at about the same wage where they left (Budig & England, 2001). D. J. Anderson et al. (2003) tied the motherhood wage penalty to a U-shaped relationship with middle-education women realizing the highest penalty and low and high-education women with little difference.

Budig and England's data (2001) showed that ten years later, the difference for low-skilled women was 12% lower wages over their lifetime than their peers who had not had time off; for high-skilled women, that number was 35% lower wages across their lifetime. No matter which study is inspected, all of the research shows that a woman with a child will see a change in her wages, especially if it is in her prime childbearing years, which are her 30s (Goldin, 2014). Even in more egalitarian cultures with long paid maternity leave, such as Denmark, similar outcomes are seen in the gender wage gap due to being a mother (Kleven et al., 2019).

More recently, Pew Research results indicate that the gender pay gap occurs across all education levels, which may indicate that the motherhood component is a critical differentiator for widening the gap (Funk & Parker, 2018). Following an extensive literature review of the gender wage gap from the 1950s to the 2017s, Blau and Kahn (2017) concluded that many factors explain the gender wage gap, including labor unions and their effect in compressing the wage gap. With strong unions also comes the tradeoff of less female participation (Blau & Kahn, 2017). Michelmore and Sassler (2016) reviewed wage data by occupation within STEM and discovered that the STEM wage gap is lower than the overall wage gap, with white women earning the highest among STEM women, 84 cents instead of 77 cents. However, the field that the women majored in and worked in showed even greater insights. For example, there are fewer women in computer science and engineering, and both are on the higher end of wages; with fewer women in those fields, STEM overall sees lower wages (Michelmore & Sassler, 2016).

It is critical that women choose their STEM fields carefully and select ones in high demand and high wages to close the wage gap (Beede et al., 2011). Closing the section on the gender wage gap with a summary of Rotman and Mandel’s (2023) findings on the explained and unexplained reasons for the wage gap: “It is vital to focus more on the institutional and structural factors that prevent women from fully utilizing their skills. Policymakers who wish to target the gender wage gap should, therefore, be aware of the economic consequences of socialization and gender beliefs that account for the low evaluation of women, as well as their education, skills, and occupations" (p. 603).

Absence of Female Role Models

When women do enter their careers, they start to realize that just as it was in college, there are few women in leadership, 25.9%, which makes the pool of seasoned mentors small (United States Equal Employment Opportunity Commission, 2019). The same need for men to be allies, mentors, and sponsors for women exists in the workforce as it did in college (Ayyala & Coley, 2022; Chrisler & McCreary, 2010; NASEM, 2019). With active interventions such as proper mentorship and sponsorship, women have the advocates in leadership that they need, yet they continue to find themselves passed up for promotions (Espinoza & Ferreira, 2022). This phenomenon of being equally capable but unable to advance was coined as the "glass ceiling" by author Marylin Loden in 1978 in answering a question at a women's conference. She later codified it in her books (Loden, 1985).

Women's training programs, mentoring circles, and ERGs are a great way to build networks, learn new skills, and create a sense of belongingness in male-dominated fields (W. M. Green, 2018). There is a positive relationship between sense of belonging and persistence in STEM fields (Hansen et al., 2023; Rainey et al., 2018). Employee resource groups are voluntary groups that gather to support one another. They are usually a union of communities of practice based on race, sexual orientation, ethnicity, or gender (Welbourne et al., 2015). Employee resource groups are ideally a safe space for discussing bias and providing visibility to leadership regarding matters important to the group (Colgan & McKearney, 2012; Nishii, 2013). Employee resource groups allow the group to speak with one voice (McNulty et al., 2018). Ideally, the

ERGs serve as a support system to mitigate attrition and create a sense of belonging and inclusion (Rodriguez, 2021). An example of one of their focus areas might be to work with human resources to increase recruiting efforts for their community (NASEM, 2020; Shadding et al., 2016).

On the topic of role models, one might expect seasoned female leaders to be helping to bring up more junior women (Freedman et al., 2023). However, some studies have examined what is called the Queen Bee Phenomenon / Syndrome (Mavin, 2008), where a female senior leader actively works to sabotage the newer and less seasoned women, thereby causing harm and keeping the latter from progressing in their careers (Derks et al., 2016; Ellemers et al., 2004; Neto et al., 2022; A. Xiong et al., 2022). Kremer et al. (2019) found that when the Queen Bee effect occurs, subordinate women then counteract with the Princess Bee effect whereby the early in career women start distancing themselves from the Queen Bee, and creating an identity that is different than those of the Queen Bee. For example, if the Queen Bee has taken on masculine work styles to survive and be accepted in the male dominated field, then the Princess Bee will take on feminine characteristics and behaviors to distance themselves from the Queen Bee identity. These individualistic survival tactics do little to help the collective female population in the workplace (Sterk et al., 2018).

Microaggressions

Many women experience repeated small or “micro” injustices over time by coworkers, supervisors, customers, and partners (Basford et al., 2013; Fattoracci & King, 2023; García et al., 2021). The term for this phenomenon of doling out subtle insults and diminishment of credibility is “microaggression” (Kim & Meister, 2023; Pierce, 1970, pp. 265–282). When it finally reaches a point where they no longer want to suffer the daily doses of disrespect, they leave the workforce and academia, including STEM fields (Ortiz-Martínez et al., 2023). D. D. King et al. (2023) call this "effortful surviving" (p. 183).

Microaggression was initially coined by Pierce (1970) about the way white people spoke to and about black people. He identified a human behavior that is subtle but insidious over time, and now the term is used when the majority, often white males, slight URMs in "micro" amounts via insults, assaults, and invalidation. Black people report most microaggressions like "anti-Black stereotype expression, racialized role assignment, and interactional injustice" (King et al., 2023, p. 183).

Other communities, such as women, members of the LGBTQIA+, or members of other races and ethnicities, are also recipients of microaggressions (Nadal et al., 2016; Sue et al., 2007; Yosso et al., 2009). An example of a microaggression directed at members of the LGBTQIA+ community would be to question a person if they consider themselves a family with their partner and children (Haines et al., 2018). As people intersect with multiple memberships in minority groups, their experience of microaggressions also increases (Balsam et al., 2011).

Microaggressions and lack of persistence in STEM are related in that it creates an unwelcome culture and environment for the recipient, who is typically not white, heterosexual, able-bodied cis-gender men (E. Cech, 2022; Dancy et al., 2020). These stereotypical queues create an unwelcome culture, driving a drop in STEM women's participation in STEM fields (Cheryan et al., 2009). Fundamentally, women do not set off to earn difficult STEM degrees and then leave the STEM workforce intentionally (Glass et al., 2013). Their exposure to microaggressions can be traced back to high school, significantly impacting the youth of LGBTQIA+ communities (Banks et al., 2022; Baricevic & Kashubeck-West, 2019; Suárez-Orozco et al., 2015). The impact of microaggressions is real and long-lasting (Holter et al., 2023). Holter et al. (2023) have shown the relationship between microaggressions in Indigenous high school students and future adult depression. Experiencing microaggressions is pervasive on college campuses where URM academics and students struggle with mental health challenges caused by this behavior (DeCuir-Gunby & Gunby, 2016; Wilkins-Yel et al., 2022). K. Young et al. (2015) have shown the severity of microaggressions in academia based on the hierarchies of titles and roles in universities.

With microaggressions, it is possible that the aggressor does not know the impact of their words and actions (Paludi, 2012). Simple omissions from emails or excluding a person from a critical meeting are examples of microaggressions. It could be stereotypes mentioned in casual conversation or repeatedly mispronouncing a person's name (Ehie et al., 2021). Even if the affronts are deemed "micro," the impact of the words and actions degrades the recipient's confidence and self-esteem while raising their stress levels, making them feel psychologically unsafe (Amoakoh & Smith, 2020; M. Williams, 2020). Due to these comments and actions being very personal, the aggressor may be unaware of their bias and deeply rooted beliefs in stereotypes (Alabi, 2015). Sue et al. (2007) placed microaggressions into nine categories. Some of the ones most commonly experienced by women in STEM could be "assumptions of lesser intelligence, promotion of the myth of meritocracy, being treated as a second-class citizen, and having to endure environmental messages of being unwelcome or devalued" (Sue et al., 2007, p. 278).

Women and minorities facing microaggressions are advised by critics of the phenomena to ignore or fight back to avoid being a victim, thus requiring critical skills to manage oneself (Lilienfeld, 2017). Other scholars believe repeated exposure to microaggressions is pure toxicity to the self, the rise of stress levels, and the hormone cortisol's subsequent adverse health outcomes (Nam et al., 2022; M. Williams, 2020). Fighting back chips away at the goodwill and capital the woman has built over time in their organization may open them up to retaliation (De Souza v. Planned Parenthood Federation of America, 2022). Both options have their mental health downsides (Lundberg, 2011). The long-term effect of microaggressions is unknown. However, the collateral damage to those witnessing injustices to others has been studied and has a negative effect (Hillebrandt & Barclay, 2017). E. Washington, a leading expert on diversity, equity, and inclusion, suggests that women consider whether they respond and the moment (public or private) to respond, given one's relationship with the aggressor (2022).

STEM as Experienced by URMs

In this section, the focus narrows to Black and Latina women, who are a small subset of STEM employees, representing two percent of the STEM employee base (NSF, 2017). The anticipation of future discrimination keeps minorities from pursuing STEM fields as early as high school (Diamond & Kislev, 2021). Rogers et al. (2021) have shown that there is a relationship between high school girls experiencing discrimination and their sentiment and orientation moving away from science. Janssen et al. (2022) have shown that trusted adults, such as high school guidance counselors, act as gatekeepers by discriminating against people of color when the student is inquisitive about STEM. Hispanic Heritage Foundation (2020) reports that Hispanic students have just as much a desire to participate in STEM as other overrepresented groups.

These injustices mirror the discrimination from faculty and peers faced in college and its impact on student retention (J. Park et al., 2020). In contrast, community colleges offer lower discrimination environments for Black women (D. Allen et al., 2022). They feel the sharp contrast once they transfer to universities, especially if they transfer to a predominately white institution (PWI) where they experience being marginalized, isolated, and alienated (Dortch & Patel, 2017; Leath & Chavous, 2018). Black and Latina women engineers report experiencing racism in everyday life while attending college (M. J. Lee et al., 2020; M. T. Williams et al., 2020). Friendship diversity has been found to mitigate discrimination and increase intent to major in STEM by ethnically diverse students (A. R. Hall et al., 2017). Black doctoral engineering students have shared how microaggressions impact their sense of belonging and identity, especially when their work goes unrecognized (A. J. Brockman et al., 2022; M. Miles et al., 2020). Discrimination against URMs is even more subtle than the microaggression overtly felt (Eaton et al., 2020; Halsey et al., 2020). By manipulating resumes' names, Eaton et al. (2020) showed that physics and biology professors of post-doctoral students rated those not of the majority gender and race with a lower hireability factor. These hidden stereotypes are another type of discrimination that keeps women and URMs out of STEM and in lower occupational pay across most occupations (Alonso-Villar & del Río, 2023). Black women engineers in college report feeling "ignored, under-estimated, dismissed, or excluded because of their intersectional identities" (Stitt & Happel-Parkins, 2019, p. 70; J. Williams et al., 2016).

Over half of Blacks surveyed stated experiencing discrimination in employment and hearing microaggressions in the workplace (Bleich et al., 2019). Members of sexual and gender minorities (SGM) report working to fit in through how they present themselves and who they surround themselves with (Campbell-Montalvo et al., 2022). Black women report having to change identities at work, including behaving as the "model Black citizen" where they feel the pressure to represent all Black people (Dickens & Chavez, 2018, pp. 269-270). In contrast, white female engineers enter the workforce reasonably blind to the discrimination around them, whereas even early entrants who are minority women into engineering notice it (Doerr et al., 2021). Similarly, minority women in geosciences experience discrimination, causing them to decide whether to isolate or assimilate, the stress of which contributes to a lack of persistence in STEM fields (C. Burton et al., 2023; Mattheis et al., 2022).

Another area where URMs are discriminated against is the gender pay gap, which has been studied extensively, where a positive work climate is one of the mitigators of attrition (Beede et al., 2011; Landivar, 2013; Park–John & Carnoy, 2019). The gender pay gap exists for all women in STEM at a higher differential than the overall gender pay gap in all occupations. White women make $66,200 on average to the $57,000 annual earnings of Black and Latina women (Fry et al., 2021). All demographics earn less than Asian men, earning $103,300 annually, and white men earning $90,600 (Fry et al., 2021).

However, the cost of being a Black or Latina woman goes beyond pay and shows up in poor health outcomes (Braveman et al., 2022; J. W. Collins et al., 2004). Mydam et al. (2019) showed the negative influence of race in lower birth weights associated with Black Latina women's blackness. Evidence further shows that higher maternal stress, caused by discrimination and racism, contributes to low birth rates (J. W. Collins et al., 2004; Dunkel-Schetter, 2011). Gender and race discrimination factors into mental health challenges (Hennein et al., 2021; Wilkins-Yel et al., 2022). STEM is no exception to the injustices Black and Latina women face in other male-dominated industries such as law (García-López, 2008; Melaku, 2019). Latina/o are lauded for their resilience, but even in Hispanic Serving Institutions (HSIs), they face challenges such as being marginalized or their ability being questioned (Valenzuela, 2020). Research has shown that Latina/o families' and friends' support is one of the differentiators for their persistence (Peralta et al., 2013; Starr et al., 2022).

The gender wage gap and the microaggressions discussed above are a few of the disparities that keep women from advancing in their STEM careers; performance reviews, promotions, and inhospitable work cultures also factor into the attrition (Schieder & Gould, 2016; Travis & Thorpe-Moscon, 2018). Other factors include being assigned undesirable work, no mentors, limited learning opportunities, and care responsibilities for children and elders (Lambert & Henly, 2012; Pal & Waldfogel, 2016). Creating a culture of belongingness is one way to combat the feelings of isolation that come from discriminatory practices such as microaggressions (Balsam et al., 2011; Basford et al., 2013; DeCuir-Gunby & Gunby., 2016; Fattoracci & King, 2023; Kim & Meister, 2023). As always, the presence of male allies and vested mentors offers a much-needed support mechanism to combat these systemic patterns of discrimination (DuBow & Ashcraft, 2016; Nkrumah & Scott, 2022).

STEM Women in Leadership

As STEM women matriculate from college to their early days as STEM professionals, some of what they experienced in college continues in the workplace, as campus culture is a foreshadowing of what is to come in the workplace (D. P. Evans et al., 2019; Prieto-Rodriguez et al., 2022). Additional challenges emerge when women become managers and leaders (Ketchiwou & Lineo, 2023). In this section, issues such as ageism, the “glass ceiling” and the “glass cliff”, bullying and harassment, and the need for mentors and sponsors will be discussed (Bollestad et al., 2022; Espinoza & Ferreira, 2022; Malani et al., 2020; Ryan & Haslam, 2005; Sunil, 2022). STEM women are not the only female leaders facing these challenges, but these challenges are amplified in male-dominated fields, which are known for their “bro” and “dude” culture where misogynistic and homophobic sentiments make it an inhospitable environment for non-white, cis-gender men (Chrisler et al., 2012; R. A. Miller et al., 2021; Worthen, 2021). In leadership, women must be “twice as good and work twice as hard” as men (D. P. Evans et al., 2019, p. 3). These challenges, including a lack of work-life balance, compound in male-dominated fields, where other women's support is absent, leading to attrition (Brue, 2019). As stated before, outcomes are always worse for women of color as they ascend to leadership (Corneille et al., 2019).

Ageism

Ageism is a type of discrimination where unconscious bias, typically about older people, can lead to disparities for workers, such as lack of promotions, poor performance reviews, and being sidelined or pushed out (Malinen & Johnston, 2013; NASEM, 2022; Thomas et al., 2014). Ageism is worse for women and challenging to prove (Burn et al., 2020; Lahey & Oxley, 2021). Women pay a higher price than men for aging as sociocultural and sociological views do not allow women to age (Deutsch et al., 1986; L. A. Jackson, 1992). Typically, ageism refers to bias against older people. However, it can also include a younger person, perhaps with power or title, who is being discriminated against by their peers or subordinates due to their youth and achievement of a leadership role (Francioli & North, 2021; Officer & de la Fuente-Núñez, 2018). Ageism bias makes coworkers believe that older workers know less than them. However, studies have proven that experience is a better predictor of performance, and older people are no less capable than their younger counterparts (B. Avolio et al., 1990; Brough et al., 2011). Ageism bias makes older workers contemplate and then accelerate their retirement, sometimes before they are ready to leave (Carr et al., 2021; Schermuly et al., 2014). It is increasingly challenging for older workers to be recruited and hired (Farber et al., 2017; Kleissner & Jahn, 2021; Neumark et al., 2019).

These stereotypes create prejudice and discrimination (Ilișanu & Andrei, 2018; North & Fiske, 2012) and harm the health of the person on the receiving end of the bias (Chang et al., 2020). Ageism studies typically look at ages 50 and above for research (Ayalon et al., 2019; Burnes et al., 2019; Chang et al., 2020). Kite et al. (2005) conducted a meta-analysis of papers on ageism and discovered that younger people were considered more attractive and competent than older workers. In a youth-obsessed culture, surrounded by mostly men and trying to influence men, STEM women leaders find their authority undermined by ageist sentiments, putting them in double jeopardy at the intersection of two discriminations: age and gender (Krekula, 2007). A challenge that female leaders face is being judged based on something they have little control over their age and how the aging process is affecting them, including the impact of menopause, which warrants mention in an aging workforce (Colby & Ortman, 2014; D'Angelo et al., 2023).

Ageism is not exclusive to STEM fields and is not a U.S.-centric problem (Lagacé et al., 2022). Ageism also comes into play for some STEM-specific roles, such as those working in an Agile software development environment, where a preference exists for middle-aged but not older or younger software developers (Schloegel et al., 2018). Ageism is an employment barrier amplified as discrimination, which is worse for Black women (Chance, 2022; Delaney & Lahey, 2019). Human Resources teams need to be focused on combating it as they would racism and sexism (Dordoni & Argentero, 2015).

Glass Ceiling and Glass Cliff

Another set of discriminatory practices that are associated with female leadership is the phenomenon of the "glass ceiling" and the "glass cliff" (Loden, 1985; Ryan & Haslam, 2005). The glass ceiling describes the situation many women in leadership find themselves in, where they have reached a certain level beyond which they cannot seem to promote (Cundiff & Vescio, 2016; Giguère et al., 2023; Maume, 1999; Miegroet et al., 2019; Shaffer et al., 2013). The US

Federal government deemed it necessary to appoint a commission to study the glass ceiling (US Department of Labor, 1995). They felt it was critical to the economy to understand why this happens so that all of the country's human capital, including women, are deployed on the United States' biggest problems.

In a study by Swafford and Anderson (2020), nearly 80% of women in STEM identified the glass ceiling as a barrier. They also identified 21 other barriers, including a lack of encouragement by men. According to Jauhar and Lau (2018), receiving encouragement is a moderating factor. In other words, women need men's mentorship to shatter the glass ceiling (Baumgartner & Schneider, 2010). Martínez-Fierro and Lechuga-Sancho (2021) researched 823 studies regarding the glass ceiling from 1987 to 2019. They learned that although this is a much-researched topic in business and ethics forums, there is still work to be done regarding quantifying setbacks for women encountering this phenomenon. Da Rocha et al. (2022) identified 26 barriers to women achieving higher levels. Masser and Abrams (2004) attribute the selection of men over qualified women as being due to higher levels of hostile sexism directed at women for managerial positions.

The glass ceiling is a very challenging phenomenon to overcome because it operates at a subtle level of consciousness with the current media and culture perpetuating stereotypes (Daniels, 2021). In addition to STEM industries, it shows up in the world of business, law, as well as in academia, where advancement to tenured professors is stalled (Berry & Franks, 2010; Brooks, 2017; Miegroet et al., 2019; Montoya & Kew, 2020). In STEM leadership, not only does it impact the woman who is not getting promoted, but it also creates a threat to the other women who see the lack of female leadership advancement by qualified women (Shaffer et al., 2013).

The cohort with the likelihood of experiencing the harshest barriers of the glass ceiling effect are underrepresented minorities, including Black, Latina, and Asian American women (Goon et al., 2022; Huang, 2021; Maume, 1999; Rahming, 2022). The data show that Asian Americans as a whole are some of the highest-paid STEM employees, with over 52% of their population having at least a bachelor's degree (Okrent & Burke, 2021; United States Census Bureau, 2016), yet they face ethno-racialized challenges when attempting to move forward in organizations (F. Lee, 2019). Their specific set of challenges combines the glass ceiling with being Asian American and is referred to as the "bamboo ceiling" (Hyun, 2005).

There is a nuanced version of the glass ceiling, known as the "glass cliff" (Ryan & Haslam, 2005, p. 83). The glass cliff refers to situations where the organization is facing a crisis, and it is at this point, that they put a woman in charge of course-correcting the situation (Barreto et al., 2008). Ryan and Haslam (2005) studied the Financial Times Stock Exchange and discovered that companies that put women in charge had up to five consecutive quarters of decline. They posed stressful scenarios and asked participants whether they would put men or women in charge (Ryan & Haslam, 2005). The participants often chose women to lead a crisis (Adams et al., 2009; Ashby et al., 2007; Ryan & Haslam, 2005). It is unclear whether they were protecting the men from stress or assumed the women were more capable of managing the crisis (Mulcahy & Linehan, 2014). If she succeeds, then it is business as usual. However, if she fails, it sets off a chain of events of stress and discouragement, which often leads to her disenfranchisement and disassociation, leading to a path of her exit (Barreto et al., 2008). Women who are put in glass cliff situations and fail face burnout, and their organizations see turnover (Eagly & Karau, 2002; S. E. Jackson et al., 1986; Stroh et al., 1996). Men put in glass cliff situations receive organizational support and do not experience the same consequence of stress and exhaustion from the emotional labor (Ohlott et al., 1994; Pugliesi, 1999).

Bullying and Harassment

Women and minorities in male-dominated fields, such as most of the STEM fields, experience bullying and harassment in the workplace at a greater number than men (Ammerman & Groysberg, 2021; Davis, 2021; Diele-Viegas et al., 2021; Schneider et al., 2011; Settles et al., 2006). Studies show that in spaces where men dominate in numbers, harassment is prevalent due to the amount of gender stereotypes held by men (Dresden et al., 2018; Smyth & Nosek, 2015). Bullying is “purposeful breaches of an individual’s space of dignity, rights, and integrity” (Anjum et al., 2019, p. 1), followed by “bullying means harassing, offending, socially excluding someone, and negatively affecting someone’s work tasks”. Bullying and harassment hinder women in STEM persistence (Charlesworth & Banaji, 2019; Else, 2018; Marín-Spiotta et al., 2020). These behaviors are pervasive in the science fields, from bullying in academia at all levels to STEM professions such as roles in geosciences and conservation (Chidozie et al., 2020; Hollis, 2017, 2022; James et al., 2023; S. Moss & Mahmoudi, 2021). Bullying is particularly menacing and pervasive in nursing, even though that field has most women working in it (Akella & Seay, 2022; Yoo & Hye, 2020). In a workplace study of bullying conducted by S. Moss and Mahmoudi (2021) within higher education, 84% reported being subjected to bullying, and almost 60% said they had witnessed it. In a survey of female field scientists, 71% reported being sexually harassed (Clancy et al., 2014). Twenty-nine percent report bullying, and 58% state adverse outcomes such as retaliation (S. Moss & Mahmoudi, 2021).

Many men and some women use bullying as an advancement tool at the expense of their victims (Täuber & Mahmoudi, 2022). Research shows that most often the perpetrator is the boss, followed by peers (Beale & Hoel, 2011; Hoel & Cooper, 2000; Zahra et al., 2022), but bullying can also come from subordinates in what has been discussed as the “paradox of power” (Busby et al., 2022; Folke et al., 2020; C. E. O'Connell & Korabik, 2000). Sometimes, bullying is by proxy, where the boss leverages other people by mobbing, gossiping, and isolating the victim, squeezing them out of the organization (Keashly & Neuman, 2010; Pheko, 2018). According to Grauerholz, the differentiating factor is gender, specifically men's gender over women's, "Even in situations in which a woman has clearly defined authority, gender continues to be one of the most salient and powerful variables governing work relations" (1989, p. 789).

Bullying does not start overnight; in a study of over a thousand Swedish engineers, Holm et al. (2022) determined that incivility is where it starts, which can lead to bullying. This is where organizational culture and training need to stand firm in the values and behaviors that represent the company; bullying is directly related to lack of job security, lack of role clarity, and increases in uncertain times of change (Baillien & De Witte, 2009). Bullying has a ripple effect and is associated with physical and mental pain, sleep deprivation, and other adverse health outcomes (Balducci et al., 2020; Chatziioannidis et al., 2018; Hamilton et al., 1987; Lallukka et al., 2011; Rivara et al., 2019; Takaki et al., 2013). It also spills into the victim's family (Aisha et al., 2021). The resulting employee turnover costs are significant due to sick days taken to manage workplace stress, attrition, and recruitment costs (Malik et al., 2018; Nazir & Bt Ungku, 2016). Associating a cost to the loss of productivity from bullying is an area in which the literature is weak or inconsistent.

Increased emotional intelligence is one mediating factor to abate bullying (Nel, 2019). Nel (2019) were able to show that increasing everyone's emotional intelligence in an organization via training programs can reduce bullying. Mokgolo and Barnard (2019) investigated and discovered that human resources departments are powerless to address bullying cases. Social support from a friend, family member, or mentor is a solid mitigating factor to bullying (Sigursteinsdottir & Fjola, 2022). The following section will discuss the importance of mentors and sponsors for women in STEM persisting in their careers.

Mentors, Sponsors, and Role Models

One success criterion for persistence by women in STEM fields is the existence of mentors, sponsors, and role models in their educational life as well as in their careers (Barkhuizen et al., 2022; Edna et al., 2019; Lopez & Duran, 2021; D. M. Young et al., 2013). The difference between a mentor and a sponsor is that a mentor actively coaches their mentee on how to perform their job and navigate through challenges. The sponsor may also be a mentor, but more importantly, they advocate for their protégé in spaces where they are not present to fend for themselves (Pinheiro et al., 2017). Sponsors look for opportunities to place their wards in high visibility and high-impact positions, which ultimately helps advance the woman's career (Moghe et al., 2021).

All people benefit from mentors and sponsors in virtually every setting, but what makes it essential to the success of women in STEM is that these roles counterbalance some of the aforementioned discriminatory practices (Bowling & Martin, 1985). The earlier a woman cultivates their network, the sooner she can secure the social support needed to persevere in STEM fields (Dennehy & Dasgupta, 2017; Wu et al., 2022). It can be as simple as a study group in college (Borum & Walker, 2012). In their seminal work, Bowling and Martin (1985) said science is a masculine disorder. Around the same time feminist physicist Evelyn Fox Keller urged society to move towards science becoming "a human instead of a masculine project" (1985, p. 178). This way more girls would be attracted to it versus seeing it as a strictly male endeavor.

According to a study by Cheryan et al. (2017), women's representation in STEM fields is worse because masculine cultures lower women's sense of belonging. Sense of belonging is just above safety and physical needs such as food and water in Maslow's Hierarchy of Needs (1943). When women face discrimination in male-dominated spaces of STEM in academia and in the workplace, their confidence and sense of identity is challenged (Barkhuizen et al., 2022; Khan & Bhattacharya, 2022). In more recent scholarly work, the sentiment expressed about STEM fields is similar: "insular, masculine, and white male-dominated" (Joseph, 2014, p. 2). With the population of men being so much greater than women in most STEM fields, the lack of gender parity inherently creates an environment where "toxic masculinity" runs rampant (Bliss, 1987; Cheryan et al., 2017; Msosa et al., 2022). Feminists have been sharing the term "toxic masculinity" about "misogyny, homophobia, and men's violence" against women and children, including harassment & and bullying (Bliss, 1987; Harrington, 2021, p. 1). Strong networks create a buffer of strength for women.

Dennehy and Dasgupta (2017) discovered that STEM women, specifically engineers in their study, leveraged mentors as sounding boards for guidance and coaching to combat whatever injustice they faced. Underrepresented minorities benefit from mentors who act as buffers against discrimination (Estrada et al., 2018; Hernandez et al., 2017). Building on that premise, other studies have shown that URMs' resilience is amplified if mentor roles are filled by people who look like them (Adams–Harmon & Greer–Williams, 2021; Atkins et al., 2020; Borum & Walker, 2012; Dickens et al., 2021).

The mentoring relationship does not need to be one-on-one with someone in a higher rank than them; women can also receive peer mentoring with equal success (Wu et al., 2022). Employee Resource Groups can also act as proxies for mentorship if they are welcoming and informative (W. M. Green, 2018; Linehan & Scullion, 2008; Rodriguez, 2021). Communities of practice and shared interest groups, such as the Society of Women Engineers, are also helpful in creating a strong sense of identity and affiliation; women want to see that others had come before them and succeeded (Lave & Wenger, 1998; Woodwark et al., 2021). Positive social interactions raise self-efficacy in women and their belief in the ability to achieve success (Zeldin & Pajares, 2000; Zeldin et al., 2008). Networks have shown to be a success factor as women can share their experiences, discover that they are not alone, and receive valuable guidance (Linehan & Scullion, 2008; Woodwark et al., 2021)

Beck et al. (2022) conducted a meta-analysis of the literature available on mentoring programs in STEM. They examined the literature with a critical feminist lens (Beck et al., 2022). The critical feminist lens is a hybrid of feminist theory and critical theory; the former assumes the role of gender and patriarchy in creating inequity (J. Martin, 2003), and the latter states that there are "prevailing structure and practices that create or uphold disadvantage, inequity, or oppression" (Baxter & Braithwaite, 2008, p. 290). Beck et al. (2022) analyzed 46 articles about mentoring STEM women and discovered some best practices across them. They have three recommendations for those creating mentoring programs for STEM women: (a) Mentoring practices should consider all of the individuals they serve, including intersectionality based on gender plus age, race, nationality, sexual orientation, and other intersections (b) Be thoughtful about the culture of the organization within which the mentoring will be conducted, acknowledging known gender barriers and disparities and (c) Set clear goals for the mentoring program (Beck et al., 2022). The reminder about intersectionality was also firmly concluded by Dickens et al. (2021) as they reviewed literature regarding Black STEM women's mentorship. They found that mentoring could not ignore the intersection of racism and sexism (Dickens et al., 2021).

In summary, when women face chilly climates in STEM, they must turn to mentors and sponsors in whatever form they find them, be it in communities of practice, ERGs, online mentoring sites, peer mentoring, or one-on-one with a leader (Cabay et al., 2018; Rosa & Moore-Mensah, 2016; Salomone & Kling, 2017; Stoeger et al., 2023). Stable social networks guide women through learning the job and navigating the challenges faced in the male-dominated STEM fields (Etzkowitz et al., 2000). With these types of supportive programs, women in STEM have been able to speak with one voice to management and enact changes such as expressing their needs for family leave, calling out missing lactation spaces, and elevating the achievement of women (Welch et al., 2012).

Impact of COVID-19 on Women in STEM

The studies starting in 2020 through 2023 attempted to understand the impact of the COVID-19 pandemic on the workforce (Boesch et al., 2021; Heggeness et al., 2021; Kramer & Kramer, 2020; Landivar et al., 2020). Women across the world in all professions felt the impact of increased childcare and elder-care responsibilities as changes were implemented in the workforce, such as work-from-home mandates (Carli, 2020; C. Collins et al., 2020; Douglas et al., 2022; Heo et al., 2022b; Lim & Zabek, 2021). Work from home increased by three times as compared to the years prior to the COVID-19 pandemic, demonstrating that many jobs could be conducted from home (Pabilonia & Vernon, 2023). Women worldwide felt many of the same challenges, many of which are noted by special reports such as the one conducted by the Australian government regarding an increase in intimate partner violence (Pfitzner et al., 2022). Others who have researched women's state post-COVID-19 pandemic include the European Commission regarding gender equality and the Organization for Women in the Sciences for the Developing World (OWSD) regarding women scientists (European Commission, 2021; E.

Johnson, 2020). Their research points to a slippage of women's gains made over the past several decades, ones that could set women back an entire generation if active policies are not put in place to get to pre-COVID-19 periods (Haney & Barber, 2022; Myers et al., 2020). Other studies see COVID-19 as an opportunity to leap-frog stagnation by leveraging nontraditional labor markets and the gig economy (Petroff & Fierro, 2023).

In this section, both the negative and positive outcomes of COVID-19's impact on women in STEM will be discussed, starting with the added burden of childcare and eldercare, which forced many women to leave the workforce to care for their families, including homeschooling their children (Heggeness, 2021; Heggeness & Fields, 2020). In a year-over-year analysis, from January 2020 to January 2021, Frize et al. (2021) surveyed 921 men and women to see how much time they spent on childcare. Of the women surveyed who were married, 22% spent 3 hours or more a day on childcare activities; 12% of men said the same (Frize et al., 2021). When asked how much time they spent on household duties, 44% of the men spent three or more hours, and a much larger number, 55% of women, said the same (Frize et al., 2021). Remote work provides much-needed flexibility in times of a pandemic. However, some scholars believe that it has created a situation whereby women's unpaid labor has increased, further diminishing their gains in equality in the workplace. An example of this is reported by women scientists in academia who experienced a decrease in their (a) research activities, (b) publishing disruptions, and (c) work-life balance satisfaction (Caldarulo et al., 2022; Gao et al., 2021; Sevilla & Smith, 2021; Xue & McMunn, 2021).

A key metric in the sciences is research productivity, which was already low for women compared to men in pre-pandemic academia (Kaatz et al., 2014; M. M. King & Frederickson, 2021; Reuben et al., 2014). Research productivity includes such things as authorship and grants received. Studies confirmed that research productivity dropped by 19% for female scientists (K. Lee et al., 2023) as women's home workloads and caregiving increased (Heo et al., 2022a). Korbel and Stegle's (2020) research showed that women were more vulnerable in the life sciences as they, too, had less productive hours. Some of this can be attributed to lab shutdowns (Korbel & Stegle, 2020).

Many women left the workforce during the pandemic (Lim & Zabek, 2021). For those who remained and worked from home, the domestic responsibilities blended so much with work that there was a concern about permanently slipping into the homemaker role, except the professional work was still there (Çoban, 2022). Studies confirmed that women's exits were primarily attributed to having children and needing to provide childcare, with Black and Latina women experiencing a large drop in employment (Albanesi & Kim, 2021; Lim & Zabek, 2021). In STEM industries, layoffs pounded the industry in the latter part of 2022 and the start of 2023 (Statista Research Department, 2023). In many STEM fields, such as female computer science faculty, the intent to leave increased due to work-family conflict, burnout, and decreased job satisfaction (Lawson et al., 2023). More recent studies show that the divide was less along the lines of gender but of degree of college education (Goldin et al., 2023). By February of 2023, women's participation rates had edged very closely to pre-pandemic levels, with women leading the way for a recovery (U.S. BLS, 2023a).

However, the pandemic also created opportunities for women, such as being included in more significant numbers in telework arrangements, where they were formerly underrepresented (Kley & Reimer, 2023). When the US workforce became 50% remote, quadrupling its pre-pandemic numbers, it opened up a level of flexibility unseen by many working women (Brynjolfsson et al., 2020). Early in the COVID-19 pandemic, some scholars warned that working from home would further widen the inequality gap (Bonacini et al., 2021). United Nations (2020) has reinforced this position regarding the impact that COVID-19 has had on women achieving Sustainable Development Goal #5, Gender Equality (United Nations, 2015). In their brief, they stated, “The pandemic is deepening pre-existing inequalities, exposing vulnerabilities in social, political and economic systems which are in turn amplifying the impacts of the pandemic” (United Nations, Policy Brief on the Impact of Covid on Women, 2020, p. 2). The next section focuses on the pros and cons of remote work as it pertains to persistence for women in the workforce.

Remote Work

One of the ways to mitigate microaggressions, which tend to occur in in-person interactions, is to work remotely (Dowling et al., 2022). Bullying, a greater type of aggression, is decreased when in-person interactions are lessened (Bacher-Hicks et al., 2022; Bollestad et al., 2022). Tradeoffs between work and family for remote workers and their leaders have been studied worldwide across the dimensions of well-being, the benefits to the environment, and productivity (T. D. Allen et al., 2015; Gajendran & Harrison, 2007; Moen et al., 2016; Neidlinger et al., 2023; Nilles, 1994; Yang et al., 2023). Studies have shown that women prefer to work from home (Hsu & Tambe, 2021; A. Xiong et al., 2023). Remote work is also a way to encourage more STEM participation by women, as job descriptions which state ‘remote work’ yield 20% more female candidates (Hacohen et al., 2020). Women state higher work quality when working from home (Rodríguez-Modroño & López-Igual, 2021). Remote work increases productivity; thus, it is also a win for employers (Bloom et al., 2015). An estimated 37% of US jobs can be performed from home (Dingel & Neiman, 2020). Remote work has also been shown to be a way to keep women in the workforce after childbirth (Chung & van der Horst, 2018).

There are negative tradeoffs to remote work, such as increased mental health challenges, lack of structure, and increased personal problems, including increased domestic violence incidents (Madhusudhanan & Thomas, 2021; Miall et al., 2023). A World Health Organization survey of over 3800 women in Germany, ages 18-64, showed increased physical and emotional violence during the COVID-19 pandemic lock-downs (Ebert & Steinert, 2021). Setting boundaries is critical, lest women get overloaded with “technostress” (Brod, 1984, p. 16), which they report experiencing in a greater quantity (La Torre et al., 2020). Technostress was coined by Brod (1984) in reference to the load that people undertake when working with computers and technology. Different cohorts, depending on their age or child or elder care responsibilities, reported that their work increased or decreased over COVID-19’s work from home; the higher the education, the greater the leadership responsibility, and the more the work hours increased, often trampling on personal boundaries (Fan & Moen, 2022).

Boundaries between partners working from home must be established as women reported an increase in gender inequalities, such as an increase in their domestic responsibilities. At the same time, fathers used the time to work more hours (Cannito & Scavarda, 2020). Careful consideration must ensure that remote work is designed into new work paradigms so that women are not suddenly relegated to stereotypically held and typically lower-paying traditional women’s roles (de Laat, 2023). A review of census data from the United Kingdom shows that remote workers are indirectly penalized by not receiving bonuses 38% of the time (J. Martin, 2021). Remote workers in that study received worse performance reviews than in-office workers, who performed more overtime (J. Martin, 2021). There appears to be a punitive cost to remote work, even after demonstrating during the COVID-19 pandemic that there was little to no loss to productivity, with 65% of employees stating they were more productive with a flexible work schedule (Broom, 2021). Autonomy and flexibility are key to employee well-being remotely (Harkiolakis & Komodromos, 2023).

Finally, flexible work arrangements are considered a tool for reducing turnover but must be implemented thoughtfully (Bontrager et al., 2021). STEM women, with their high attrition rates from STEM careers, need to be supported with optimal organizational work design as a form of retention strategy (de Laat, 2023; Glass et al., 2013; Ortiz-Martínez et al., 2023; J. Park et al., 2020; Roulson, 2022; J. Williams et al., 2016). Remote work is only one method for attracting and retaining STEM women (de Laat, 2023). There are other strategies that employers can deploy, such as generous parental leave, childcare, and tuition reimbursement, to attract and retain female talent (Dean & Koster, 2014).

Success Strategies for Retention of Women in STEM Academia and Industries

The following section examines the body of knowledge for retaining women in STEM. Some women in STEM can successfully manage their careers and families as they advance in their careers despite the fact that STEM is still run by cis-gender white men (Diele-Viegas, 2021). The sooner she can learn how to work within that environment, the better for her persistence in STEM fields (Oosten et al., 2017). The differentiators appear to be a complex combination of personal characteristics, spousal support, company culture, supportive leadership, mentors and sponsors, allies, work-life balance, and company benefits and policies tailored to meet the needs of women and their families at various points in their lives (Bilimoria & Lord, 2014; Debebe, 2011; P. Parker et al., 2014; Sorn et al., 2023). This section will cover personal characteristics, company culture, supportive leadership styles, and company benefits and policies. Allies, mentors, and sponsors have been discussed in prior sections but are important to note as they are critical to a STEM woman's persistence (DuBow & Ashcraft, 2016; Li et al., 2023).

For a period of time, starting in the 1980s, women were being told how to talk, walk, dress, and carry themselves in order to assimilate and succeed in male-dominated fields, including STEM (Garr-Schultz & Gardner, 2018; Harris, 2003; M. A. Lewis & Neighbors, 2005; Sandberg, 2013). This bias of acting like a white male under the guise of *professionalism* has been challenged in recent years by scholars and employees for having a narrow definition of what constitutes as professional appearance and behavior in the workplace; examples are hair, makeup, tattoos (Cerdeña et al., 2022; Cumberbatch, 2021; Dove, 2023; Gray, 2019). Progress has been made via passing of the CROWN Act which passed in 2019 (CROWN Act of 2019, 116 USC §§ 3–6; Pitts, 2021). This act recognizes the burden put on Black people, especially Black women, who have had to conform to society's Eurocentric hair standards for beauty. The Sandberg (2013) type of advice is now considered outdated and unhelpful as it puts the onus on women to act a certain way. Long time feminist belle hooks called out this type of feminism as "faux feminism" (hooks, 2013, p. 674), designed to sell books but ignoring the root of the issue. In the same vein, professional development courses focused on women are no longer in vogue (Loumpourdi, 2023). Research has proven that systemic sexist barriers are behind the bias, lack of career progression, and turnover by STEM women (Denaro et al., 2022; Ireland et al., 2018; McGee, 2020).

In 1953, linguist Haugen created the term "code switching" in reference to bilingual speakers. However, that term in modern day is used to indicate the emotional work one has to undertake to be someone else in different settings such as work and school across race and gender (McCluney et al., 2021). Code-switching can take its toll on women when they are someone else at work than they are in their personal lives (Dickens et al., 2019; Spencer et al., 2022). It is emotionally taxing and unsustainable (Alexander & Hermann, 2016). Code-switching eventually results in burnout and turnover (Alexander & Hermann, 2016; Spencer et al., 2022). Further, the emotional labor of "deemphasizing a negatively-valued identity and replacing it with a positively-regarded identity" is known as *identity shifting* (Dickens & Chavez, 2018, p. 761). Underrepresented minorities have the additional burden of intersectionality across race, ethnicity, and sexual orientation, along with being a woman (Kozlowski et al., 2022; Morales et al., 2021).

Egalitarian companies that rank high on the best places to work for women have recognized that when women succeed, economies grow (International Monetary Fund, 2018). Inclusive company cultures, control over work-life balance, and many factors drive a woman's persistence, but the organization must create a hospitable environment free of discrimination (Das & Baruah, 2013). For example, the support of having ERGs requires that the programs they develop understand the specific needs of the employees they are trying to serve (Rodriguez, 2021; Welbourne et al., 2015). Broad diversity and inclusion efforts have also had mixed results as they lump all women of all ages and backgrounds together without recognizing the need to cater to varied recruiting and retention strategies (Chang et al., 2019; Hinton & Lambert, 2022; Palid et al., 2023). They can also raise the ire of the advantaged group, thereby creating a more significant divide (Iyer, 2022). When these policies and programs are enacted to check a box, they are seen as disingenuous, and they fail, ultimately not serving the needs of people and backfiring as they create cynicism (F. Yildirim & Yildirim, 2016).

The organizations that succeed in this arena recognize the need for supportive leadership alongside family-friendly policies such as flexible work and parental leave (Feeney et al., 2014; Su & Bozeman, 2016). An analysis of STEM women's preferred leadership styles shows that there is no singular leadership style with which women lead (Nash et al., 2017). However, Transformational leadership style did emerge as a theme in some studies (Burns, 1978; Nash et al., 2017). Blackburn's (2017) literature review regarding women in STEM leadership noted the importance of having supportive family and romantic relationshipsTalley.

Studies show that women leaders tend to be more empathetic (Horowitz et al., 2018), and successful female leaders carry a higher emotional load by managing their own emotions while observing and appropriately reacting to their subordinates' emotions (Vial & Cowgill, 2022). This is under higher societal expectations for women (Buse et al., 2013). The proper skills to grow as a leader set them up to succeed (Oosten et al., 2017). Upleveling leadership skills help women recognize and snuff threatening environments that poison STEM women (Casad et al., 2019; Minnotte & Pedersen, 2021).

Companies who support women leaders recognize the need for fair and equitable programs and policies in recruiting, hiring, promotion, and benefits offered to women (Crone & Kallen, 2022; W. Hall et al., 2022; Maume, 1999; Shadding et al., 2016). These companies are working to create psychologically safe spaces and increase belongingness and inclusion (Rainey et al., 2018). Psychological safety is a long-standing interpersonal construct which applies to individuals and teams (Kim et al., 2020). Psychological safety is the ability to take risks in the face of opposition without jeopardizing one's personal and social capital (Edmondson & Zhike, 2014; Schein & Bennis, 1965). The importance of psychological safety cannot be overstated, as it is foundational to innovation (Østergaard et al., 2011) and the ability of the mind to feel safe to solve problems and learn (Wynn & Correll, 2017). This concept extends to work teams (Edmondson, 1999). Leaders and team members create psychological safety with the culture they promote (Carmeli et al., 2010). When psychological safety is absent, it limits the process of learning and experimenting (Newman et al., 2017).

External factors contribute to attrition, but the women in STEM who persist have a high self-efficacy and high confidence (Blaique et al., 2023; E. Cech et al., 2011; Clark et al., 2021; Ellis et al., 2016; Kalender et al., 2020). These characteristics and a love of challenges and problem-solving help them sustain themselves in difficult times (Buse et al., 2013). Commitment to persist must be high for a woman in STEM to persist (Richardson et al., 2019).

Women in technology must constantly battle masculinities in the workplace, which chips away at a sense of belonging and inclusion (W. Hall et al., 2022; Vera-Gajardo, 2021). In the absence of psychological safety, women feel a lack of belonging, and men feel like they have to carry the emotional burden of it (Buzzanell et al., 2023). Implicit bias training swept over companies trying to up-level their employees to improve their attitudes towards STEM women, with differing success (S. M. Jackson et al., 2014).

STEM women do better when more women are in their environment, especially those who look like them (Griffith & Dasgupta, 2018; Palmer et al., 2011; Rainey et al., 2018). The study of persistence in Black and Latina women is robust. Common factors include being included, being recognized for their unique backgrounds and perspective, and not being made to feel like they are the “only” in the room (Ferguson & Martin-Dunlop, 2021; Gumpertz et al., 2017; Idahosa & Mkhize, 2021; Kachchaf et al., 2015; Leath & Chavous, 2018; Maria et al., 2023; Oseguera et al., 2022; Talley & Martinez Ortiz, 2017). The need for and the presentation of these characteristics begins as early as a woman’s high school experiences and should be solidified before they enter college (P. K. Hunt et al., 2021). Women’s life goals change when they enter college as they become more marriage-family-oriented (Barth & Yang, 2022).

To summarize this section, numerous factors influence women persisting in STEM, from test-taking anxiety to the discriminatory practices already discussed (Sehoya et al., 2020).

Participation of women in STEM is complicated and requires an alignment of desire, persistence, risk-taking, competitive company benefits, and a perfect coming together of personal characteristics in a psychologically safe environment filled with mentors, sponsors and exceptional leaders who create an inclusive culture (Almukhambetova et al., 2021; Blaique et al., 2023; Kleist, 2015; Petzel & Casad, 2022; Sorn et al., 2023; Valerie et al., 2019).

Chapter 2 Summary

Chapter 2 presented the literature review on women in STEM, their success strategies, and barriers. Chapter 2 follows a chronological order, starting with young girls' experiences in kindergarten to high school and beyond to college and the workplace. Women's experiences as STEM leaders are also examined for common denominators, which help them persist or attrit from STEM fields. Chapter 2 begins with a review of education systems in the United States in support of STEM outcomes, explicitly discussing the role of Common Core (Common Core State Standards Initiative, 2010) as well as its predecessor, No Child Left Behind (NCLB, 2002). The origin of the push for the betterment of science and math is discussed as is New Math (National Defense Education Act, 1958).

Then follows a section outlining the experiences of young girls in their early years of elementary school through high school. The importance of parental involvement and interventions such as tutoring, mentoring, and summer camps are discussed in maintaining young women's self-esteem, self-efficacy, and confidence, all of which result in young girls' persistence and interest in staying in STEM fields.

The college experience of young women in STEM fields is presented, along with their needs for female faculty, male allies, and learning support in their introductory courses. The importance of performance on introductory courses, seeking peer support, joining affinity groups, and participation in psychologically safe environments are showcased. Within the college experience, the role of community colleges surfaced as a two-way system for transfer from the community college to a four-year university and scaffolding for taking reasonably priced classes concurrently with four-year programs. This section discusses the gap between high school learning and university expectations. The learning gap is a leading cause of early college dropouts or major switches. Thus, multiple theories are presented as to why the learning gap occurs. Gender discrimination in the college experience by peers and faculty is discussed. In this section, increased disparities for underrepresented minorities are shared. The experiences of female faculty are a mirror of what is to be expected when female students enter the workforce. Female faculty challenges with lack of publishing and ascension to tenure are examples of workplace challenges for women in STEM.

The following section details women's experiences once they graduate college and enter the STEM workforce. The gender pay gap, motherhood wage penalty, and microaggressions are discussed as challenges women face in STEM. A subsection details the importance of paying attention to the experience of underrepresented minorities, especially women and those at the intersection of race and gender.

Chapter 2 continues by enumerating the challenges faced by women as they grow in their careers. Examples of ageism, bullying and harassment, the glass cliff, and the glass ceiling are outlined. The critical role mentors, sponsors, and role models play in persistence and increase of self-confidence and self-efficacy are detailed for women in STEM rising to leadership. The importance of remote work, flexibility, and work-life balance are listed as strategies women in STEM deploy to persist in their careers. This section discusses the aftermath of COVID-19 on STEM women and attrition from the workforce.

Chapter 2 culminates with success strategies deployed by long-term career women in STEM. Examples of what makes them persist are a combination of their personal characteristics and enlightened and welcoming environments, which provide fair pay, family-friendly benefits and flexibility. Additional factors such as supportive spouses, mentors, sponsors and allies are discussed as elements found in those women who manage fulfilling long term careers in STEM.

Chapter 3: Research Design and Methodology

Introduction

The purpose of this study is to illuminate the success strategies and barriers faced by women in STEM. The outcome of this study will lead to a better understanding of STEM women's persistence, resilience, and retention in STEM fields. Chapter 3 outlines the research design and methodology for this phenomenological study, by providing the philosophical underpinnings of qualitative research design. In the subsections Nature of Study and Methodology, over 150 years of German, French and other philosophers and scholars whose works are the foundation of phenomenological research are enumerated. The organic progression from sociology and psychology to phenomenology and why the researcher has chosen these methods to study women in STEM.

The Research Design section details the inclusion and exclusion criteria as well as the sampling frame. Next, the Protection of Human Subjects shares the importance of the management of privacy and security of the participants' data as well as compliance with federal Institutional Review Board processes designed to protect the participants from harm. The relationship between the research questions is restated prior to outlining the validity and reliability processes to ensure no bias is present in the research design. The researcher states their statement of bias and the steps she has taken to ensure that she remains objective throughout the research process. The final section, Data Analysis, presents the methods which will be used to gather data and codify it as themes emerge from the interviews. Chapter 3 also provides detailed information about the interview protocol including providing details regarding sources from which participants will be recruited.

Restatement of the Research Questions

There are many challenges in achieving gender diversity in most STEM fields (Glass et al., 2013; Ma & Savas, 2014; Mann & DiPrete, 2013; Sassler et al., 2011). This study aims to interview women who work in STEM fields to answer four research questions. Using Appreciative Inquiry and a Feminist Framework, the researcher will follow a phenomenological qualitative research design methodology to learn from the lived experiences of the study participants (Barrett & Fry, 2005; Cooperrider & Whitney, 2005; Friedan, 1963; Kubala, 2020; Steinem, 1969): The following research questions will answer the overarching study regarding the Success Strategies and Barriers for Women in STEM:

- RQ1: What are the challenges faced by women in STEM in ascending to leadership positions?
- RQ2: What strategies/best practices are used by women in STEM to overcome the challenges they face?
- RQ3: How do women in STEM define, measure, and track their career success?
- RQ4: What recommendations do women leaders in STEM have for aspiring female leaders?

Nature of the Study

Qualitative research was selected for this study as it is derived from the recognition that additional color and texture from people's lived experiences would produce research results that are otherwise difficult to capture by quantitative research (Frechette et al., 2020; van Manen, 1990). One of the challenges confronting phenomenology is that sociology and phenomenology have evolved in the last century sometimes together and sometimes in divergent paths, creating a competitive imbalance between them (Giorgi, 1997; Szanto, 2020). Creswell (2015) would suggest that both can coexist as they meet different needs for research. In this section, the strengths, weaknesses, and assumptions of using qualitative research methods will be enumerated.

Assumptions of Qualitative Research

In qualitative methodology, the fundamental assumption is that the lived experiences of the participants and their description of the phenomena will reveal answers regarding what occurs most frequently across a population (Creswell & Creswell, 2018; Giorgi, 1997). Another key assumption is that from the topics discussed in the interview, similar themes will emerge. By affinitizing across those themes, recommendations can be derived (Saldaña, 2015). Following the coding process, the relationship between interview questions and research questions are revealed. To derive high quality insights, the integrity and bias of the researcher must continually be kept in check (Walters, 2001). Another assumption in qualitative research is that the participant will be able to describe their experience exactly as they experienced it (C. Anderson, 2010).

For the researcher to be able to acquire appropriate responses from the participants, it is assumed that he or she is very familiar with the literature (Snyder, 2019). The researcher's depth in the topic, including knowledge of applicable theoretical frameworks, gives him or her the ability to make connections from the interview to the insights (C. S. Collins & Stockton, 2018). A well-researched literature review also distances the researcher from their own lived experience and bias, increasing their credibility with the participant (Patton, 1999). Final assumption is that the literature review and the theoretical frameworks create the lens through which the research is conducted (Lederman & Lederman, 2015; Snyder, 2019).

Strengths of Qualitative Research

Quantitative methods are best used when the results represent a variable across a generalized population and the study aims to test a hypothesis (Babbie, 1992; Steckler et al., 1992). In contrast, when researchers use qualitative methods, such as phenomenological research, the participants are asked open-ended questions with researchers actively listening to their experiences and documenting the phenomena, bringing forth the participants' personal experiences (Neubauer et al., 2019; Verhoef & Casebeer, 1997). Their insights could be used to provide recommendations to others in a similar situation (Creswell & Creswell, 2018; Neubauer et al., 2019; Teherani et al., 2015). Their insights can also be used to conduct similar research. In this case, a study of women in STEM can be used to study women in Wall Street roles or women in law. Another strength of qualitative research is that the researcher is not testing a hypothesis, meaning the possibilities are endless in the learnings (Walters, 2001).

Weaknesses of Qualitative Research

Critics of qualitative phenomenological research believe it is not scientific enough (Bourdieu, 1977; Crossley, 1996; Greifenhagen, 2008). The critics suggest that objective data on a much larger scale will produce more valid results and that the subjectivity of introspection is not a sound method by which to seek answers (Wittgenstein, 1958). Schwitzgebel (2008) calls it naïve and unreliable to depend on one's introspection. Bucklew (1955) posits that the subjective experiences of a small group of people are just opinions. C. Anderson (2010) shares that one of the weaknesses of qualitative research is the presence of the researcher. Maxwell (1996) and Walters (2001) retort by stating that the bias of the researcher can be mitigated by understanding their values, and continuing to seek peer review from disinterested. C. Anderson (2010) underscores that the researcher's interviewing skills are critical to deriving meaning from what has been shared by the participant. However, it is not mere patterns that the researcher is interested in, but the lived experiences of how people experience the world around them (Pula, 2022). If patterns emerge as the researcher conducts the interviews, it strengthens the results, especially in the work of extracting feminist experiences (Stoller, 2009).

Methodology

This study will follow the practices of phenomenological qualitative research to identify the experiences of women in STEM (Creswell & Creswell, 2018; Husserl, 1970/1900; Moustakas, 1994; van Manen, 1990). In this section, a discussion of the relevance of phenomenology to the research will be enumerated, along with a background on why it is the research method of choice for uncovering success strategies and barriers for women in STEM. Given that there are seven different types of phenomenology, it would be beyond the scope of this dissertation to discuss all of them (Embree, 1997). However, a deeper dive into transcendental phenomenology and hermeneutic phenomenology is appropriate as both will inspire components of this study.

Phenomenology's history is a mix of inputs from behavioral scientists, educators, philosophers, and the field of psychology, where scholars realized that within the human experience lies critical learning (Descartes, 1977; Husserl, 1982/1931; Kant, 1929). At the turn of the 20th century, scholars with their unique backgrounds and cultures found that in order to understand the human experience, one must inquire from the person perceiving the experience (Heidegger, 1996/1927; Husserl, 1982/1931; Merleau-Ponty, 1962; Sartre et al., 1940). Led by Husserl (1982/1931), the work of decades of philosophers eventually led to the qualitative research method of phenomenological design. Thus, a strength of phenomenology is that it has withstood the test of time.

Husserl, who is considered one of the seminal scholars and founders of phenomenology, was influenced by Kant's transcendental thinking (1929), which encouraged listening to one's intuition while staying true to science (Wilson, 1975). He was also a student of Brentano, who believed that a scientific method needed to be applied to philosophy and psychology (Brentano, 1973; Spiegelberg, 1978). Husserl agreed, as he was originally a mathematician, and recognized the importance of collecting data regarding the shared experiences of people exposed to the same phenomenon (Davidsen, 2013; Husserl, 1982/1931). He took a career pivot from the study of math and became interested in philosophy as Europe faced back-to-back wars (Beyer, 2022).

With the backdrop of World War I and later World War II, Husserl (1970/1900) created a methodology called Transcendental Phenomenology to get to the essence of a specific phenomenon. He worked tirelessly to deconstruct this method of inquiry, even as he faced antisemitism in his university (Hans, 2001). Over 40,000 of Husserl's papers were discovered posthumously, and publishing from him continued well beyond his death (Beyer, 2022).

Slightly later, and somewhat in parallel, Heidegger, a student of Husserl, branched out and created what is now called Hermeneutic Phenomenology (Heidegger, 1996/1927; Laverty, 2003). Husserl and Heidegger debated whether one's reality is internal to the person experiencing it and if it is what appears in their consciousness (Husserl, 1982/1931) or if one's lived experience is to be interpreted and essentially exists in one's lifeworld (Heidegger, 1996/1927; N. I. Lee, 2020).

The two ways of thinking are not that far apart regarding modern-day phenomenological research. For the study of women in STEM, the phenomenon is the experiences that the participants share while may or may not align with what is in the literature review. There are reasons why some women persist and others choose to leave the STEM professions (Ortiz-Martínez et al., 2023). This focus on the phenomena makes phenomenology ideal for studying a group's shared experiences, such as STEM women's experiences.

Phenomenological research also assumes reflection and self-knowledge, placing value on that which has been experienced by the participants of the research in their real world (Frechette et al., 2020; Neubauer et al., 2019), contributing to why this method was selected for gathering and learning about the lived experiences of women in STEM (S. MacDonald & Headlam, 2008). Phenomenology can be conducted through focus groups, telephone studies, and online community discussions (Maxwell, 2013; Richards & Morse, 2013). However, the method chosen in this study was the in-person interview using telephony live conference calling services. In-person is ideal, where a fellow woman in STEM, who is the researcher, can empathize and relate. The researcher can show a level of vulnerability while remaining objective during the interview process (Cotterill, 1992; Levesque-Lopman, 2000). The interview will bring forward insights and provide rich knowledge of the experiences of the participants (Høffding et al., 2022).

Structured Process of Phenomenology

The process of phenomenology in this study was inspired by best practices and recommendations from leading scholars in the field of qualitative research (Bengtsson, 2016; Creswell & Creswell, 2018; Giorgi, 1997; Groenewald, 2004). From the beginning of phenomenology's history, the interview was treated with a "masculinist mechanistic attitude" (Oakley, 2016, p. 196) with its only intention to be a means to gathering data. When researcher Ann Oakley (1981) wrote a chapter on interviewing women based on her experience as a researcher in the social sciences. She realized that there could be reciprocity instead of the long-held belief of the power dynamic the interviewer held over the interviewee. Oakley's (1981) book chapter started a wave of other social scientists thinking about feminism and the act of interviewing women (Cotterill, 1992; McRobbie, 1982). The role of friendship, rapport, and mutual altruism began to surface in interviews of women by women researchers (Luff, 1999;

Ribbens, 1989). Criticism also emerged from some who deemed it fake and exploitative of the interviewee's trust in the interviewer (Dunscombe & Jessop, 2002).

Appropriateness of the Phenomenological Process

In the study of STEM women, the researcher is a woman with prior experience in STEM who will adopt Oakley's (1981) perspective for empathy, active listening, and reciprocity. As such a woman interviewing women is one of the reasons that phenomenology is the most appropriate method to conduct this study. The modernized version of phenomenological research of conducting qualitative studies follows the steps outlined by Bengtsson (2016) and Giorgi (1997). Bengtsson states to organize "the aim, the sample and unit of analysis, the choice of data collection method, the choice of analysis method and the practical implications" (Bengtsson, 2016, p. 10). Whereas Giorgi simplified it even further with his three steps "(1) the phenomenological reduction, (2) description, and (3) search for essences" (1997, p. 235). The researcher has pulled from both scholars to study the phenomena of being a woman in STEM and will follow these steps (Bengtsson, 2016; Giorgi, 1997):

- The Aim. In a qualitative research analysis, this is the planning phase. Who are the people the researcher is interested in learning from, and from those learnings, what solution is being sought (Bengtsson, 2016, p. 10; Downe-Wamboldt, 1992). In this study the aim is to study women in STEM with five or more years of experience.
- The Sample and Unit of Analysis. Please see the subsections in Chapter 3's Research Design section (Bengtsson, 2016, p. 10).
- The Choice of Data Collection Method. The choice for this study is to conduct in-person interviews using the Zoom telephony tool. Interviewing participants is a method that has a significant track record for revealing the truth of lived experiences

(Bengtsson, 2016; Giorgi, 1985; Moustakas, 1994; van Manen, 1990). Focus groups or written open-ended questionnaires have their place in qualitative research. However, in this study, the researcher is seeking answers to open-ended questions and to build upon the answers provided by the participants.

- The Choice of Analysis Method. This step lies in Giorgi's phenomenological reduction and description (1997, p. 235). Please see the section on Data Analysis in Chapter 3.
- The Practical Implications. Within this step lies Giorgi's "search for essence" (1997, p. 235). The researcher is seeking the truth from the lived experiences of the participants. Their insights are reflections of the meaning they have assigned to their personal experiences (Hourigan & Edgar, 2020; Husserl, 1982/1931).

Phenomenology is appropriate for the study of women in STEM to illuminate their success strategies and barriers as it will bring forward the true nature and essence of their lived experience.

Weaknesses of Phenomenological Research

Critics of phenomenology cite possible researcher bias, low sample size relative to quantitative studies, and participant's subjectivity, including poor memory, as some of the main weaknesses of this research process (Hutto & Myin, 2017; Kockelmans, 1967; Mohanty, 1997; Moreno, 2002). Whether the qualitative methodology uses phenomenology, narrative, case study, ethnography, or grounded theory, all of them depend on the way the participant sees and interprets their world (Husserl, 1982/1931). Maxwell (1996) discusses challenges to the credibility of the research if conclusions are not reached accurately by the researcher. To mitigate these possible weaknesses, the researcher adopts epoché, the suspension of his or her beliefs (Husserl, 1982/1931; Zahavi, 2021). The process of epoché is discussed in its own section. Subjectivity and interpretation are the largest criticism of phenomenology (Bucklew, 1955).

Research Design

This section outlines the overarching research design for the phenomenological study of women in STEM. This section contains the Participants and Sampling subsection which includes the unit of analysis, the population, the sample size, and purposive sampling. In addition, Participant Selection is discussed which includes the sampling frame, the criteria for inclusion and exclusion, and maximum variation, stating the rationale for each.

Participants and Sampling

The following section describes how the participants are identified, recruited, and ultimately chosen. These elements ultimately form the sampling frame (Moser & Korstjens, 2018).

Unit of Analysis. The unit of analysis is one woman who has worked in STEM industries for over five years within a STEM discipline. Scholars state that the unit of analysis is driven by what/who and the phenomenon the researcher is trying to shed light upon (Gorichanaz et al., 2018; Milne & Adler, 1999; Patton, 2014).

Population. All women who have worked in Bureau of Labor Statistic’s STEM occupations for five years or more within a STEM industry are considered to be in the population being studied. The population of a phenomenological study is the set of individuals brought together by a phenomenon and their lived experiences within that event or set of events (Casteel & Bridier, 2021; Porter, 1999). The current population of all women in STEM is 12.9 million (NSF, 2023).

Sample Size. The sample size for this phenomenological study will be 15 women working in a STEM field with over five years experience working in STEM industries. Sample size in research design is often debated as guidance suggests randomness and large sample sizes for quantitative studies until one comes across the intervention being studied (Sandelowski, 1995; Sargeant, 2012; Vasileiou et al., 2018). However, more is not always better in qualitative methods, as saturation will inevitably occur (Morse, 1995). Saturation is a concept founded in grounded theory (Glaser & Strauss, 1967). Charmaz states that saturation occurs when "gathering fresh data no longer sparks new theoretical insights, nor reveals new properties of your core theoretical categories" (2006, p. 113). Moreover, saturation is a sign that the researcher has repeatedly seen, heard, and documented the same theme (Fusch & Ness, 2015; Guest et al., 2006). Guest et al. (2006) analyzed 60 sets of interviews and noted that saturation occurred at about the 12th person. Other researchers have found that it occurs closer to a sample size of 17 (Francis et al., 2010). Thus, with a sample size of 15, this study is within the range of scholarly recommendations.

Purposive Sampling. This concept is commonly discussed in qualitative research as it looks at sample size and participants who can provide rich color and texture to the studied topic (Casteel & Bridier, 2021; Luborsky & Rubinstein, 1995). Intentionally selecting the sample ensures the desired characteristics being studied are brought forward in the group being studied (Etikan et al., 2016). When the goal is depth, not breadth, purposive sampling is the answer (Palinkas et al., 2015). Unlike quantitative methods, where much more randomness is encouraged (Creswell & Creswell, 2018), purposive sampling aims to find participants with the phenomenon being sought to be studied (M. L. Miles & Huberman, 1994). In this study of women in STEM, the phenomenon is the experience of women with five or more years working in STEM fields. In this study, the goal was to select a purposive sample of twenty to twenty-five women from those who had responded to the recruitment post and met the inclusion criteria. If they met the inclusion criteria, they were added to the master list. If they did not meet the inclusion criteria, the researcher thanked them and let them know that their participation was not needed. From the master list, the goal was to arrive at fifteen volunteer participants who met the sampling frame to be selected to participate in the study.

Participants Selection

Finding appropriate study participants with lived experiences reflective of the studied phenomena is critical to a qualitative phenomenological study (Creswell, 2009; Sargeant, 2012). In this study, participants were encouraged to voluntarily respond to a recruitment script (See Appendix A), which was posted on the researcher’s LinkedIn site and then shared to other LinkedIn Groups (see Sampling Frame section for details on the LinkedIn group selection process). The respondents’ names were collected and added to a master list maintained by the researcher in a password protected google sheet with only the researcher knowing the password. See Protection of Human Subjects regarding the specifics of protecting this data.

The researcher used publicly available profile data to decide whether to add the interested participant’s name to the master list or not. The list was organized in priority of years of experience as it was important to ensure all levels of work experience were represented. The literature review revealed that many barriers occur when a woman is seasoned in her career (Bollestad et al., 2022; Espinoza & Ferreira, 2022; Ketchiwou & Lineo, 2023; Malani et al., 2020; Ryan & Haslam, 2005; Sunil, 2022). Three extra participants were also selected as reserve if challenges or dropouts occurred during the research. A total of 18 eligible participants rounded out the master list.

Sampling Frame. The sampling frame ensures that the participants are representative of the population being studied (Kölln et al., 2019; Martínez-Mesa et al., 2016). LinkedIn was heavily leveraged to identify and recruit women in STEM with five or more years of experience. The search terms used were geared to find the LinkedIn groups where it was most likely that these women would be found. LinkedIn groups were identified using the following initial search terms "women" and "STEM". Then "women" and "tech" and "global" terms were searched together as this was intended to be a global study. Women and STEM produced 651 groups. From that search, STEM Sisters and Women in STEM groups ranked first and second on the returned results. With over 2,000 (STEM Sisters) and 11,000 (Women in STEM) members, they were added to the participant recruitment options. The researcher requested to join these groups and was accepted.

The next search, with the terms "STEM", "tech", and "global" returned 149 groups with Women in Tech Global Movement being near the top and having numerous followers at 163,000. Thus, in addition to the researcher's LinkedIn network, three open LinkedIn groups also met the criteria for recruitment. The researcher then posted the recruitment script (Appendix A) to her LinkedIn home page, providing an email address requesting that women who qualified for the study reach out to her. She then reposted her post to the following groups on LinkedIn to reach additional participants:

- The LinkedIn group called STEM Sisters – The researcher's goal was to ensure that underrepresented minorities have a chance to participate in this study. This group has 2,000 members.
- The LinkedIn group called Women in STEM. With over 11,000 members and easily searchable, this group was identified for recruiting appropriate participants.

- The LinkedIn group called Women in Tech – Global Movement. With over 163,000 members, and a willing leader to help reshare the recruitment script, this group was identified for reaching participants.

The recruitment script stated that participants had two weeks to email the researcher with their interest. The researcher compiled the names of those who replied in response to the recruitment script, creating a master list of women who could be possible participants. Then she reviewed their education, the companies they had worked for or were working in currently. Details regarding profile characteristics and completion of the master list can be found in criteria for inclusion, exclusion and maximum variation sections. The Data Collection section details how the master list was narrowed to reach the purposive sample of 25. Protection of Human Subjects details how the master list was deleted following completion of the interview.

Criteria for Inclusion. The criteria for inclusion for the participant was to be a woman in a STEM industry who has worked for five or more years STEM occupations. In the sampling frame, the researcher reviewed the prospective participant's LinkedIn profiles for the following inclusion criteria. Participants were included if:

- Number of years working in STEM. Number of years working as a woman in STEM was five years or more.
- Industry. Woman in STEM and their industry, for example healthcare, high technology, environmental sciences.
- Education. Although the participant did not need to have a STEM undergraduate degree, those with STEM majors were prioritized higher in the master list. Those with graduate degrees were also prioritized higher than those without. See Data Collection for details.

- Profession. Women in fields which are listed in the U.S. BLS STEM occupations (U.S. BLS, 2022).

If they met all of the above inclusion criteria, they were placed on a password protected master list in google sheets which would be prioritized after all of the prospective volunteers had been identified (see Data Collection). If they did not meet the above criteria, they received an email thanking them for their interest and letting them know that they would not be participating in the study. In addition to the above profile characteristics, graduate school attendance, leadership level/role, and working through COVID-19 years, 2020-2022 were noted, but were not considered an inclusion criterion. These characteristics would later be used to narrow the master list (see Data Collection).

Criteria for Exclusion. The criteria for exclusion were that the woman has worked in STEM *industries* but not in STEM fields. An example would be a woman who has worked at Microsoft Corporation in a human resources or accounting capacity. Another criterion for exclusion was if the woman has not worked in a STEM field between 2020-2023 as it was critical to capture the impact of the COVID-19 pandemic on STEM women in the workforce. Additional exclusion criteria were noting whether the woman was working in healthcare field during the COVID-19 pandemic as circumstances were very challenging during that time and not representative of the typical work experience for a woman in STEM.

Criteria for Maximum Variation. Maximum variation was achieved by choosing the participants across a list of volunteers who had met the inclusion criteria. The final group of 20-25 STEM women were selected based on their seniority, industry, and occupational professions from the master list with an attempt made to get as much diversity in professions and industries. Preference was given to those with STEM undergraduate degrees, graduate degrees, belonging in a leadership role, and tenure through COVID-19. Recent experience, especially through COVID-19, with the exception of healthcare workers, was an essential marker of persistence, as many women left the workforce during that time (Albanesi & Kim, 2021; Brynjolfsson et al., 2020). The aim for maximum variation was to have five early in career participants (five to ten years of years of work experience), five mid-career women (10 to 15 years of experience) and five participants with 15 or more years of seniority. See Data Collection for how the master list was narrowed to arrive at the final 15-25 participants.

Protection of Human Subjects

Human subject research has a checkered past (Stark, 2012; Weindling, 2001). Not only was there extensive human testing, against their will, of prisoners of concentration camps by Nazis but also, in the United States, testing on prisoners and military personnel continued for decades through the early 1960s (Comfort, 2009; Jones, 1993; Reverby, 2012). Following the end of World War II and the Nuremberg trials (Office of Military Government for Germany [US], 1946), there was a broad recognition of the atrocities that had taken place in concentration camps under the guise of medical research (Annas & Grodin, 1992; Weindling, 2001). From The Doctors Trials in 1949, a new set of rules emerged called the Nuremberg Code, which was established to govern medical research (Weindling, 2001). The American Medical Association and the U.S. military modeled a code of ethics which was inspired by the Nuremberg Code (American Medical Association, 2022; Stark, 2012). Even with this early phase of governance on medical research, there was still a gap in a growing area of research, which was testing on healthy people (Ladimer, 1957).

The concept of “informed consent” (Greene & Podolsky, 2012; Tobbell, 2011) came to the forefront as demand for research increased in order to obtain drug approvals from the newly formed Food Drug and Cosmetics Administration (now Food and Drug Administration, FDA). This was a hopeful next step as prospective participants in research were informed of the risks and provided the opportunity to participate or not (Moon, 2009). By this point, a practice was already adopted at the National Institute of Health Clinical Center to have a review committee approve medical trials (Stark, 2012). The laws continued to evolve as more focus was placed on the dangers of unknown participation in research involving humans. The current FDA regulations on human subjects research are in CFR Title 21 Parts 50 and 56, Protection of Human Subjects and Institutional Review Boards (United States Department of Health and Human Services, 2009).

Even with this focus, there continued to be gaps in medical research for vulnerable populations. In the 1960s, it was common practice to use prisoners for medical trials (Hornblum, 1998; Stark, 2012). Prisoners and children had been easy targets for testing for decades as they could not provide consent (M. G. White, 2020). Incremental improvements in medical testing continued until they eventually led to a significant evolution in laws, such as the ones following the Belmont Report (United States Department of Health and Human Services, 1979) and the Menlo Report (United States Department of Homeland Security, 2012). These reports now govern laws explicitly articulating how human research should be conducted. They are especially strict when it pertains to vulnerable populations. In the Belmont Report (United States Department of Health and Human Services, 1979), vulnerable populations are prisoners, pregnant women, fetuses, and people under 18.

Internal Review Boards (IRBs), which were formally ratified by the Belmont Report are stewards and reviewers of all research pertaining to human subjects (United States Department of Health and Human Services, 1979). They have an obligation to ensure the horrors of the past do not repeat (Yanow & Schwartz-Shea, 2008). An empirical review conducted by Abbott and Grady (2011) showed that there still needs to be more consistent application and interpretation of the IRB requirements. Every institution, including universities such as Pepperdine University, adheres to the IRB requirements, which are stated in the Common Rule section of the Belmont Report (Moon, 2009; United States Department of Health and Human Services, 1979).

Pepperdine University strictly complies with U.S. Code of Federal Regulations, DHHS (CFR), Title 45 Part 46 Protection of Human Research Subjects (United States Department of Health and Human Services, 2009). According to Pepperdine University's IRB site (n.d., para. 1) it aims to "provide a full circle of protection for research participants and researchers by:

- Promoting and facilitating the protection of rights, welfare, and dignity of human research participants;
- Helping ensure compliance with federal regulations, state laws, University policies, and national standards for research involving human research participants;
- Providing timely and directed high-quality education, review, and monitoring for human research projects;
- Assist investigators in conducting ethical, sound research of the highest quality that complies with applicable regulations" (Pepperdine University, n.d.).

Additional information can be found on Pepperdine's online IRB site under Policies (n.d., paras. 1-3). To adhere to this policy, study participants were provided an Informed Consent form, which can be found in Appendix B.

In addition, this study respected the following principles of ethics from the Belmont Report Common Rule (United States Department of Health and Human Services, 1979):

- Respect for Persons. The ethical responsibility is to ensure that no one with diminished capabilities partakes in this study.

- Beneficence. Maximizing benefit and minimizing harm is at the core of this principle. Due to the voluntary nature of this study, participants are under no obligation to participate if they feel they would be harmed.
- Justice. This principle ensures that “research carries both benefits and burdens, fairness requires that no one group—gender, racial, ethnic, or socioeconomic group—receive disproportionate benefits or bear disproportionate burdens of research” (Mastroianni et al., 1994, p. 76).

Protection of Human Subjects Prior to the Interview Process

Prior to the selection of the interview candidates, a master list was created. That master list was created in a google sheet with names and emails of volunteer prospective participants. The master list was saved on the researcher’s password protected laptop in a google sheets file. Google sheets, in the researcher’s personal google drive, resides within the password protected Pepperdine google share. Access to Pepperdine’s digital assets is protected by two factor authentication which is managed by the DUO application. On a monthly basis DUO reauthenticates access to all Pepperdine digital assets, including all student access. With the student’s Pepperdine login credentials, DUO application’s multi factor authentication, and the researcher’s password protected computer, there were four layers of protection.

Once the participant was selected and agreed to participate, they received the Informed Consent Form by email from the researcher (see Appendix B). They were asked to carefully read the Informed Consent, and encouraged to ask for clarity if needed. If they had no questions, they were instructed to sign and return the form to the researcher. The researcher saved the informed consent form using the pseudonym assigned to the participant (see below). The file was saved on a dedicated folder in the researcher's google sheet, named Informed Consent Folder STEM Women, which resides on the Pepperdine University password protected google drive.

The researcher used a dedicated password protected google sheet that they only have access to and created a mapping between the participant's real name, email address, and the pseudonyms given to the participant. As mentioned in the Interview Technique section, pseudonyms were based on famous female scientists. The mapping google spreadsheet was saved on the researcher's google drive which is on a server within the Pepperdine University firewall. Access to Pepperdine University's digital assets requires multi-factor authentication via the DUO application, which adds another layer of digital privacy and protection. In total, between the password on the researcher's laptop, the password on the googles sheet, the password and authentication of Pepperdine University's digital assets and the DUO application's multi-factor authentication, there were four layers of protection regarding the data which matched the participant's real name and email to their pseudonym. This googlesheet which contained the real names and pseudonym mapping was deleted after all of the interviews were conducted.

Protection of Human Subjects During the Interview

When the participant joined the Zoom meeting, they were asked whether they would like to stay on camera or not. They were reminded that the meeting was not being recorded, and that Otter.ai tool would be producing transcripts from the conversation. The participant was provided the opportunity to ask questions about the process. The researcher reviewed Informed Consent again to ensure the participant was comfortable with the interview process. The researcher advised the participant that they could opt out at any time. The researcher then asked the participant to change their name on the Zoom to the pseudonym provided to them. Once that was done, Otter.ai was turned on and the interview began.

The researcher maintained a password protected Word document for jotting notes during the interview as well as a paper notebook. Care was taken not to mention the participant's name or company in the researcher's paper notebook or the Word document. Upon completion of the interview and after the researcher spent 30 minutes reflecting on the interview, anything notable that was written on the paper notebook was entered into the Word document. The paper was then shredded. As mentioned in the Interview Protocol section, the naming convention of the Word document also followed the sequence of the pseudonym, the tenure group, and date of interview. An example of a Word document file name is Lovelace_Group1_Feb_2_2024.doc. The Word document was stored on the researcher's password protected laptop and was destroyed following the completion of the Ph.D. program.

Security of Interview Data

Audio data was captured during the interviews using Otter.ai too for transcription. The Zoom application did not record or store the transcripts. Upon receipt of the transcripts from Otter.ai, they were each renamed to a new file name using the following file naming convention: Otter, pseudonym, the tenure group, and date of interview. An example of a converted audio file name is Otter_Lovelace_Group1_Feb_2_2024. For additional protection, these files were stored in a password protected folder on the researcher's password protected laptop under the C:\Users\[Username]\Documents\Otter folder.

The data was then imported into the password-protected transcription tool called Delve. Delve can identify themes, bracket the data, and capture insights. Delve (2022) refers to data brought into their tool for analysis as User Submitted Information (USI). In this study, User Submitted Information refers to the transcripts of the 15 interview participants' conversations with the researcher. Only the researcher had access to Delve, which is password-protected as well. Delve privacy protections were in place for the USI. The following is an excerpt from Delve's privacy statement (User Submitted Information, 2022, section 9):

> When you use the Delve App, you may choose to provide us with User Submitted Information. All User Submitted Information is owned by you and is never sold to third parties. User Submitted Information is only shared with our trusted vendors and sub-processors and only for the purpose of enabling and enhancing your use of the Services. To view a list of our sub-processors and what they do, please visit our Delve Software Sub-processor page.
>
> We store your User Submitted Data with database providers rather than on our own servers. We work with trusted third-party vendors and sub-processors for the storage and transfer of User Submitted Information and enter into data processing agreements and standard contractual clauses whenever feasible. Regardless of where you use our Services or provide information to us, the User Submitted Information may be transferred to and maintained on servers located inside and outside the U.S., including to countries outside the European Economic Area ("EEA"). By using our Services you acknowledge, agree and consent to your User Submitted Information being processed outside your jurisdiction, including in countries and jurisdictions that may not provide the same level of protection.
>
> We take the security of your User Submitted Information seriously and we use a variety of security measures to help keep your information safe. Some of these features include encrypted in transit, encrypted at rest, SSL certificates and OA Authentication for user logins.

Once the researcher had the transcripts uploaded to Delve, she de-identified the data to ensure nothing in the interviews made mention of the company or person in the interview. It is important to note that only the researcher had access to these audio transcripts. Upon completion of the study and receipt of the Ph.D. graduate degree, only summary data was kept for three years from the interviews. All data on the researcher's laptop, Word documents and Zoom audio transcripts were deleted following completion of the Ph.D.

Confidentiality

Although it is nearly impossible to guarantee confidentiality, the researcher, who has worked in the STEM technology sector for over 30 years, took participant confidentiality very seriously. Every measure was taken to ensure participant confidentiality, including using pseudonyms and shredding field notes as they were written during interviews. Before audio recording began on Otter.ai, the interviewee was asked to change their name so it appeared on transcripts by their pseudonym. The IRB document provides additional details regarding confidentiality (see Appendix B). The only person who had access to the Word document and corresponding Otter.ai audio transcripts was the researcher. Data from both file types was deleted. The audio transcripts were deleted immediately after coding and the researcher deleted field notes and memos completion of the Ph.D. Delve data which was deidentified was planned to be destroyed within three years. All correspondence with participants was conducted using Pepperdine email which resides on the Pepperdine University's password protected information technology assets.

Data Collection

The Recruitment Plan (the Plan) was to commence on the LinkedIn professional social media platform following receipt of IRB approval. The IRB approved Recruitment Script (see

Appendix A) was posted on the LinkedIn platform by the researcher using a dedicated post which was written by the researcher, and promoted on the researcher's LinkedIn page. The Plan was to then to reshare that post on LinkedIn groups named STEM Sisters, Women in STEM, and Women in Tech Global Movement. These groups were identified during creation of the Sampling Frame and were chosen using search terms yielding the highest likelihood of eliciting eligible volunteer participants. Fellow cohort and Committee members, as well as various close allies of the researcher were to reshare the post to their networks. Interested participants were asked to reach out to the researcher by email.

Once the researcher received a prospective volunteer's email expressing interest in participating in the study, their names were added to the master list. As mentioned in the Protection of Human Subjects, the master list was kept on a secure password protected laptop owned by the researcher. The researcher used google sheets and saved the master list within the password protected Pepperdine google share (see Protection of Human Subjects for additional details).

The researcher then reviewed the prospective volunteer participants' LinkedIn profiles. Of importance were the profile characteristics specified in the inclusion and exclusion criteria as well as the maximum variation sections. A column for each of these characteristics was added to the master list in the google sheet: number of years worked, highest education, major in college for undergrad, major in college for graduate school, STEM industry, and STEM profession. An example of profile data was: 10 years working in STEM, undergrad of engineering, graduate school with an MBA, profession of software engineer, working in High Tech industry, being currently in a leadership role, and tenure during COVID-19. At this point the researcher did not prioritize the participants, simply taking in as many volunteers as possible.

By the end of the first week of open recruitment, if the researcher had not received enough interest, the Plan was for the researcher to reshare the post to ensure it was reaching the intended audience. If a person did not qualify for the study by meeting the exclusion criteria, the researcher replied to them with an email thanking them and letting them know that they were not selected. The recruitment script allowed for a two-week open window for participants to reach the researcher with interest in participating in the study.

When the two-week call for volunteers commenced, the master list of all interested participants based on their publicly available data was listed by inclusion and exclusion criteria as well as characteristics for maximum variation. The following profile characteristics were sequenced in priority order:

- Number of years of employment – Ranked from highest to lowest number of years of employment with anyone who had less than five years automatically meeting the exclusion criteria.
- Industries of employment – All STEM industries accepted on the master list as with healthcare being prioritized lowest due to its more balance male to female ratios.
- Profession – The volunteer participant's profile was reviewed to ensure they worked in, past or present, fields considered as STEM fields.
- Undergraduate degrees – With STEM undergraduate degrees placed highest and no undergraduate degree automatically meeting the exclusion criteria.
- Graduate degrees – Although not necessary for this study, if a volunteer participant had a graduate degree, they were ranked higher on the master list as they could provide insights regarding their academic experience. Within those who had graduate degree, those with STEM graduate degrees were placed higher than non-STEM

graduate degrees.

- Leadership role – The level of the participant was noted based on the most recent title stated in their profile. Though there was no prioritization by level, knowing the level was used in meeting the criteria for maximum variation.
- COVID-19 – If the participant was employed during COVID-19 pandemic, 2020-2022, and was not in healthcare, they were placed higher on the master list to ensure that they could provide their experiences during that period. This profile characteristic was only used as a tie-breaker in meeting maximum variation.

The prioritized master list's initial review eliminated those volunteers who did not meet the inclusion criteria or did meet the exclusion criteria. They were notified and thanked for their interest by an email from the researcher. The researcher then sequenced the remaining participants across the criteria for maximum variation by placing everyone in the order of work experience category, aka "tenure group". All of the women fell into one of three tenure groups; those who had 5-10 years of experience (Group 1), those who had 10 to 20 years of experience (Group 2), and those with 20 or more years of experience (Group 3). To ensure different perspectives were represented, the volunteer participants were evaluated group by group ensuring representation from each tenure group would be in the final interviews.

Next, within the groups, the researcher reviewed every participant's industry and field profile characteristics. In order to ensure maximum variation, the profile characteristics were used as noted in the in two separate columns their profession and industry were listed. If they were unique in their field across the participants, they were given a 'yes' in a separate column. If others also had their same field and industry, they were given a 'no'. For each of the tenure categories, those who were not unique in their field, were placed on a stand-by state. For example, if two women were both in the 10-to-20-year tenure and both were software engineers, the researcher selected only one of them with a 'yes', using their undergraduate degree with those having a STEM degree prioritized higher. If both had STEM degrees, then their leadership role became the next factor by which to prioritize for their criteria for maximum variation with leaders of higher level ranking higher on the master list. If they were exactly the same, those with graduate degrees ranked higher. If still the same characteristics, those with experience working through COVID-19 ranked higher. By the end of the prioritization process, the researcher had 20 qualifying participants who met the inclusion criteria sequenced by the maximum variation. For each tenure group, there were at least five women whose STEM field and industry, college education, leadership status and work during COVID-19 was identified in the master list. The goal was to arrive at 15 participants ultimately. It was expected that from the 20 on the master list up to five would have scheduling issues or change their minds, choosing not to participate.

The 20 prospective participants were sent the IRB Informed Consent form found in Appendix B. The participants were asked about their schedule for the best interview times. The researcher gave the prospective participants three days to reply with preferred scheduling options. The researcher scheduled the interviews via a google calendar invite upon receipt of the signed IRB Consent Form. The participants were reminded by the email sent by the researcher that audio recording capabilities of Otter.ai would record their conversation's audio and that the camera would be turned off if they chose. The participant would be given time in advance of recording to change their profile name to a pseudonym on Zoom as well. It is a best practice in qualitative interviews to record the conversation so that the interviewer can stay in the moment with the participant and ensure accurate data is collected and is not dependent on field notes or memory of the researcher (Jamshed, 2014). The following section outlines the specific details of the interview process.

Interview Technique

Once the participant emailed the signed Informed Consent to the researcher and the interview timing was agreed upon by email, the researcher scheduled a 60 minute google calendar meeting invite with a Zoom link for the interview with the participant.

Researcher Preparation

On the day of the interview, the researcher started the meeting 10 minutes early with a paper notebook, a dedicated Word document for the interview, and a pre-assigned pseudonym for that participant. The Word document contained a template of the final interview questions with blanks to be completed during the interview. The Word document was saved to the researcher's laptop which is password protected and resides in her home. The file names followed the sequence of the pseudonym, the tenure group, and date of interview. The pseudonyms were names of famous female scientists that were pre-assigned to each participant. An example of a Word document file name was Lovelace_Group1_Feb_2_2024.doc.

Start of Interview

Once the participant joined the Zoom meeting, a few minutes of greetings and gratitude were exchanged, ensuring the participant felt safe, and knew the process that would follow. To raise trust and establish rapport researchers briefly share their background (Oakley, 1981). Then a verbal review of the Informed Consent was provided to confirm that the participant was still agreeable to conducting the interview. Confidentiality, and how the participant's data would be protected were discussed, ensuring the participant both understood and agreed to proceeding with the interview. With a verbal agreement to proceed, the researcher asked the participant to change their Zoom name to the pseudonym.

The Interview

The researcher gave the participant the opportunity to turn off their camera if they chose. Note, the video of the conversation was not being recorded. An on-camera presence allows for capturing pauses, verbal cues and animation in expression (Sutton & Austin, 2015). The researcher then turned on Otter.ai's transcription which records only the audio to create the transcript.

The interview began with the researcher asking demographic questions. The participant was told that any demographic question or interview question that they did not wish to answer could be "passed". They simply needed to say "pass" and the researcher would move to the next question. In order for the interview to take a natural, conversational, and organic tone, the researcher had practiced asking the questions multiple times offline with friends and family. Creswell and Creswell (2018) suggest familiarity with questions as a best practice.

The interview questions are numbered in Table 4 to show their relationship to Research Questions 1 through 4. The interview questions were asked in the order seen in Table 4 with the researcher explaining the intent for each question. The researcher gave ample time for pauses and reflection between questions, recognizing that the sequence of interview questions does not always follow the sequence of matching research questions. During the interview, notes were taken on a paper pad, as reminders of key statements which came about. Similarly, the Word document was leveraged to put in key thoughts. The researcher maintained a friendly, interested and neutral facial expression throughout the interview.

Closing the Interview

After the last interview question was asked, the researcher provided the participant the opportunity to add anything that they wished should be noted, but had not been asked. The researcher then reaffirmed confidentiality process, thanking the participant for their candor and providing them the opportunity to ask any questions about the process. Once all questions were answered, the researcher closed the Zoom session.

Post-Interview Process

The researcher spent 30 minutes following the interview, cross-checking the notes and moments where additional clarity was needed. For example, if the participant had taken a long pause to reflect, the researcher had written in the Word document "Pause at Question 3, reminder to note the story which followed". This type of memo clean-up ensured that the researcher would not have to depend on her memory once analysis began. The researcher summarized their overall impression of the interview in the Word document as well.

Next the researcher received the Otter.ai audio text transcript and saved it to a password protected laptop in a folder named for the research study. The file name was changed to match the structure of the aforementioned Word document file naming convention. For example, the interview with Ms. Loveless was renamed to a transcript file named Otter_Lovelace_Feb_2_2024.txt. All Otter.ai audio transcripts were saved in C:\Users\[Username]\Documents\Otter folder. Upon completion of the research study, the Word documents were deleted. However, the audio transcripts from Otter.ai were deleted immediately after coding.

Interview Protocol

For this study, a semi-structured interview process was chosen. According to DiCicco-Bloom and Crabtree (2006), semi-structured interviews are conducted only once, lasting from 30-90 minutes, and follow an interview guide, with a preset list of questions the interviewer poses. Semi-structured interviews depend on the researcher's ability to ask, listen generously, and probe further if necessary (Galletta, 2013). The order of the interview questions and the way they tie back to the research question is critical to exploring the lived experiences of the phenomena being researched (Creswell, 2008). In-person interviews, even if on a telephony platform such as Zoom, are better than phone or written essays as the interviewer can ask questions dynamically, looking for tone and body language (Opdenakker, 2006). Sometimes even a sigh or a pause produces insights (Sutton & Austin, 2015). If the interview participant demonstrates discomfort with a question, the researcher can pivot the discussion to a more pleasant area of exploration (McGrath et al., 2019).

Several methods of validity and reliability were deployed to ensure confidence and trustworthiness in the interview questions. The methods were prima facie validity, validity and reliability from peer review, pilot review, and expert review. Each of these measurement methods is discussed in this section, along with the steps the researcher took to ensure preparedness for the interviews. In phenomenological research high-quality question allow the participant to describe their experiences (Bevan, 2014). The interview questions need to provide the participant space to contextualize and expound upon the question being posed and any prior questions (Høffding et al., 2022). The interview questions for this study considered the literature review which largely focused on challenges experienced by STEM women and how they were able to overcome them. Thus, the original interview questions were rewritten following peer review and expert review. The participants were asked the following questions:

- Interview Question 1: Think of the single most difficult challenge you have faced in advancing to your position.
    a. What was that challenge and

b. How did you experience it?

- Interview Question 2: What are other similar career-advancement challenges you have experienced?
- Interview Question 3: Are you personally aware of similar challenges that other women in the STEM field may have faced?
- Interview Question 4: How has your background impacted your experience?
- Interview Question 5: IQ5: What strategies and best practices did you employ or what resources did you seek to overcome this particular challenge?
- Interview Question 6: IQ6: What strategies or best practices did you employ, or resources did you seek to overcome these challenges?
- Interview Question 7: IQ7: Are you personally aware of strategies or best practices employed or resources sought by these women?
- Interview Question 8: What are the metrics you track to measure success in developing your career? (limit them to 3-5 if they went long)
- Interview Question 8: What are the metrics you track to measure success in developing your career? (limit them to 3-5 if they went long)
- Interview Question 9: What tools or resources does your organization give you in measuring and tracking your career development?
- Interview Question 10: What metrics would you like to measure and track but are unable to do so?
- Interview Question 11: As a woman in STEM, what lessons have you learned that we have not covered in this interview?
- Interview Question 12: If you could, what is the one thing you would do differently?

- Interview Question 13. Was it all worth it? How?

Relationship Between Research Questions and Interview Questions

The literature review established that some life experiences for women in STEM become barriers to advancement, persistence, and retention, and others produce successes from which follow-on advancement and opportunities occur. By adhering to Appreciative Inquiry (Barrett & Fry, 2005; Cooperrider & Whitney, 2005; Watkins et al., 2011), open-ended questions were constructed to bring forward success strategies, barriers, and challenges.

Validity and Reliability

Merriam and Tisdell (2009) consider reliability to be the ability to repeat the research. Validity ensures that the questions are straightforward and in a language that will elicit open and honest discussion while raising confidence (Merriam & Tisdell, 2009). To ensure reliability and validity in the interview questions, the researcher took several steps to validate the interview questions. Following Appreciate Inquiry (Cooperrider & Whitney, 2005), an initial set of Interview Questions were created from which the Research Questions could be derived. The initial set of questions were peer reviewed with three PhD cohort members, with a request to provide feedback on the clarity of the interview questions. After receiving feedback and updating the interview questions, the interview questions were then sent to a group of five former Microsoft Corporation colleagues, all of whom are women in STEM. They were asked to review the questions as if they were a participant in the interview. Additional feedback was provided from these women. The next step was expert review provided by the Ph.D. Committee. The final step was a second pilot review by two more women who have experience with phenomenological research. In this section the iterative process, the learnings and updates are discussed for achieving validity and reliability.

Prima-facie and Content Validity

The researcher took the first pass at creating the interview questions. After completing the literature review, a table of thoughtful interview questions was developed to support the research questions. This is called prima-facie content validity (Mills & Birks, 2014). Interview Questions 1-4 were tied to Research Question 1, which asks, "RQ1: What are the challenges faced by women in STEM in ascending to leadership positions?" The literature review exposed barriers such as ageism, racism, microaggressions, and lack of preparedness for college (Bahr et al., 2017; Ilișanu & Andrei, 2018; McGee, 2020). Interview Questions 4-7 looked to expose ways women in STEM mitigated these barriers. These interview questions were tied to Research Question 2, which looks for "RQ2: What strategies/best practices are used by women in STEM to overcome the challenges they face?" Interview Questions 8-11 sought answers to what level of support systems were in place for these women in STEM, such as mentors, sponsors, and leadership training programs as revealed in the literature review (Barkhuizen et al., 2022; Edna et al., 2019; Lopez & Duran, 2021; D. M. Young et al., 2013). These questions were tied to Research Question 3, "RQ3: How do women in STEM define, measure, and track their career success?" The last two interview questions were tied to Research Question 4, "RQ4: What recommendations do women leaders in STEM have for aspiring female leaders?" Table 1 shows the original research questions and their respective interview questions as created by the researcher.

Table 1

Prima-Facie and Content Validity

Research Question	Corresponding Interview Question
Demographic Questions	1. Industries served – public, private,

Research Question	Corresponding Interview Question
	healthcare, software et 2. Your level (director, VP, etc) 3. Age range? (?) 4. Public versus Private college or none attended 5. Degree level (BS, MS etc) 6. Type of degree (Eng, chemistry, et) 7. Do you have any children? 8. Do you have a spouse?
RQ1: What are the challenges faced by women in STEM in ascending to leadership positions?	1. When you look at your career what is the single most difficult obstacle(s) you have faced? 2. What other challenges have you faced? 3. Are you aware of other challenges that other women have faced? 4. How has your background impacted your experience?
RQ2: What strategies/best practices are used by women in STEM to overcome the challenges they face?	5. How did you overcome it (whatever they stated in IQ1)? 6. How did you overcome it/them (the second/third or next challenge)? 7. How did they overcome it (related to IQ3)?
RQ3: How do women in STEM define, measure, and track their career success?	8. What are the metrics you track to measure success in developing your career? (limit them to 3-5 if they went long) 9. What outcome (s) are you willing to accept? 10. What assistance does your organization give you in measuring and tracking your career development?

Research Question	Corresponding Interview Question
RQ4: What recommendations do women leaders in STEM have for aspiring female leaders?	11. What factors would you like to measure and track but are unable to do so? What lessons have you as a STEM leader learned that we have not covered in this interview? 12. What would you not do again?

Note. Table 1, Research Questions and Corresponding Interview Questions. The table identifies four research questions and corresponding interview questions as developed by the researcher.

Once these questions were created, the researcher moved to the next step, which was to achieve peer review validity.

Peer Review Validity

By asking three Ph.D. cohort members to review the interview questions, the researcher ensured clarity in the questions and removed any bias (see Appendix C). According to Pannucci and Wilkins, “Bias can occur at any phase of research, including study design or data collection, as well as in the process of data analysis and publication” (2010, p. 7). The peer review group received the document, which contained Table 2.

The peer review team identified several areas where clarity was needed. Interview Question 1’s language was updated to ask for a singular obstacle. Also, in Interview Question 1, “career” was replaced with “journey” to encompass the whole path, including relationships and parenting, as examples. Interview Question 2 was updated to add the words “if any” so as not to assume the women in STEM had faced multiple challenges. Interview Question 3 was updated to ask “if any other challenges”, to imply not repeating one’s own challenges. Here, the researcher looked for other women’s challenges the participant might have seen or heard. Interview Question 3 was also updated to seek specificity regarding ascension to leadership. A new question was added: “How has your background impacted your experience?” This would allow the participants to talk about their ethnicity, immigration status, or any other background information beyond demographics if they chose to share. This became the new Interview Question 4. Interview Questions 5–7 had modest linguistic updates for more clarity. Interview Question 8 was updated to ensure the participant highlighted the “most important” metrics to measure. There was unanimous agreement by the peer review team that interview question nine was unnecessary, and thus, it was removed. In Interview Question 10’s language, the word “assistance” was replaced by “tools and resources”. Interview Question 11 was updated by replacing the word “factors” with “metrics”. Interview Question 12 was updated with slightly modified grammar and word placement. Interview Question 13’s language was updated to narrow the focus to 1-2 things the participant would not do again. Table 2 shows the updates from the Ph.D. cohort peer review validity exercise.

In addition to peer review, the researcher asked three women in STEM to review the output of the peer reviewed questions. Their feedback was incorporated into the peer reviewed validity. The reviewers assessed the depth and breadth of the questions by putting themselves in the position of prospective participants. They provided feedback, sought clarification, and pointed out several areas where the language could pose a risk of misunderstanding. Specifically, the original set of questions had the word “leader” in several questions. Some of the expert reviewers asked what “leader” really meant. In their opinion, everyone has a role of being a leader in STEM fields. The expert reviewers wanted to know if the researcher meant “manager, director, or VP” in the word “leader” or any other such titles by stating this part in the question “journey to leadership”. The researcher chose to update the verbiage for IQ1 and IQ2 based on this feedback to the following:

IQ1: Thinking back over your STEM journey, what is the single most difficult obstacle you have faced?

IQ2: What other challenges, if any, have you faced when ascending in your career?

The next feedback received was for Interview Question 3, which states “What other challenges have other women have faced in moving or attempting to move into leadership roles?” One member sought clarification on whether the question was asking for what they had personally *witnessed* or if it would be considered acceptable if they had only *heard* about other women’s challenges but not witnessed it first-hand. The researcher chose to opt for the more extensive set of observations, which include first- and second-hand experiences that participants had seen or heard. The question remained unchanged. Regarding Interview Question 4, one of the STEM women asked if it was necessary to provide examples for the word “background” in the question “How has your background impacted your experience?” It was in the researcher’s judgment to not put bias into that question or risk limiting the answers that may come about. The question remained unchanged. The final comment was regarding Interview Question 13, which states “What are 1-2 things you wish you could do differently in your career?” One of the STEM women asked for clarity. She wanted to know if this question looked in the past or current state. The researcher’s intent is for the participants to reflect on their past. As such, the question was clarified: “What are 1-2 things you wish you could do differently in your career if you could do it over again?”

The researcher updated the table with the peer review feedback. Table 2 contains the updated set of interview questions which were then presented to the Expert Review.

Table 2

Peer Review Validity

Research Question	Corresponding Interview Question
Demographic Questions	1. Industries served – public, private, healthcare, software et 2. Your level (director, VP, etc) 3. Age range? (?) 4. Public versus Private college or none attended 5. Degree level (BS, MS etc) 6. Type of degree (Eng, chemistry, et) 7. Do you have any children? 8. Do you have a spouse?
RQ1: What are the challenges faced by women in STEM in ascending to leadership positions?	IQ1: Thinking back over your STEM journey, what is the single most difficult obstacle you have faced? IQ2: What other challenges, if any, have you faced when ascending in your career? IQ3: What other challenges have other women have faced in moving or attempting to move into leadership roles? **IQ4: New Question**: How has your background impacted your experience?
RQ2: What strategies/best practices are used by women in STEM to overcome the challenges they face?	IQ5: What strategy did you use to successfully overcome that single most difficult obstacle you faced? IQ6: What strategy did you use to overcome those additional challenges?

Research Question	Corresponding Interview Question
	IQ7: How do you believe those other women overcame their challenges?
RQ3: How do women in STEM define, measure, and track their career success?	IQ8: What do you believe are most important metrics for measuring success in developing your career? **Removed**: What outcome (s) are you willing to accept? IQ9: What Tools or Resources does your organization give you in measuring and tracking your career development? IQ10: What metrics would you like to measure and track but are unable to do so?
RQ4: What recommendations do women leaders in STEM have for aspiring female leaders?	IQ11: As a STEM leader, what lessons have you learned that we have not covered in this interview? IQ12: What are 1-2 things you wish you could do differently in your career if you could do it over again?

Note. Table 2, Research Questions and Corresponding Interview Questions (Revised). The table identifies four research questions and corresponding interview questions with revisions based on feedback from the pilot reviewers. Subsequent changes were made to the order and phrasing of questions within the interview protocol.

Expert Review

The Expert Review is the final step for vetting the interview questions. As a part of the Preliminary Orals feedback process, the Ph.D. Committee provided suggestions to the researcher regarding her interview questions. They used the Pilot review (Table 4) as their baseline and made several recommendations starting with an Ice Breaker question which can be used to build rapport (Oakley, 1981). The following changes were made based on Expert review feedback:

- Interview Question 1 had two sub-parts added to develop the inquiry further and to gain specificity regarding the nature of the challenge the woman faced and how she experienced it.
- Interview Question 2's wording was slightly modified, but the intent stayed the same.
- Interview Question 3 had the word "personally" added to it, ensuring that the participants answered from their direct experiences.
- Interview Questions 5, 6, and 7 were reworded to follow strategies employed to overcome challenges first for the singular challenge, then other challenges, followed by challenges observed by others. All of the wording for these Interview Questions were updated for clarity.
- Interview Question 13 was revised to close out the interview with a thoughtful ask of the participants to share whether they found it all to be worth it.

Table 3 represents the final changes to the Interview Questions.

Table 3

Research Questions and Corresponding Interview Questions. (Revised After Expert Review)

Research Questions	Corresponding Interview Questions
Demographic Questions	1. Industries served – public, private, healthcare, software et 2. Your level (director, VP, etc) 3. Seniority range (early in career, mid-career, senior level) 4. Public versus Private college or none attended 5. Degree level (BS, MS etc)

Research Questions	Corresponding Interview Questions
	6. Type of degree (Eng, chemistry, et) 7. Do you have any children? 8. Do you have a spouse?
RQ1: What are the challenges faced by women in STEM in ascending to leadership positions?	Tell me how you developed your interest for STEM? IQ1: Think of the single most difficult challenge you have faced in advancing to your position. • What was that challenge and • How did you experience it? IQ2: What are other similar career-advancement challenges you have experienced? IQ3: Are you personally aware of similar challenges that other women in the STEM field may have faced? IQ4: How has your background impacted your experience?
RQ2: What strategies/best practices are used by women in STEM to overcome the challenges they face?	IQ5: What strategies and best practices did you employ or what resources did you seek to overcome this particular challenge? IQ6: What strategies or best practices did you employ, or resources did you seek to overcome these challenges? IQ7: Are you personally aware of strategies or best practices employed or resources sought by these

Research Questions	Corresponding Interview Questions
	women?
RQ3: How do women in STEM define, measure, and track their career success?	IQ8: What are the metrics you track to measure success in developing your career? (limit them to 3-5 if they went long) IQ9: What tools or resources does your organization give you in measuring and tracking your career development? IQ10: What metrics would you like to measure and track but are unable to do so?
RQ4: What recommendations do women leaders in STEM have for aspiring female leaders?	IQ11: As a woman in STEM, what lessons have you learned that we have not covered in this interview? IQ12: If you could, what is the one thing you would do differently? IQ13: Was it all worth it? How?

Note. Table 3, Research Questions and Corresponding Interview Questions (Revised). The table identifies four research questions and corresponding interview questions with revisions based on feedback from the expert reviewers. Subsequent changes were made to the order and phrasing of questions within the interview protocol.

Pilot Review Validity

This is a necessary final step to ensure the researcher's bias and lived experiences do not creep into the interview questions. As Hammersley (2023) states, there are few methods to ensure trustworthiness in qualitative methods. Accordingly, once all of the reviews were completed, the researcher tested the questions with a few expert women in STEM who fit the inclusion criteria. This process is called Pilot Review.

Statement of Personal Bias

A scholar's passion for a topic factors into the decision to pursue a Ph.D. (E. O. McGee et al., 2016; Woolston, 2019). However, that passion must be managed carefully and continually, especially during research. Bias can creep in unintentionally during research design and data gathering (Gardenier & Resnik, 2002; Simundić, 2013). In qualitative research, care is taken to ensure the researcher's bias or agenda is not injected into any components of the process. Thirsk and Clark (2017) emphasize that "the rigor of qualitative research is particularly vulnerable when it lacks some of the devices that have been employed in quantitative research to ensure that what is produced is not just well-composed rhetoric of a well-meaning, but biased, researcher's opinion" (p. 4). Some examples of bias are how the researcher asks the questions, what he/she chooses to ask, and what he/she chooses to include in the themes and results. To mitigate bias in the research, the researcher must acknowledge their worldview and life experiences. In this study, the following lived experiences are present for the researcher:

- The researcher is a white woman with a master's degree in business administration and an engineering undergraduate degree.
- The researcher has worked in STEM fields and industries for over 30 years as an engineer in private and public organizations. She has held numerous leadership positions and has risen through the ranks. She has worked with many women in STEM.
- The researcher is an immigrant to the United States.
- The researcher is married with two adult children, and worked outside the home for most of the children's upbringing.

Bracketing and Epoché

The concept of epoché can be found in the earliest of phenomenological methods (Husserl, 1982/1931; Zahavi, 2021). Epoché is the ability to suspend judgment by the researcher even if they have experienced the phenomenon being studied (Husserl, 1982/1931). As phenomenological methods shed light on lived experiences, it is possible for the researcher to fit the inclusion criteria. Nevertheless, their experience with the world around them will differ from those of their research subjects. Giorgi followed a similar thought process (1994). He believes that all phenomenological studies need to follow some level of epoché and reduction (Giorgi, 1994). Reduction, also known as 'bracketing', is "suspending our tacit belief in the absolute existence of the world, by no longer simply taking reality as the unquestioned point of departure, we start to pay attention to how and as what worldly objects are given to us" (Zahavi, 2021, p. 262).

Modern phenomenological scholars recommend bracketing to mitigate researcher bias (Creswell, 2003; Moustakas, 1994). Multiple methods include personal reflection, journaling, memoing, and conducting a rigorous literature review (Bednall, 2006; Weatherford & Maitra, 2019). The researcher in this study chose two methods in addition to the literature review. The first was to memo throughout the research process, especially during the literature review, which brought forward many of her assumptions and experiences of being a woman in STEM. Tufford and Newman (2012) say the memoing process frees the researcher. The second method was to ask one of her trusted Ph.D. peers to conduct the interview with her as a participant. The process of being interviewed with her questions allowed the researcher to reflect on her own experiences as a woman in STEM.

Data Analysis

In this phenomenological research study of STEM women's experiences, the data was gathered via transcripts from interviews between the participants and the researcher. The researcher also maintained a journal to take notes during the interview in case there were additional cues or behaviors that she needed to capture or to ensure no memory bias took place between the timing of the interviews and the analysis of the data (Kraemer et al., 2022; Neusar, 2014). Memory bias can distort what one has experienced, including during the interviews, as the researcher uses his/her current knowledge or values in interpreting the data (Schacter, 1999). The sections below will outline the data analysis method used in this research study as the researcher moved from gathering the data to interpreting its meaning.

Data Analysis and Coding

The quantity of data is estimated at approximately 20-30 pages of text per 45–60-minute interview (Sutton & Austin, 2015). For 15-20 interviews, the researcher should have 300-450 pages of interview data. The researcher followed the three-step process defined by Giorgi (1997). The first step is reduction, also known as coding (Giorgi, 1997). Coding refers to the researcher's process of assigning themes to the data (Saldaña, 2015). Van Manen (1990) encourages the researcher to leverage their knowledge of the phenomena during the analysis. As the researcher interprets the data from the transcripts, he/she will begin to see codes that emerge from multiple interviews (O'Brien et al., 2014; Saldaña, 2015). The codes are derived from the insights the participant shares with the researcher and may tie to what the researcher has seen in the literature review or be completely new insights (DeCuir-Gunby et al., 2011). The code consists of one or two words, helpful reminders of emerging themes. With enough coding and themes analyzed, the researcher begins seeing patterns. When the codes and themes start to repeat themselves, it is called saturation (Saunders et al., 2018). Saturation is the standard for qualitative research, indicating that the analysis has reached a level where enough data has been collected on a topic (Fusch & Ness, 2015; Morse, 1995). In this study, with a participant size of 18 interviewees, all of the data was analyzed (M. Mason, 2010). To ensure confidence in the study and high-quality peer review was conducted, the researcher deployed interrater reliability and validity.

Interrater Reliability and Validity

In the Data Collection section, the validity and reliability of the interview questions were discussed, and the method of achieving internal validity was outlined. That process ensured there was no internal bias in the method and design of the interview questions (Hartling et al., 2012). Interrater reliability and validity confirm that the external facing conclusions and recommendations are also free of bias and repeatable if another researcher chooses to repeat the study (McHugh, 2012; Morse et al., 2002; Tinsley & Weiss, 1975). The researcher must continually ask themselves if the analysis explains people's behaviors, why people act a certain way, and whether this matches with what we know from the literature review (Mays & Pope, 1996). These factors are considered as the researcher analyzes the data. By following the steps below, qualitative studies achieve credibility and provide the transparency that a peer review has taken place (Belur et al., 2021; Jirschitzka et al., 2017):

1. *Baseline Themes* - After the first three interviews were conducted, the researcher proceeded to code them. From these interviews, themes emerged. Some were expected from the literature review, and others were new. The researcher then sent the codes and transcripts to her peer coders. The coders were fellow doctoral students who were trained in qualitative methods.
2. *Interrater Review* - The peer group received the transcripts and the codes from the

researcher. They reviewed the transcripts and codes and provided feedback to the researcher. The researcher made the appropriate modifications. At that point, a meeting was called with the peer group and the researcher. The goal of the meeting was to reach a consensus on the first set of codes and themes. If the meeting did not reach a consensus, the results were sent to the committee for insights and guidance.

3. *Baseline Themes* - The researcher continued interviewing the next 15 participants. She used the codes from Step 2 and added codes and themes that emerged from the 15 new participants. The researcher then shared these results with the peer group.
4. *Interrater Review* - The goal of step 4 is to achieve consensus. If consensus cannot be reached, that is a sign of an error or bias (DeVellis, 2005). Thus, the peer group received the results of Step 3 and was asked to review the results.
5. *No Consensus > Expert Review* – This is a step that is only conducted if step four does not reach consensus. In this study Step 4 arrived at consensus following a brief discussion on two questions (see Chapter 4, Data Collection for details).

Data Presentation

It is the task of the researcher to take what he/she has heard in the interviews and present the data in a manner that is true to the lived experiences of the participants without creating a tedious chore for the reader (Sutton & Austin, 2015). The data needs to reflect the meaning the participants gave to their stories and, simultaneously, be balanced by not representing the researcher’s subjective thoughts or opinions (C. Anderson, 2010). The process of analysis followed the sequence of “reduction, description, and search for essence” (Giorgi, 1997, p. 100). Each interview question was outlined in the following format in Chapter 4:

- Following the description of the demographic data, the researcher methodically presented the results of each interview question, reminding the reader of the intent of that question. The demographic data was presented in pie chart format with percentages for each question.

- The researcher reviewed all of the participant's interview answers for each interview question and considered themes that applied to that question. Internal and external validity and reliability took place for each interview question. The researcher used the Delve Tool to extrapolate keywords, themes, and appropriate data synthesis from all participants for the interview question he/she analyzed.
- As the researcher reviewed all of the answers from participants, specific quotes from interviewers came to the forefront which synthesized the essence of the meaning attributed to that question. The researcher identified those quotes and used her judgment to match them with the thematic analysis she derived in Step 2.
- The researcher created a histogram with the most notable themes for that question, noting the number of times that theme appeared.
- The final step for the interview question was to explain in narrative form each theme that emerged from the interview question analysis.

Once all of the interview questions were processed through Steps 1-5 above, the researcher aggregated the findings to the original relationship between interview questions and research questions. At this point, the literature review was used to substantiate the findings if there was a relationship between the findings and what is known in the body of knowledge related to the phenomena. The researcher then tied the conclusions to findings and recommendations for the population he/she has studied.

Chapter 3 Summary

Chapter 3 outlined the qualitative method and phenomenological process of research for the study of success strategies and barriers for women in STEM. The research questions and the interview questions which support this study were stated. The background of phenomenological methodology, along with its rich history and evolution over the past century, were provided for context. The Research Design section presented many considerations, including participant selection process, the sampling frame and how the inclusion and exclusion criteria along with maximum variation would support having the right participants. Research Design also listed the recruitment process, including the social media sites for recruitment. Protection of Human Subjects section provided the details behind the need for studies which involve humans, including Federal laws which govern treatment of and methods defining participant's consent. Privacy and confidentiality are integral to protecting humans who participate in research studies. In this study, both were considered thoughtfully, including end to end protection of data inside and outside all of the tools being used in the study. Protection of Human Subjects outlined the IRB process for this study.

Next, the Data Collection section detailed the interview technique and interview protocol which follow semi-structured questions in this study. The section which followed was the Relationship Between the Interview Questions and the Research Questions. This section began with prima-facie and content validity, which illustrates how the researcher baselined the interview questions which were largely from the literature review. In order to achieve reliability and validity, the peer review and expert review sections illustrated the process the researcher used with help from her Ph.D. cohort members as well as her network of experts. The researcher acknowledged her experience and how she would manage objectivity throughout the research process in the Statement of Bias. Bracketing and epoché would be the method by which she would mitigate any potential for bias.

Chapter 3 closed with a focus on Data Analysis, the process for Interrater Validity and Reliability, and Data Presentation. Steps were outlined which showed mitigation of bias in the interview results by following a process where peers reviewed codes and themes at multiple steps throughout the data analysis process. These steps included consulting by the committee when issue arose on reaching consensus on themes and codes.

Chapter 4: Data Analysis and Results

Introduction

The purpose of this study is to illuminate the challenges women in STEM face, and to seek to understand the success strategies they employ to overcome these barriers. Eighteen women in STEM of various levels of experience in different industries were interviewed by the researcher to uncover their challenges and strategies. Of their interviews, sixty-two themes emerged which would ultimately answer the four research questions stated below.

Chapter 4 details the data collection and analysis process as well as outlines the findings which ensued from conducting the interviews of the STEM women participants. The interviews spanned from 2/5/24 - 2/11/24, during which time 18 women were interviewed. The purpose of the interviews was to seek to understand the answers to the following research questions:

- RQ1: What are the challenges faced by women in STEM in ascending to leadership positions?
- RQ2: What strategies/best practices are used by women in STEM to overcome the challenges they face?
- RQ3: How do women in STEM define, measure, and track their career success?
- RQ4: What recommendations do women leaders in STEM have for aspiring female leaders?

Thirteen interview questions and a set of demographic questions were asked of each participant. Age, which was originally on the list was not asked as it was implied within seniority level. Level and Seniority level were duplicative and were combined during the analysis. The demographic questions asked were:

- Which industries did you serve – for example, healthcare, software etc.

- Your level – this question was answered by their title.
- Seniority level – this question was based on the number of years worked. The participants were placed in early in career (5 to 10 years worked), mid-career (10 to 20 years worked), and senior leader (20 or more years worked).
- Public or Private college or none attended
- Degree(s) level earned (BS, MS etc)
- Type of degree (engineering, chemistry, etc.)
- Do you have any children?
- Do you have a spouse?

The following interview questions were asked, and had been vetted through multiple validity and reliability processes (see Chapter 3):

- IQ1: Think of the single most difficult challenge you have faced in advancing to your position.
    - What was that challenge and
    - How did you experience it?
- IQ2: What are other similar career-advancement challenges you have experienced?
- IQ3: Are you personally aware of similar challenges that other women in the STEM field may have faced?
- IQ4: How has your background impacted your experience?
- IQ5: What strategies and best practices did you employ or what resources did you seek to overcome this particular challenge?
- IQ6: What strategies or best practices did you employ, or resources did you seek to overcome these challenges?

- IQ7: Are you personally aware of strategies or best practices employed or resources sought by these women?
- IQ8: What are the metrics you track to measure success in developing your career?
- IQ9: What tools or resources does your organization give you in measuring and tracking your career development?
- IQ10: What metrics would you like to measure and track but are unable to do so?
- IQ11: As a woman in STEM, what lessons have you learned that we have not covered in this interview?
- IQ12: If you could, what is the one thing you would do differently?
- IQ13: Was it all worth it? How?

The above interview questions were developed to inform the research questions posed in this study. In Chapter 4, each interview question will be analyzed for the themes which emerged from the participants' answers. Emphasis will be placed on the themes occurring most often, and the occasional outlier where poignant insights were garnered.

Participants

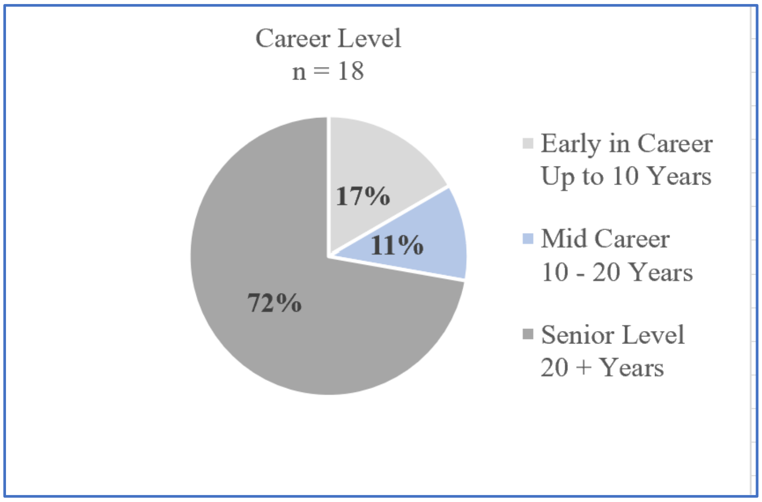
Participants were chosen using volunteer sampling methods. The researcher drew from her LinkedIn community and from her network's community by others in her network who reshared her post twenty-seven times. Overall, over 4000 people on LinkedIn saw or reacted to the call for volunteer participants. Eighteen participants were ultimately chosen to participate in the research study.

During the recruitment phase twenty-seven women in STEM expressed interest by emailing or messaging the researcher. If they met the inclusion, exclusion and maximum variation criteria, they were asked to email the researcher at her university's email address to receive an Informed Consent Form (Appendix B). Of the twenty-seven women who reached out, nine were not interviewed due to either not returning their Informed Consent Form, not agreeing to be recorded, or had scheduling conflicts. The researcher reached saturation with the first fifteen who did meet the requirements; however, three more highly qualified STEM women were added as they were either early in career or represented underrepresented minorities in their field. These three participants were added to the interview list.

The researcher asked the demographic questions at the start of each interview. The questions ranged from their occupational backgrounds, their educational backgrounds, whether they were mothers, and whether they had a partner or a spouse. The participants' industry experiences were varied and largely fell into these categories: aerospace, military, healthcare, information technology, high technology, sports entertainment, retail, manufacturing, education, telecommunication, and government roles, such as working for the Department of Defense. The following figures represent their responses for some of the pertinent demographic questions such as level of seniority, highest degree education earned, motherhood status and whether they had a spouse or partner, noted as relationship status. Most of the women, 72%, were at the senior leader level with 20 or more years of experience. The remaining participants were at mid-career, 11%, and early in career, 17%. See Figure 1.

Figure 1

Seniority Level of Participants by Number of Years in the Workforce

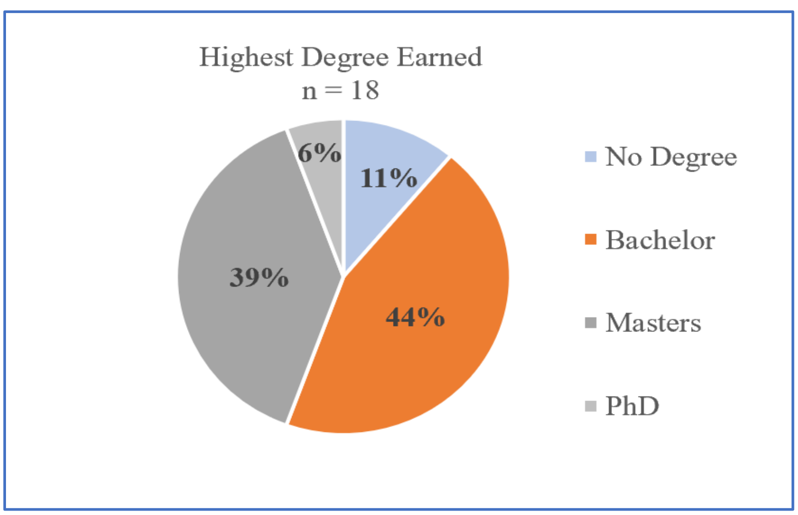


Note. Figure 1 shows the distribution of the participants' seniority level.

The next demographic question was regarding the distribution of participants across their educational backgrounds. Forty-four percent had a bachelor's degree, 39% had earned a Master's and 6% had a PhD. Eleven percent had not attended college. See Figure 2.

Figure 2

Highest Level of Education Earned

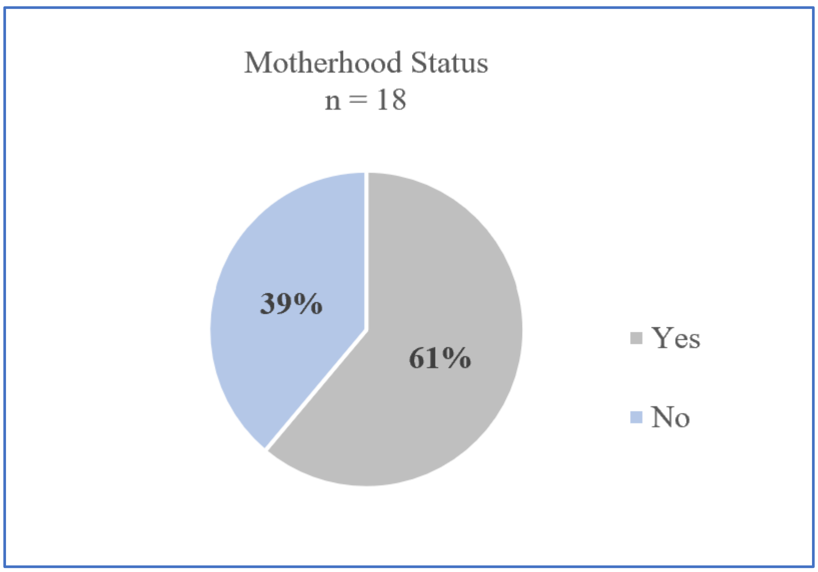


Note. Figure 2 shows the distribution of participants by their degree level.

Motherhood status was another demographic question which was asked. Sixty-one percent of the participants answered the question, as “yes”, and stated the number of children they had. Number of children was noted, but was not tracked, as the literature shows that even one child changes the outcomes for career progression (Budig & England, 2001). Thirty-nine percent of the participants did not have children. All of the early in career, 17%, did not have children. See Figure 3.

Figure 3

Status of Motherhood by Participants

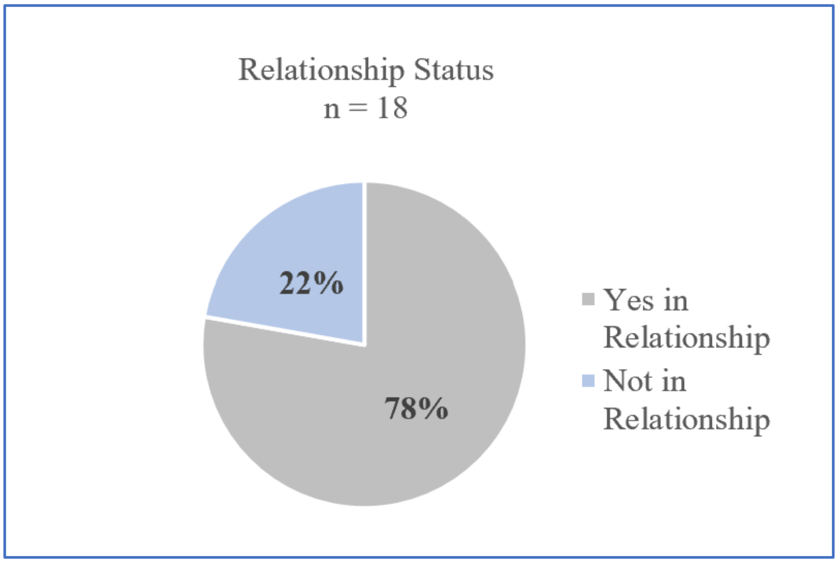


Note. Figure 3 shows whether the participant stated that they were a mother.

Participants were also asked if they had a spouse or a partner. Seventy-eight percent of the participants said yes. Twenty-two percent said they did not. See Figure 4.

Figure 4

Relationship Status of Participants



Note. Figure 4 represents the participants' relationship status.

Data Collection

As per the Citi Certificate training requirements (Appendix D), upon receipt of IRB Approval Notice on 1/31/24 (Appendix E), recruitment began. The IRB approved Recruitment Script (Appendix A) was posted on LinkedIn on 2/1/24. As mentioned in Participants section, the researcher selected 18 participants from the master list and sent them the Informed Consent Form (Appendix B). They were asked to read, sign and return the form to the researcher. The researcher then sent the interested participants a Zoom meeting invite with an Otter.AI-enabled Zoom link. Data collection took place 2/5/24 – 2/11/24. See Table 4 for details.

Table 4

Dates of the Participant Interviews

Participant Label	Interview Date
1	2/9/24
2	2/10/24
3	2/5/24
4	2/9/24
5	2/6/24
6	2/9/24
7	2/8/24
8	2/11/24
9	2/9/24
10	2/9/24
11	2/6/24
12	2/5/24
13	2/6/24
14	2/7/24
15	2/6/24
16	2/5/24
17	2/7/24
18	2/10/24

Note. Table 4 shows the participant numbers and their respective interview dates.

Data Analysis

Components of data analysis began as early as the interview meetings ended. The researcher received Otter.AI's interview transcripts within moments of completing each interview. The researcher reviewed the transcripts, ensuring no personal information was discussed and deleting any references to names of companies. Two interrater review processes were conducted (see Chapter 3 for details on the process, and below specifics for this activity).

Using the DelveTool and the feedback from the interrater reliability process, the researcher coded the transcripts. Themes emerged once all of the answers to the interview questions were coded. The DelveTool allowed for poignant quotes to be highlighted per interview question. The DelveTool also allowed for counting the number of occurrences per theme from which the percentages of participants for that theme were calculated.

Inter-Rater Review Process

Following the first three interviews, which took place on 2/5/24, the researcher met with three of her PhD peers to conduct an interrater review process on 2/6/24. The PhD peers were shown the early themes which were emerging from the initial interviews. The panel of co-raters received an excel spreadsheet which contained the summary of each interview question per participant, along with proposed codes and themes from the first three interviews. Their feedback on IQ1 was to ensure that the common denominator among these answers was that the women were experiencing challenges in male-dominated spaces. Their feedback on IQ2 was to label "gender exclusion" as the theme for sentiments such as "boys' club", "bro culture" and other lived experiences where women were not allowed to participate fully as themselves. For IQ2, the peer reviewers also noted the "motherhood penalty" as a clear theme, echoing the researcher's notes. Interview Question 4, "tokenism" resonated for the peer reviewers as all of the women at some point had noted being the "only", a term coined by C. Burton et al. (2023), and the challenges it had created for them. For IQ8, even though there was not enough data yet, the peer reviewers highlighted that so far, none of the participants appeared to have mentioned having a clear plan for their career. The researcher took note to see if this was a pattern that would emerge from the remaining participants' feedback. One of the peer reviewers noted that for IQ11, there was a theme of "paying forward." The researcher took note. There was consensus that IQ12 had subtle undertones of the “gender pay gap” and the realization by the participants that women were underpaid (Korn et al., 2022). The gender pay gap is one of the key reasons women attrit from STEM fields (X. Chen, 2013; Moakler & Kim, 2014; Pell, 1996; United States Census Bureau, 2019).

After all of the interviews were conducted, the peer reviewers met again on 2/14/24 to review all of the participants’ feedback, and the codes and themes the researcher had drawn from the analysis. The process entailed reviewing the code(s) within a theme and asking questions regarding the transcript source from which that code or theme was derived. The reviewers suggested succinct verbiage depending on the theme, ensuring the underlying data and sentiment from the participant was represented accurately. Two questions which arose regarding IQ13 needed to be escalated to the researcher’s Expert Review Committee. One question was requesting permission to present the data on the Y-axis of each IQ’s corresponding Figure in increments of two. The other question was regarding IQ13. By the way it is written, it asked two questions and the cohort sought guidance as to whether the answers should be displayed in two charts. The Expert Review Committee replied on 2/15/24 with the guidance that tick marks in increments of two per figure, would be acceptable and that IQ13 was in reality a question about the “how” and the yes/no responses did not need to be included in the chart for IQ13. Guidance was noted and applied.

Data Display

The section below outlines each Research Question with its set of corresponding interview questions. Each interview question is coded and themed with a graph which shows the number of times a theme emerged from all of the participants. The participants may have used different words to express the same sentiment, which is how a theme is derived **(**O’Brien et al., 2014; Saldaña, 2015**)**. For each interview question, the themes are listed by the largest to smallest themes, providing the percentage of each theme as it was noted in the interviews. There is a brief explanation of each theme, including the most relevant quote from one of the participants for that theme. The interviewees names are listed in accordance to the participant number assigned to each (see Table 8).

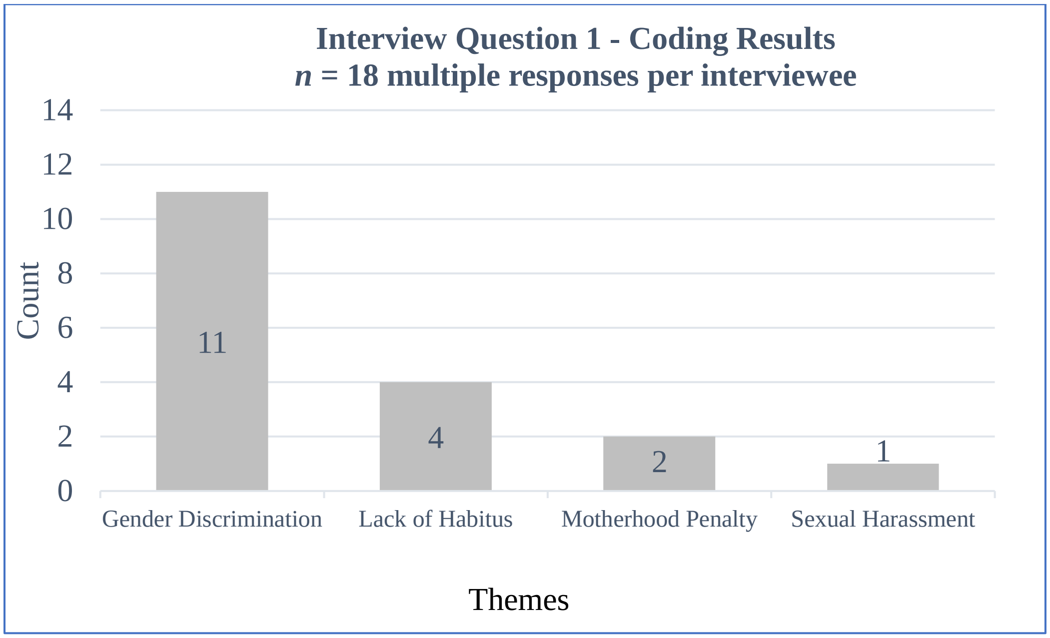
Research Question 1

Research Question 1 seeks to understand the challenges faced by women in STEM as they ascend to leadership positions. It is comprised of four interview questions which ask about the single most difficult challenge the participant has faced, additional challenges she may have faced, and other challenges she has witnessed women in STEM face. The fourth interview question seeks to understand the participant's background and how it may have contributed to these challenges or provided her strength to overcome them.

Interview Question 1. Think of the single most difficult challenge you have faced in advancing to your position. What was the challenge? How did you experience it? This is the only IQ where the total themes needed to sum to 18, as the researcher was seeking for the "single" biggest challenge and there were 18 participants, thus 18 total answers. The themes which emerged were gender discrimination, lack of habitus, motherhood penalty, and sexual harassment (Figure 5).

Figure 5

The Single Most Difficult Challenge



Note. Figure 5 shows the four key themes which emerged from participants' answers for IQ1. The chart illustrates the themes that emerged. Data are presented in decreasing order of frequency. The number in each theme indicates the number of statements made by participants assigned to that theme.

Gender Discrimination. Gender discrimination was ranked as the highest occurring theme for IQ1 with 61% of the women stating it as their single biggest challenge managing a career in STEM. Within this theme, there were four components; biased treatment for being a woman, the 'bro club' (K. C. Martin, 2013) and its lack of inclusion, STEM women not being credited properly for their work, and working for other women. Regarding the biased treatment, Participant 15 stated "From my experience the women just have to be 10 times as good as the men" (personal communication, February 6, 2024).

Lack of Habitus. The next theme which emerged was a lack of habitus with 22% of the participants stating it as their single biggest challenge. Habitus is the belief that you are capable of doing something. This theme included lack of confidence, imposter syndrome, loneliness and the inability to self-promote one's achievements (Clance & Imes, 1978; Huecker et al., 2023). "Throughout the 10 years that I have been working in this industry I have been facing impostor syndrome, where I feel like everybody else is so much smarter than me" said Participant 16 (personal communication, February 5, 2024).

Motherhood Penalty. This theme emerged as the third most stated theme, with 11% of the women relating it as their single biggest challenge. However, it is important to note that Demographic question 7 asked whether the participants had children and 7 of the 18 did not. Thus, the real number of women impacted in this research by the motherhood penalty is 18% as the seven without children are not impacted by that challenge. According to Funk and Parker (2018), motherhood is a contributor to the gender pay gap as options for managing childcare and balancing a career are limited. Participant 14 summed it up as "I was naive, and I really thought that I could do anything and then I got my MBA and I'm like, yeah, all these doors are going to be opened and then I had my first child, and I just really wanted to be flexible. And that was not an option" (personal communication, February 5, 2024).

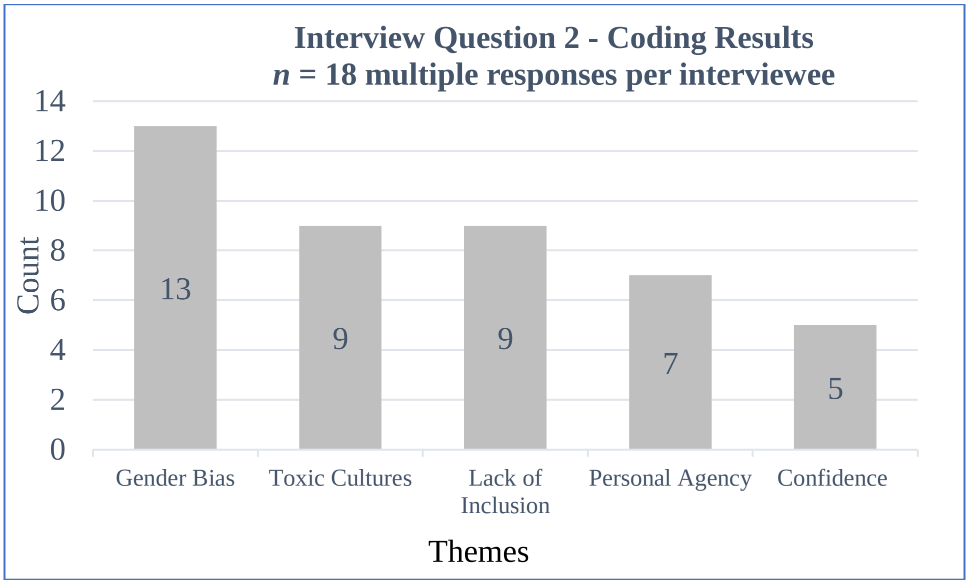
Sexual Harassment. Sexual harassment was noted by one participant, making it 6% of the interviewers. However, it is notable, and is themed as such due to its high occurrences both in the workplace and in academia where women are subject to sexual harassment in STEM fields (Aycock et al., 2019; D. P. Evans et al., 2019; Folke et al., 2020, NASEM, 2018). It was this participant's single biggest challenge as she had to take legal action against her employer, a Fortune 100 company. These occurrences are often underreported as women are embarrassed and concerned about backlash if they come forward and report (Reidy et al., 2023). Reidy et al.

(2023), reporting on college women, found that they were three and a half times more likely to be victims of attempted rape and almost three times as likely to be raped in STEM fields, versus more gender-balanced fields. Funk and Parker (2018) reported that up to 22% of women in STEM have experienced sexual harassment. It is possible that something so sensitive, with societal judgement typically against the woman, sexual harassment would be better investigated via mixed methods which included quantitative methods (Testa et al., 2011). Testa et al. (2011) recommends the use of mixed methods for researching violence against women. Participant 1 spoke of that time as “it made me stronger, to say stand up for yourself and you don’t worry about the noise. Don’t worry about what the possible outcome could have been. It was about integrity. It was about my morale. It was about my value. So that was probably the biggest challenge was making that decision” (personal communication, February 9, 2024).

Interview Question 2. What are other similar career-advancement challenges you have experienced? This question provided the participants an opportunity to think through additional challenges they had experienced. It is different from IQ1 in that there can be multiple challenges. Five themes emerged from this interview question. The themes were gender bias, toxic cultures, lack of inclusion, personal agency, and confidence. See Figure 6.

Figure 6

Other Similar Career-advancement Challenges



Note. Figure 6 shows the participants' feedback regarding other personal challenges they may have experienced in response to IQ2. The chart illustrates the themes that emerged. Data are presented in decreasing order of frequency. The number in each theme indicates the number of statements made by participants assigned to that theme.

***Gender Bias*.** In alignment with the literature (Grogan, 2019; Isbell et al., 2012), a significant portion of the participants, 72% noted experiencing gender bias. Components of gender bias were not being heard, being infantilized, not being promoted at the same rate as their male counterparts, and being treated unkindly for not conforming to cisgender heteronormative life. Participant 2 stated "I did have a bad boss who was not supportive when he found out I was queer. I found their reception to be different after they found out" (personal communication, February 10, 2024).

Toxic Cultures. Fifty percent of the participants expressed having experienced working in toxic cultures. Rivera and Scholar (2020) point to how common this is in traditionally male dominated cultures. Toxic cultures included leadership demonstrating a low tolerance for non-conformity, arbitrary performance measurement standards, bad managers, being bypassed for promotion with little to no feedback, and retaliation for pointing out bad behaviors. Regarding arbitrary performance measurement standards, Participant 6 stated “they (management) don’t really give any constructive feedback. So, I would say there’s been a lot of subjective feedback and not a lot of objective feedback” (personal communication, February 9, 2024).

Lack of Inclusion. The third theme to emerge was lack of inclusion which was experienced by 50% of participants. One of the markers of successful participation is inclusion (Ayyala & Coley, 2022; Goon et al., 2022). Behaviors such as not being included on meeting invites, not being invited to social gatherings, and not being able to attend social gatherings as the timing, venue and presence of alcohol was not inclusive. Two of the participants stated they either preferred to go home to their families or did not feel safe socializing after hours where drinking was the central focus. Sometimes business was being conducted during these events without the women who often were leading the projects being discussed. Participant 3 stated lack of inclusion as “Not being in the room when there’s conversations happening, like opportunities being created, because of the career field that I’m in, or because of gender or just their social networks” (personal communication, February 5, 2024).

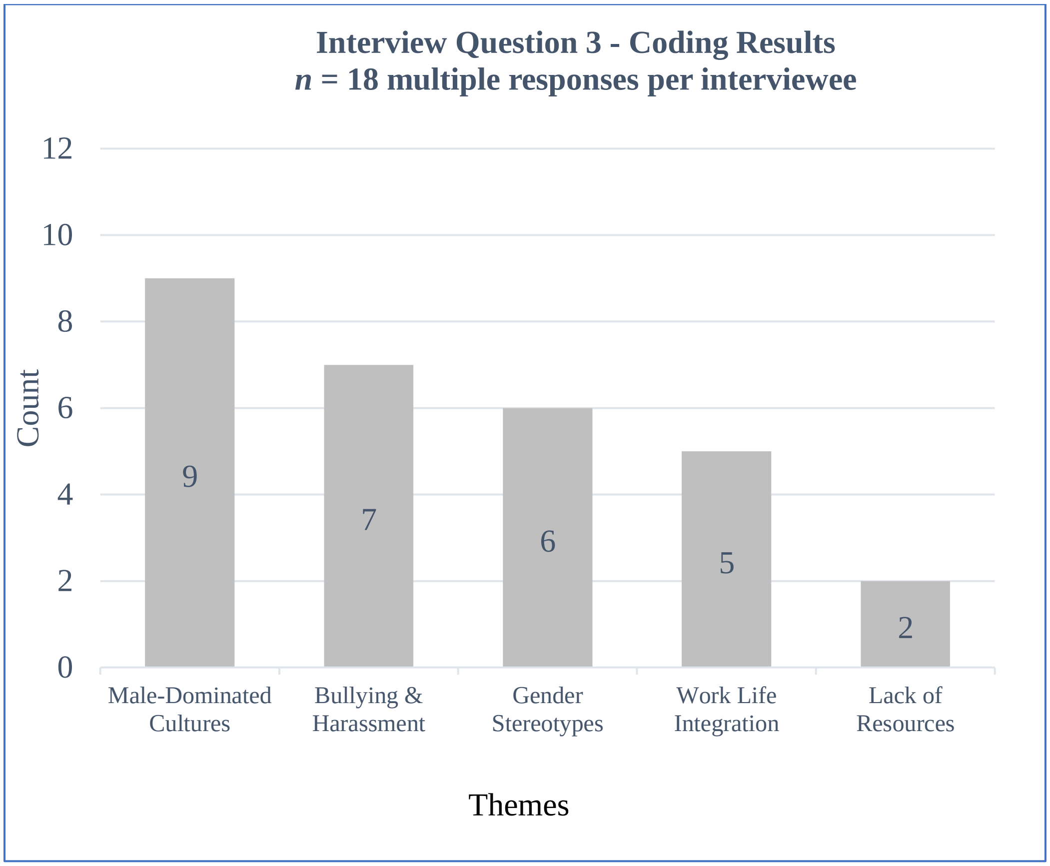
Personal Agency. Thirty-nine percent of the participants stated that their own personal challenges got in the way of their STEM careers. Examples included caregiving for children and elders, not setting boundaries with their colleagues, staying too long in a role, and not seeking mentors sooner (Fan & Moen, 2022). The importance of mentors as a success strategy is a focus in the literature (Moghe et al., 2021; Spaulding et al., 2020). Participant 12 noted that she was the first woman in a lab of 200 men and how much she would have appreciated another woman around. She said “I faced judgment around having children, because everyone else had a wife at home” (personal communication, February 6, 2024).

Confidence. The final theme to emerge for 28% of the participants was a lack of confidence. Congruent with the literature, the confidence gap is a predictor of the gender pay gap (Sterling et al., 2021). Participant 9 described her lack of confidence and how it showed up in her career as “Knowing I needed to speak up and have a voice, but not feeling comfortable to do so” (personal communication, February 9, 2024).

Interview Question 3. Are you personally aware of similar challenges that other women in the STEM field may have faced? This interview question provided the space to discuss other challenges that the participants had seen or heard from other women. As expected, the participants who were categorized as senior level leader had a greater number of observations. Early in career participants acknowledged that they knew there were more challenges to be expected, but they had not been exposed to many of them yet. Interview Question 3 had five themes. They were: functioning in male-dominated cultures, being exposed to bullying and harassment, facing gender stereotypes, having trouble with work life integration, and lacking resources. See Figure 7.

Figure 7

Challenges Other Women in STEM May Have Faced



Note. Figure 7 shows the participants' feedback regarding other women's challenges they observed, as answered in IQ3. The chart illustrates the themes that emerged. Data are presented in decreasing order of frequency. The number in each theme indicates the number of statements made by participants assigned to that theme.

***Male-dominated Cultures*.** The highest occurring theme for IQ3 was the participants' challenges of working in male-dominated cultures. Fifty percent of the participants noted a 'boy's club' (K. C. Martin, 2013) atmosphere in the workplace where business continued to be conducted after hours or on the golf course. Participant 4 stated "When you are the token, you aren't conforming to the usual ways. They pick the people who they have gone to happy hour with or played golf with. They can build those deeper connections” (personal communication, February 9, 2024).

Bullying and Harassment. The second theme which emerged was bullying and harassment, where 39% of participants said they had seen or heard of this behavior impacting other women in STEM. This theme included behaviors such as microaggressions (Ortiz-Martínez et al., 2023) and retaliation (J. Yang & Katz, 2020). Participant 4 shared her observations regarding underrepresented minorities “For my Black colleagues, women colleagues, it’s way worse. I’ve personally been dismissed from another software company that I’ve worked with, because I noticed the bullying and harassment that was happening with one of my female Black colleagues, and I brought it to HR’s attention. We were both canned” (personal communication, February 9, 2024).

Gender Stereotypes. This theme was noted by 33% of the participants. The codes which were included in this theme included observations which put men and women into stereotypical roles. Examples of this included the assumption that women had been hired to meet quotas, the concept of the ‘boy genius’ (L. Bowman, 2023; Starr, 2018) who is a stereotype and has a halo around him by management, whereas the reality is, he is often the person who has created the very chaos he is now tasked to solve, later becoming the hero. Participant 2 said “Women have had stereotypes baked into us. We aren’t the target demographic for computer science, and video games. I really loved computer science and wanted to pursue it in undergrad” (personal communication, February 10, 2024). She later added that she was encouraged to study biology instead.

Work Life Integration. Twenty-eight percent of participants noted work life integration as a challenge. The literature supports this as being a significant hardship for STEM women

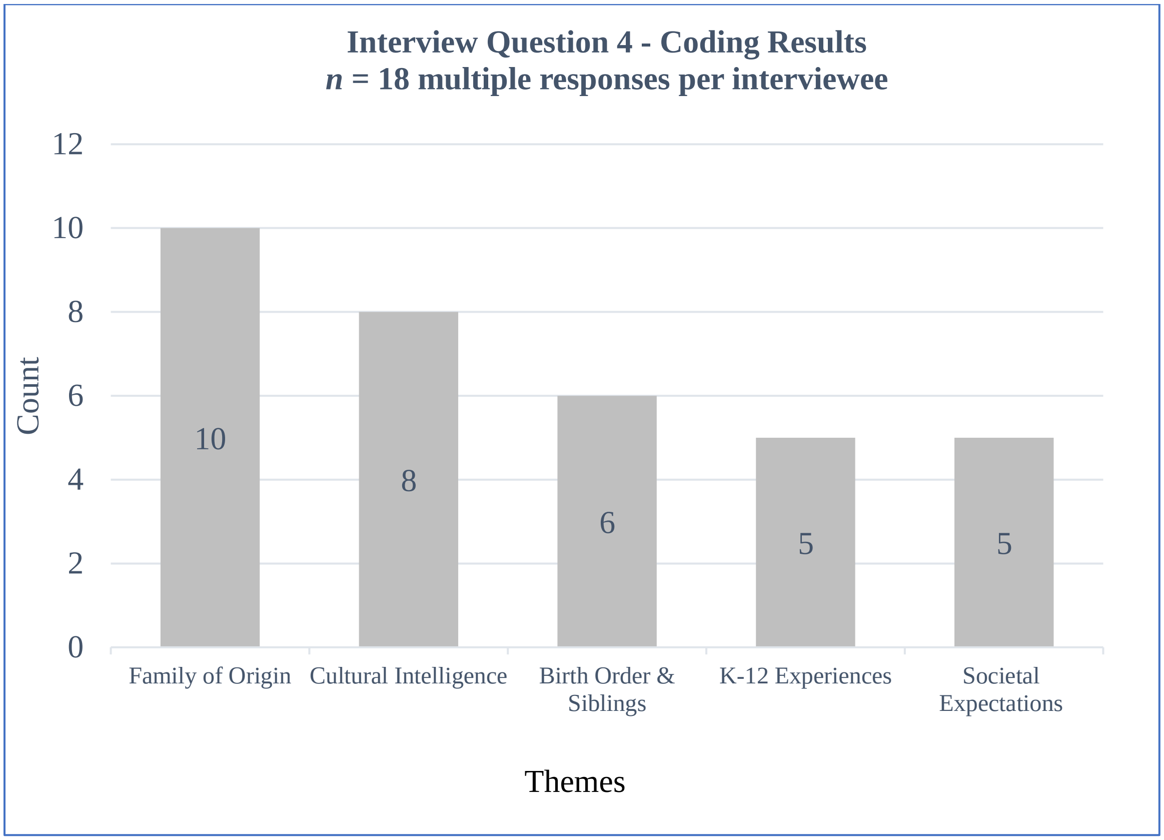
(Brue, 2019; Kachchaf et al., 2015; Neidlinger et al., 2023). The spirit of the comments in this theme were about challenges encountered as women integrated their home life and work life, especially if the home life included caring for children (61% of participants) and elders. Participant 12 stated “The expectation for everybody, men and women, is work as many hours as you can give us as much as you’ve got, travel, and stay late. That expectation was for everybody, but for women with kids, there’s a different set of responsibilities outside” (personal communication, February 6, 2024).

Lack of Resources. Eleven percent of the participants noted a lack of support resources such as access to mentors or coaching (Pechac & Slantcheva–Durst, 2021) to raise the confidence of the women they had observed having challenges. Participant 4 underscored the importance of mentors by stating “I’ve seen other women that don’t have peers or have a mentor that understand their perspective better” (personal communication, February 9, 2024).

Interview Question 4. How has your background impacted your experience? This open-ended interview question allowed the participants the chance to discuss formative experiences that shaped them into being who they are. The themes were family of origin, cultural intelligence, impact of birth order and siblings, kindergarten to high school experiences, and societal expectations. Although this question was not specific to challenges, it was important information regarding influences which shape the world view that women have as they embark on their education and careers. The themes below are strong indications of mitigations which are possible at every stage of a girl and woman’s life to ensure resilience in the face of challenges. See Figure 8.

Figure 8

Impact of Their Background on Participants' Experiences



Note. Figure 8 shows the themes associated with participants' backgrounds and the impact it had on their experiences as answered by IQ4. Data are presented in decreasing order of frequency. The number in each theme indicates the number of statements made by participants assigned to that theme.

Family of Origin. The influence of family of origin was raised by 56% of the participants. Participants noted their parents as role models, as well as the impact of their upbringing where they were taught not to tolerate bullying. Within this theme, the strong influence of the father echoed the literature (Hite & Spott, 2022; Kesar, 2017, 2018). The guidance of mothers was also noted. Participant 15 stated "my background, leading up to me getting an undergraduate degree in math, really set the tone for how I was going to lead and manage. Also, my mother was really hell bent on telling the three of us ‘you have to have your own career’, and my mother worked her whole life” (personal communication, February 6, 2024).

Cultural Intelligence. Forty-four percent of participants noted their cultural awareness had helped them in their career, especially if they were immigrants or children of immigrants. Cultural intelligence is a known indicator of effectiveness across a diverse workforce (Alifuddin & Widodo, 2022; Kao, 1999). Participant 5 stated “being culturally aware, made it really much easier to work with people of different backgrounds. It also helps in a team environment, to be open and inclusive so that you can make a better product or bring ideas to the table, incorporating people’s ideas into the mix” (personal communication, February 6, 2024).

Birth Order and Siblings. For 33% of the participants, their birth order and the influence of their siblings played a role in forming their identities. Though the latest literature suggests that birth order is not a strong indicator of career choice (Ioana & Spengler, 2021), for these participants it did define their role in their family. The breakdown between youngest and oldest child was even between the participants. They shared that the eldest were often tasked with taking care of their siblings earlier than their peers and the youngest were sometimes left to fend for themselves. A few participants stated the importance of having brothers and playing sports with them, in preparation for leading careers in male-dominated fields. Participant 19 spoke of her brothers’ influence fondly “I’m one of three kids and the only girl. My brothers were my best friends” (personal communication, February 6, 2024).

Kindergarten to High School Experiences. This theme was shared by 28% of the participants whose formative school interactions with peers, counselors, and teachers, influenced their desire and direction to move into STEM careers. The literature shows the importance of adults and their influence on self-confidence of girls in these formative years (Siani & Harris, 2023; Won et al., 2017). Participant 11 paraphrased what her high school college counselor told her “Writing is not a secure career. You won’t make any money. You’re pretty good at math *for a girl*. You should go into tech” (personal communication, February 6, 2024).

Societal Expectations. This theme connected expectations that society puts on women. Twenty-eight percent of participants shared that they had expectations to behave a certain way. Be it serving in the miliary or growing up with parents who were first generation immigrants or the first to be raised off of a Native American reservation. This permeated across the workplace and well into hiring decisions (Enav & Efrat–Treister, 2023). Participant 9 shared the conflict this created for her “I am the first generation to be raised off of an Indian Reservation. Neither (parent) went to college. My father was taught, as most native people are, to be quiet. I learned don’t take up space. I have to do the opposite in Corporate America” (personal communication, February 9, 2024).

Summary of Research Question 1

Research Question 1 sought to discover the challenges women in STEM faced. Starting with their own biggest challenge, other challenges, and challenges they had seen other women face. The set of interview questions asked in service to RQ1 probed for answers as to why so many women do not enter STEM fields, and when they do, why so many end up leaving. The interview questions in this section were capped off by IQ4 which focused on what made the person who they are. The participants were given the space to reflect on their whole set of lived experiences, pulling out the ones that were most meaningful to them in their STEM journeys.

Nineteen themes emerged in total for IQ1-IQ4. Interview Question 1 had four themes. They were gender discrimination, lack of habitus, motherhood penalty, and sexual harassment.

Interview Question 2 also had four themes. They were gender bias, toxic cultures, personal agency, and confidence. Interview Question 3 had five themes. They were male-dominated cultures, bullying and harassment, gender stereotypes, work life integration, and lack of resources. Interview Question 4 had five themes, and showcased the influence of family of origin, cultural intelligence, birth order and siblings, kindergarten to 12th grade experiences, and societal expectations.

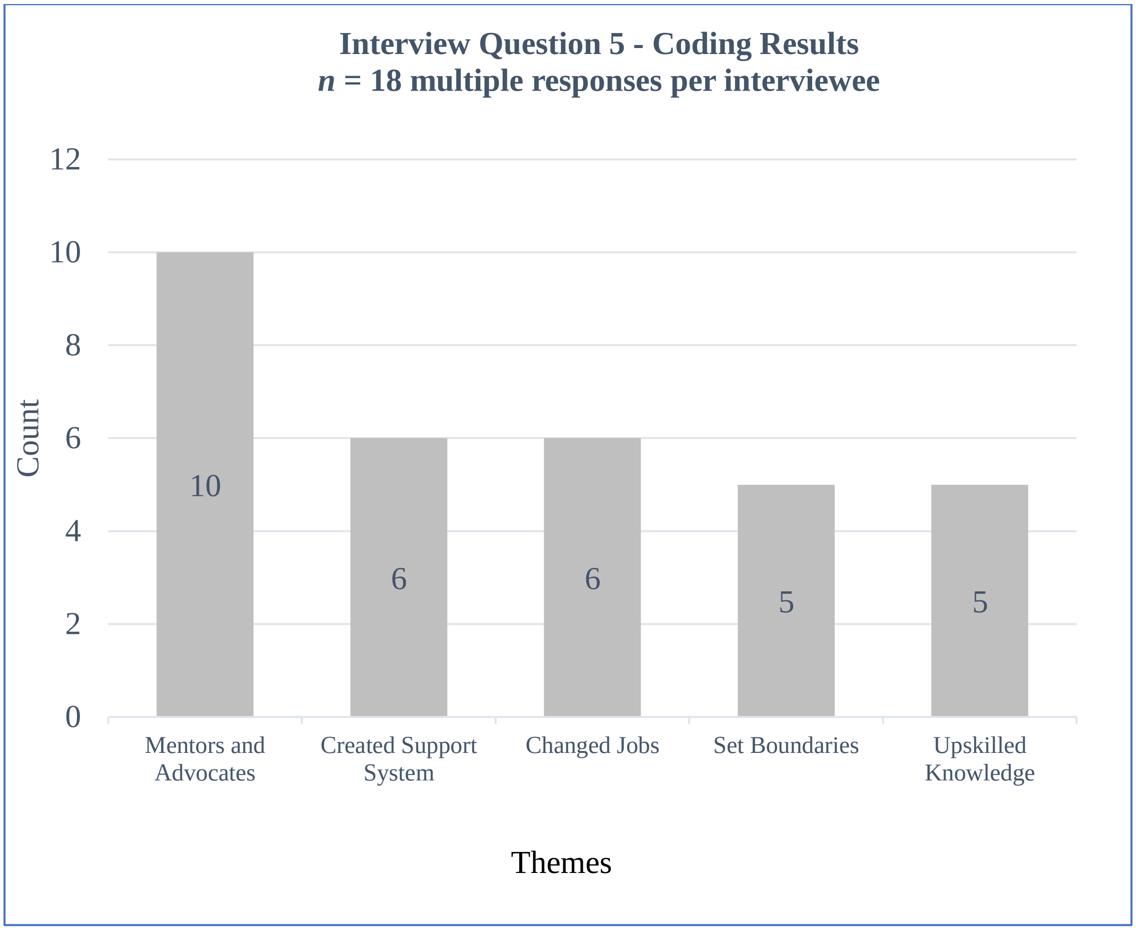
Research Question 2

Research Question 2 is focused on best practices and strategies used by women in STEM as they face the challenges discussed in IQ1-IQ3 while ascending to leadership positions. It is comprised of three interview questions which inquire about overcoming the single most difficult challenge the participant had noted in IQ1, additional challenges she may has faced (noted in IQ2) and how she overcame those, and other challenges she has witnessed women in STEM experience (IQ3) and how they overcame those challenges. Interview Questions 5, 6, and 7 are discussed below.

Interview Question 5. What strategies and best practices did you employ or what resources did you seek to overcome this particular challenge? This question directly ties to IQ1 as the single biggest challenge which needed overcoming. Five themes emerged. They were the influence of advocates and mentors, the importance of creating a support system, changing jobs, setting boundaries, and upskilling their knowledge. See Figure 9.

Figure 9

Strategies and Best Practices for Overcoming Their Single Biggest Challenge



Note. Figure 9 shows the strategies and best practices participants used to overcome their single biggest challenge as answered for IQ5. The chart illustrates the themes that emerged. Data are presented in decreasing order of frequency. The number in each theme indicates the number of statements made by participants assigned to that theme.

Mentors and Advocates. The largest theme which emerged for 56% of participants was the concept of having mentors and advocates, including allies. The research supports the need for mentors (Estrada et al., 2018; Moghe et al., 2021; Spaulding et al., 2020). These are people who can help the woman in STEM persist by coaching them or simply being in community with her to support her through challenges as they arise. The participants stated having a mix of male and female advocates. In STEM's male dominated fields, one cannot ignore the importance of having the support of both genders. Participant 2 stated "Most of my mentors were older and generally men. I've also had a few older female mentors at the vice president and director level. Those folks were there for me for recommendations and beyond" (personal communication, February 10, 2024).

Created Support System. Within this theme, sponsors, supportive partners and the importance of participating in ERGs was highlighted. The literature refers to these organizations by various names, however the scholars are in agreement that there is great benefit to feeling belongingness when one communes in ERGs (Colgan & McKearney, 2012; W. M. Green, 2018). Thirty-three percent of participants stated the importance of this theme in overcoming their single biggest challenge. Participant 11 stated "As I got older, I was part of women's groups. I would host monthly women's get togethers like a lunch once a month, where we were talking about what issues they are dealing with" (personal communication, February 9, 2024).

Changed Jobs. Thirty-three percent of participants branched out on their own by starting their businesses or moving to new roles either within their company or to a new company. One woman changed her career entirely and returned to technology after a few years. Participant 7 stated "I left tech to pursue what I thought was going to be fitness, Kinesiology biomechanics. Only to discover there's also a lot of sexism in that field too" (personal communication, February 8, 2024).

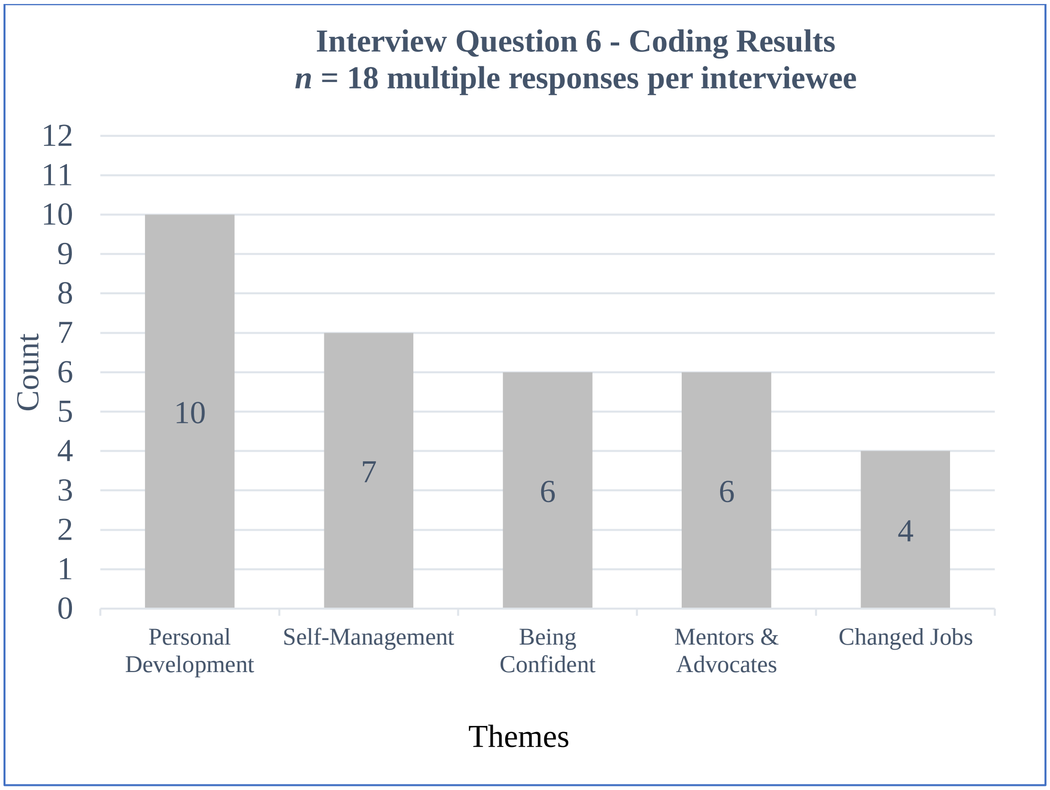
Set Boundaries. For twenty-eight percent of participants, it was important to set boundaries with whatever or whoever the single biggest challenge was. Pluut and Wonders (2020) stated the criticality of boundaries especially during remote work. Participant 13 found that she needed to do that in her job as she needed to leave work on time to pick up her child. She stated “I set boundaries especially with regard to kids” (personal communication, February 6, 2024).

Upskilled Knowledge. Twenty-eight percent of the participants noted that they needed to acquire new skills to overcome their single biggest challenge. They invested in training and coaching, which has a known return on investment especially for underrepresented minorities (Norman et al., 2021; Pechac & Slantcheva–Durst, 2021). Participant 17 stated “I hired a business coach, started my own company, made my salary back within a month, and I’m on path to make significantly more money than I’ve ever made working for someone else” (personal communication, February 8, 2024).

Interview Question 6. What strategies or best practices did you employ, or resources did you seek to overcome these challenges? This question is in reference to the other challenges the participants faced when they answered IQ2. Five themes emerged. They were personal development, self-management, being confident, engaging mentors and advocates, and changing jobs. As can be expected, there were some similarities in these themes and the themes which were stated in IQ5. For example, the role of mentors and changing jobs to overcome their other challenges. See Figure 10.

Figure 10

Strategies and Best Practices Employed or Resources Sought to Overcome Challenges



Note. Figure 10 shows the themes which emerged as the strategies and best practices as answered by participants for IQ6. The chart illustrates the themes that emerged. Data are presented in decreasing order of frequency. The number in each theme indicates the number of statements made by participants assigned to that theme.

Personal Development. More than half, 56% of the participants, stated that they sought additional training, including self-directed learning, as well as coaching offered by executive coaches, sometimes paid for by the STEM woman herself. This theme also included participating and learning from ERG sessions, which repeatedly shows up in literature as an excellent investment in community (Colgan & McKearney, 2012; McNulty et al., 2018; Nishii, 2013; Rodriguez, 2021). B. J. Avolio and Chávez (2023) underscore the importance of the STEM woman taking her professional development seriously and managing it. Participant 5 stated the benefits of investing in coaching “My own venturing into personal coaching, and understanding what limiting beliefs are, are some of the things that hold ourselves back” (personal communication, February 6, 2024).

Self-management. Thirty-nine percent of participants stated the importance of knowing themselves, leaning on their family support systems, and doing their jobs really well. Self-management is a critical skill in career advancement (Madrid et al., 2020; Urquijo et al., 2019). Regarding the emotional intelligence which is needed to self-manage through challenges, Participant 4 stated “I didn’t make my boss the enemy even though I was very upset” (personal communication, February 9, 2024).

Being Confident. Over a third, 33% of participants, stated the importance of being confident during challenging times. This ranged from making their boundaries clear when it came to needing time to pump for breastfeeding to standing their ground and speaking up in a meeting. Confidence is a STEM success strategy and within the literature scholars have studied it from high school to academia to workplaces (Clark et al., 2021; Ellis et al., 2016; P. K. Hunt et al., 2021). Participant 7 stated “And if there’s any whiff, you’re going to start mansplaining to me, because you’re going to be the expert in the room just because you’re the man, you basically have sorted yourself out” (personal communication, February 8, 2024).

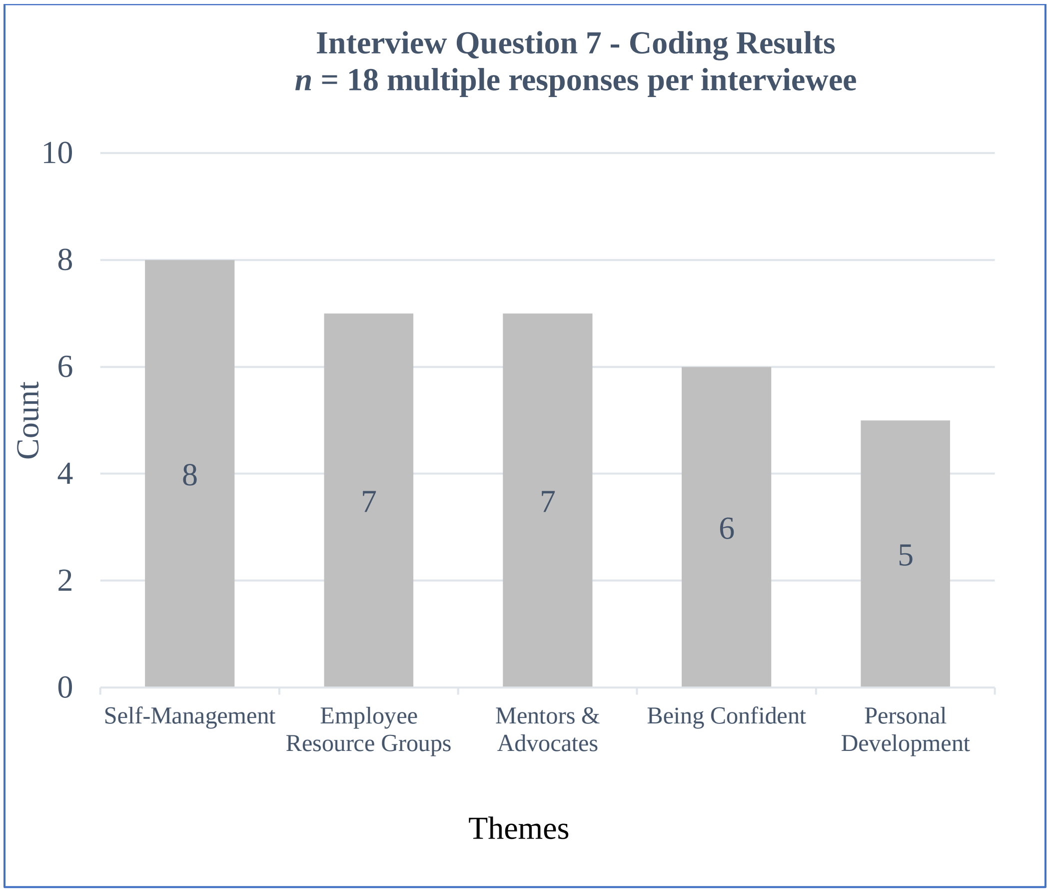
Mentors and Advocates. Another theme which repeated itself, as it had in IQ5, was the need for mentors and those who advocate for you, including allies and sponsors. The literature repeatedly affirms the key role mentors play as role models as well (Estrada et al., 2018; Moghe et al., 2021; Spaulding et al., 2020). Thirty-three percent of participants emphasized the role mentors play in teaching them how things worked in their companies. Participant 6 was trying to get promoted. After the first round of being passed up for a promotion to senior director, she shared how she prepared for the next time the opportunity arose “Every week I would journal accomplishments and how that tied to a specific goal (or a mis-step goal). I would allocate an hour a week to do that. It provided that evidence to go on a selling tour, the door-to-door campaigning and road-show. That’s a part of knowing how the system works. You have to have someone (mentor) show you how it is done” (personal communication, February 6, 2024).

Changed Roles. When all else was tried, 22% of the participants stated that they changed roles. Participant 8 shared that while she was trying to manage the challenge, she also “applied to different departments. I got a call for a senior level position. She saw the skills in me. She also liked the positive attitude” (personal communication, February 11, 2024). She ultimately moved to a team where she was wanted and appreciated.

Interview Question 7. Are you personally aware of strategies or best practices employed or resources sought by these women? This question directly tied to the challenges the participants discussed in IQ3. The question seeks strategies and best practices employed by those women to overcome these challenges. Five themes emerged. They were self-management, ERGs, mentors and advocates, being confident, and personal development. See Figure 11.

Figure 11

Strategies or Best Practices Employed or Resources Sought by These Women



Note. Figure 11 shows themes of strategies to overcome challenges by women. These are the responses to IQ7. The chart illustrates the themes that emerged. Data are presented in decreasing order of frequency. The number in each theme indicates the number of statements made by participants assigned to that theme.

Self-management. The theme of self-management emerged for 44% of participants as they reflected on IQ3. They shared the best practices other women had used to overcome their challenges. The literature is clear on the importance of this skill for career success (Madrid et al., 2020; Urquijo et al., 2019). Included in this theme was the idea of not getting disillusioned or quitting during tough times. Instead, participants observed other women practicing resilience and having an active role in managing their careers. A few participants mentioned seeing other women changing roles to move away from challenges. Participant 7 stated “What I’m noticing is that some of the women get disillusioned and completely leave the industry. Others get inspired” (personal communication, February 8, 2024).

Employee Resource Groups. The idea of receiving support from ERGs had been mentioned in IQ5 and IQ6 within the context of creating support systems. It also emerged in IQ7 as a theme with 39% of participants mentioning observing other women leveraging ERGs to their advantage to overcome challenges in the workplace. Workplaces who offer ERGs see tremendous results in increased belongingness (Colgan & McKearney, 2012; W. M. Green, 2018). Participant 4, in reference to ERGs, stated “Women who got promoted had each other’s back. They asked for feedback from each other. They sought mentoring and fed the network” (personal communication, February 9, 2024).

Mentors and Advocates. Allies and sponsors were coded along with the mention of mentors within this category where 39% of participants stated the importance of having them in the other women’s lives who were facing challenges. This is a theme which showed up in multiple questions and its importance aligns with the literature on success for women in the workplace (Estrada et al., 2018; Moghe et al., 2021; Spaulding et al., 2020). In the context of supporting quieter women, if they were being ignored, Participant 17 said she admired a manager who “would stop the meeting to ask for clarification to get people to pay attention to her” (personal communication, February 9, 2024).

Being Confident. Thirty-three percent of participants noted the importance of confidence in managing challenging situations. E. Cech (2022) have noted the relationship that confidence has on women engineers. (Participant 1 explained what being confident looked like to her “You can brag, you can speak up, you can make sure, especially if somebody's trying to take credit for something that you've done, you know, have a voice and speak up for yourself and call that out" (personal communication, February 9, 2024).

Personal Development. The final theme which emergent for 28% of the participants was personal development which included going back to school and learning through company sponsored programs. Participant 8 shared "Some companies have good DEI programs which support women. Also, the lady from China, worked on her communication skills. Others have kept learning and like to keep learning" (personal communication, February 11, 2024).

Summary of Research Question 2

In total, IQ5-IQ7 had 15 themes, with each having five themes. Interview Question 5's themes were mentors and advocates, created support system, changed jobs, set boundaries, and upskilled knowledge. Interview Question 6's themes were personal development, self-management, being confident, mentors and advocates, and changed jobs. Interview Question 7's themes were self-management, ERGs, mentors and advocates, being confident, and personal development. Similar themes emerged from IQ5, IQ6, and IQ7. Replies to all three questions mentioned the importance of having mentors & advocates, including ERGs, allies, and sponsors. Personal development was also a reoccurring theme for all three questions. Personal development included continuing education, executive coaches, and reading books. The theme of being confident appeared in IQ6 and IQ7. Changing jobs, including moving into new ventures such as entrepreneurship, appeared in IQ5 and IQ6. Self-management appeared as a theme in IQ6 and Q7, including learning to advocate for one's self and being resilient through challenges. Finally, creating a support system and setting boundaries were themes for IQ5, especially as women became mothers and needed more help and flexibility.

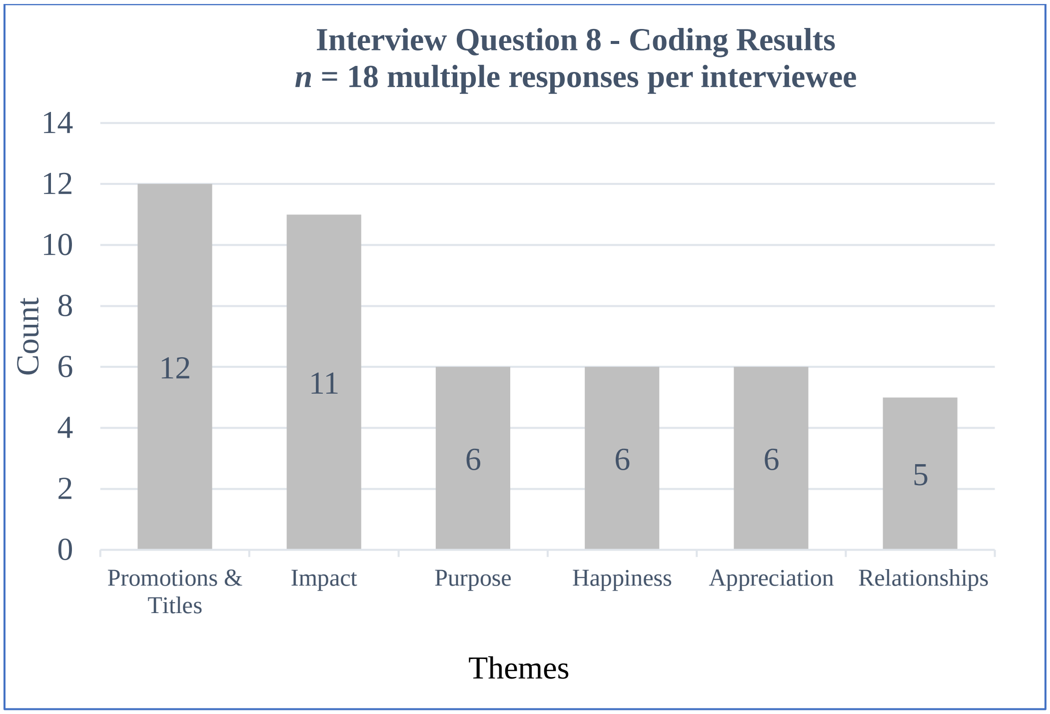
Research Question 3

How do women in STEM define, measure, and track their career success? RQ3 seeks to define the metrics by which participants, and other women they know in STEM, define, measure, and track their career success. To arrive at the answer, three interview questions are asked; IQ8, IQ9, and IQ10. By answering IQ8, the participants stated what they have historically used to measure the progress of their career. By answering IQ9, they provided the resources and tools that their organization used to help support them in tracking to their career metrics. Finally, IQ10 sought answers as to what metrics they wished to measure but were unable to.

Interview Question 8. What are the metrics you track to measure success in developing your career? Six themes emerged from participants. They were promotions and titles, impact, purpose, happiness, appreciation, and relationships. See Figure 12.

Figure 12

Participants Metrics That They Track to Measure Success in Their Careers



Note. Figure 12 shows participant metrics that they track to measure success in their careers. The chart illustrates the themes that emerged from responses to IQ8. Data are presented in decreasing order of frequency. The number in each theme indicates the number of statements made by participants assigned to that theme.

Promotions and Titles. This theme was shared by 67% of participants. Promotion and titles encompassed an increase in wages, including bonuses, stock awards and other financial rewards. Though more challenging for women to advance (M. Murphy et al., 2021), it is still an important indicator of success. Participant 3 stated the importance of this theme especially in light of the gender pay gap "if I'm making the lives of my family more comfortable, like for myself, my husband and the next generation, my grandkids, (building) generational wealth, future for them where they're comfortable and is the income that I'm making, am I getting paid fairly for what I’m doing or am I barely being compensated?” (personal communication, February 5, 2024).

Impact. Several codes accrued to the theme of impact. They included an expansion of scope, number of publications that they contributed to or were lead author on, conferences attended or invited to speak at, and whether they were adding to the maturity of their profession. Sixty-one percent of participants indicated the importance of impact on measuring their career growth. Participant 7 defined impact as “The kinds of projects I get to work on and invited to speak or present at professional conferences, being able to speak or present in front of executives, and the frequency with which I get to do those things” (personal communication, February 8, 2024).

Purpose. Thirty-three percent of participants stated measuring being aligned with their purpose as a metric of measuring their career development. Career purpose is a motivator for staying in role and persisting (Sadowski & Schrager, 2016). Included in this theme was whether they were continuously learning and growing. Participant 7 defined success and alignment with purpose as “success looks like being able to be flexible, being able to contribute, and really finding purpose and meaning in my work” (personal communication, February 7, 2024).

Happiness. Thirty-three percent of participants stated finding happiness and joy in their work as a measure of career progression. If they were happy, then they were aligned to their career development goals. The literature agrees that happy employees are more productive employees and their intention to stay is increased (Charles-Leija et al., 2023; Walsh et al., 2018). The opposite of which was true as stated by Participant 11 when she found herself unhappy “I would come home, being mentally exhausted, start watching TV with the hubby and ready to fall asleep by eight o’clock and he’d say, ‘you’re not even mentally here when you’re physically here'" (personal communication, February 9, 2024).

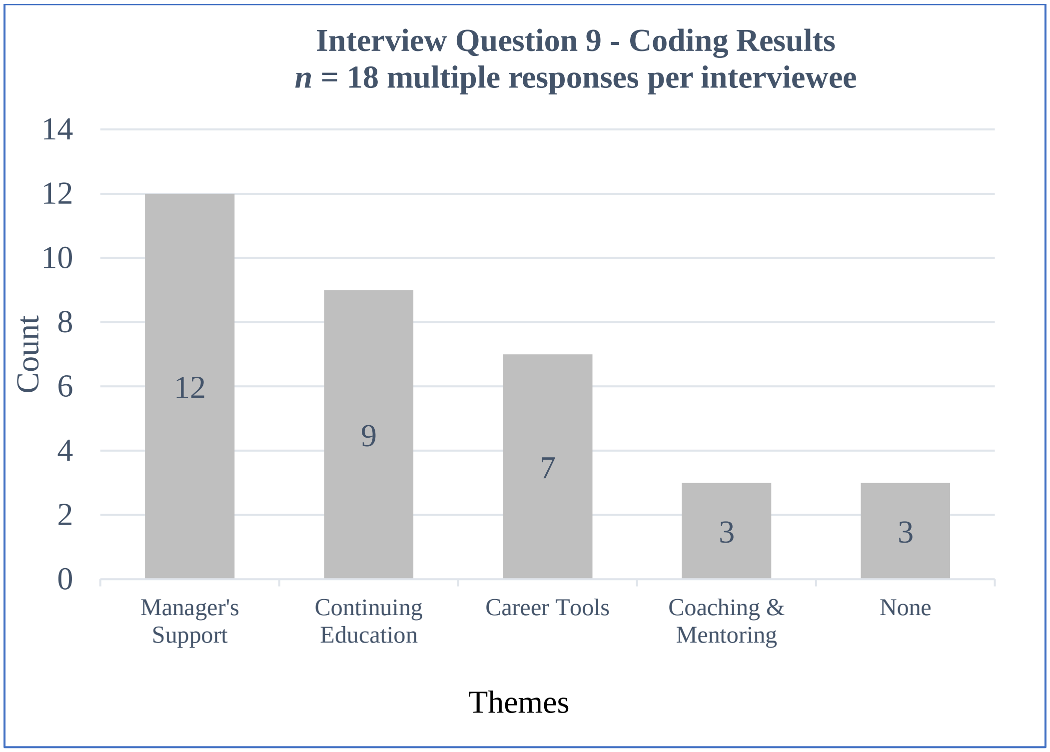
***Appreciation*.** To 33% of participants being appreciated was an important measure of career progression. Garrido-Vásquez et al. (2020) state that it can buffer career frustration and is key to well-being. Pfister et al. (2020) state that appreciation leads to job satisfaction and that employers should pay particular attention to how they show appreciation. Conversely, those who felt unappreciated felt their career progress was stagnating. Participant 1 shared "feeling accomplished and feeling recognized for the work that I was doing. That was my measure. That was my measure of success" (personal communication, February 9, 2024).

Relationships. For 28% of participants building and growing relationships was an important measure of developing their careers. The literature supports the premise that positive relationships are a measure of successful careers (Abun & Basilio, 2023; Bulińska-Stangrecka & Bagieńska, 2021; Tran et al., 2018). This includes earning happy clients. Participant 1 shared "I always enjoyed who I worked for. I always enjoyed the people I worked with" (personal communication, February 9, 2024).

Interview Question 9. What tools or resources does your organization give you in measuring and tracking your career development? Five key themes emerged for IQ9. They were manager's support, continuing education, career tools, coaching and mentoring, and no tools & resources (indicated in Figure 13 as 'none'). See Figure 13.

Figure 13

Tools and Resources Provided by Organization to Measure and Track Career Development



Note. Figure 13, the themes organizations provide to measure & track career development as answered by participants for IQ9. The chart illustrates the themes that emerged. Data are presented in decreasing order of frequency. The number in each theme indicates the number of statements made by participants assigned to that theme.

Manager's Support. The role of the manager was at the root of this theme. Sixty-seven percent of participants weighed in with examples of how their manager supported them with the necessary tools and resources to grow their careers. This included putting them on succession plans, nominating them for awards, and aligning the scope of the participant with their professional goals. The importance of the direct manager is studied in the literature with direct relationship to employee happiness (Mkwizu, 2023; Mosadeghrad & Ferdosi, 2013). Conversely, bad managers can affect the employee's health, both mental and physical in negative ways

(Hämmig, 2017; Kuroda & Yamamoto, 2018). Participant 15 stated in the positive way the simplicity of her manager's supports "it's just me talking to him and him making an actionable item of how he can help me progress in my goals" (personal communication, February 6, 2024).

Continuing Education. Half of the participants shared that they received funding for coaching and support for continuing education, including tuition reimbursement by some companies. Tuition reimbursement has been shown to an effective retention tool (Manchester, 2012). Participant 1 expressed gratitude for being nominated for on-site training courses that her employer sponsored "The courses that I went through just were incredible, very equivalent to earning an MBA with everything that they taught us" (personal communication, February 9, 2024).

Career Tools. This theme was raised by 39% of participants, and included ERGs, branding training, and templates for completing performance reviews. Participants shared that their company had some form of quarterly or annual cadence of conducting performance reviews with their manager. Most of the tools they were provided were to enable the capture and documentation of career progression within the construct of these conversations. Manager feedback can be a powerful tool and motivator if it is future-focused (Gnepp et al., 2020). DeNisi and Murphy (2017) found that feedback was only applied if the person receiving it agreed and accepted to adopt the feedback. Participant 11's experience with these tools was articulated as such "We have a standard career development template. We had a requirement to populate it and include it in our twice a year connect or review process. And we had plenty of training that you could do on your own" (personal communication, February 9, 2024).

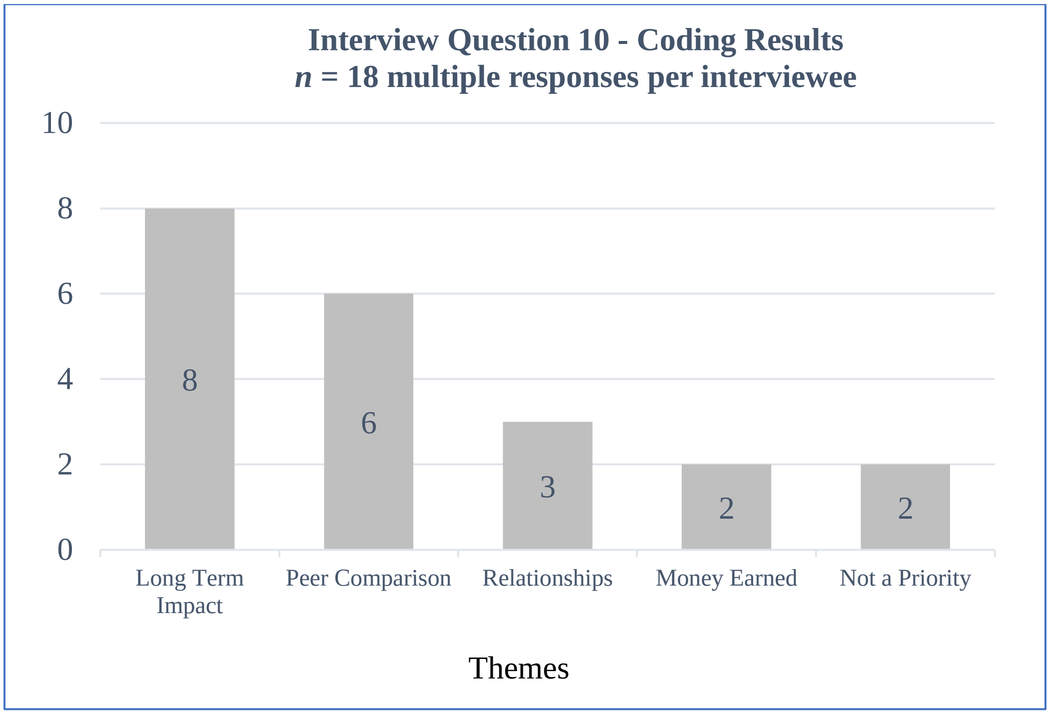
Coaching and Mentoring. Seventeen percent of participant were supported with formal coaching and mentoring programs which their organizations had enabled for them. There is no doubt that coaching employees makes them feel supported (Norman et al., 2021; P. Parker et al., 2014), however, this was not always a perfect solution. Participant 6 shared “They got me an executive coach. My manager absolved himself then of doing any real coaching. Some mentoring here and there. You had to be in the in-crowd” (personal communication, February 9, 2024).

None. Seventeen percent of participant worked in organization who had no tools or resources to help them measure and track their career success. Participant 3 stated “My organization fails at this entirely. My organization is struggling in those areas. So, I think I could talk about other organizations have done as well, but I’d say mine doesn’t do this well at all” (personal communication, February 5, 2024).

Interview Question 10. What metrics would you like to measure and track but are unable to do so? Four themes emerged for this question. They were measuring long-term impact, career progression against their peers, the health and growth of their relationships, and for two participants, not a priority. See Figure 14.

Figure 14

Desired Measurements Which the Participants are Unable to Track



Note. Figure 14 participants' themes regarding hard to track measures as answered by participants for IQ10. The chart illustrates the themes that emerged. Data are presented in decreasing order of frequency. The number in each theme indicates the number of statements made by participants assigned to that theme.

Long-term Impact. Fifty-six percent of participants shared that long-term was important to them, but they were unable to track a project or program once it was out of their purview. They also wished to track the return on investment of continuing education. The role of scope and its impact have been studied by Bechtold et al. (1981), including inappropriate scope, which drives dissatisfaction. Inappropriate scope would be one that is not commensurate with the STEM woman's skills or what she was hired to do. A couple of the participants shared that money was important to them and that they wished they could do a better job of knowing whether the money they were earning was going to be getting them what they ultimately desire. The literature supports that fair pay promotes justice and job satisfaction (Judge et al., 2010). Participant 8 shared that she would like to track whether she is ultimately successful “Am I making the money I want to be making? Am I living the lifestyle I want to be living? so I definitely say, you know, freedom for me is working with who I want when I want as much as I want, where I want and when I want and if I’ve achieved those things, then I’ve achieved the pinnacle of what I want to do with my career” (personal communication, February 8, 2024).

Peer Comparison. Thirty-three percent of participants expressed desire to know how they compared relative to their peer group in compensation. The literature shows that knowing your peers’ salaries and finding out that one is paid less than them is directly correlated to job dissatisfaction, and cause to look for another job (Card et al., 2010). Participant 15 noted “I would have liked to know where I stood against the men that held my same position and how large the projects were monetarily compared to them so I could see if I was actually compensated at the right level. Because at times I question whether I really should have been at a higher level” (personal communication, February 6, 2024).

Relationships. The role of relationships was raised by 17% of participants. Whether they learned from official engagement surveys or through direct interactions with people in their sphere of influence, these participants desired a great degree of measurement of the impact of their relationships. Tran et al. (2018) state the importance of positive relationships in job satisfaction. Participant 6 shared that if she could “I would have tracked who was my allies, advocates, sponsors” (personal communication, February 9, 2024).

Not a Priority. Eleven percent shared that they did not consider tracking anything. For them, it was not a priority. The literature makes a strong point about career self-management and planning, the absence of which may lead to attrition and surprises given how pervasive layoffs are now in the high technology sector (Hirschi, 2018; Hirschi & Koen, 2021). Participant 7 stated “I am happy that I build something that I can do and contribute, but I don’t really put a lot of stress on myself to measure it in a real way” (personal communication, February 8, 2024).

Summary of Research Question 3

Research Question 3 sought answers about the methods STEM women use to measure and career success. Fourteen themes emerged for IQ8, IQ9, and IQ10. Interview Question 8 had five themes. They were promotions and titles, impact, purpose, happiness, and appreciation. Interview Question 9 had five themes as well. They were manager’s support, continuing education, career tools, coaching and mentoring, and none. Interview Question 10 had four themes. They were long term impact, peer comparison, relationships, and not a priority. The researcher heard varied answers from participants, with a wide range of topics. High on the list was the theme of title and promotions, including money, as a measure of career development. However intrinsic satisfaction of a job well done, and delivery of a challenging project or solving a problem which helped customers and society was also of immense value. The power of relationships, especially the one with their manager, their peers, and customers was shared as a way by which a successful career was tracked. Ultimately when it came to measuring the unmeasurable, participants shared the desire to know whether their impact had made a difference and how they compared to their peers in terms of compensation and size of projects. A small population found it unnecessary to track career success.

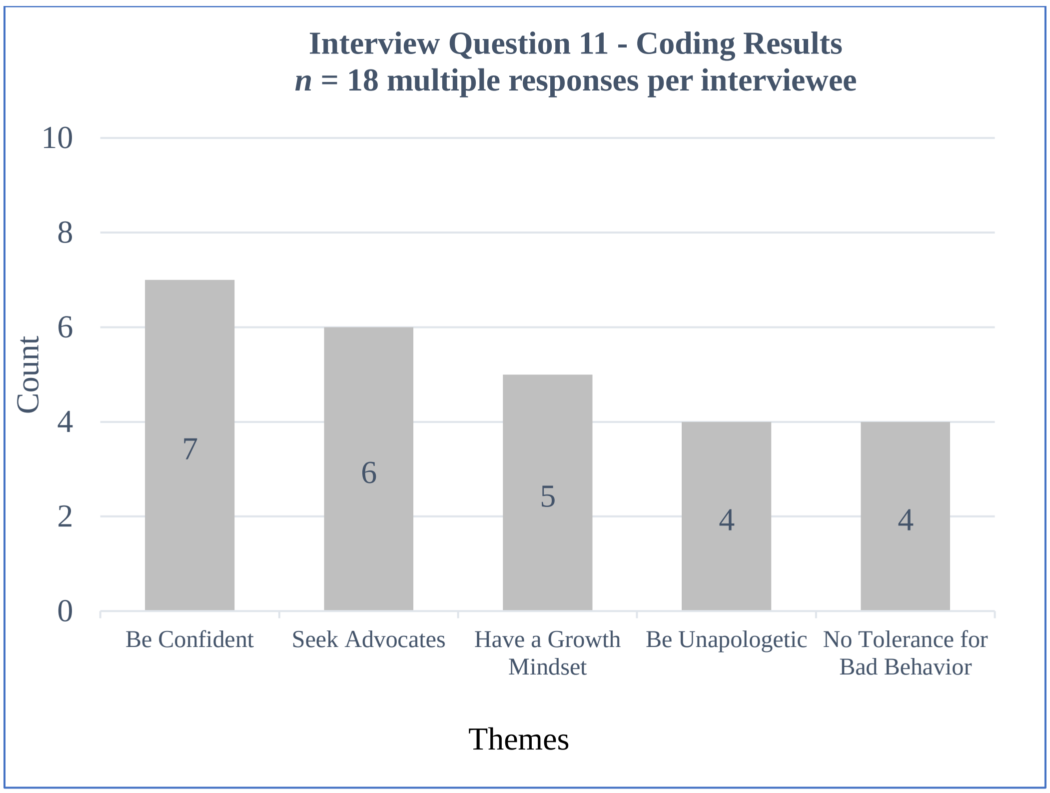
Research Question 4

What recommendations do women leaders in STEM have for aspiring female leaders? Research Question 4 is the opportunity for current women in STEM to inform the next generation of aspiring female women in STEM on how to be successful. There were three interview questions, IQ11, IQ12, and IQ13 which aggregated to answer RQ4.

Interview Question 11. As a woman in STEM, what lessons have you learned that we have not covered in this interview? Five themes emerged from IQ11. They were: be confident, seek advocates, have a growth mindset, be unapologetic, and have no tolerance for bad behavior. See Figure 15.

Figure 15

Lessons Learned by Participants Which Have Not Been Discussed



Note. Figure 15 shares the themes of the lessons that Participants would like to impart on future generation of aspiring STEM women. These are the responses to IQ11. The chart illustrates the themes that emerged. Data are presented in decreasing order of frequency. The number in each theme indicates the number of statements made by participants assigned to that theme.

Be Confident. Thirty-nine percent of the participants shared the importance of being confident. Some wished that confidence had come earlier in their career or they had been told to be more confident. Confidence was a theme which emerged in several places in the interviews, namely IQ6 and IQ7. The literature agrees that confidence is a significant factor in resilience in the workplace (E. Cech et al., 2011; Clark et al., 2021; Ellis et al., 2016; P. K. Hunt et al., 2021) Encouraging words from Participant 12 summed up the sentiment “I learned the lesson was never say, ‘No, I can’t do something’. Just go! There’s a way to go figure out how to do it. It’s on you” (personal communication, February 6, 2024).

Seek Advocates. Thirty-three percent of respondents expressed the importance of community and ensuring women in STEM had a cadre of mentors, sponsors, allies and to actively seek them. Joining and intentionally participating in ERGs was recommended to widen their network (Colgan & McKearney, 2012; McNulty et al., 2018; Nishii, 2013; Rodriguez, 2021). Participant 14 shared this wisdom “You’re just one person. I started my career thinking that I could do anything…and you can, but sometimes you need community. And so, I don’t think we’re going to drive change here without doing it all together” (personal communication, February 7, 2024).

Have a Growth Mindset. To have a growth mindset (Dweck, 2006) is to assume that you are able to continue to learn. Dweck suggests that intelligence and skill is not a fixed property. For this theme 28% of participants wanted to remind aspiring female leaders in STEM to remember to continue to expand and learn. Participant 13 shared “Start somewhere. But be ready to take the risk of learning something new that you didn’t know before because that right there could likely take you down a path you didn’t know” (personal communication, February 6, 2024).

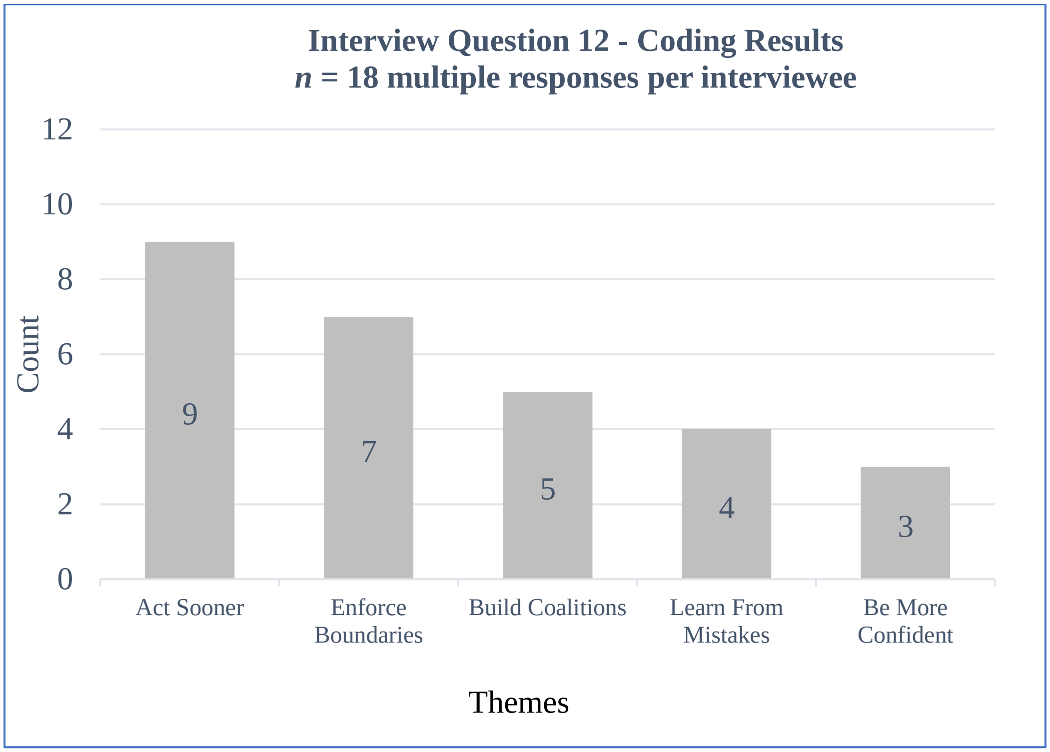
Be Unapologetic. This theme was raised by 22% of participants who wanted to remind aspiring leaders that they had every right to be in STEM fields, and for no one to take that away from them. Dickens and Womack (2020) researched the importance of being unapologetic especially for early in career Black women. Participant 9 expressed her encouragement by stating "You have every right to sit at that table, be in that room, to take up space and oxygen in whatever field you are in" (personal communication, February 9, 2024).

No Tolerance for Bad Behavior. Twenty-two percent of participants shared that aspiring female leaders should not tolerate bad behavior. They shared stories of drunk bosses and being told they were too attractive to be promoted to management. One was told that she made the interview cycle because the team assumed her gender-neutral name was a man's name. Fifty percent of women in STEM report being discriminated against (Funk & Parker, 2018). Bad behavior creates a ripple effect of disruption in the workplace leading to poor morale and attrition (Holloway & Kusy, 2010; Tartaglia, 2019). Ultimately whether in the office, on business trips, with peers, managers, or clients, Participant 17 stated "I feel like those of us who have survived, do not tolerate (bad) behavior" (personal communication, February 9, 2024).

Interview Question 12. If you could, what is the one thing you would do differently? Five themes emerged from the responses to IQ12. They were: to act sooner, enforce boundaries, build coalitions, learn from mistakes, and to be confident. The researcher allowed for the woman to provide more than one answer. See Figure 16.

Figure 16

What Would Do Differently?



Note. Figure 16 is comprised of the themes for IQ12 which asked participants what they would do differently if they could. The chart illustrates the themes that emerged. Data are presented in decreasing order of frequency. The number in each theme indicates the number of statements made by participants assigned to that theme.

Act Sooner. Fifty percent of participants wished that they had acted sooner. The circumstances for each were different, but the common denominator was that they had allowed too much time to pass before taking action such as reporting sexual harassment, changing jobs, leaving jobs, and starting their own. Participant 10 advised "speak up on things that are uncomfortable sooner. If you see a train wreck coming, speak up. Don't try to be strategic. If it's wrong, it's wrong" (personal communication, February 9, 2024).

Enforce Boundaries. Thirty-eight percent of participants shared that they should have set, and then enforced better boundaries whether it was in their work life integration or when inappropriate behavior was directed at them. The literature supports the importance of setting boundaries (Fan & Moen, 2022; Pluut & Wonders, 2020). The other side of this theme was, to hold people accountable when they did cross a boundary. Participant 4 reflected “Early in my career, I was a victim of sexual harassment. I did not call these people out. Only recently I understood how it impacted me. I wish I had been better at boundaries” (personal communication, February 9, 2024).

Build Coalitions. Twenty-nine percent of participants shared that they would have helped others sooner, found mentors sooner, and identified opportunities sooner. The importance of all of these support systems is aligned to the literature where women supporting other women creates a special bond of trust and support which is reciprocal (Guevara-Ramírez et al., 2022). The lack of perceived or real resources crates rivalry even among women (Stockley & Campbell, 2013). That is why it is important to build coalitions. Participant 9 shared “I would have been more purposeful about finding mentors. Then I would have found those people who have it and I would have improved sooner” (personal communication, February 9, 2024).

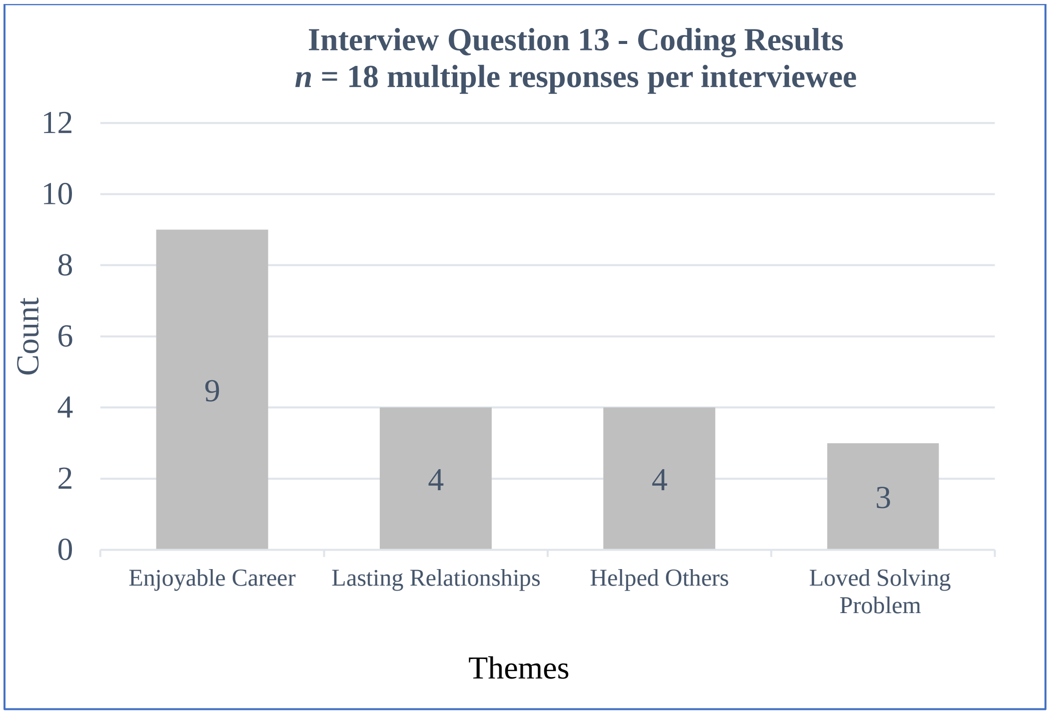
Learn from Mistakes. Twenty-two percent of participants recognized that they had learned from their mistakes and that perfectionism was not possible. Freedman et al. (2023) asked seasoned STEM women to write letters to future women in STEM, and not being afraid of failing was stated as a theme. Participant 1 encouraged future aspiring leaders to reflect and to grow from their mistakes. She stated “Definitely made mistakes, but the part of learning from it is part of the overall experience” (personal communication, February 9, 2024).

Be More Confident. Confidence appeared again, just as it had for IQ6, IQ7, and IQ11. This theme is repeated in the literature from the time the STEM woman is a young girl to being a senior leader (E. Cech, 2022; Clark et al., 2021; Ellis et al., 2016; P. K. Hunt et al., 2021). Seventeen percent of the participants noted the importance of confidence. In this context, Participant 19 shared that she had wished that she had been more thoughtful as she chose her college major. She ultimately ended up in a STEM career, but said "I probably would have started earlier in my consulting entrepreneurship. I would have looked at all kinds of different things. Maybe I would have gone into engineering…choose your major, more thoughtfully" (personal communication, February 9, 2024).

Interview Question 13. Was it all worth it? How? This question allowed the participant to reflect on their entire journey in STEM fields and their career. It was an open-ended question and not specific to a time and place. Future generations of women in STEM can draw from these answers. All participants resoundingly stated that it *was* worth it. Then they expounded on their answer. The themes which emerged ranged from having had an enjoyable career, building lasting relationships, helping others, and solving problems. See Figure 17.

Figure 17

Participants' Answers to "Was it all Worth it? and How?"



Note. Figure 17 shows the themes from the participants answering IQ13, "Was it worth it, and how?" Data are presented in decreasing order of frequency. The number in each theme indicates the number of statements made by participants assigned to that theme.

***Enjoyable Career*.** Half of the participants shared that they thoroughly enjoyed their career, and that is what made it all worth it. Regarding STEM women's subjective measure of fulfillment in their careers, there is literature which supports that STEM women are motivated by social impact, collaboration and self-development (Amon, 2017). Participant 11 shared her enthusiasm regarding her career even despite its challenges "Over my career, almost 30 years, I feel like I learned a ton. I can be proud of the career that I had. And that means a lot to me to set the example for my daughters, and for others in the community. It certainly helped put me in a position to be able to retire early. So, all those sacrifices had financial benefits. And overall, I think I worked with some of the best people ever" (personal communication, February 9, 2024).

Lasting Relationships. Twenty-two percent of participants shared that it was all worth it due to the relationships they had built, once more affirming the importance of relationships as noted in the literature (Tran et al., 2018). Participant 10 shared "I met some amazing people and developed long lasting relationships" (personal communication, February 9, 2024).

Helped Others. Twenty-two percent of participants were motivated by the help they were able to provide through their careers. This finding aligned with the scholarly studies about following your purpose (Sadowski & Schrager, 2016). Participant 2 shared with pride the direct impact of her work "I can see the fruits of my labor, such as safe water births in Texas directly due to my work. Work I've done to make the community safer. I take my responsibility very seriously. I worked crazy hours for years, it was worth if I can make someone healthier, and safer" (personal communication, February 10, 2024).

Loved Solving Problems. Seventeen percent of participants shared that their STEM careers provided them an opportunity for learning and that they are capable of thriving in a STEM career. Participant 5 shared her enthusiasm for problem solving "…addicted to solving problems. I love solving problems with a team. And that is exactly what engineers do in STEM. We are a village and we're stronger working together" (personal communication, February 6, 2024).

Summary of Research Question 4

What recommendations do women leaders in STEM have for aspiring female leaders? Research Question 4 was the opportunity for participants to make recommendations, share learnings, and express any remorse that they may have had regarding their careers. Fourteen themes emerged. Interview Question 11 had five themes. They were: be confident, seek advocates, have a growth mindset, be unapologetic, and no tolerance for bad behavior. Interview Question 12 also had five themes. They were act sooner, enforce boundaries, build coalitions, learn from mistakes, and be more confident. The last question, Interview Question 13 had four themes. They were enjoyable career, lasting relationships, helped others, and loved solving problems. Altogether, the themes of being confident, having mentors and advocates, and learning from one's mistakes was mentioned across all of the participant's answers for IQ11, IQ12, and IQ13. There was unanimous agreement that they did not regret their participation in STEM fields, however some felt that they could have pursued other vocations if exposed to more tailored college counseling. Participants focused on the positive components of STEM fields, such as solving problems, building lasting relationships, the ability to help others via products and services. The downsides, upon reflection, was that some participants had not acted sooner when faced with challenges, or had not sought mentors and advocated to support them.

Chapter 4 Summary

Chapter 4 outlined the findings per research questions from corresponding interview questions. The chapter began with describing the demographics of the 18 participants from the study. The process of interviewing was summarized in the Data Collection section. Eighteen participants were interviewed in the time period between 2/5/24-2/11/24. Their interviews' audios were recorded and transcribed by Otter.AI. From their interviews 234 questions were answered. For some questions, the participants provided multiple answers. Their answers were prepared for upload to the Delve Tool, where the researcher evaluated, coded and themed the answers.

Interrater reliability was conducted twice in the process, once following the first three interviews and again after all of the interviews were completed. There was a need for escalation to the Expert Review regarding two questions which were answered and applied. Sixty-four themes emerged from the coding process. They can be found in Table 5.

Table 5

Summary of Themes for Four Research Questions

RQ1: What are the challenges faced by women in STEM in ascending to leadership positions?	RQ2: What strategies/best practices are used by women in STEM to overcome the challenges they face?	RQ3: How do women in STEM define, measure, and track their career success?	RQ4: What recommendations do women leaders in STEM have for aspiring female leaders?
Gender Discrimination	Mentors and Advocates	Promotions and Titles	Be Confident
Lack of Habitus	Created Support System	Impact	Seek Advocates
Motherhood Penalty	Changed Jobs	Purpose	Have a Growth Mindset
Sexual Harassment	Set Boundaries	Happiness	Be Unapologetic
Gender Bias	Upskilled Knowledge	Appreciation	No Tolerance for Bad Behavior
Toxic Cultures	Personal Development	Manager’s Support	Act Sooner
Lack of Inclusion	Self-Management	Continuing Education	Enforce Boundaries
Personal Agency	Being Confident	Career Tools	Build Coalitions
Confidence	Mentors & Advocates	Coaching & Mentoring	Learn From Mistakes
Male-Dominated Cultures	Changed Jobs	None	Be More Confident
Bullying & Harassment	Self-Management	Long Term Impact	Enjoyable Career
Gender Stereotypes	ERGs	Peer Comparison	Lasting Relationships
Work Life Integration	Mentors & Advocates	Relationships	Helped Others
Lack of Resources	Being Confident	Not a Priority	Loved Solving Problem
Family of Origin	Personal Development		
Cultural Intelligence			
Birth Order & Siblings			
K-12 Experiences			
Societal			

RQ1: What are the challenges faced by women in STEM in ascending to leadership positions?	RQ2: What strategies/best practices are used by women in STEM to overcome the challenges they face?	RQ3: How do women in STEM define, measure, and track their career success?	RQ4: What recommendations do women leaders in STEM have for aspiring female leaders?
Expectations			

Note. Table 5 lists each theme by its respective research question.

Chapter 5: Conclusions and Recommendations

Chapter 5 begins with a summary of the study, which details the purpose of the study, the approach to the literature review, the methodology chosen, and the process by which the data was gathered. The discussion section then follows. Each research question is discussed with its conclusions and subsequent recommendations from the study's findings. Insights discovered during the study provide the foundation for the Application section in Chapter 5 which highlights actions that can be taken to attract, retain, and promote women in STEM. The chapter concludes with recommendations for future studies, final thoughts, and the researcher's notes.

Summary of Study

The purpose of this study was to expand the body of knowledge regarding women in STEM, centering their lack of participation, attrition and retention issues (Chrisler et al., 2012; V. E. Johnson et al., 2021; R. A. Miller et al., 2021; Settles et al., 2006; Worthen, 2021). Additionally, STEM women's participation rate in the workforce does not seem to be moving forward fast enough (Folke et al., 2020; McCullough, 2020; Weinhardt, 2017). The study's research questions sought insights regarding the challenges the participants had faced first-hand as well as ones they had seen other women endure. The second research question looked for answers as to how these women had overcome their challenges as well as those they had witnessed being mitigated by other women. The third research question focused on career development, specifically how women in STEM measure and track their career progress and development. Research Question 4 looked for recommendations from participants to share with aspiring female leaders to apply in their careers.

The lack of participation by women in STEM fields has been studied for many generations (Beede et al., 2011; Fayer et al., 2017). Chapter 1 provided the background of the problem, and the significance of contributing to the body of knowledge, sharing the four research questions at the center of the study. Theoretical frameworks, such as Feminist Theory and Appreciative Inquiry were discussed as being foundational for the study of STEM women. (Barrett & Fry, 2005; Cooperrider & Whitney, 2005; Friedan, 1963; hooks, 2000; Steinem, 1969; Watkins et al., 2011). Chapter 1 also explained the assumptions, limitations and definitions which would scaffold the study.

The study delved deep into the literature review in Chapter 2. The organizing factor for this study’s literature review was to start with young girls and follow their lives from kindergarten to becoming a senior leader in STEM. The literature review began with a review of the education systems, such as Common Core (Common Core State Standards Initiative, 2010). The standards had been an attempt to raising the learning levels of all students in math and English. Then a discussion of the early years through middle and high school was shared, including the importance of parents, teachers, and counselors (Hite & Spott, 2022; Janssen et al., 2022; Siregar et al., 2023). In these years, there is an opportunity to raise confidence and self-identity by teaching young girls to STEM with creative methods such as project-based-learning (Drobnic, 2023; S. Han et al., 2015).

The literature review then followed the young woman through her college years. In this section the discussion pivoted to the importance of mentors and female faculty (Hansen et al., 2023; Solanki & Xu, 2018), presence of male allies (Silver, 2023), and the use of community colleges for upskilling missing STEM knowledge (Bottia et al., 2020; X. Wang et al., 2019; Xie et al., 2015), especially in the early foundational courses. In the review of the college years, an extensive discussion of the critical role female faculty and female peers played ensued. In this context, the discriminatory practices which female faculty face, resulting in their attrition

(Caldarulo et al., 2022; Gao et al., 2021; Sevilla & Smith, 2021; Xue & McMunn, 2021) was also discussed.

Next the literature review discussed challenges women in STEM face as they enter the workforce. Examples of these challenges are the gender pay gap, the motherhood wage penalty, the absence of role models, sexual harassment, and microaggressions. A section of the literature review focused on STEM as experienced by URMs, for whom the challenges are amplified at the intersection of race and gender (Crenshaw, 1989).

The literature review pivoted to STEM women who are senior leaders. Examples of challenges facing this level of women are ageism, the glass ceiling/cliff, and bullying and harassment. The importance of having mentors, sponsors, and role models was discussed as were the Queen Bee and Princess Bee phenomenon (Kremer et al., 2019; Mavin, 2008). The literature review closed with two sections, the impact of COVID-19 on STEM women where the importance of remote work was discussed, and a final section on success strategies of women in STEM.

Chapter 3 provided a background on the history of scholars who have contributed to qualitative phenomenological method of researching lived experiences. Chapter 3 also outlined why phenomenological methodology was chosen including its weaknesses and strengths. The methodology chapter also described the manner in which interviews were planned and conducted, while keeping to the best practices of human subject research, including IRB approval of all assets such as the recruitment script. Extensive discussion regarding the privacy and confidentiality of all digital interview resources and tools were discussed in Chapter 3 to support future researchers in replicating this study.

Chapter 4 detailed the data collection methods, the interrater reliability process, and the participants' demographics. Also in Chapter 4, the findings from the participants' interviews and how they accrue to answer their respective research questions were enumerated. Sixty-two themes emerged from 234 interview question answers, including an interview question which dove into the participants' backgrounds, such as immigration, family of origin, and educational choices. Chapter 5 concludes the research study with below discussion of the research findings as well as closing with the application of the findings, the researcher's final thoughts, recommendations for future studies, and the researcher's notes.

Discussion of the Findings

This study used a phenomenological qualitative method for research. Thus, 18 participants were interviewed, asking them 13 questions. The lived experiences were the key to insights for challenges impacting women in STEM as well as how they overcame these challenges. Following the completion of the interviews and the coding and theming of the interview questions, answers emerged regarding each research question. For each research question, three to four interview questions provided the data for these insights. In below section the result of each research question will be listed with its respective themes. Within each research question's results section, a comparison to the supporting literature review will be made to ensure there are no gaps, and to bring forward any unexpected theme which may have been illuminated during the study.

Research Question 1 Results

Research Question 1 was designed to learn of the challenges faced by women in STEM as they ascended to leadership. Four interview questions inquired about the single most difficult challenge the participants had faced, additional challenges they may have faced, and challenges they had witnessed other women in STEM face. The fourth interview question was a broad open-ended inquiry regarding their background and its impact to challenges or to overcoming them. Overall, nineteen themes emerged for RQ1. They were consolidated into the four highest occurring challenges. These challenges and the background on each are listed below.

Sexism. Operating in male-dominated cultures creates unique challenges for women in the workplace (Schmidt, 2022). Participants provided examples such as not being included in meetings and projects, being stereotyped for being hired as the diversity hire, being infantilized, being bypassed by their male colleagues for promotions, while their expertise was continually questioned. Participants noted being left out of after-work social settings where business was conducted without them, sometimes for the very projects they were leading. J. Wang (2009) shares the importance of these types of social networks in career advancement for women. McPherson et al. (2001) call the behavior of men hiving around other men homophily and it costs women being in the right places and spaces to develop networks. In parallel there is a shift to create a narrative that there is anti-male sentiment due to advances of women for which Zehnter et al. (2021) have created a scale as an instrument to measure. It is called the belief in sexism shift (BSS). Cyr et al. (2021) agree that positive relationships across genders help the women, but not necessarily the men. In their study, they showed that men overtly create barriers to keep women in STEM from participating in social activities, including sports-centered or work events after-hours with the presence of alcohol. The women participants, felt uneasy if they did participate during after hour activities. They stated safety concerns and not wanting time away from their families. In some cases, they also felt unsafe to participate due to the presence of alcohol in non-work settings. The women added that they saw a stark difference in their promotion velocity versus their male peers' trajectory in similar roles and careers, even if the male peer was less experienced and less educated. They attributed it largely to not wanting to or being invited to participate in the ‘bro club’ and ‘boys club’ cultures (K. C. Martin, 2013). In work deliverables, which sometimes led to patents, they would not be credited for their work, and at best receive an award for it (Heilman & Haynes, 2005).

Hostile and Unsupportive Work Environments. Participants noted a lack of psychological safety and at times being bullied and harassed by managers and peers. A participant shared experiencing sexual harassment which ultimately needed to be managed by legal recourse. The next dominant theme in toxic cultures was a lack of work life integration, especially as children arrived in the STEM women’s lives. Participants explained the lack of options provided to them by employers, when they sought flexibility to care for their families, be it children or elders. Whereas the same type of flexibility was being offered to male colleagues who needed accommodations for recovering from a major illness. Thus, it was not the lack of availability of resources by the company, but the lack of desire to support women and their families. Related to the work life integration theme, the motherhood penalty (Anderson et al., 2002; England et al., 2016; Kahn et al., 2014) emerged as a secondary byproduct of having families, where some participants had been told that their career would suffer now that they had become a mother. Participants discovered that they were paid less relative to their male peers, thus affirming the existence of the gender pay gap (Korn et al., 2022; Kray et al., 2023; K. Miller & Vagins, 2018).

Intrinsic Challenges. There were a few challenges which the participants noted as intrinsic challenges such as having lower confidence, which led to imposter syndrome (Clance & Imes, 1978; Huecker et al., 2023). Some could trace their hesitation to their college and high school counselors and teachers who had cast doubt in the women’s abilities to be successful in STEM. Some participants noted that it took them decades of delivering successful products and services to overcome their lack of confidence. Gottlieb et al. (2022) have studied the relationship between competence and confidence and show the rise of one with the other. They found that self-confidence is about directing and completing actions. Thus, it is not a surprise that the majority of senior leader participants noted that this was more of a challenge earlier in their career.

Formative Experiences. Without exception, participants reflected on their childhood experiences and noted where they gained both strength and insecurity about their STEM abilities. Societal expectations were deeply rooted in influence from parents, especially the male parent. Some participants added that their cultural intelligence originated from traveling or immigrating to a new country, making them more resilient (Alifuddin & Widodo, 2022; Kao, 1999). It had shaped their ability to self-manage in times of ambiguity and crisis. These types of experiences allowed the participants to integrate more easily within diverse organizations. Family of origin also factored into whether the women had been exposed to STEM early in their lives such as taking robotics course or computer science courses and exposure to STEM tools. Having siblings who challenged them, such as brothers, also was notable in surviving the future male-dominated spaces. Similarly playing sports provided the backdrop of understanding the male dynamics in the workplace, namely competitiveness (Bradshaw, 2002). Mothers who pushed their daughters to seek financial independence had a significant part in driving STEM women's ambitions. Having parents who were educated especially if they were in STEM careers also increased the confidence of pursuing a STEM career (Svoboda et al., 2016). Finally, parental expectation which were differentiated by gender impacted how the women saw themselves and what they thought they would be capable of accomplishing (Zhan et al., 2023).

Discussion of Research Question 1

Many challenges plague women in STEM. The participants shared their single biggest challenge, in addition to other challenges they and other women they knew, had faced. One hundred and twenty-four lived experiences were shared across the four interview questions underpinning RQ1. The three key challenges emerged. They were sexism, hostile and unsupportive work environments, and intrinsic challenges. Within this set of interview questions, the participants were provided an opportunity to speak about their background. In this section, the challenges and their insights from their personal backgrounds will be shared. The participants' backgrounds contributed to both positive and negative future STEM experiences. When their childhood experiences were positive, they were more resilient and less likely to leave the profession, showing that resilience beings as early as childhood. Participants with older brothers, or those who played team sports, or had supportive fathers stated their ability to be resilient when challenged with sexism. Interest in STEM started early, especially if the participants had parents who were also in STEM professions.

The most reoccurring challenge experienced by all women, regardless of their career level, was sexism. Aligning with the literature review, the symptoms of this challenge could be seen by the way the STEM women were mistreated in the workplace and in academia: bullying and harassment (Akella & Seay, 2022; Beale & Hoel, 2011), and being bypassed for promotions which ultimately resulted in being paid less than their male counterparts (X. Chen, 2013; Moakler & Kim, 2014; Pell, 1996; United States Census Bureau, 2019). The women were regarded within the constructs of gender stereotypes as being less intelligent, often their ideas not being heard, and their contributions not recognized, such as their names being omitted on patents (Reuben et al., 2014; Ross et al., 2022). This created toxic and psychologically unsafe cultures where the women had to navigate bullies, including sexual predators. As illuminated by the literature, discrimination is pervasive in male-dominated workplaces (Else, 2018; Holm et al., 2022). Often the participants referred to these behaviors as ‘bro culture’ and ‘boys club’ just as K. C. Martin (2013) and Schwiegershausen (2013) had noted. Indeed, Else (2018) found that science has a bullying problem.

Hostile and unsupportive environments further eroded the women’s confidence, which they had touched upon in the interviews as their own intrinsic challenges. It is notable that the more senior level participants had overcome issues with confidence as they had demonstrated a proven track record of delivering successful products and services, raising their confidence by demonstrated competence. The participants took responsibility for developing their skills to overcoming these challenges (more on this in Research Question 2’s results). They knew themselves well enough to note their lack of confidence while working in STEM fields. They were also self-aware that they could trace their lack of confidence to specific moments in their lives and careers, where Imposter Syndrome (Clance & Imes, 1978; Huecker et al., 2023) had created unease in performing their jobs. The more current thinking around Imposter Syndrome confronts the assertation that it is a women’s intrinsic confidence problem (E. McGee et al., 2022). Instead, it suggests that it is a problem due in part by the psychologically unsafe and toxic cultures. For the past decade, experts have been telling women to power pose (Cuddy et al., 2012) or to lean in (Sandberg, 2013), which for many seemed simplistic and trite. What is resonating with women is that their lack of confidence tends to only show up when they are operating in psychologically unsafe spaces, surrounded by toxic masculinity (Stergiou-Kita et al., 2015).

The last set of key experiences which impacted the women in their STEM lives, both in a positive and negative way, was due to experiences in their formative years. Be it immigration status, the siblings and adults in their lives, or the amount of STEM exposure they had. Much of what took place in her formative years impacted the STEM woman, especially her confidence. As noted above, some women gained confidence, despite experiencing sexism, and others were intrinsically more confident due to their lived experiences in their family of origin. Many of the women cited unique early learning experiences where they had been faced with parents, teachers, and counselors who suggested pursuing a more gender stereotypical career path. The importance of these adults in the lives of young STEM women is supported by the literature (Hite & Spott, 2022; Janssen et al., 2022; Siregar et al., 2023). Hite and Spott (2022) conducted experiments with parents to raise their daughter's doxa, specifically in support of STEM. Researchers exposed the parents to STEM women professionals and STEM activities, then tested them three months later. They saw an increase in interest in STEM as it pertained to their daughters. The participants shared that even a single comment, such as suggesting the STEM girl's brother had done her computer science homework, could crush the confidence of a young girl. One participant mentioned how a teacher had accused her of reusing her older brother's projects. In her case, it fueled her drive to prove the adults wrong. Resilience was amplified if the girl's father was supportive or the girl's parents had a STEM background (Linlin et al., 2022: Zhan et al., 2023). Without parental support and with gender stereotypical messaging coming from many directions from society, including boys, the young girls were more likely to lose interest in STEM and the opportunity for their participation in STEM would be missed. Zhan et al. (2023) surveyed parents across multiple dimensions, including innovation and social factors, and discovered that parents leaned towards boys for innovation and girls for social factors. They discovered that the parent's opinions of their daughter's abilities or strengths makes a significant difference in whether the daughter enters STEM fields. These are systemic and cultural enablers or inhibitors.

Closing the section on RQ1, on challenges experienced by women in STEM, it is important to note that one of the surprising findings of this study was that ageism was mentioned by the younger women who felt they were treated as a child, but not mentioned by the 72% of the participants who were senior leaders. The literature is very clear that ageism affects women of all ages and is pervasive in the workplace, keeping women over age 40 from moving forward in their careers as ageism affects hiring and promotion decisions due to implicit and explicit bias (J. O. Allen et al., 2022; NASEM, 2022). It presents a conundrum, where women are never the right age (Diehl & Dzubinski, 2023). Early in career, they are infantilized and later in career, they are disregarded for a variety of reasons such as being menopausal or having to care for family. What the early in career women participants experienced is referred to as "youngism" which is another type of discriminatory behaviors directed towards early in career women, compounded by stereotypes which are directed at that specific generation (Francioli & North, 2021).

Research Question 2 Results

Research Question 2 was the counterpart to Research Question 1. In RQ2 the participants had the opportunity to discuss strategies and best practices the women employed or saw other women employ, in face of challenges discussed in RQ1. In total, the participants provided 98 answers which distilled into fifteen themes for RQ2. They were consolidated into the four highest occurring best practices and strategies. These strategies are building community, investing in themselves, self-awareness and confidence, and changing their outcomes sooner. In this section, each strategy will be discussed with examples and connections to the literature.

Building Community. The women realized quickly in their careers, as noted by early in career participants' feedback, that they could not be successful going the distance alone in STEM fields. Once they started creating their own "board of directors" which was comprised of mentors, sponsors, allies, and other advocates, such as members of ERGs, the women had the foundational network and community to rely upon in times of crisis. Mentors would guide the women in navigating corporate processes, and would support the women by providing guidance when specific challenges arose (Kesar, 2017, 2018). Sponsors could speak to the STEM woman's talents, and were key in promotions, new job opportunities, and elevated the woman's corporate standing in spaces where she was not present. Allies understood the particular challenges of being a woman in STEM and would step in when they observed sexism (Arif et al., 2022; Bishop, 2002). All of these advocates were a mix of men and women.

Employee resource groups had a key role for STEM women as it would help them meet other women who were slightly ahead of themselves, providing camaraderie, and a network of like-minded individuals who could discuss the women's needs in the workplace (Colgan & McKearney, 2012; McNulty et al., 2018; Nishii, 2013; Rodriguez, 2021). Creative exchange of ideas and often consolidation of the women's needs made the ERG an invaluable resource for the women and management.

Investing in Self. Women who found themselves in challenging situations discovered that working on their own skills created a pathway to self-improvement, which then led to more opportunities. Examples of self-improvement strategies were going back to school for additional degrees, earning certification programs, reading books, attending seminars, and hiring executive coaches. Some organizations provided funding for the aforementioned strategies. Participants who were nominated for special training courses interpreted these overtures as a vote of confidence in their abilities by their management.

Self-awareness. The participants noted that when they were resolute in what they believed, they were able to navigate challenges more adeptly. Courage and confidence in other women were also strategies they had observed. Many of the senior leader women noted that their confidence grew as they amassed career successes. They also observed their Imposter Syndrome (Clance & Imes, 1978) decrease as confidence rose. Self-awareness led to self-management and the ability to observe their reactions to difficult situations, self-regulation. Regulating their emotional response was seen as a strength (Goleman, 2005). Many observed that emotional intelligence gave them the clarity to regulate their stress, providing them the focus to improve their situations.

Changing their Outcomes. The strategy to move roles seemed to be a last resort for many of the women. Several of the participants noted the courage it took for them to leave unpleasant situations, even as they were grateful that they had. Some participants noted staying too long in a company or a role which ultimately held them back from making progress in their careers, including achieving their financial goals.

Discussion of Research Question 2

As the literature review pointed out, from college to senior leader, it is essential to have people in STEM women's lives who believe in them, push them forward, and stand behind them if they fall. These people come in all forms. Some participants noted having excellent managers, during which periods they saw their careers flourish and their confidence rise. Participants recognized that they needed to commune with other women from the start of their career and those who had not done that felt as if they had fallen behind. Even senior leaders who thought they could go the distance alone, arrived at the conclusion that having deep and meaningful networks, who knew the quality of their work, would be necessary in times of crisis, especially when an accelerated job change was needed to escape a bad situation such as harassment and bullying, and toxic cultures.

Some women had avoided ERGs, thinking there was no need in a modern world to have groups of women joining together to discuss critical issues related to being a woman in the workplace. However, nearly every single participant asserted that ERGs provide a special sense of community (W. M. Green, 2018; Rodriguez, 2021; Welbourne et al., 2015). Examples of issues ERGs would discuss were local, such as the need for closer bathrooms and breastfeeding facilities, and global such as maternity and paternity leave benefits or needs for on-site childcare. Only when the women combined their voices were they able to influence policy and benefits changes in their organizations. To this end, women represented by unions have a lower wage gap than non-union members (U.S. BLS, 2023d). With the exception of government employees, it is not typical for STEM professionals to be members of unions. That is a consideration for women in light of advances in artificial intelligence.

Next, the results highlighted two intrinsic competencies as strategies best practices deployed by STEM women. They were confidence and self-awareness. In RQ1, some women had discussed having a high sense of confidence due to experiences which shaped their outlook in their formative years. Many of the participants with high confidence and high self-identity had parents, especially fathers, who had shown an interest in their STEM schooling (Davis-Kean et al., 2007). One participant was very proud of the role-model her grandmother played in her life. Her grandmother was an early physics major in a Mid-Western university, defying the odds. Another participant shared how growing up with only sisters, her mother insisted that they take on high-paying vocations so that they would not depend on a man for financial security. Several

STEM women mentioned how their partners and spouses were a strong source of support for them during times of crisis. This especially applied while trying to juggle career and motherhood. As the literature has shown, the motherhood wage penalty is significant for higher paid women where each child contributes to lower wages (Budig & England, 2001).

Finally, tied into confidence, was the ability to change outcomes once it was determined that there was no other way out of the crisis. Participants noted having waited too long to change jobs, leave companies, and pivot in their professions. Participants wished to impact to future STEM women to leave sooner once they realized those spaces and jobs no longer served them. Several of the participants had branched out and started their own thriving businesses. This typically happened after realizing that the corporate workplace did not offer flexibility for their households. They lamented the much-needed remote work options which were not offered to them, even as they were offered to men undergoing medical interventions.

The importance of remote work, as cited by the literature cannot be overstated for enabling women to stay in their STEM careers (Bacher-Hicks et al., 2022; Bollestad et al., 2022; Dowling et al., 2022). Companies with the courage to stick to their remote work pledges from the Covid-19 era will attract the talent and position themselves as destination organizations. Even as the employment market fluctuates, offering employees flexibility in their work preferences will draw top talent. Employees across the board apply to more jobs with the words ‘remote’ and ‘hybrid’ (Hsu & Tambe, 2021). For women with children, or those who are considering having children, this could be the difference between staying in the workforce or dropping out. Employees who are given a work from home or work from anywhere option state that they are 50% less likely to quit (Choudhury et al., 2021). Further, the same employees see a 13% increase in productivity, making this a win-win for employees and employers. It is estimated that 69% of work performed by college graduates can be done remotely (Delventhal & Parkhomenko, 2023). The call to action to employers is to not succumb to commercial real estate's pressures and instead start thinking creatively on how to repurpose and adapt existing real estate to address housing shortages (Van Nieuwerburgh, 2023).

Research Question 3 Results

Research Question 3 was seeking insights into the measurement systems that participants used to track their career development. Three interview questions inquired about what measures for career success the participants tracked, what their organizations provided in terms of tools and resources to track their career success, and what they wish they could track and were unable. The participants provided 101 answers to these questions which resulted in 16 distinct themes. Their answers varied quite a bit, but largely fell into these categories: extrinsic rewards, personal fulfillment, and expansion of influence. Below, each are enumerated along with the components of the participants' feedback.

Extrinsic Rewards. The answers which aggregated to this category ranged from an increase in promotions and titles to earned bonuses, stock grants, and wage increases. The STEM women prioritized this category at the highest level of importance. For them, seeing their overall financial rewards growing signaled that their career was progressing. Several participants at the senior leader level discovered that men who reported to them earned more than they did. When they broached this topic with human resources, they were given minimal support, and rarely was the discrepancy addressed. There is a myth about women not negotiating which leads to the gender pay gap. That myth has been debunked repeatedly in the literature (Kray et al., 2023). Indeed, women do ask and are turned down more often. There is also another myth that titles and salaries do not matter. Y. Chen et al. (2023) have shown that merit-based pay for performance is still very much top of mind for employees and a tremendous motivator for retention. Pay is also a proxy for justice, thus showing when women discover they are underpaid, how detrimental an impact it has on them.

When the participants discussed their organization's ability to support them with tools and resources, most of the women worked in organizations which had some tools which were focused on performance management and documentation. The documentation usually could be done either by them or by a combination of them and their manager. This cycle of feedback was another way that the participants tracked their career development. Positive feedback signaled that they were progressing and negative feedback often was the start of a downhill slide in their career development. The manager's support was of utmost importance, and when faced with a bad manager, they immediately saw their career progression come to a halt. The manager's overall support in items such as the participant's work life integration needs and remote work flexibility options, provided the participants a measure of forward progress in their career advancement. The literature supports the important role that a transformational manager plays in an employee's life. As a secondary benefit, when the manager is interested in the employee, it triggers self-management of career as well (Liu et al., 2022).

Personal Fulfillment. In the category of personal fulfillment, the participants shared that the impact of the projects, products, and services in which they played a key role was of utmost importance to them. When the impact was aligned to their personal values and goals, it brought forward a sense of happiness for them. One participant noted their contribution to making water births safer in the state of Texas. For them, no money could replace the impact of providing safe options for mothers and their babies. On a related topic, participants noted that if they felt appreciated, that it directly influenced their sense of well-being, and that corelated to career advancement.

Expansion of Influence. The final category for RQ3 was growth in relationships and the influence that the participants had on their network. As their sphere of influence grew, they saw that as a positive sign of their career progressing. A majority of participants noted gratification from mentoring other women, especially those who are early in career. The literature on mentoring as a source of satisfaction states that mentors have greater job satisfaction and see themselves more committed to their workplaces (Ghosh & Reio, 2013). Having a network of go-to individuals, male and female, who could depend on them brought them joy. For these participants the need to be needed was a sign of increased influence, which translated to career progression, resilience and staying with STEM.

Discussion of Research Question 3

The participants struggled the most with these set of interview questions. A few had not thought of measuring and tracking career success at all. They happened to be two of the first three participants interviewed, which was noted in the first interrater review discussion. Fortunately, the remaining participants, once given the opportunity to think through the questions, had answers which fell into the three categories discussed above in the Results of RQ3 section. Below, the relationship to the literature review regarding these findings will be discussed.

For the extrinsic rewards group of findings, the literature review supports that the gender pay gap, which some of the senior level leaders discovered with men at equal or lower rank, is real. STEM women on average earn less than their male counterparts, with URMs always faring worse (Beede et al., 2011; L. Landivar, 2013; J. Park et al., 2020). The importance of flexibility in the workplace is also well-documented especially in the post-COVID-19 era where caregiving needs were illuminated (Goldin et al., 2023). The participants noted necessary career slow-downs or leaving due to being forced out by the lack of flexibility in their workplaces. Several women had started their own businesses as a result of this lack of flexibility, especially following motherhood. The motherhood wage penalty literature shows that even one child sets women back, especially for high earning women (Goldin, 2014). Without available and affordable childcare, and companies moving back to onsite and in office work, this leaves women with very few choices in staying with their careers in STEM (Schochet, 2019).

The participants noted the fulfillment they received from mentoring and growing their networks. The literature supports women who are mentored are more resilient (Ayyala & Coley, 2022; Chrisler & McCreary, 2010; NASEM, 2019). Conversely, the literature also notes that it is not always the case that women will help other women. That is called the Queen Bee and Princess Bee phenomenon (Derks et al., 2016; Ellemers et al., 2004; Kremer et al., 2019; Neto et al., 2022; A. Xiong et al., 2022). Both phenomena do not serve women's interests and are damaging when women actively distance themselves from each other in order to survive in the corporate workspaces.

Finally, supportive managers and healthy cultures were cited as essential to retaining women in STEM (Lawson et al., 2024). This includes lack of toxic behaviors such as those discussed under bullying, microaggressions, and sexual harassment (Akella & Seay, 2022; Aycock et al., 2019; Fattoracci & King, 2023). Many of the participants stayed with or followed a good manager for years to protect their sense of peace and ability to function in healthy work environments. One of the early in career participants noted staying with the same company for a decade, since she was a college intern, because her manger was the kind of person she wants to work for when she becomes a mother. For ten years, she has planned and forgone increases in pay which can occur with job-hopping, just to mitigate the risk of landing in a toxic workplace or under a bad manager.

Research Question 4 Results

Research Question 4 provided the participants the opportunity to share any final thoughts about being a woman in STEM, giving them the chance to impart wisdom for future generations of aspiring female STEM leaders. In these set of questions, the participants also had the opportunity to reflect on their entire career, and answer whether they thought it was all worth it. The participants resoundingly and unanimously responded that it had been worth it. Even the participants who wished she had studied writing instead of mechanical engineering, agreed that the STEM career she enjoyed prior to having children provided her opportunities no other path would have given for her. Overall, fourteen themes emerged from seventy-four distinct thoughts that the participants had. Their feedback was largely on trusting themselves earlier in career, investing in relationships, urgently addressing what was unacceptable, be it harassment, bad managers or unequal pay. Below, each of these strategies are discussed.

Trust Yourself. A running theme across many of the interview questions was confidence in one's ability. In that same spirit, many of the participants wished to share that once they had arrived at the state where they trusted themselves, they felt liberated to act. The confidence boost of feeling like they belonged in STEM, and the opinions of others was immaterial, opened up a newfound ability to focus and achieve in their careers. The participants acknowledge that it was after repeat successes where they could begin to trust themselves. They also saw in this self-trust the ability to move jobs, leave companies, start new businesses, and act on unacceptable situations such as harassment and bullying.

Invest in Relationships. Many of the participants shared gratitude for the meaningful relationships they had built over their careers. They encouraged aspiring female STEM leaders to focus on their network, ensuring they had a blend of people who were not necessarily like them and who had a diverse set of business experiences. Once again, they raised the importance of mentors and advisors and not just by other women, but men who could be allies and sponsor in their careers. It was the presence of these relationships, such as those formed within ERGs, that they women used to get them through challenging times, including those brought about as they grew their families.

Urgently Address the Unacceptable. One of the regrets that was a repeated theme was the hesitation to move quickly to action when things reached the point of affecting their physical and mental health. Participants shared events such as sexual harassment, bullying, microaggressions directed towards them, usually by men. For too long, they endured bad boss, toxic cultures, pay gap, bad peers, and inappropriate scope. With the benefit of hindsight, the participants shared that they should have acted quickly. Be it leaving their job, their company, or taking legal action against their employer. Moving quickly is not a subject for which a lot of scholarly literature exists. This is an area which needs to be further explored as there is a bias against resume gaps and moving too quickly between companies. Of course, that was at a time when companies, especially in high technology could offer a level of job security not seen since COVID-19, making mass layoffs a frequent occurrence now in STEM industries.

Discussion of Research Question 4

Research Question 4 represents the complete viewpoint of the lived experiences and the learnings of 18 women in STEM. Although these participants were at various career levels, they shared many of the same experiences. Thus, when it came to answering the need to impart wisdom to the next generation of aspiring female leaders, their aggregated advice was to trust themselves, build their relationships, and urgently address the unacceptable.

Aligned with the literature, focusing on themselves meant raising their confidence in their ability. Habitus, the belief that you are capable, came later to some of the women (E. Cech et al., 2011; Clark et al., 2021). They realized that they had an important voice and it needed to be heard. Confidence also meant when they made mistakes, to learn from them versus eroding their trust in their abilities, which is a sign of having a growth mindset (Dweck, 2006). Participants encouraged future female STEM leaders to stay in STEM fields, as there were many problems in the world to be solved. With only one exception, all participants were grateful to have entered STEM fields. STEM vocations had provided them high-paying jobs (Okrent & Burke, 2021; United States Census Bureau, 2016) and the ability to support their families. It is important to that these are high paying jobs because they are not easy jobs. The market pays for the endurance and grit it takes to study STEM fields, and then continues to reward those that stay in STEM industries. If it were not for the inherent sexism built into male-dominated spaces, more women would join and stay in STEM. From a young age, if encouraged by the people in their lives, from parents to teachers and counselors, to be interested in STEM, they would never doubt their abilities.

The sexism noted in RQ1 is foremost challenge that the study participants wanted to warn future STEM women to be aware of and to action quickly if they found themselves at the receiving end of bullying, harassment, and microaggressions. Many of the participants had experienced toxic behaviors by other women, and highly encouraged future STEM women to surround themselves with members of ERGs, join clubs in college, and contribute to communities where they could find support and increase their sense of belongingness.

The relationships that the participants had built over the years were repeatedly mentioned as an asset and a source of comfort during difficult times. STEM women participants encouraged aspiring women to be intentional about building their networks (Barkhuizen et al., 2022; Colgan & McKearney, 2012; Edna et al., 2019; Lopez & Duran, 2021; McNulty et al., 2018; Nishii, 2013; Rodriguez, 2021; D. M. Young et al., 2013). All participants shared stories of someone who believed in them and mentored them. Some of the women pointed to allies and sponsors, including men, who had been instrumental in their career growth.

Mid-career and senior leader participants, advised future STEM women to move quickly when the situation became intolerable. Whether it was bullying or sexual harassment, in their experience, nothing repaired itself. They emphasized the need for confidence and action versus long-term suffering. They wanted to impart the wisdom that there would be other jobs, other companies, and other cultures where they would be welcomed and appreciated. The participants had learned the hard way that loyalty was not reciprocated as a rule. Above all, the participants resoundingly wanted to make sure that the future women in STEM should confidently enter STEM fields, knowing they were securing their financial well-being.

The generosity with which the STEM women shared their lived experiences in service to helping future women in STEM was incredibly inspiring. Sometimes it was through tears and other times through frustrated laughter. They all shared the good and the bad situations they had endured or witnessed.

Implications of Study

The retention, attrition, and lack of attraction to STEM fields by women and girls has been studied by many scholars (Chrisler et al., 2012; Martinez & Christnacht, 2021; R. A. Miller et al., 2021; Worthen, 2021). In this study, 18 women in STEM were interviewed and asked to reflect on their lived experiences. They answered 13 interview questions, which focused on the challenges they had experienced and witnessed others experience. They were then asked about their, and other women's, success strategies and best practices. Reflecting on their lives, they were asked about the measurements and tools they used to track their career progress, and the advice they wanted to share with future STEM women leaders. Ultimately, the participants provided 397 responses to 13 interview questions. Sixty-two themes emerged to answer the four research questions. Chapter 4 shared the results for each research question and Chapter 5 discussed the highest-level challenges, success strategies, measurements, and advice to future STEM women.

In this section, the discussion pivots to the usefulness of these learnings. From the answers to the research questions, four distinct groups can benefit and take specific actions to attract and retain women in STEM. These four groups are (a) parents, (b) educators at all levels, (c) policy-makers, and (d) leaders of corporations. Examples of how each group can take this study and directly provide actions to improve the state of girls and women in STEM will be provided and enumerated upon in the Applications section.

Parents

The role parents play in the success of their daughters entering and staying in STEM fields cannot be overstated (Davis-Kean et al., 2007; Dotterer, 2022; Marcus et al., 2021). From early childhood, they have the opportunity to foster a love of STEM education in fun and novel ways (Law et al., 2021). Further, parents, especially the father, can play a significant role in raising their daughter's confidence and self-identity (Davis-Kean et al., 2007). Siblings and mothers also pay a role in mitigating against gender stereotypes such as who can work in a STEM field. Participants raised their mothers' push for their daughters to be financially independent. Parents who are employed in STEM fields can act as role models for their girls, and there is a greater likelihood their daughter will follow in their footsteps (Mues et al., 2021; Siregar et al., 2023).

As the child grows older and is influenced by other adults and peers in middle school and high school, there is an opportunity for exposure to additional role models, beyond their parents. These role models are typically teachers and counselors who can step in and provide an example of what is possible versus discouraging girls from entering STEM fields. Participants experienced gender stereotyping from high school counselors. As an example, telling them they were good in math, *for a girl*. The more exposure the young ladies have to adults who are supportive, the more likely they are to pursue a STEM vocation in the future. The opposite is true as well. A simple snub or disregard for the girls' self-esteem can do permanent damage.

Educators

Educators, especially female faculty in higher education, can play a significant role in bolstering the confidence of young women. Female STEM faculty are themselves at risk of attrition (D. P. Evans et al., 2019; Gregor et al., 2023). Thus, it is important that the significant number of men in charge of universities (Silbert et al., 2022) take note and ensure their female faculty receive the support and sponsorship they deserve so that in turn they can help support the female STEM students, who are greatly influence by them.

Community colleges also pay a key role in supporting students who arrive to four-year universities unprepared for the rigor of early STEM classes. Young women are particularly subject to disappointment and subsequent attrition once they realize they are not performing well in their foundational classes (R. Cohen & Kelly, 2020; Cotter et al., 2022). Community colleges offer a lower cost alternative to four-year universities as the students secure their STEM knowledge (Ginder et al., 2018; Hanson, 2023; Hilmer, 1998; Malcom & Dowd, 2012; Voorhees et al., 2023). Funding for community college STEM programs is essential to more women entering STEM fields.

Educators should ensure the presence of vibrant on-campus women's organizations such as Women in Engineering and American Association of University Women (AAUW). Women's organizations offer camaraderie, access to role models, mentoring opportunities and a greater sense of belonging (Rainey et al., 2018). Peer group support is critical to success while managing the challenging STEM curriculum. Study groups where more senior students tutor younger women pull the younger ones forward. Organized clubs such as match clubs, are also an excellent way to support students. Educators should encourage these organizations with resources and funding for speakers, rooms, and events.

Policy-makers

Global and local leaders should promote STEM student achievement with the policies which they enact. However, additional focus and funding which directly benefits female STEM students will promote additional interest and retention of female students' interest. Novel approaches have produced promising results. One example is the presence of mobile STEM labs which travel around in districts, providing STEM learning opportunities (Irizarry-Barreto et al., 2018; Jones & Stapleton, 2017). Funding for additional high school computer science courses, especially if taught by female teachers can promote life-long interest in STEM (N. A. Bowman et al., 2022). Successes in high school translates to self-efficacy in the future for STEM girls (Sublett & Plasman, 2017). Another example is providing funding for all-girls robotics clubs, where girls can build their confidence in psychologically safe spaces. Their self-identity and confidence are being shaped in the critical teen years (Blotnicky et al., 2018; Brown et al., 2016).

Leaders of Private and Public Organizations

This study should influence leaders who act as employers to STEM women. If they are concerned about recruiting, hiring, and retaining women in STEM, they need to take action by providing equal opportunity psychologically safe spaces. Specifically, they should pay attention to the number one challenge which was raised by the study participants, sexism. Leaders should regularly audit their workforce for gender pay discrepancies, and not just the obvious comparison of career stages. The heart of gender pay discrepancy is that women at lower levels are delivering equal, or higher in complexity, scope. Leaders need to be cross-checking, at every promotion cycle, if decision-makers are promoting men for potential and women for proven capability (De Paola et al., 2017; Player et al., 2019). Performance reviews should be checked regularly for biased language to ensure women are not given stylistic feedback and the men given tangible and actionable feedback (Doldor et al., 2019).

Flexibility in work schedule was noted as a best practice and is currently inconsistently applied. Remote work during COVID-19 benefited URMs and women by providing them hybrid options to care for their families and to avert microaggressions (Hacohen et al., 2020; Rodríguez-Modroño & López-Igual, 2021; A. Xiong et al., 2023). Companies who offer job autonomy and evaluate employee performance on delivery of goals are going to attract women in STEM based on the participants' feedback. Similarly, companies who offer maternity and paternity leave are going to attract women and men who are looking for options to ensure there is sufficient time to care for their families.

Employee resource groups, mentoring circles, and formal training were greatly appreciated by the participants. All of these strategies build community which makes for a more fulfilling STEM experience. Women learned both hard skills and how to navigate their organizations from their mentors (Barkhuizen et al., 2022; Edna et al., 2019; Lopez & Duran, 2021; D. M. Young et al., 2013). The participants also saw support for additional learning by way of tuition reimbursement and on-site classes as a way that their organizations were investing in them. These are all strategies that leaders in organizations should fund and visibly support.

Succession planning, and ensuring enough women were on succession slates, was another strategy that bolstered the pipeline of qualified women available for leadership positions. Proactive management of recruitment practices, ensuring candidate slates for jobs represented a mix of men and women, were two ways to mitigate hiring managers' bias. Auditing recruitment and hiring practices for bias is another way to create healthy and balanced cultures. Gender equality oversight is everyone's responsibility. Managers at all levels should be empowered to call out discrepancies in gender pay and have the ability to correct it.

The absence of healthy cultures results in toxic cultures. This created a hostile work environment rife with microaggressions, bullying, and harassment. Forward-thinking companies stop rewarding leaders who exhibit the Dark Triad characteristics (Karim, 2022; Rogoza & Cieciuch, 2020). Given "gender discrimination and gender bias" was the number one challenge encountered by the STEM women, sexism which is at the root of it, needs to be addressed by company policies. Companies should pay particular attention who they reward, what behavior they allow, and how they hold those people who cross the line accountable. Performative authenticity by leaders, while simultaneously backstabbing women, needs to be investigated and dealt with, whether it is done by male or female leaders.

Finaly, organizations should pay attention to their after-hours and non-on-site activities where business is still taking place in spaces which contain alcohol or create an unsafe environment for all of their employees, especially the women. This was a theme which repeatedly pointed to the boys' club culture created in male-dominated STEM industries.

Applications

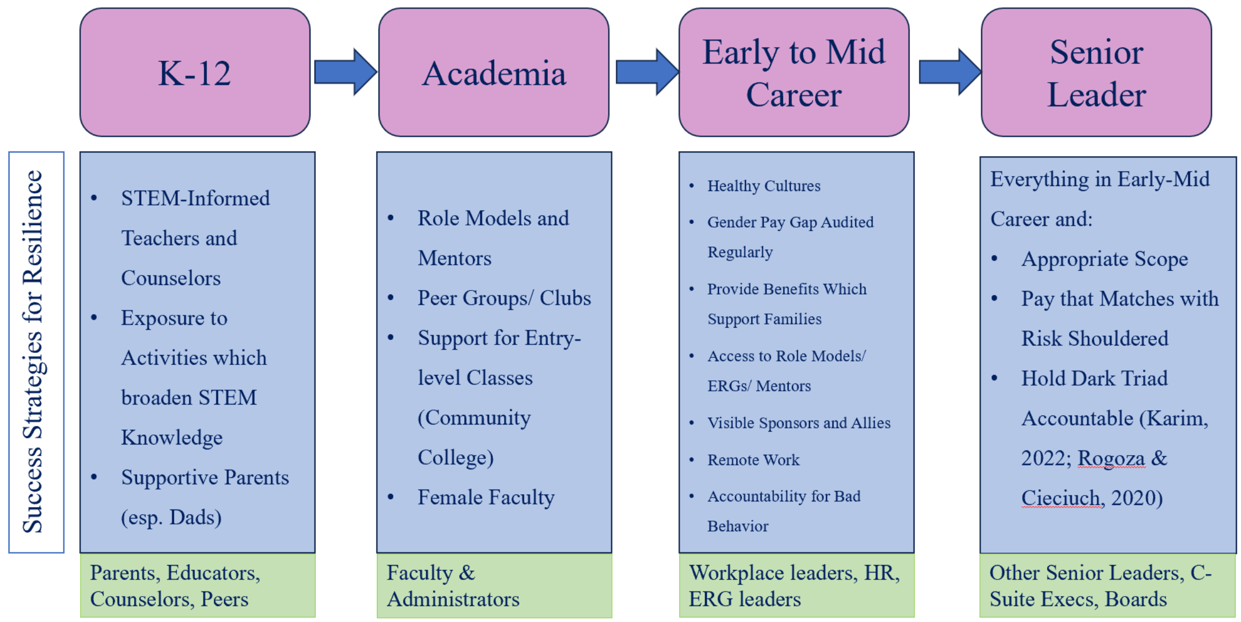
There are significant challenges on the journey of a young girl who is interested in STEM to seeing that vision through and becoming a senior leader in a STEM field. Taking all that has been learned from the literature review as well as the participants' lived experiences, The Moore STEM Girls and Women's Resilience Model (Figure 18) was created. The goal of this Model is to provide success strategies which build resilience against the challenges stated in RQ1. They take the best of the answers from the literature review and participants' answers from RQ2, RQ3, and RQ4.

The Model is read from the left to right, depicted by the phases in pink as the girl grows from her K-12 experiences to college, then early to mid-career, and finally as a senior leader. The success strategies in the Model can be found in the blue boxes under each phase of a girl and woman's life. Below each phase, are the respective blue boxes of success strategies, each bullet representing one of the success strategies. In the green boxes, stakeholders who influence the success strategies can be found. For example, under the K-12 phase, the success strategies are suggestions for parents, educators, counselors and peers. Ultimately, the Model offers solutions to attract and retain girls and women in STEM. These success strategies can be applied at every stage of a girl and woman's life.

The success strategies require adaptive or technical leadership (Heifetz et al., 2009), and sometimes a combination of the two. Heifetz et al. (2009) differentiated adaptive from the technical, in that adaptive strategies require behavioral changes, and technical strategies leadership require tangible changes. An example of a behavioral change is to try to change gender stereotyping in children. A technical strategy would be to offer children games that are gender neutral. The discussion below will frame the success strategies into adaptive and technical leadership methods which aim to keep girls and women interested and participating in STEM. The discussion will also highlight the strategies which aligned with the literature. Finally, the strategies which are new from the results of the participants' interviews will be noted.

Figure 18

Moore's STEM Girls and Women's Resilience Model



Note. Figure 18 shows strategies of resilience and persistence at every phase of a girl and woman's life.

Success Strategies for Kindergarten to 12th Grade

Beginning with the K-12 group of girls, their influencers are parents, educators, counselors, and peers. If all of these stakeholders are able to follow the respective suggested success strategies for resilience, it will increase the self-confidence, self-concept, and habitus of the girls. In turn, these intrinsic qualities maintain their interest and makes them stronger for the future as well. The success strategies for K-12 girls are: STEM-informed teachers and counselors, exposure to activities which broaden STEM knowledge, and supportive parents. These success strategies have been shown in the literature to create interest and resilience in STEM (Hite & Spott, 2022; Janssen et al., 2022; Siregar et al., 2023). For example, in the case of parents, if they can be engaged early enough in STEM activities, kindergarten through elementary school, they can put in place a strong foundation for their young girls to become confident and ready for the gender stereotyping which is bound to occur in middle school and high school (Hite & Spott, 2022).

Parents’ overt interest in STEM is another proven adaptive success strategy both stated by the participants as well as supported by the literature (Heifetz et al., 2009; Siregar et al., 2023). Siregar et al. (2023) studied the parents’ education, vocation, and interest in STEM and saw a direct correlation with interest by their girls. Another example of a technical success strategy in the K-12 phase is for educators to provide access to project-based STEM activities, which the literature has shown to increase STEM interest (Drobnic, 2023; S. Han et al., 2015). Educators can ensure STEM interest stays high by creating psychologically safe and welcoming environments where girls are ready to experiment and fail without judgment (Master et al., 2016). Master et al. (2016) studied that even the physical spaces girls occupy makes a significant difference in their level of long-term interest. Offering tutoring and computer science classes in high school as a part of the curriculum or in summer camps and after school programs raises the girl’s confidence and interest in STEM (Fernández-Martín et al., 2020; Merritt et al., 2021; Roberts et al., 2018). These are examples of technical strategies which educators can apply in designing their physical spaces and STEM programs.

Success Strategies for Women in Academia

In the next phase of the Model, the focus is on women in academia. These young women in STEM majors depend on faculty and administration to provide them with success strategies which keep them in STEM majors. Examples of technical leadership (Heifetz et al., 2009) implemented by universities would be to offer formal STEM mentoring programs that expose young women to role models, thereby mitigating attrition (Rennane et al., 2022). J. Zhang et al. (2023) studied men and women's behaviors in conferences and noted that women tend to ask less questions. These types of gender differences are important for academics to understand. Another example would be to create safe spaces for women to meet other peers via resourcing for clubs, and supporting them if they struggle in their entry-level classes. Both strategies are supported by the literature which showed the importance of mentors, especially female ones, at this stage (Moghe et al., 2021).

For those students who are struggling with the early STEM classes, community colleges play a significant role in bolstering their education, especially if they were not sufficiently prepared for the challenging first year of STEM classes (R. Cohen & Kelly, 2020; Cotter et al., 2022). In community colleges and universities female faculty act as role models and influencers, buffering gender stereotypical messages young women receive in school and society, and ultimately providing a safety net against attrition from STEM majors (Hansen et al., 2023; J. Park et al., 2020; Robst et al., 1998; Solanki & Xu, 2018).

Success Strategies for Women in Early to Mid-Career

The next stage in a woman's STEM life is early in career to mid-career. This stage is represented by the third column from the left. There are many success strategies for resilience in the workplace. Leaders, human resources and ERGs can put in place technical and adaptive strategies (Heifetz et al., 2009) which limit attrition by women in STEM. Adaptive leadership success strategies include creating healthy cultures (Hewlett, 2007; M. J. Lee et al., 2020;

Malinen & Johnston, 2013; NASEM, 2018; M. Williams, 2020), active and visible sponsors and allies (Arif et al., 2022; Bishop, 2002; Silver, 2023), and holding employees accountable for bad behaviors. Accountability is an adaptive leadership quality that when consistently applied shows women that their concerns about bad behaviors will be addressed by management (Heifetz et al., 2009; R. Williams, 2006). Examples of technical leadership for this group of women are addressing the gender pay gap by regularly auditing the salaries of men and women, providing for and encouraging access to role models, financially supporting ERGs, and offering remote work. The literature states that as more work is distributed and across teams, with less hierarchical structures, that everyone is accountable for accountability, especially when it is related to unethical behavior (Bergsteiner, 2012; Beu & Buckley, 2001).

Organizational leaders can ensure family-friendly benefits such as maternity and paternity leave are in place to provide women the support that they need especially during the motherhood years, where many women face the motherhood wage gap (Funk & Parker, 2018). In addition, they can demonstrate courage, in the face of entropy of remote-work and the gains made during COVID-19, by maintaining flexible work arrangements. Organizational leaders can use the data in this Model to hold those who exhibit unacceptable behavior such as harassment and bullying, accountable for their actions. They are responsible for creating cultures where women can feel included with a strong sense of belonging. Psychological safety is demonstrated to be key to resilience in the literature as well as participants' expression of personal agency and confidence (Kim et al., 2020; Rainey et al., 2018).

Another example of a technical success strategy is for organizational leaders to implement mentoring programs, ERGs, and sponsoring women's ongoing education. These types of communities increase women's sense of belongingness (Colgan & McKearney, 2012; W. M.

Green, 2018). Over one third of participants overtly called out ERGs as a safe harbor during challenging times. When ERGs have their race or sexual orientation in common, they form an even stronger bond than just gender and provide employees a space to learn and grow (Colgan & McKearney, 2012; Nishii, 2013).

When it comes to closing the gender pay gap (Alonso-Villar & del Río, 2023; Markovic & Plickert, 2023), employers must put in place technical strategies to ensure they have equitable recruitment, hiring and promotion practices. They must audit their pay by scope and gender. Not just pay according to level as it is a known workaround to make women work on harder scope for the same pay (Ashby et al., 2007; Mulcahy & Linehan, 2014).

Success Strategies for Senior Leader Women

The final phase of the Model addresses the challenges that STEM women in senior leadership face. In this phase of a STEM woman's life, it is expected that all of the barriers faced in early and mid-career are also present, but she has been able to navigate them successfully to reach senior leadership. Namely, barriers such as ageism, sexism, racism, do not go away just because a woman has arrived at senior leadership (Hewlett, 2007; M. J. Lee et al., 2020; Malinen & Johnston, 2013; NASEM, 2018; M. Williams, 2020). The cumulative toll of facing all of the "isms" may still contribute to her leaving STEM fields. That is why it is critical that the C-suite executives provide the success strategies for resilience in this phase.

The three main success strategies for a senior level leader are holding the Dark Triad of Leadership accountable (Karim, 2022; Rogoza & Cieciuch, 2020), aligning with the right scope, and appropriate pay to risk ratio. Holding the Dark Triad accountable is a direct as a result of participants' feedback and is substantiated by the literature which states that there is a positive correlation between executives exhibit the characteristics of narcissist, psychopaths, and

Machiavellian behaviors, resulting in toxic cultures (Diller et al., 2021; Rivera & Scholar, 2020). The success strategies for STEM women leaders are influence by executives in charge of setting direction, establishing policies and benefits, and creating a healthy culture in their organizations. Thus, even a few Dark Triad leaders can create intolerable environments, even as they may show short term external success, internally they are detrimental to organizational performance (Haar & de Jong, 2023). The literature shows that people with Dark Triad characteristics are more likely to ascend to executive leadership such as the CEO level (Brunell et al., 2008).

Summary of the Model

The Model showcases the top resilience success strategies to use at every stage from a girl to a STEM woman's life phases. Current women in STEM can use these learnings to influence better outcomes for themselves, knowing that their experiences are not isolated or unique, but part of a larger societal problem of sexism. They can self-advocate knowing that it is not a shortcoming on their part when they feel Imposter Syndrome (Clance & Imes, 1978). The societal pressures placed on girls and women is present at every phase. By seeing the results of this study, they can pay particular attention to having a large group of advocates comprised of mentors, allies, and sponsors. They can use this study to advocate for equal pay. They can stand in their confidence when presented with overt acts of racism, ageism, youngism, and sexism.

This Model will be the foundation for the book which will follow this study, authored by the researcher. The researcher will also disseminate these findings in industry and educational conferences, women's conferences, and as by being a guest speaker in women's affiliated panels.

Study Conclusion

Using Appreciative Inquiry (Cooperrider & Whitney, 2005) and looking at the world through a Feminist lens (Friedan, 1963; hooks, 2000; Steinem, 1969), this study affirmed, in a post COVID-19 environment, that at the root of the recruitment, attrition, and retention challenges of women and girls in STEM continues to be the fundamental sexism they face from their entry into kindergarten through senior level leader positions. The pervasive and persistent gender discrimination they encounter throughout their lives at all stages, creates a difficult environment in which they can succeed without specific interventions. This confirms volumes of literature on reasons for women's attrition from STEM fields (Batz et al., 2015; Dennehy & Dasgupta, 2017; Glass et al., 2013; Idahosa & Mkhize, 2021; Gumpertz et al., 2017).

The study participants provided tangible examples of gender discrimination they had faced, and they also provided examples of interventions without which they would not have persisted. The interventions started when they were young girls with the role parents, teachers, counselors, college academics, mentors, allies, sponsors, and supportive leaders played in their lives, which contributed to their resilience. When it came to persistence in the workplace, the company policies, flexibility and availability of family benefits contributed to persistence in STEM careers. Organizations with healthy cultures, designed for all to thrive, were highlighted as success criteria. The literature and the participants confirmed that adults involved in a young STEM girl's life have a critical role in treating her as equally capable, encouraging her and dispelling any societal gender stereotype directed at her. Furthermore, the adults in her future need to create psychologically and physically safe spaces so she can thrive as a woman in STEM. She should be treated and paid as an equal, free to share her ideas, and given credit for her work while supported by mentors, sponsors, and allies.

This study adds to the body of knowledge by validating that working in male-dominated STEM spaces still subjects the women to sexism as their number one challenge. The study also provides tangible success strategies for STEM girls and woman to persist in STEM fields.

Recommendations for Future Research

There remain cohorts of STEM women who need to be exclusively studied repeating this methodology. They are the underrepresented minorities of STEM women: LGBTQIA+, Black and Latinas, Asian Americans, and members of Indigenous tribes including Native Americans. In this study's participants, two were Asian American, one was Native American (Blackfeet), one was a descendant from an indigenous European tribe, and one was a member of the LGBTQIA+ community. This made for partial representation of their experiences as STEM women. However, dedicated studies of Black, Latina, Indigenous and LGBTQIA+ members of STEM communities should be conducted, given the extraordinary amount of added discrimination they face (Brockman et al., 2022; Eaton et al., 2020; M. Miles et al., 2020).

One of the surprising findings was that Ageism did not present as a theme in this study. Although the participant makeup was 72% senior level leaders, they did not bring forth the known discriminatory practice of Ageism (Malinen & Johnston, 2013; NASEM, 2022). With an aging population, future studies should focus on this dynamic with five generations about to enter the workforce. Similarly, a longitudinal study which follows women in STEM entering the workforce now, would be an excellent way to study the barriers which get in their way.

The data regarding the participants' backgrounds opened a new opportunity to study the role of parents as key contributors to their children's future success as STEM women. Future STEM woman's confidence, self-identity, and habitus, directly correlates with resilience and retention in STEM fields. Parents, especially the father's role in a girl's upbringing, presented as a critical factor to continue to explore.

Future studies, should consider a companion mixed methods quantitative anonymous survey which can seek insights about sexual harassment in the workplace. This is a topic, due to its sensitive and private nature, that may be better suited with the anonymity that a quantitative survey provides.

Final Thoughts

I have spent more than 30 years as a woman in STEM, first as an engineer and then as a business leader in various high technology companies. I grew my career and managed to raise two wonderful humans in a loving household with my husband. It was never easy, and at the same time I would not trade it for any other experience, just as the women participants stated with great enthusiasm. During my tenure, I saw and heard things that both inspired and disappointed me. The lack of leadership and the poor treatment of STEM women started to become noticeable as I rose in the ranks. The first time I saw the presence of Dark Triad behaviors (Karim, 2022; Rogoza & Cieciuch, 2020), I assumed it was an anomaly, however it is pervasive in leadership ranks. The higher up I climbed in organizational responsibility, the more I was challenged for my skills and knowledge. I chose to pause a vibrant career to examine the good and bad sides of leadership as a science, so that I could give back to future generations of STEM women.

This time of reflection, learning, research, and writing has prepared me to give back to current and future women in STEM. The fact that the participation and attrition numbers have not changed significantly over the past 30 years is baffling (Martinez & Christnacht, 2021). Many of the challenges I witnessed, both mine and other women's, can be mitigated before the girl or woman decides to give up on STEM. The stories of this study participants needs to be shared so we can all learn from them. In due time, I will also share my direct experiences, which are now fuel. With these stories in the open, we can make the necessary changes in how we design education, envision and execute public policy, manage workspaces, and how we parent our girls and boys. When women rise, all outcomes for society improve (Lwamba et al., 2022; Mishra et al., 2020). Earning a PhD on a topic for which I have unending passion is truly a blessing. I am grateful that I had the time and support to follow my purpose.

It is my hope that a future female leader in STEM will pick up this study, and anticipate the challenges that may arise for her as she grows her career. This research, conducted in 2024, reflects little to no change in what my mother would have experienced 30 years ago in the STEM workforce. New college graduates can prepare themselves with the right support systems and communities, including consciously choosing mentors and sponsors. They can be active participant in working for the right leaders in organizations where their contributions are valued. When a woman in STEM experiences discrimination which is discussed extensively in this study, she will recognize it for what it is, overt sexism. As the participants recommended, the future STEM woman can change her outcomes sooner than her predecessors did.

The Importance of Representation in Artificial Intelligence Innovations

At this inflection point of humanity and technology, namely Artificial Intelligence (AI), the importance of the need for women to participate in the creation of the future cannot be overstated. Specifically, Artificial Intelligence innovations, the respective large language models which are the backbones of them, need unbiased data to train and create applications representative of the diverse societies we live in. If left unchecked, they will further codify sexism and racism into the tools of the future. Including women’s voices will ensure we, as a society, do not institutionalize sexism. It is imperative to have women of all backgrounds and voices bringing their thought-leadership to the evolution of Artificial Intelligence. The urgent call to action in this study is for parents, academics, and organizational leaders is to ensure STEM women’s valuable insights are integrated as we build the future.

I am ending this study, as I started it, with much gratitude to the Pepperdine University community who supported, taught, encouraged and ultimately led me to completion of my hero's journey (Campbell, 1949).

REFERENCES

Abbott, L., & Grady, C. (2011). A systematic review of the empirical literature evaluating IRBs: What we know and what we still need to learn. *Journal of Empirical Research on Human Research Ethics*, 6, 19–3. https://doi.org/10.1525/jer.2011.6.1.3.

Abun, D., & Basilio, G. J. (2023). The effect of workplace relationship on job satisfaction of employees: School context. *Divine Word International Journal of Management and Humanities 2*(1), 227–242. https://ssrn.com/abstract=4398755

Acevedo, N., Nunez–Rivera, S., Casas, Y., Cruz, E., & Rivera, P. (2021). Enacting spiritual activism to develop a sense of belonging: Latina community college students choosing and persisting in STEM. *Journal of Women and Gender in Higher Education, 14*(1), 59–78. https://doi.org/10.1080/26379112.2021.1891928

Adams, S. M., Gupta, A., & Leeth, J. D. (2009). Are female executives over–represented in precarious leadership positions? *British Journal of Management*, *20*, 1–12. doi:10.1111/j.1467-8551.2005.00433.x

Adams–Harmon, D., & Greer–Williams, N. (2021). Successful ascent of female leaders in the pharmaceutical industry: A qualitative, transcendental, and phenomenological study. *Equality, Diversity and Inclusion: An International Journal, 40*(7), 819–837. https://doi.org/10.1108/EDI-01-2019-0031

Age Discrimination in Employment Act 29 U.S.C. § 621 to 29 U.S.C. § 634 (1967). https://www.dol.gov/general/topic/discrimination/agedisc

Ahn, H. S., Bong, M., & Kim, S. (2017). Social models in the cognitive appraisal of self–efficacy information. *Contemporary Educational Psychology*, *48*, 149–166. https://doi.org/10.1016/j.cedpsych.2016.08.002

Aisenbrey, S., Evertsson, M., & Grunow, D. (2009). Is there a career penalty for mothers' time out? A comparison of Germany, Sweden and the United States. *Social Forces*, *88*(2), 573–605. https://doi.org/10.1353/sof.0.0252

Aisha, S., Sajid, B., & Karim, K. A. (2021). Spillover of workplace bullying into family incivility: Testing a mediated moderation model in a time–lagged study. *Journal of Interpersonal Violence*, *36*(17–18), 8092–8117. https://doi.org/10.1177/0886260519847778

Akella, D., & Seay, E. (2022). 'Gender' in workplace bullying: A phenomenological study on nurses. *Journal of Nursing Management*, *30*(6), 1700–1712. https://doi.org/10.1111/jonm.13556

Alabi, J. (2015). Racial microaggressions in academic libraries: Results of a survey of minority and non–minority librarians. *Journal of Academic Librarianship. 41*(1), *47–53.* https://doi.org/10.1016/j.acalib.2014.10.008Get rights and content

Albanesi, S., & Kim, J. (2021). Effects of the COVID–19 recession on the US labor market: Occupation, family, and gender. *Journal of Economic Perspectives, 35,* 3–24. doi:10.1257/jep.35.3.3

Alexander, Q. R., & Hermann, M. A. (2016). African-American women's experiences in graduate science, technology, engineering, and mathematics education at a predominantly White university: A qualitative investigation. *Journal of Diversity in Higher Education*, *9*(4), 307. https://doi.org/10.1037/a0039705

Alifuddin, M., & Widodo, W. (2022). How is cultural intelligence related to human behavior? *Journal of Intelligence*, *10*(1), 3. https://doi.org/10.3390/jintelligence10010003

Allen, D., Dancy, M., Stearns, E., Roslyn, M., & Martha, B. (2022). Racism, sexism and disconnection: Contrasting experiences of Black women in STEM before and after transfer from community college. *International Journal of STEM Education, 9*(1). https://doi.org/10.1186/s40594–022–00334–2

Allen, K. A., Gray, D. L., Baumeister, R. F., & Leary, M. R. (2022). The need to belong: A deep dive into the origins, implications, and future of a foundational construct. *Educational Psychology Review*, *34*(2), 1133–1156. https://doi.org/10.1007/s10648–021–09633–6

Allen, J. O., Solway, E., Kirch, M., Singer, D., Kullgren, J. T., Moïse, V., & Malani, P. N. (2022). Experiences of everyday ageism and the health of older us adults. *JAMA Network Open*, *5*(6), e2217240. https://doi.org/10.1001/jamanetworkopen.2022.17240

Allen, T. D., Golden, T. D., & Shockley, K. M. (2015). How effective is telecommuting? Assessing the status of our scientific findings. *Psychological Science in the Public Interest*, *16*(2), 40–68. https://doi.org/10.1177/1529100615593273

Almeda, M. V., & Baker, R. S. (2020). Predicting student participation in STEM careers: The role of affect and engagement during middle school. *Journal of Educational Data Mining, 12*(2), 33–47. https://doi.org/10.5281/zenodo.4008054

Almukhambetova, A., Hernández-Torrano, D., & Nam, A. (2021). Fixing the leaky pipeline for talented women in STEM. *International Journal of Science and Mathematics Education, 21*(1), 305-324. https://doi.org/10.1007/s10763-021-10239-1

Alonso–Villar, O., & del Río, C. (2023). Disentangling occupational sorting from within–occupation disparities: Earnings differences among 12 gender–race/ethnicity groups in the US. *Population Research and Policy Review, 42*(3), 45. https://doi.org/10.1007/s11113–023–09791–1

Amarnani, R., Garcia, P., Restubog, S., Bordia, P., & Bordia, S. (2018). Do you think I'm worth it? The self–verifying role of parental engagement in career adaptability and career persistence among STEM students. *Journal of Career Assessment*, *26*(1), 77–94. https://doi.org/10.1177/1069072716679925

American College Test. (2022). *Profile report, graduating class, 2022*. American College Test. https://www.act.org/content/dam/act/unsecured/documents/2022/2022–National–ACT–Profile–Report.pdf

American Medical Association. (2022). *Physician specialty data report by sex and specialty*. https://www.aamc.org/data–reports/workforce/data/active–physicians–sex–specialty–2021

Amin, A., Ali, R., Ramiz, R., Naseem, M., & Muhammad, I. (2022). Female presence in corporate governance, firm performance, and the moderating role of family ownership. *Economic Research–Ekonomska Istraživanja, 35*(1), 929–948. doi:10.1080/1331677X.2021.1952086

Ammerman, C., & Groysberg, B. (2021). *Glass half–broken: Shattering the barriers that still hold women back at work.* Harvard Business Review Press.

Amoakoh, J., & Smith, W. A. (2020). Diamonds on the sole of their boots: The experiences of African immigrant men in STEM careers in the USA. *Spectrum, 8*(1), 29–53. https://doi.org/10.2979/spectrum.8.1.03

Amon, M. J. (2017). Looking through the glass ceiling: A qualitative study of STEM women's career narratives. *Frontiers in Psychology*, *8*(236), 1-10. https://doi.org/10.3389/fpsyg.2017.00236

Anderson, C. (2010). Presenting and evaluating qualitative research. *American Journal of Pharmaceutical Education*, *74*(8), 141. https://doi.org/10.5688/aj7408141

Anderson, D. J., Binder, M., & Krause, K. (2002). The motherhood penalty: Which mothers pay and why? *American Economic Review, 92*(2), 354–358. http://www.jstor.org/stable/3083431

Anderson, D. J., Binder, M., & Krause, K. (2003). The motherhood wage penalty revisited: Experience heterogeneity, work effort, and work–schedule flexibility. *Industrial and Labor Relations Review*, *56* (2), 273–294. https://doi.org/10.1177/001979390305600204

Anjum, A., Muazzam, A., Manzoor, F., Visvizi, A., Pollock, G., & Nawaz, R. (2019). Measuring the scale and scope of workplace bullying: An alternative workplace bullying scale. *Sustainability*, *11*(17), 4634. https://doi.org/10.3390/su11174634

Annas, G. J., & Grodin, M. A. (1992). *The Nazi doctors and the Nuremberg Code: Human rights in human experimentation*. Oxford University Press.

Archer, L., DeWitt, J., Osborne, J., Dillon, J., Willis, B., & Wong, B. (2010). “Doing” science versus “being a scientist”: Examining 10/11–year–old schoolchildren’s constructions of science through the lens of identity. *Science Education, 94*(4), 617–639. https://doi.org/10.1002/sce.20399

Arif, S., Afolabi, T., Mitrzyk, B. M., Thomas, T. F., Borja-Hart, N., Wade, L., & Henson, B. (2022). Engaging in authentic allyship as part of our professional development. *American Journal of Pharmaceutical Education*, *86*(5), 8690. https://doi.org/10.5688/ajpe8690

Arora, S., & Kumari, N. (2022). Diverging women on the mommy track to the career track. *Journal of International Women’s Studies*, *23*(5), 142–153. https://vc.bridgew.edu/jiws/vol23/iss5/10

Arredondo, P., Miville, M. L., Capodilupo, C. M., & Vera, T. (2022). *Women and the challenge of STEM professions: Thriving in a chilly climate*. Springer International Publishing AG.

Arslan, G. (2021). School belongingness, well–being, and mental health among adolescents: Exploring the role of loneliness. *Australian Journal of Psychology, 73*(1), 70–80. doi:10.1080/00049530.2021.1904499

Ashby, J., Ryan, M. K., & Haslam, S. A. (2007). Legal work and the glass cliff: Evidence that women are preferentially selected to lead problematic cases. *William and Mary Journal of Women and the Law, 13*, 775–794. https://scholarship.law.wm.edu/wmjowl/vol13/iss3/5

Ashcroft, J., Jaramillo, V., Blatti, J., Guan, S. A., Bui, A., Villasenor, V., Adamian, A., Chavira, G., Saetermoe, C., le, E., Horowitz, B., Palacios, B., Williams, P. B., Brockman, E., & Moses, J. (2021). BUILDing equity in STEM: A collaborative undergraduate research program to increase achievement of underserved community college students. *Scholarship and Practice of Undergraduate Research, 4*(3), 47–58. DOI:10.18833/spur/4/3/11

Atkins, K., Dougan, B. M., Dromgold–Sermen, M., Potter, H., Sathy, V., & Panter, A. T. (2020). “Looking at myself in the future”: How mentoring shapes scientific identity for STEM students from underrepresented groups. *International Journal of STEM Education, 7*(42), 1–15. https://doi.org/10.1186/s40594–020–00242–3

Avolio, B., & Chávez, J. (2023). Professional development of women in stem careers: Evidence from a Latin American country. *Global Business Review, 0*(0), 1–21. https://doi.org/10.1177/09721509221141197

Avolio, B. J., Waldman, D. A., & McDaniel, M. A. (1990). Age and work performance in nonmanagerial jobs: The effects of experience and occupational type. *Academy of Management Journal*, *33*(2), 407–422. https://doi.org/10.2307/256331

Ayalon, L., Dolberg, P., Mikulionienė, S., Perek-Białas, J., Rapolienė, G., Stypinska, J., Willińska, M., & de la Fuente-Núñez, V. (2019). A systematic review of existing ageism scales. *Ageing Research Reviews*, *54*, 100919. https://doi.org/10.1016/j.arr.2019.100919

Aycock, L. M., Hazari, Z., Brewe, E., Clancy, K. B. H., Hodapp, T., & Goertzen, R. M. (2019). Sexual harassment reported by undergraduate female physicists. *Physical Review Physics Education Research*, *15*(1), 1–13. https://doi.org/10.1103/PhysRevPhysEducRes.15.010121

Ayuso, N., Fillola, E., Masia, B., Murillo, A. C., Trillo–Lado, R., Baldassarri, S., Cerezo, E., Ruberte, L., Mariscal, M. D., & Villarroya–Gaudo, M. (2021). Gender gap in STEM: A cross–sectional study of primary school students' self–perception and test anxiety in mathematics. *IEEE Transactions on Education*, *64*(1), 40–49. https://doi.org/10.1109/TE.2020.3004075

Ayyala, R. S., & Coley, B. D. (2022). Promoting gender equity and inclusion through allyship. *Pediatric Radiology*, *52*(7), 1202–1206. https://doi.org/10.1007/s00247–022–05345–3

Babbie, E. (1992). *The practice of social research, 6th edition*. Wadsworth Publishing.

Bacher-Hicks, A., Goodman, J., Greif Green, J., & Holt, M. K. (2022). The COVID-19 pandemic disrupted both school bullying and cyberbullying. *American Economic Review: Insights*, 4 (3), 353–70. doi:10.1257/aeri.20210456

Bagley, P. (1968). *Extension of programming language concepts*. PN Publisher.

Bahr, P. R., Jackson, G., McNaughtan, J., Oster, M., & Gross, J. (2017). Unrealized potential: Community college pathways to STEM baccalaureate degrees. *Journal of Higher Education*, *88*(3), 430–478. https://doi.org/10.1080/00221546.2016.1257313

Baillien, E., & De Witte, H. (2009). Why is organizational change related to workplace bullying? Role conflict and job insecurity as mediators. *Economic and Industrial Democracy*, *30*(3), 348–371. https://doi.org/10.1177/0143831X09336557

Balducci, C., Baillien, E., Van den Broeck, A., Toderi, S., & Fraccaroli, F. (2020). Job demand, job control, and impaired mental health in the experience of workplace bullying behavior: A two–wave study. *International Journal of Environmental Research and Public Health*, *17*(4), 1358. https://doi.org/10.3390/ijerph17041358

Ballen, C., Aguillon, S., Awwad, A., Bjune, A., Challou, D., Drake, A., Driessen, M., Ellozy, A., & Ferry, V. (2019). Smaller classes promote equitable student participation in STEM. *BioScience 69*(8,) 669–680 doi:10.1093/biosci/biz069

Balsam, K. F., Molina, Y., Beadnell, B., Simoni, J., & Walters, K. (2011). Measuring multiple minority stress: The LGBT people of color microaggressions scale. *Cultural Diversity & Ethnic Minority Psychology*, *17*(2), 163–174. https://doi.org/10.1037/a0023244

Banks, B. M., Cicciarelli, K. S., & Pavon, J. (2022). It offends us too! An exploratory analysis of high school–based microaggressions. *Contemporary School Psychology*, *26*(2), 182–194. https://doi.org/10.1007/s40688–020–00300–1

Baricevic, M. L., & Kashubeck-West, S. (2019). They matter: Sexual orientation microaggressions in high school. *Journal of LGBT Youth, 16*(1), 83–106. https://doi.org/10.1080/19361653.2018.1534632

Barkhuizen, E. N., Masakane, G., & van der Sluis, L. (2022). In search of factors that hinder the career advancement of women to senior leadership positions. *SA Journal of Industrial Psychology*, *48*, 1–15. https://doi.org/10.4102/sajip.v48i0.1986

Baroody, A. J., Clements, D. H., & Sarama, J. (2022). Lessons learned from 10 experiments that tested the efficacy and assumptions of hypothetical learning trajectories. *Education Sciences*, *12*(3), 195. https://dx.doi.org/10.3390/educsci12030195

Barr, D. A., Gonzalez, M.E., and Wanat, S.F. (2008). The leaky pipeline: Factors associated with early decline in interest in premedical studies among underrepresented minority undergraduate students. *Academic Medicine*, *83*(5), 503–511. doi:10.1097/ACM.0b013e31816bda16

Barrett, F., & Fry, R. (2005). *Appreciative inquiry: A positive approach to building cooperative capacity*. CreateSpace Independent Publishing.

Barreto, M., Ryan, M., & Schmitt, M. (2008). *Glass ceiling in the 21st Century: Understanding barriers to gender equality*. American Psychological Association.

Barth, J. M., & Yang, Y. (2022). Changes in life goals over college: A comparison between men and women majoring in STEM. *Sex Roles*, *87*(1–2), 20–34. https://doi.org/10.1007/s11199–022–01300–6

Basford, T., Offermann, L., & Behrend, T. (2013). Do you see what I see? Perceptions of gender microaggressions in the workplace. *Psychology of Women Quarterly*. *38*(3), 340–349. https://doi.org/10.1177/0361684313511420

Batz, Z., Olsen, B. J., Dumont, J., Dastoor, F., & Smith, M. K. (2015). Helping struggling students in introductory biology: A peer–tutoring approach that improves performance, perception, and retention. *CBE Life Sciences Education*, *14*(2), 16. https://doi.org/10.1187/cbe.14–08–0120

Baum, C. (2002). The effect of work interruptions on women's wages. *Labour* (16), 1–36. https://doi.org/10.1111/1467-9914.00185

Baum, F., Musolino, C., Gesesew, H., & Popay, J. (2021). New perspective on why women live longer than men: An exploration of power, gender, social determinants, and capitals. *International Journal of Environmental Research and Public Health*, *18*(2), 661. https://doi.org/10.3390/ijerph18020661

Baumgartner, M. S., & Schneider D. E. (2010). Perceptions of women in management: A thematic analysis of razing the glass ceiling. *Journal of Career Development*, *37*(2), 559–576. https://doi.org/10.1177/0894845309352242

Baxter, L. A., & Braithwaite, D. O. (Eds.). (2008). *Engaging theories in interpersonal communication: Multiple perspectives*. SAGE Publications. https://doi.org/10.4135/9781483329529

Beale, D., & Hoel, H. (2011). Workplace bullying and the employment relationship. *Work, Employment and Society*, *25*, 5–18. DOI:10.1177/0950017010389228.

Bebell, D., Dorris, S., & Muir, M. (2012). *Emerging results from the nation's first kindergarten implementation of iPad*s. Amazon News. Retrieved from https://s3.amazonaws.com/hackedu/Adv2014_ResearchSum120216.pdf

Bechtold, S. E., Sims, H. P., & Szilagyi, A. D. (1981). Job scope relationships: A three-wave longitudinal analysis. *Journal of Occupational Behavior*, *2*(3), 189–202. http://www.jstor.org/stable/3000071

Beck, M., Cadwell, J., Kern, A., Wu, K., Dickerson, M., & Howard, M. (2022). Critical feminist analysis of STEM mentoring programs: A meta–synthesis of the existing literature. *Gender, Work & Organization*, *29*(1), 1–21. https://doi.org/10.1111/gwao.12729

Bednall, J. (2006). Epoché and bracketing within the phenomenological paradigm. *Issues in Educational Research, 16*(2), 123–138. https://iier.org.au/iier16/bednall.html

Beede, D. N., Julian, T. A., Langdon, D., McKittrick, G., Khan, B., & Doms, M. E. (2011). *Women in STEM: A gender gap to innovation* (Issue Brief). U.S. Department of Commerce, Economics and Statistics Administration. https://files.eric.ed.gov/fulltext/ED523766.pdf

Beekman, J., & Ober, D. (2015). Gender gap trends on mathematics exams position girls and young women for STEM careers. *School Science and Mathematics, 115(1)*, 35–50. https://doi.org/10.1111/ssm.12098

Belur, J., Tompson, L., Thornton, A., & Simon, M. (2021). Interrater reliability in systematic review methodology: Exploring variation in coder decision–making. *Sociological Methods & Research*, *50*(2), 837–865. https://doi.org/10.1177/0049124118799372

Bengtsson, M. (2016). How to plan and perform a qualitative study using content analysis. *Nursing Plus Open, 2*, 8–14. https://doi.org/10.1016/j.npls.2016.01.001

Bergsteiner, H. (2012). *Accountability theory meets accountability practice.* Emerald Group Publishing.

Berry, P., & Franks, T. J. (2010). Women in the world of corporate business: Looking at the glass ceiling. *Contemporary Issues in Education Research*, *3*(2), 1–10. DOI:10.19030/cier.v3i2.171

Beu, D., & Buckley, M. (2001). The hypothesized relationship between accountability and ethical behavior. *Journal of Business Ethics*, *34*(1), 57–73. doi:10.1023/A:1011957832141

Bevan, M. T. (2014). A method of phenomenological interviewing. *Qualitative Health Research*, *24*(1), 136–144. https://doi.org/10.1177/1049732313519710

Beyer, C. (2022). Edmund Husserl. In E. Zalta & U. Nodelman (Eds.), *The Stanford encyclopedia of philosophy* (Winter 2022 ed.). Stanford University. https://plato.stanford.edu/archives/win2022/entries/husserl/

Bian, L., Leslie, S. J., & Cimpian, A. (2017). Gender stereotypes about intellectual ability emerge early and influence children's interests. *Science 355*(6323), 389–391. https://doi.org/10.1126/science.aah6524

Bickerstaff, S., Barragan, M., & Zawadi, R. (2017). Experiences of earned success: Community college students' shifts in college confidence. *International Journal of Teaching and Learning in Higher Education*, *29*(3), 501–510. https://files.eric.ed.gov/fulltext/EJ1151074.pdf

Bilimoria, D., & Lord, L. (2014). *Women in STEM careers: International perspectives in increasing workforce participation, advancement and leadership*. Edward Elgar.

Bishop, A. (2002). *Becoming an ally: Breaking the cycle of oppression in people* (2nd ed.). Fernwood Publishing.

Blackburn, H. (2017). The status of women in STEM in higher education: A review of literature 2007–2017. *Science & Technology Libraries, 36*(3), 235–273. DOI:10.1080/0194262X.2017.1371658

Blaique, L., Pinnington, A. H., Al–Malkawi, H., & Aldabbas, H. (2023). The influence of personal skills development and coping self–efficacy on the affective occupational commitment of women in STEM fields. *Equality, Diversity and Inclusion: An International Journal*, *42*(2), 173–192. https://doi.org/10.1108/EDI–10–2021–0264

Blanchard, M. R., Gutierrez, K. S., Swanson, K. J., & Collier, K. M. (2023). Why do students attend STEM clubs, what do they get out of it, and where are they heading? *Education Sciences, 13*(5), 480. https://doi.org/10.3390/educsci13050480

Blaney, J. M. (2022). Cultivating community college pathways to STEM leadership: Examining the relationships between gender, upward transfer, and students' computing leadership identity. *Community College Review*, *50*(3), 269–291. https://doi.org/10.1177/00915521221087283

Blau, F., & Kahn, L. (2017). The gender wage gap: Extent, trends, and explanations. *Journal of Economic Literature*, 55(3), 789–865. DOI:10.1257/jel.20160995

Bleich, S. N., Findling, M. G., Casey, L. S., Blendon, R. J., Benson, J. M., SteelFisher, G. K., Sayde, J. M., & Miller, C. (2019). Discrimination in the United States: Experiences of Black Americans. *Health Services Research, 54,* 1399–1408. https://doi.org/10.1111/1475–6773.13220

Bliss, S. (1987). Revisioning masculinity: A report on the growing men's movement. *Gender Context Institute*, 16, 21. https://www.context.org/iclib/ic16/bliss/

Bloodhart, B., Balgopal, M., Casper, A., McMeeking, L., & Fischer, E. (2020). Outperforming yet undervalued: Undergraduate women in STEM. *PloS One*, *15*(6). https://doi.org/10.1371/journal.pone.0234685

Bloom, N., Liang, J., Roberts, J., & Ying Z. J., (2015). Does working from home work? Evidence from a Chinese experiment. *The Quarterly Journal of Economics, 130*(1), 165–218. DOI:10.3386/w18871

Blotnicky, K. A., Franz-Odendaal, T., French, F., & Joy, P. (2018). A study of the correlation between STEM career knowledge, mathematics self-efficacy, career interests, and career activities on the likelihood of pursuing a STEM career among middle school students. *International Journal of STEM Education*, *5*(22), 1–15. doi:10.1186/s40594-018-0118-3

Boesch, T., Grunewald R., Nuun R., & Palmer V. (2021). *Pandemic pushes mothers of young children out of the labor force.* Federal Reserve Bank of Minneapolis. https://bit.ly/3te2a4b.

Bollestad, V., Amland, J. S., & Olsen, E. (2022). The pros and cons of remote work in relation to bullying, loneliness and work engagement: A representative study among Norwegian workers during COVID–19. *Frontiers in Psychology*, *13*, 1016368. https://doi.org/10.3389/fpsyg.2022.1016368

Bonacini, L., Gallo, G., & Scicchitano, S. (2021). Working from home and income inequality: Risks of a 'new normal' with COVID-19. *Journal of Population Economics, 34*(1), 303–360. https://doi.org/10.1007/s00148-020-00800-7

Bontrager, M., Clinton, S., & Tyner, L. (2021). Flexible work arrangements: A human resource development tool to reduce turnover. *Advances in Developing Human Resources, 23,* 124–41. https://dx.doi.org/10.1177/1523422320982930

Borum, V., & Walker, E. (2012). What makes the difference? Black women's undergraduate and graduate experiences in mathematics. *The Journal of Negro Education*, *81*(4), 366–378. https://doi.org/10.7709/jnegroeducation.81.4.0366

Bottia, M. C., Stearns, E., Mickelson, R. A., Moller, S., & Jamil, C. (2020). The importance of community colleges in students' choice to major in STEM. *Journal of Higher Education, 91*(7), 1116–1148. https://doi.org/10.1080/00221546.2020.1742032

Bourdieu, P. (1977). *Outline of a theory of practice.* Cambridge University Press.

Bowling, J., & Martin, B. (1985). Science: a masculine disorder? *Science and Public Policy, 12*(6), 308–316. https://doi.org/10.1093/spp/12.6.308

Bowman, L. (2023). Genius culture: how we influence student identity in STEM. *Frontiers in Education*, *8*, 1-4. https://www.frontiersin.org/articles/10.3389/feduc.2023.1159417

Bowman, N. A., Logel, C., LaCosse, J., Jarratt, L., Canning, E. A., Emerson, K. T. U., & Murphy, M. C. (2022). Gender representation and academic achievement among STEM–interested students in college STEM courses. *Journal of Research in Science Teaching, 59*(10), 1876–1900. https://doi.org/10.1002/tea.21778

Bradshaw, A. (2002). Empowerment and sport feminism: A critical analysis. *International Sports Studies*, *24*(1), 5–31.

Braveman, P., Arkin, E., Proctor, D., Kauh, T., & Holm, N. (2022). Systemic and structural racism: Definitions, examples, health damages, and approaches to Dismantling. *Health Affairs, 41*(2), 171–3. https://doi.org/10.1377/hlthaff.2021.01394

Brentano, F. (1973). *Psychology from an empirical standpoint*. Humanities Press.

Brint, S., & Karabel, J. (1989). *The diverted dream: Community colleges and the promise of educational opportunity in America, 1900 –1985*. Oxford University Press.

Brockman, A. J., Naphan–Kingery, D., & Pitt, R. N. (2022). When talent goes unrecognized: Racial discrimination, community recognition, and STEM postdocs' science identities. *Studies in Graduate and Postdoctoral Education, 13*(2), 221–241. https://doi.org/10.1108/SGPE–12–2020–0079

Brod, C. (1984). *Technostress: The human cost of the computer revolution.* Basic Books.

Brooks, R. L. (2017). *The racial glass ceiling: Subordination in American law and culture.* Yale University Press.

Broom, D. (2021). *Home or office? Survey shows opinions about work after COVID–19*. World Economic Forum. https://www.weforum.org/agenda/2021/07/back–to–office–or–work–from–home–survey/

Brough, P., Johnson, G., Drummond, S., Pennisi, S., & Timms, C. (2011). Comparisons of cognitive ability and job attitudes of older and younger workers. *Equality, Diversity and Inclusion: An International Journal, 30*(2), 105–126. https://doi.org/10.1108/02610151111116508

Brown, P. L., Concannon, J. P., Marx, D., Donaldson, C., & Black, A. (2016). An examination of middle school students' STEM self-efficacy, interests and perceptions. *Journal of STEM Education: Innovations and Research, 17*(3), 27–38.

Brue, K. L. (2019). Work–life balance for women in STEM leadership. *Journal of Leadership Education*, *18*(2), 32–52. https://journalofleadershiped.org/jole_articles/work-life-balance-for-women-in-stem-leadership/

Brunell, A. B., Gentry, W. A., Campbell, W. K., Hoffman, B. J., Kuhnert, K. W., & DeMarree, K. G. (2008). Leader emergence: The case of the narcissistic leader. *Personality and Social Psychology Bulletin, 34*(12), 1663–1676**.** doi:10.1177/0146167208324101

Brynjolfsson, E., Horton, J., Ozimek, A., Rock, D., Sharma, G., & TuYe, H.-Y. (2020). *COVID-19 and remote work: An early look at US data.* National Bureau of Economic Research. https://www.nber.org/system/files/working_ papers/w27344/w27344.pdf

Bucklew, J. (1955). The subjective tradition in phenomenological psychology. *Philosophy of Science, 22*(4), 289–299. http://www.jstor.org/stable/185348

Budig, M. J., & England, P. (2001). The wage penalty for motherhood. *American Sociological Review, 66*(2), 204–225. https://doi.org/10.2307/2657415

Budiman, A., & Ruiz, N. (2021). *Key facts about Asian Americans, a diverse and growing population.* Pew Research Center. https://www.pewresearch.org/short–reads/2021/04/29/key–facts–about–asian–americans/

Buffington, C., Cerf, B., Jones, C., & Weinberg, B. A. (2016). STEM training and early career outcomes of female and male graduate students: Evidence from UMETRICS data linked to the 2010 census. *American Economic Review, 106*, 333–338. https://www.aeaweb.org/articles?id=10.1257/aer.p20161124

Bulińska-Stangrecka, H., & Bagieńska, A. (2021). The role of employee relations in shaping job satisfaction as an element promoting positive mental health at work in the era of COVID-19. *International Journal Of Environmental Research And Public Health, 18*(4), 1903. https://doi.org/10.3390/ijerph18041903

Burn, I., Button, P., Figinski, T.F., & McLaughlin, J.S. (2020). Why retirement, Social Security, and age discrimination policies need to consider the intersectional experiences of older women. *Public Policy and Aging Report, 30*(3), 101–106. https://doi.org/10.1093/geroni/igaa057.2939

Burnes, D., Sheppard, C., Henderson, C. R., Jr, Wassel, M., Cope, R., Barber, C., & Pillemer, K. (2019). Interventions to reduce ageism against older adults: A systematic review and meta-analysis. *American Journal of Public Health*, *109*(8), e1–e9. https://doi.org/10.2105/AJPH.2019.305123

Burns, J. M. (1978). *Leadership*. Harper & Row.

Burton, C., Duran, G., Wright, V., & Chmiel, R. (2023). Strategies for and barriers to collaboratively developing anti-racist policies and resources as described by geoscientists of color participating in the unlearning racism in geoscience (URGE) program. *Earth's Future*, *11*(2), 1–15. https://doi.org/10.1029/2022EF002957

Burton, M., Maiorca, C., & Tripp, L. (2022). The relationship between teacher candidates' affective dispositions and instructional planning actions in STEM. *Education Sciences 12(2)*, 82. https://dx.doi.org/10.3390/educsci12020082

Busby, L., Patrick, L., & Alice, G. (2022). Upwards workplace bullying: A literature review. *Sage Open*, *12*(1). https://doi.org/10.1177/21582440221085008

Buse, K., Bilimoria, D., & Perelli, S. (2013). Why they stay: Women persisting in US engineering careers. *Career Development International*, *18*(2), 139–154. DOI:10.1108/CDI–11–2012–0108

Bushe, G. (2011). Appreciative inquiry: Theory and critique. In D. Boje, B. Burnes, & J. Hassard (Eds.), *The Routledge companion to organizational change* (pp. 87–103). Routledge.

Butler, R. (1968). Ageism, another form of bigotry. *The Gerontologist*, 9(4)243–246. https://doi.org/10.1093/geront/9.4_Part_1.243

Buzzanell, P. M., Arendt, C., Dohrman, R. L., Zoltowski, C. B., & Rajan, P. (2023). Engineering emotion sustainably: Affective gendered organizing of engineering identities and third space. *Sustainability, 15*(6), 5051. https://doi.org/10.3390/su15065051

Cabay, M., Bernstein, B. L., Rivers, M., & Fabert, N. (2018). Chilly climates, balancing acts, and shifting pathways: What happens to women in STEM doctoral programs. *Social Sciences, 7*(2), 23. https://doi.org/10.3390/socsci7020023

Çakir, Z., & Altun-Yalçin, S. (2021). The investigation of the effect of Montessori approach–based STEM activities on the problem–solving skills of pre–service pre–school teachers. *Journal of Theoretical Educational Science, 14*(2), 93–119. https://files.eric.ed.gov/fulltext/EJ1294608.pdf

Caldarulo, M., Olsen, J., Frandell, A., Islam, S., Johnson, T. P., Feeney, M. K., Michalegko, L., & Welch, E. W. (2022). COVID–19 and gender inequity in science: Consistent harm over time. *PLoS One*, *17*(7) https://doi.org/10.1371/journal.pone.0271089

Campbell, J. (1949). *The hero with a thousand faces*. Pantheon Books.

Campbell-Montalvo, R., Malaykhan, M., Smith, C. A. S., Michelle, H. M., Puccia, E., Mayberry, M., Skvoretz, J., & Wao, H. (2022). Sexual and gender minority undergraduates' relationships and strategies for managing fit in STEM. *PLoS One, 17*(3). https://doi.org/10.1371/journal.pone.0263561

Cannito, M., & Scavarda, A. (2020). Childcare and remote work during the COVID–19 pandemic. Ideal worker model, parenthood and gender inequalities in Italy. *Italian Sociological Review, 10*(3), 801–820,801A. https://doi.org/10.13136/isr.v10i3S.399

Cantwell, B. (2015). Are international students cash cows? Examining the relationship between new international undergraduate enrollments and institutional revenue at public colleges and universities in the US. *Journal of International Students, 5*(4), 512–525. doi:https://doi.org/10.32674/jis.v5i4.412

Card, D., Mas, A., Moretti, E., & Saez, E. (2010). *NBER working paper series inequality at work: The effect of peer salaries on job satisfaction. Working Paper 16396*. National Bureau of Economic Research. https://davidcard.berkeley.edu/papers/winequ%20work.pdf

Carli, L. L. (2020). Women, gender equality and COVID–19. *Gender in Management 35*, 647–655. https://doi.org/10.1108/GM–07–2020–0236

Carmeli, A., Reiter-Palmon, R., & Ziv, E. (2010). Inclusive leadership and employee involvement in creative tasks in the workplace: The mediating role of psychological safety. *Creativity Research Journal*, *22*(3), 250–260. https://doi.org/10.1080/10400419.2010.504654

Carr, D., Matz, C., Taylor, M., & Gonzalez, E. (2021). Retirement transitions in the US: Patterns and pathways from full–time work. *Public Policy and Aging Research, 3(*31), 71–77. https://doi.org/10.1093/ppar/prab013

Carrell, J., Keaty, H., & Wong, A. (2020). Humanities-driven STEM: Using history as a foundation for STEM education in honors. *Honors in Practice, 16*, 53–69. https://files.eric.ed.gov/fulltext/EJ1256520.pdf

Casad, B. J., Oyler, D. L., Sullivan, E. T., McClellan, E. M., Tierney, D. N., Anderson, D. A., Greeley, P. A., Fague, M. A., & Flammang, B. J. (2018). Wise psychological interventions to improve gender and racial equality in STEM: GPIR. *Group Processes & Intergroup Relations*, *21*(5), 767–787. https://doi.org/10.1177/1368430218767034

Casad, B. J., Petzel, Z. W., & Ingalls, E. A. (2019). A model of threatening academic environments predicts women STEM majors' self–esteem and engagement in STEM. *Sex Roles*, *80*(7–8), 469–488. https://doi.org/10.1007/s11199–018–0942–4

Casteel, A., & Bridier, N. L. (2021). Describing populations and samples in doctoral student research. *International Journal of Doctoral Studies*, *16*, 339-362. https://doi.org/10.28945/4766

Cech, E. A. (2022). The intersectional privilege of white able–bodied heterosexual men in STEM. *Science Advances*, *8*(24), 1558. https://doi.org/10.1126/sciadv.abo1558

Cech, E., & Loy, M. (2019). The changing career trajectories of new parents in STEM. *Proceedings of the National Academy of Sciences*, *116*(10), 4182–4187. https://doi.org/10.1073/pnas.1810862116

Cech, E., Rubineau, B., Silbey, S., & Seron, C. (2011). Professional role confidence and gendered persistence in engineering. *American Sociological Review*, *76*(5), 641–666.

Cerdeña, J. P., Asabor, E. N., Rendell, S., Okolo, T., & Lett, E. (2022). Resculpting professionalism for equity and accountability. *Annals of Family Medicine*, *20*(6), 573–577. https://doi.org/10.1370/afm.2892

Chance, N. L. (2022). Resilient leadership: A phenomenological exploration into how Black women in higher education leadership navigate cultural adversity. *The Journal of Humanistic Psychology*, *62*(1), 44–78. https://doi.org/10.1177/00221678211003000

Chang, E. S., Kannoth S., Levy S., Wang S. Y., Lee J. E., & Levy B. R. (2020). Global reach of ageism on older persons' health: A systematic review. *PLoS One, 15*. DOI:10.1371/journal.pone.0220857

Chang, E., Milkmana, K., Grometb, D., Rebelec, R., Masseya, C., Duckworth, A., & Grant, A. (2019). The mixed effects of online diversity training. *Proceedings of the National Academy of Sciences*, *116*(16), 7778–7783. https://doi.org/10.1073/pnas.1816076116

Charles-Leija, H., Castro, C. G., Toledo, M., & Ballesteros-Valdés, R. (2023). Meaningful work, happiness at work, and turnover intentions. *International Journal of Environmental Research and Public Health*, *20*(4), 3565. https://doi.org/10.3390/ijerph20043565

Charlesworth, T., & Banaji, M. (2019). Gender in science, technology, engineering, and mathematics: Issues, causes, solutions. *The Journal of Neuroscience*, *39*(37), 7228–7243. https://doi.org/10.1523/JNEUROSCI.0475–18.2019

Charmaz, K. (2006). *Constructing grounded theory: A practical guide through qualitative analysis.* Sage Publications.

Chatziioannidis, I., Bascialla, F. G., Chatzivalsama, P., Vouzas, F., & Mitsiakos, G. (2018). Prevalence, causes and mental health impact of workplace bullying in the Neonatal Intensive Care Unit environment. *British Medical Journal Open*, *8*(2), 1–9. https://doi.org/10.1136/bmjopen–2017–018766

Chen, X. (2013). *STEM attrition: College students' paths into and out of STEM fields (NCES 2014–001).* National Center for Education Statistics, Institute of Education Sciences, U.S. Department of Education.

Chen, Y., Zhang, Z., Zhou, J., Liu, C., Zhang, X., & Yu, T. (2023). A cognitive evaluation and equity-based perspective of pay for performance on job performance: A meta-analysis and path model. *Frontiers in Psychology, 13*, 1-26. https://doi.org/10.3389/fpsyg.2022.1039375

Cheryan, S., Plaut, V., Davies, P., & Steele, C. (2009). Ambient belonging: How stereotypical cues impact gender participation in computer science. *Journal of Personality and Social Psychology, 97*, 1045–1060. https://doi.org/10.1037/a0016239

Cheryan, S., Ziegler, S. A., Montoya, A. K., & Jiang, L. (2017). Why are some STEM fields more gender balanced than others? *Psychological Bulletin, 143*(1), 1–35. https://doi.org/10.1037/bul0000052

Chidozie, E. M., Idowu, P. O., Fasuyi, F. O., Oluwafemi, D. A., Fatoye, C. T., Idowu, O. A., Johnson, O. E., Adesola, C. O., Adaobi Margaret, O. K., & Fatoye, F. (2020). Prevalence and correlates of bullying in physiotherapy education in Nigeria. *British Medical Journal, Medical Education, 20*, 1–11. https://doi.org/10.1186/s12909–020–02019–2

Choudhury, P., Foroughi, C., & Larson, B. (2021). Work-from-anywhere: The productivity effects of geographic flexibility. *Strategic Management Journal, 42*(4), 655–683.

Chrisler, J. C., Bacher, J. E., Bangali, A. M., Campagna, A. J., McKeigue, A. C., & Chrisler, J. C. (2012). The bro code: How contemporary culture creates sexist men. *Sex Roles: A Journal of Research, 66*(11–12), 810–811. https://doi.org/10.1007/s11199–012–0123–9

Chrisler, J. C., & McCreary, D.R. (2010). *Handbook of gender research in psychology* (Vol. 2). Springer.

Christensen, R., & Knezek, G. (2017). Relationship of middle school student STEM interest to career intent. *Journal of Education in Science Environment and Health, 3*(1), 1–13. https://doi.org/10. 21891/jeseh.275649

Chung, H., & van der Horst, M. (2018). Women's employment patterns after childbirth and the perceived access to and use of flextime and teleworking. *Human Relations*, *71*(1), 47–72. https://doi.org/10.1177/0018726717713828

Civil Rights Act of 1964, Pub. L. No. 88-352. 78 Stat. 241. (1964). Office of the Assistant Secretary for Administration & Management. https://www.archives.gov/milestone-documents/civil-rights-act

Clance, P. R., & Imes, S. A. (1978). The imposter phenomenon in high achieving women: Dynamics and therapeutic intervention. *Psychotherapy: Theory, Research & Practice, 15*(3), 241–247. https://doi.org/10.1037/h0086006

Clancy, K., Nelson, R. G., Rutherford, J. N., & Hinde, K. (2014). Survey of academic field experiences (SAFE): Trainees report harassment and assault. *PLoS One 9*(7), e102172. https://doi.org/10.1371/journal.pone.0102172

Clapp, P. (2023). *The disproportionate impact of the COVID–19 pandemic on women in the workforce*. United States Census Bureau. https://www.census.gov/data/academy/webinars/2023/impact–of–the–covid–19–pandemic–on–women–in–the–workforce.html

Clark, S. L., Dyar, C., Inman, E. M., Maung, N., & London, B. (2021). Women's career confidence in a fixed, sexist STEM environment. *International Journal of STEM Education, 8*(56), 1–10. https://doi.org/10.1186/s40594–021–00313–z

Clements, D. H., & Sarama, J. (2023). Rethinking STEM in the elementary grades: Honoring the special role of math in cognitive development. *American Educator*, *47*(1), 16–21. https://files.eric.ed.gov/fulltext/EJ1380226.pdf

Çoban, S. (2022). Gender and telework: Work and family experiences of teleworking professional, middle-class, married women with children during the COVID-19 pandemic in Turkey. *Gender, Work and Organization*, *29*(1), 241–255. https://doi.org/10.1111/gwao.12684

Cohen, R., & Kelly, A. M. (2020). Mathematics as a factor in community college STEM performance, persistence, and degree attainment. *Journal of Research in Science Teaching, 57*(2), 279–307. https://doi.org/10.1002/tea.21594

Cohen, S. M., Hazari, Z., Mahadeo, J., Sonnert, G., & Sadler, P. M. (2021). Examining the effect of early STEM experiences as a form of STEM capital and identity capital on STEM identity: A gender study. *Science Education*, *105*(6), 1126–1150. https://doi.org/10.1002/sce.21670

Colby, S., & Ortman, M. (2014). *The baby boom cohort in the United States: 2012 to 2060*. Current Population Reports Population Estimates and Projection P25–1141. U.S. Department of Commerce Economics and Statistics Administration.

Colgan, F., & McKearney, A. (2012). Visibility and voice in organizations: Lesbian, gay, bisexual and transgendered employee networks. *Equality Diversity and Inclusion: An International Journal*, *31*, 359–378. doi:10.1108/02610151211223049

College Board. (2021). *Trends in college pricing and student aid*. https://research.collegeboard.org/media/pdf/trends–college–pricing–student–aid–2021.pdf

Colletti, L. (2023). An inclusive approach to teaching quantum mechanics in secondary school. *Education Sciences*, *13*(2), 168. https://doi.org/10.3390/educsci13020168

Collins, C., Landivar, L. C., Ruppanner, L., & Scarborough, W. J. (2020). COVID–19 and the gender gap in work hours. *Gender, Work, & Organization*, *28*(1), 1–12. https://doi.org/10.1111/gwao.12506.

Collins, C. S., & Stockton, C. M. (2018). The central role of theory in qualitative research. *International Journal of Qualitative Methods*, *17*(1). https://doi.org/10.1177/1609406918797475

Collins, J. W., David, R. J., Handler, A. (2004). Very low birthweight in African American infants: The role of maternal exposure to interpersonal racial discrimination. *American Journal of Public Health*, *94*(12), 2132–2138. DOI:10.2105/ajph.94.12.2132

Comfort, N. (2009). The prisoner as model organism: Malaria research at Stateville Penitentiary. *Studies in History and Philosophy of Science, Part C 40*, (3), 190–203. https://doi.org/10.1016/j.shpsc.2009.06.007

Committee on STEM Education. (2018). *Charting a course for success: America's strategy for STEM education.* National Science and Technology Council. https://www.nasa.gov/sites/default/files/atoms/files/stem–education–strategic–plan–2018.pdf

Common Core State Standards Initiative. (2010). Council of the Great City Schools. https://www.cgcs.org/domain/108#:~:text=http%3A%2F%2Fwww.corestandards.org%2F/

Community College Research Center. (2021). *Community college frequently asked questions*. https://ccrc.tc.columbia.edu/Community–College–FAQs.html

Companies Market Cap. (n.d.). *Total market capitalization of US publicly traded companies*. Retrieved July 16, 2023 from https://companiesmarketcap.com/usa/largest–companies–in–the–usa–by–market–cap/

Conley, D. T. (2010). College and career ready: Helping all students succeed beyond high school. Jossey–Bass.

Conner, D. (2014). Financial freedom: Women, money, and domestic abuse. *William and Mary Journal of Women and Law*. https://dvcc.delaware.gov/wp–content/uploads/sites/87/2017/06/Financial–Freedom–Women–Money–DV.pdf

Cooper, K., Krieg, A., & Brownell, S. (2018). Who perceives they are smarter? Exploring the influence of student characteristics on student academic self-concept in physiology. *Advances in Physiology Education, 42, 200–208.* DOI:10.1152/advan.00085.2017

Cooperrider, D., & Whitney, D. (2005). *Appreciative inquiry: A positive revolution in change*. Barrett-Koehler.

Corbett, C., & Hill, C. (2015). *Solving the equation: The variables for women's success in engineering and computing*. American Association of University Women. https://www.aauw.org/app/uploads/2020/03/Solving–the–Equation–report–nsa.pdf

Corneille, M., Lee, A., Allen, S., Cannady, J., & Guess, A. (2019). Barriers to the advancement of women of color faculty in STEM: The need for promoting equity using an intersectional framework. *Equality, Diversity and Inclusion: An International Journal, 38*(3), 328–348. https://doi.org/10.1108/EDI–09–2017–0199

Cortina, L. & Areguin, M. A. (2021). Putting people down and pushing them out: Sexual harassment in the workplace. *The Annual Review of Organizational Psychology and Organizational Behavior* 8, 285–309 https://doi.org/10.1146/annurev-orgpsych-012420-055606

Cotner, S., Ballen, C., Brooks, D., & Moore, R. (2011). Instructor gender and student confidence in the sciences: A need for more role models. *Journal of College Science Teaching, 40*(5), 96–101. https://d47239b3-d0bf-4a74-98e0-2d377d9cb721.filesusr.com/ugd/d0a6b6_ca2a09fcb58a492d82157385dd961cf2.pdf

Cotter, R., Kiser, S., Rasmussen, J., & Vemu, S. (2022). Supporting biology education research at community colleges: Implementing and adapting evidence–based practices. *New Directions for Community Colleges*, *2022*(199), 201–213. https://doi.org/10.1002/cc.20534

Cotterill, P. (1992). Interviewing women: Issues of friendship, vulnerability, and power. *Women's Studies International Forum*, *15*(5–6), 593–606. https://doi.org/10.1016/0277-5395(92)90061-Y

Cranston, S., & Keller, S. (2013). Increasing the meaning quotient of work. *McKinsey Quarterly*, *1*, 48–59. https://www.mckinsey.com/capabilities/people-and-organizational-performance/our-insights/increasing-the-meaning-quotient-of-work

Crenshaw, K. (1989). Demarginalizing the intersection of race and sex: A Black feminist critique of antidiscrimination doctrine, feminist theory and antiracist politics. *University of Chicago Legal Forum, 1989(1),* 139. https://chicagounbound.uchicago.edu/cgi/viewcontent.cgi?article=1052&context=uclf

Creswell, J. (2003). *Research design: Quantitative, qualitative, and mixed methods approaches.* Sage Publications.

Creswell, J. (2008). *Research design: Qualitative, quantitative, and mixed methods approaches.* Sage Publications.

Creswell, J. (2009). *Research design: Qualitative, quantitative, and mixed methods approaches.* Sage Publications.

Creswell, J. (2015). *A concise introduction to mixed methods research.* Sage Publications.

Creswell, J., & Creswell, D. (2018). *Research design.* Sage Publications.

Crone, C. L., & Kallen, R. W. (2022). Interview with an avatar: Comparing online and virtual reality perspective taking for gender bias in STEM hiring decisions. *PLoS One, 17*(6). https://doi.org/10.1371/journal.pone.0269430

Crossley, N. (1996). *Intersubjectivity: The fabric of social becoming*. Sage Publications.

Crossley, N. (2001). The phenomenological habitus and its construction. *Theory and Society, 30*(1), 81–120. https://www.jstor.org/stable/658063

CROWN Act of 2019, 116 USC §§ 3–6 (2019). https://www.congress.gov/116/bills/s3167/BILLS–116s3167is.pdf

Cuddy, A., Caroline, A., Carney, W., & Carney, D. (2012). The benefit of power posing before a high-stakes social evaluation. *Harvard Business School Working Paper*, No. 13-027.

Cumberbatch, S. (2021). When your identity is inherently "unprofessional": Navigating rules of professional appearance rooted in cisheteronormative Whiteness as Black women and gender non–conforming professionals. *Journal of Civil Rights and Economic Development*, 34(2), 81–123. https://scholarship.law.stjohns.edu/cgi/viewcontent.cgi?article=1904&context=jcred

Cundiff, J. L., & Vescio, T. K. (2016). Gender stereotypes influence how people explain gender disparities in the workplace. *Sex Roles, 75*(3–4), 126–138. https://doi.org/10.1007/s11199–016–0593–2

Cunningham, B. C., Hoyer K. M., & Sparks, D. (2015). Gender differences in science, technology, engineering, and mathematics (STEM) interest, credits earned, and NAEP performance in the 12th grade (NCES 2015–075). U.S. Department of Education. https://nces.ed.gov/pubs2015/2015075.pdf

Cyr, E. N., Bergsieker, H. B., Dennehy, T. C., & Schmader, T. (2021). Mapping social exclusion in STEM to men's implicit bias and women's career costs. *Proceedings of the National Academy of Sciences of the United States of America, 118*(40), e2026308118. https://doi.org/10.1073/pnas.2026308118

Dajani, R., Tabbaa, Z., Al–Rawashdeh, A., Gretzel, U., & Bowser, G. (2021). Peer mentoring women in STEM: An explanatory case study on reflections from a program in Jordan. *Mentoring & Tutoring: Partnership in Learning, 29*(3), 284–304. https://doi.org/10.1080/13611267.2021.1927429

Daker, R. J., Gattas, S. U., Necka, E. A., Green, A. E., & Lyons, I. M. (2023). Does anxiety explain why math–anxious people underperform in math? *NPJ Science of Learning, 8*(1), 6. https://doi.org/10.1038/s41539–023–00156–z

Dancy, M., Rainey, K., Stearns, E., Mickelson, R., & Moller, S. (2020). Undergraduates' awareness of White and male privilege in STEM. *International Journal of STEM Education, 7*. https://doi.org/10.1186/s40594–020–00250–3

D'Angelo, s., Bevilacqua, G., Hammond, J., Zaballa, E., Dennison, E. M., & Walker–Bone, K. (2023). Impact of menopausal symptoms on work: Findings from women in the health and employment after fifty (HEAF) study. *International Journal of Environmental Research and Public Health*, *20*(1), 295. https://doi.org/10.3390/ijerph20010295

Daniels, G. (2021). Glass ceilings: Cybermisogyny is a sign of unchecked sexism in media and newsrooms. *Agenda: A Journal about Women and Gender, 35*(2), 123–135. https://doi.org/10.1080/10130950.2021.1917296

Da Rocha, G., Silva, L., & Esnard, C. (2022). I broke the glass ceiling, now what? Overview of metaphors to explain gender inequality in organizations. *International Journal of Organizational Analysis*, *30*(6), 1523–1532. https://doi.org/10.1108/IJOA-07-2020-2281

Das, B. L., & Baruah, M. (2013). Employee retention: A review of literature. *IOSR Journal of Business and Management, 14*(2), 8–16. https://www.iosrjournals.org/iosr–jbm/papers/Vol14–issue2/B01420816.pdf

Davidsen, A. S. (2013). Phenomenological approaches in psychology and health sciences. *Qualitative Research in Psychology*, *10*(3), 318–339. https://doi.org/10.1080/14780887.2011.608466

Davis, M. (2021). Anti–Black practices take heavy toll on mental health. *Nature Human Behavior*, *5*(4), 410. https://doi.org/10.1038/s41562–021–01058–z

Davis-Kean, P., Jacobs, J., & Bleeker, M. (2007). *Educating a STEM workforce: New strategies for U-M and the State of Michigan*. National Science Foundation.

Dean, D., & Koster, J. (2014). *Equitable solutions for retaining a robust STEM workforce: Beyond best practices.* Elsevier Science & Technology.

Debebe, G. (2011). Creating a safe environment for women's leadership transformation. *Journal of Management Education. 35*, 679–712. DOI:10.1177/1052562910397501

DeCuir–Gunby, J., & Gunby, N. W. (2016). Racial microaggressions in the workplace: A critical race analysis of the experiences of African American educators. *Urban Education, 51*(4), 390–414. https://doi.org/10.1177/0042085916628610

DeCuir-Gunby, J. T., Marshall, P. L., & McCulloch, A. W. (2011). Developing and using a codebook for the analysis of interview data: An example from a professional development research project. *Field Methods, 23*(2),136-155. https://doi.org/10.1177/1525822X10388468

de Laat, K. (2023). Remote work and post–bureaucracy: Unintended consequences of work design for gender inequality. *ILR Review*, *76*(1), 135–159. https://doi.org/10.1177/00197939221076134

Delaney, N., & Lahey, J. (2019). The ADEA at the intersection of age and race. *Berkeley Journal of Employment and Labor Law,40*(1), 61–90. https://doi.org/10.15779/Z38FJ29D28

Delve. (2022). *User privacy policy*. https://delvetool.com/privacy–policy

Delventhal, M., & Parkhomenko, A. (2023). *Spatial implications of telecommuting.* http://dx.doi.org/10.2139/ssrn.3746555

Denaro, K., Dennin, K., Dennin, M., & Sato, B. (2022). Identifying systemic inequity in higher education and opportunities for improvement. *PloS One*, *17*(4), e0264059. https://doi.org/10.1371/journal.pone.0264059

DeNisi, A. S., Murphy, K. R. (2017). Performance appraisal and performance management: 100 years of progress? *Journal of Applied Psychology*, *102*, 421–433. 10.1037/apl0000085

Dennehy, T. C., & Dasgupta, N. (2017). Female peer mentors early in college increase women's positive academic experiences and retention in engineering. *Proceedings of the National Academy of Sciences of the United States of America, 114*(23), 5964–5969. https://doi.org/10.1073/pnas.1613117114

De Paola, M., Ponzo, M., & Scoppa, V. (2017). Gender differences in the propensity to apply for promotion: Evidence from the Italian Scientific Qualification. *Oxford Economic Papers*, *69*(4), 986–1009. https://www.jstor.org/stable/48691500

Derks, B., Van Laar, C., & Ellemers, N. (2016). The queen bee phenomenon: Why women leaders distance themselves from junior women. *The Leadership Quarterly, 27*(3), 456-469. https://doi.org/10.1016/j.leaqua.2015.12.007

Descartes, R. (1977). *The essential writings* (J. Blom, Ed.). Harper & Row.

Desilver, D. (2017). *U.S. students' academic achievement still lags that of their peers in many other countries.* Pew Research Center. https://www.pewresearch.org/fact–tank/2017/02/15/u–s–students–internationally–math–science/

Deslauriers, B., Harris, S., Lane, E., & Wieman, C. (2012). Transforming the lowest–performing students: An intervention that worked. *Journal of College Science Teaching, 41*(6), 76–84. https://www.researchgate.net/publication/264959437_Transforming_the_Lowest-Performing_Students_An_Intervention_That_Worked

De Souza v. Planned Parenthood Federation of America, 21 Civ. 5553 (LGS) S.D.N.Y. (2022). https://casetext.com/case/de–souza–v–planned–parenthood–fedn–of–am–5

Deutsch, F. M., Zalenski, C. M., & Clark, M. E. (1986). Is there a double standard of aging? *Journal of Applied Social Psychology, 16*(9), 771–785. https://doi.org/10.1111/j.1559-1816.1986.tb01167.x

DeVellis, R. (2005). Inter–rater reliability. In K. Kempf–Leonard (Ed.), *Encyclopedia of Social Measurement*. Elsevier. https://doi.org/10.1016/B0–12–369398–5/00095–5

De Witt, M. (2022a, December 5). *Why are there so many tech layoffs, and why should we be worried? Stanford scholar explains*. Stanford University News. https://news.stanford.edu/2022/12/05/explains–recent–tech–layoffs–worried/

De Witt, M. (2022b, December 5). *Why "copycat" layoffs won't help tech companies — or their employees.* Stanford University News. https://www.gsb.stanford.edu/insights/why–copycat–layoffs–wont–help–tech–companies–or–their–employees

Diamond, A. H., & Kislev, E. (2021). Perceptions of science and their effects on anticipated discrimination in STEM for minority high school students. *Cambridge Journal of Education*, *51*(2), 213–230. https://doi.org/10.1080/0305764X.2020.1806989

Dias, F. (2021). The racial gap in employment and layoffs during COVID–19 in the United States: A visualization. *Sociological Research for a Dynamic World 7*, 1–3. DOI:10.1177/2378023120988397

DiCicco–Bloom, B., & Crabtree, B. F. (2006). The qualitative research interview. *Medical Education, 40*(4), 314–21. DOI:10.1111/j.1365-2929.2006.02418.x

Dickens, D. D., & Chavez, E. L. (2018). Navigating the workplace: The costs and benefits of shifting identities at work among early career U.S. Black women. *Sex Roles, 78*(11–12), 760–774. https://doi.org/10.1007/s11199–017–0844–x

Dickens, D. D., Ellis, V., & Hall, N. M. (2021). Changing the face of STEM: Review of literature on the role of mentors in the success of undergraduate Black women in STEM education. *Journal of Research Initiatives*, *5*(3), 14. https://digitalcommons.uncfsu.edu/jri/vol5/iss3/14

Dickens, D., & Womack, V. (2020). *Unapologetic authentic early career black women*. Routledge. DOI:10.4324/9781003026907-2.

Dickens, D. D., Womack, V. Y., & Dimes, T. (2019). Managing hypervisibility: An exploration of theory and research on identity shifting strategies in the workplace among Black women. *Journal of Vocational Behavior, 113*, 153. https://doi.org/10.1016/j.jvb.2018.10.008

Diehl, A., & Dzubinski, L. (2023). *Glass walls: Shattering the six gender bias barriers still holding women back at work.* Rowman & Littlefield Publishers.

Diele–Viegas, L. M., Cordeiro, T. E. F., Emmerich, T., Hipólito, J., Queiroz-Souza, C., Sousa, E., Cardoso, A., Leite, V., & Leite, L. (2021). Potential solutions for discrimination in STEM. *Nature Human Behavior, 5*, 672–674. https://doi.org/10.1038/s41562–021–01104–w

Diller, S. J., Czibor, A., Szabó, Z. P. (2021). The positive connection between dark triad traits and leadership levels in self- and other-ratings. *Leadership Education Personal Interdisciplinary Journal*, 3, 117–131. https://doi.org/10.1365/s42681-021-00025-6

Dingel, J. I., & Neiman, B. (2020). How many jobs can be done at home? *Journal of Public Economics*, *189*, 104235. https://doi.org/10.1016/j.jpubeco.2020.104235.

Dinh, T. V., & Zhang, Y. L. (2021). Engagement in high–impact practices and its influence on community college transfers' STEM degree attainment. *Community College Journal of Research and Practice*, *45*(11), 834–849. https://doi.org/10.1080/10668926.2020.1824133

Doerr, K., Riegle-Crumb, C., Russo-Tait, T., Takasaki, K., Sassler, S., & Levitte, Y. (2021). Making merit work at the entrance to the engineering workforce: Examining women's experiences and variations by race/ethnicity. *Sex roles, 85*(7-8), 422–439. https://doi.org/10.1007/s11199-021-01233-6

Doldor, E., Wyatt, M., & Silvester, J. (2019). Statesmen or cheerleaders? Using topic modeling to examine gendered messages in narrative developmental feedback for leaders. *The Leadership Quarterly, 30*(5). https://doi.org/10.1016/j.leaqua.2019.101308.

Dordoni, P., & Argentero, P. (2015). When age stereotypes are employment barriers: A conceptual analysis and a literature review on older workers stereotypes. *Ageing International, 40*(4), 393–412. https://doi.org/10.1007/s12126–015–9222–6

Doris, A., O'Neill, D., & Sweetman, O. (2013). Gender, single–sex schooling and math achievement. *Economics of Education Review*, *35*, 104–119. https://doi.org/10.1016/j.econedurev.2013.04.001

Dortch, D., & Patel, C. (2017). Black undergraduate women and their sense of belonging in STEM at predominantly White institutions. *NASPA Journal about Women in Higher Education, 10*(2), 202–215. https://doi.org/10.1080/19407882.2017.1331854

Dotterer, A. M. (2022). Parent involvement, expectancy values, and STEM outcomes among underrepresented adolescents. *Social Psychology of Education: An International Journal, 25*(1), 113–127. https://doi.org/10.1007/s11218–021–09677–0

Douglas, H. M., Settles, I. H., Cech, E. A., Montgomery, G. M., Nadolsky, L. R., & Hawkins, A. K. (2022). Disproportionate impacts of COVID–19 on marginalized and minoritized early–career academic scientists. *PLoS One 17*(9), e0274278. https://doi.org/10.1371/journal.pone.0274278

Dove, L. M. (2023). A professor's reflection: What the pandemic is teaching us about the importance of deconstructing professionalism. *Reflections: Narratives of Professional Helping, 29*(1), 26–34. https://reflectionsnarrativesofprofessionalhelping.org/index.php/Reflections/article/view/1907

Dowling, B., Goldstein, D., Park, M., & Price, H. (2022). *Hybrid work: Making it fit with your diversity equity and inclusion strategy*. McKinsey & Company. https://www.mckinsey.com/capabilities/people–and–organizational–performance/our–insights/hybrid–work–making–it–fit–with–your–diversity–equity–and–inclusion–strategy

Downe-Wamboldt, B. (1992). Content analysis: Method, applications, and issues. *Health Care for Women International*, *13*(3), 313–321. DOI:10.1080/07399339209516006

Doyle, W. R. (2009). The effect of community college enrollment on bachelor's degree completion. *Economics of Education Review, 28*(2), 199–206. https://doi.org/10.1016/j.eco nedurev.2008.01.006

Dreisbach, C., Wright, M., Walker, R., Byon, H., & Keim–Malpass, J. (2022). Nursing science as a federally–recognized STEM degree: A call to action for the United States with global implications. *International Journal of Nursing Studies Advances, 4*, 100084. https://doi.org/10.1016/j.ijnsa.2022.100084

Dresden, B. E., Dresden, A. Y., Ridge, R. D., & Yamawaki, N. (2018). No girls allowed: Women in male–dominated majors experience increased gender harassment and bias. *Psychological Reports, 121*(3), 459–474. https://doi.org/10.1177/0033294117730357

Drobnic, V. A. (2023). Comparison of interdisciplinary connections between mathematics and other subjects through student–centered approaches. *Journal of Research in Mathematics Education*, *12*(1), 29–55. DOI:10.17583/redimat.10178

DuBow, W. M., & Ashcraft, C. (2016). Male allies: Motivations and barriers for participating in diversity initiatives in the technology workplace. *International Journal of Gender, Science and Technology*, *8*(2), 160–180. https://genderandset.open.ac.uk/index.php/genderandset/article/view/379

Dunkel–Schetter, C. (2011). Psychological science on pregnancy: Stress processes, biopsychosocial models, and emerging research issues. *Annual Review of Psychology, 62*, 531–558. https://doi. org/10.1146/annurev.psych.031809.130727

Dunscombe, J., & Jessop, J. (2002). Doing rapport, and the ethics of 'faking friendship'. In T. Miller, M. Birch, & M. Mauthner (Eds.), *Ethics in qualitative research* (pp. 108–121). Sage Publications.

Dweck, C. S. (2006). *Mindset: The new psychology of success*. Random House.

Eagly, A. H., & Karau, S. J. (2002). Role congruity theory of prejudice toward female leaders. *Psychological Review, 109*(3), 573–598. https://doi.org/10.1037/0033-295X.109.3.573

Eaton, A. A., Saunders, J. F., Jacobson, R. K., & Keon, W. (2020). How gender and race stereotypes impact the advancement of scholars in STEM: Professors' biased evaluations of physics and biology post-doctoral candidates. *Sex Roles, 82*(3–4), 127–141. https://doi.org/10.1007/s11199–019–01052–w

Ebert, C., & Steinert, J. I. (2021). Prevalence and risk factors of violence against women and children during COVID-19, Germany. *Bulletin of the World Health Organization*, *99*(6), 429–438. https://doi.org/10.2471/BLT.20.270983

Edmondson, A. (1999). Psychological safety and learning behavior in work teams. *Administrative Science Quarterly*, *44*(2), 350–383. https://doi.org/10.2307/2666999

Edmondson, A., & Zhike, L. (2014). Psychological safety: The history, renaissance, and future of an interpersonal construct. *Annual Review of Organizational Psychology and Organizational Behavior, 1*(1), 23–43. https://doi.org/10.1146/annurev-orgpsych-031413-091305

Edna, D. C., Tives, H. A., Madianita, B. M., Fagundes, F., & José Antonio Siqueira, d. C. (2019). Barriers faced by women in software development projects. *Information*, *10*(10), 309. https://doi.org/10.3390/info10100309

Ehie, O., Muse, I., Hill, L., & Bastien, A. (2021). Professionalism: Microaggression in the healthcare setting. *Current Opinion in Anesthesiology*, *34*(2), 131–136. https://doi.org/10.1097/ACO.0000000000000966

Ekmekci, A., & Serrano, D. M. (2022). The impact of teacher quality on student motivation, achievement, and persistence in science and mathematics. *Education Sciences, 12*(10), 649. https://doi.org/10.3390/educsci12100649

El Bedewy, S., Lavicza, Z., Haas, B., & Lieban, D. (2022). A STEAM practice approach to integrate architecture, culture and history to facilitate mathematical problem-solving. *Education Sciences*, *12*(9), 1–24. https://doi.org/10.3390/educsci12010009

Ellemers, N., van den Heuvel, H., de Gilder, D., Maass, A., & Bonvini, A. (2004). The underrepresentation of women in science: Differential commitment or the queen bee syndrome? *The British Journal of Social Psychology, 43*, 315-38. DOI:10.1348/0144666042037999

Ellis, J., Fosdick, B. K., & Rasmussen, C. (2016). Women 1.5 times more likely to leave STEM pipeline after calculus compared to men: Lack of mathematical confidence a potential culprit. *PloS One, 11*(7), e0157447. https://doi.org/10.1371/journal.pone.0157447

Else, H. (2018). Does science have a bullying problem? *Journal Nature*, *563*, 616–618. DOI:10.1038/d41586–018–07532–5

Else–Quest, N., Hyde, J. S., & Linn, M. C. (2010). Cross–national patterns of gender differences in mathematics: A meta-analysis. *Psychological Bulletin, 136*(1), 103–127. https://doi.org/10.1037/a0018053

Embree, L. (Ed.). (1997). *Encyclopedia of phenomenology contributions to phenomenology* (Volume 18). Springer.

Enav, F., & Efrat–Treister, D. (2023). Gender bias in STEM hiring: Implicit in–group gender favoritism among men managers. *Gender & Society, 37*(1), 32–64. https://doi.org/10.1177/08912432221137910

England, P., Bearak, J., Budig, M. J., & Hodges, M. J. (2016). Do highly paid, highly skilled women experience the largest motherhood penalty? *American Sociological Review, 81*(6), 1161. https://doi.org/10.1177/0003122416673598

Epstein, J. L., Sanders, M. G., Sheldon, S., Simon, B. S., & Salinas, K. C. (2009). *School, family, and community partnerships: Your handbook for action (3rd ed.)*. Corwin Press.

Ersozlu, Z., Swartz, M., & Skourdoumbis, A. (2023). Developing computational thinking through mathematics: An evaluative scientific mapping. *Education Sciences*, *13*(4), 422. https://doi.org/10.3390/educsci13040422

Espinoza, M., & Ferreira, E. (2022). Gender implicit bias and glass ceiling effects. *Journal of Applied Economics*, *25*(1), 37–57. https://doi.org/10.1080/15140326.2021.2007723

Estrada, M., Hernandez, P. R., & Schultz, P. W. (2018). A longitudinal study of how quality mentorship and research experience integrate underrepresented minorities into STEM careers. *CBE Life Sciences Education*, *17*(1). https://doi.org/10.1187/cbe.17–04–0066

Etikan, I., Musa, S. A., & Alkassim, R. S. (2016). Comparison of convenience sampling and purposive sampling. *American Journal of Theoretical and Applied Statistics, 5*(1), 1–4. https://doi.org/10.11648/j.ajtas.20160501.11

Etzkowitz, H., Kemelgor, C., & Uzzi, B. (2000). *Athena unbound: The advancement of women in science and technology*. Cambridge University Press.

European Commission. (2021). *Report on Gender Equality in the EU.* https://ec.europa.eu/info/sites/default/files/aid_development_cooperation_fundamental_rights/annual_report_ge_2021_printable_en_0.pdf

Evans, C. A., Chen, R., & Hudes, R. P. (2020). Understanding determinants for STEM major choice among students beginning community college. *Community College Review, 48*(3), 227–251. https://doi.org/10.1177/0091552120917214

Evans, D. P., Sales, J. M., Krause, K. H., & Carlos, d. R. (2019). You have to be twice as good and work twice as hard: A mixed–methods study of perceptions of sexual harassment, assault and women's leadership among female faculty at a research university in the USA. *Global Health, Epidemiology and Genomics,4,* E6. https://doi.org/10.1017/gheg.2019.5

Every Student Succeeds Act, 20 U.S.C. § 6301 (2015). https://www.congress.gov/bill/114th–congress/senate–bill/1177

Fan, W., & Moen, P. (2022). Working more, less or the same during COVID-19? A mixed method, intersectional analysis of remote workers. *Work and Occupations*, *49*(2), 143–186. https://doi.org/10.1177/07308884211047208

Farber, H. S., Silverman, D., & von Wachter, T. (2017). Factors determining callbacks to job applications by the unemployed. *RSF: The Russell Sage Foundation Journal of the Social Sciences*, *3*, 168–201. https://doi.org/10.7758/rsf.2017.3.3.08

Fassinger, R. E., & Asay, P. A. (2006). Career counseling for women in science, technology, engineering, and mathematics (STEM) fields. In B. Walsh & M. Heppner (Eds.), *Handbook of career counseling for women* (pp. 432–457). Routledge.

Fattoracci, E., & King, D. (2023). The need for understanding and addressing microaggressions in the workplace. *Perspectives on Psychological Science*, *18*(4), 738–742. https://doi.org/10.1177/17456916221133825

Fayer, S., Lacey, A., & Watson, A. (2017, January 1). *STEM occupations: past, present, and future*. United States Bureau of Labor Statistics. https://www.BLS.gov/spotlight/2017/science–technology–engineering–and–mathematics–stem–occupations–past–present–and–future/home.htm#:~:text=Science%2C%20technology%2C%20engineering%2C%20and,The%20.gov%20means%20it's%20official

Federal Committee on Statistical Methodology. (2020). *A Framework for Data Quality. FCSM 20–04.* U.S. Department of Education, the National Center for Education Statistics (NCES). Retrieved July 13, 2023 from https://nces.ed.gov/fcsm/pdf/FCSM.20.04_A_Framework_for_Data_Quality.pdf

Feeney, M. K., Bernal, M., & Bowman, L. (2014). Enabling work? Family–friendly policies and academic productivity for men and women scientists. *Science & Public Policy (SPP) 41*(6), 750–64. DOI:10.1093/scipol/scu006

Ferguson, D., & Martin–Dunlop, C. (2021). Uncovering stories of resilience among successful African American women in STEM. *Cultural Studies of Science Education, 16*(2), 461–484. https://doi.org/10.1007/s11422–020–10006–8

Fernández–Martín, F., Arco–Tirado, J., Carrillo–Rosúa, F., Hervás–Torres, M., Ruiz–Hidalgo, J., & Romero–López, C. (2020). Making STEM education objectives sustainable through a tutoring program. *Sustainability*, *12*(16), 6653. https://doi.org/10.3390/su12166653

File, T., & Lee, J. (2021). *Household pulse survey updates sex question, now asks about sexual orientation and gender identity*. United States Census Bureau. https://www.census.gov/library/stories/2021/08/household–pulse–survey–updates–sex–question–now–asks–sexual–orientation–and–gender–identity.html

Fisher, S., & Kingson, J. (2022). *Millennials drive remote work push*. Axios Harris 100 poll. https://www.axios.com/2022/05/24/millennials–drive–remote–work–push

Flesch, R. (1955). *Why Jonny can't read: And what you can do about it*. Harper & Brothers Publishers.

Flesch, R. (1981). *Why Jonny still can't read: A new look at the scandal of our schools.* Harper & Row Publishers.

Fletcher, L. A., & Carter, C. (2010). The important role of community colleges in undergraduate biology education. *Life Sciences Education*, 9, 382–383. DOI:10.1187/cbe.10-09-0112

Folke, O., Rickne, J., Tanaka, S., & Tateishi, Y. (2020). Sexual harassment of women leaders. *Daedalus 149*(1), 180–197. https://doi.org/10.1162/daed_a_01781

Fouad, N. A., Singh, R., Fitzpatrick, M. E., & Liu, J. P. (2012). *Stemming the tide: Why women leave engineering.* University of Wisconsin, Milwaukee.

Francioli, S. P., & North, M. S. (2021). Youngism: The content, causes, and consequences of prejudices toward younger adults. *Journal of Experimental Psychology: General, 150*(12), 2591–2612. https://doi.org/10.1037/xge0001064

Francis. J. J, Johnston, M., Robertson, C., Glidewell, L., Entwistle, V., & Eccles, M. P. (2010). What is an adequate sample size? Operationalizing data saturation for theory–based interview studies. *Psychol Health*, *25*(10), 1229–45.

Frechette, J., Bitzas, V., Aubry, M., Kilpatrick, K., & Lavoie–Tremblay, M. (2020). Capturing lived experience: Methodological considerations for interpretive phenomenological inquiry. *International Journal of Qualitative Methods*, *19*, 1–12. https://doi.org/10.1177/1609406920907254

Freedman, G., Green, M. C., Kussman, M., Drusano, M., & Moore, M. M. (2023). “Dear future woman of STEM”: Letters of advice from women in STEM. *International Journal of STEM Education*, *10*(1), 20. https://doi.org/10.1186/s40594–023–00411–0

Freedman, R. B. (2010). What does global expansion of higher education mean for the United States? In C.T. Clotfelter (Ed). *American Universities in a Global Market* (pp. 1–29). University of Chicago Press.

Friedan, B. (1963). *The feminine mystique*. Norton & Company.

Frischmann, J. A., & Moor, K. S. (2017). Invited article: Bridging the gap--Supporting the transition from high school to college. *Administrative Issues Journal: Connecting Education, Practice, and Research*, *7*(2), 1–10. https://eric.ed.gov/?id=EJ1169306

Frize, M., Lhotska, L., Marcu, L. G., Stoeva, M., Barabino, G., Ibrahim, F., Lim, S., Kaldoudi, E., Marques da Silva, A. M., Tan, P. H., Tsapaki, V., & Bezak, E. (2021). The impact of COVID-19 pandemic on gender-related work from home in STEM fields-Report of the WiMPBME Task Group. *Gender, Work, and Organization*, *28*(Suppl 2), 378–396. https://doi.org/10.1111/gwao.12690

Fry, R., Kennedy, B., & Funk, C. (2021). *STEM jobs see uneven progress in increasing gender, racial and ethnic diversity*. Pew Research Center. https://www.pewresearch.org/science/2021/04/01/stem–jobs–see–uneven–progress–in–increasing–gender–racial–and–ethnic–diversity/

Fuller, J., & Raman, M. (2022). *The partnership imperative: Community colleges, employers, and America's chronic skills gap.* Harvard Business School.

Funk, C., & Parker, K. (2018). *Women and men in STEM often at odds over workplace equity*. Pew Research Center. https://www.pewresearch.org/social–trends/2018/01/09/women–and–men–in–stem–often–at–odds–over–workplace–equity/

Fusch, P. I., & Ness, L. R. (2015). Are we there yet? Data saturation in qualitative research. *Qualitative Report, 20*(9),1408–16. https://doi.org/10.46743/2160-3715/2015.2281

Gajendran, R. S., & Harrison, D. A. (2007). The good, the bad, and the unknown about telecommuting: Meta–analysis of psychological mediators and individual consequences. *Journal of Applied Psychology, 92*(6), 1524–1541. https://doi.org/10.1037/0021–9010.92.6.1524

Galano, S., Liccardo, A., Amodeo, A. L., Crispino, M., Tarallo, O., & Testa, I. (2023). Endorsement of gender stereotypes affects high school students' science identity. *Physical Review: Physics Education Research*, *19*(1). https://doi.org/10.1103/PhysRevPhysEducRes.19.010120

Gale, J., Alemdar, M., & Boice, K. (2022). Student agency in a high school computer science course. *Journal for STEM Educ Res 5*, 270–301. https://doi.org/10.1007/s41979–022–00071–9

Galletta, A. (2013). *Mastering the semi–structured interview and beyond: From research design to analysis and publication.* NYU Press.

Gangl, M., & Ziefle, A. (2009). Motherhood, labor force behavior, and women's careers: An empirical assessment of the wage penalty for motherhood in Britain, Germany, and the United States. *Demography 46*(2), 341–369. https://doi.org/10.1353/dem.0.0056

Ganley, C. (2018, August 14). Are boys better than girls at math? *Scientific American.* https://www.scientificamerican.com/article/are–boys–better–than–girls–at–math/#:~:text=The%20mean%20performance%20scores%20for,'%20and%20girls'%20math%20skills

Gao, J., Yin, Y., Myers, K. R., Lakhani, K. R., Wang, D. (2021). Potentially long–lasting effects of the pandemic on scientists. *Nature Communications*, *12*(1), 6188. https://doi.org/10.1038/s41467–021–26428–z

García, I., Jackson, A., Greenlee, A. J., Yerena, A., Chrisinger, B., & Lee, C. A. (2021). Feeling like an "Odd Duck." *Journal of the American Planning Association, 87*(3), 326–340. https://doi.org/10.1080/01944363.2020.1858936

García–López, G. (2008). “Nunca te toman en cuenta [They never take you into account]”: The challenges of inclusion and strategies for success of Chicana attorneys. *Gender & Society*, *22*(5), 590–612. https://doi.org/10.1177/0891243208321120

Gardenier, J. S., & Resnik, D. B. (2002). The misuse of statistics: concepts, tools, and a research agenda. *Accountability in Research*, 9(2), 65–74. http://dx.doi.org/10.1080/08989620212968

Garrett–Peters, P. T., Mokrova, I. L., Carr, R. C., & Vernon–Feagans, L., (2019). Early student (dis)engagement: Contributions of household chaos, parenting, and self–regulatory skills. *Developmental Psychology*, *55*(7), 1480–1492. https://doi.org/10.1037/dev0000720

Garrido-Vásquez, M. E., Garrido-Vásquez, P., & Otto, K. (2020). Two sides of workplace interactions: How appreciation and social stressors shape the relationship between job insecurity and well-being. *Europe’s Journal of Psychology*, *16*(3), 458–478. https://doi.org/10.5964/ejop.v16i3.2023

Garr–Schultz, A., & Gardner, W. L. (2018). Strategic self–presentation of women in STEM. *Social Sciences*, *7*(2), 20. https://doi.org/10.3390/socsci7020020

Gauthier, T. (2020). A renewed examination of the stigma associated with community college career and technical education. *Community College Journal of Research and Practice, 44*(10–12), 870–884. https://doi.org/10.1080/10668926.2020.1758835

Geldenhuys, D. J. (2020). Valuing and adapting appreciative inquiry to enhance well–being using a neuropsychotherapeutic framework. *SA Journal of Industrial Psychology*, *46* https://doi.org/10.4102/sajip.v46i0.1823

General Accounting Office. (2022). *Women in the workforce: The gender pay gap is greater for certain racial and ethnic groups and varies by education level*. General Accounting Office. https://www.gao.gov/products/gao–23–106041

Ghazy, N., Ratner, E., & Rosenberg-Lee, M. (2019). Differential contributions of empathy to math achievement in women and men. *Frontiers in Psychology, 10*(1941), 1-13. DOI:10.3389/fpsyg.2019.01941.

Ghazzawi, D., McKinney, L., Horn, C., Carales, V., & Burridge, A. (2020). The road to the baccalaureate: Assessing the viability of community colleges as transfer pathways for international students. *Journal of International Students*, *10*(2), 420–442. https://doi.org/10.32674/jis.v10i2.339

Ghosh, R., & Reio, T. G. (2013). Career benefits associated with mentoring for mentors: A meta-analysis. *Journal of Vocational Behavior*, *83*, 106-116.

Giardina, C. (2018). MOW to NOW: Black feminism resets the chronology of the founding of modern feminism. *Feminist Studies, 44*(3), 736–765,780. https://lib.pepperdine.edu/login?url=https://www.proquest.com/scholarly–journals/mow–now–black–feminism–resets–chronology–founding/docview/2256109408/se–2

Giguère, É., Pelletier, M., Bilodeau, K., & St–Arnaud, L. (2023). Breaking through the glass ceiling, but at what cost? From transitions between hierarchical levels to the diversity of ascending, lateral, or descending career paths of women executives. *Australian Journal of Career Development*, *32*(1), 60–68. https://doi.org/10.1177/10384162221141350

Ginder, S. A., Kelly–Reid, J. E., & Mann, F. B. (2018). *Postsecondary institutions and cost of attendance in 2017–18; degrees and other awards conferred, 2016–17; and 12–Month enrollment, 2016–17: First look (provisional data) CBE—Life Sciences Education • 21:ar25, Summer 2022 21:ar25, 9 Equity and Community College Students (NCES 2018–060rev).* National Center for Education Statistics, U.S. Department of Education. http://nces.ed.gov/pubsearch

Giorgi, A. (Ed.). (1985). *Phenomenology and Psychological Research.* Duquesne University Press.

Giorgi, A. (1994). A phenomenological perspective on certain qualitative research methods. *Journal of Phenomenological Psychology 25*(2), 190–220. DOI:10.1163/156916294x00034

Giorgi, A. (1997). The theory, practice, and evaluation of the phenomenological method as a qualitative research procedure. *Journal of Phenomenological Psychology, 28*(2), 235–260. https://doi.org/10.1163/156916297X00103

Gladstone, J. R., & Andrei, C. (2021). Which role models are effective for which students? A systematic review and four recommendations for maximizing the effectiveness of role models in STEM. *International Journal of STEM Education, 8*(1)https://doi.org/10.1186/s40594–021–00315–x

Glaser, B. G., & Strauss, A. L. (1967). *The discovery of grounded theory: Strategies for qualitative research.* Aldine.

Glass, J. L., Sassler, S., Levitte, Y., & Michelmore, K. M. (2013). What’s so special about STEM? A comparison of women’s retention in STEM and professional occupations. *Social Forces, 92*(2), 723–756. https://doi.org/10.1093/sf/sot092

Glauber, R. (2018). Trends in the motherhood wage penalty and fatherhood wage premium for low, middle, and high earners. *Demography*, *55*(5), 1663–1680. https://doi.org/10.1007/s13524–018–0712–5

Gnepp, J., Klayman, J., Williamson, I. O., & Barlas, S. (2020). The future of feedback: Motivating performance improvement through future-focused feedback. *PloS One*, *15*(6), e0234444. https://doi.org/10.1371/journal.pone.0234444

Gold, J., & Ciorciari, J. (2020). A review on the role of the neuroscience of flow states in the modern world. *Behavioral sciences 10*(9), 137. https://doi.org/10.3390/bs10090137

Goldin, C. (2014). A grand gender convergence: It's last chapter. *American Economic Review, 104*(4), 1091–1119 http://dx.doi.org/10.1257/aer.104.4.1091

Goldin, C., Albanesi, S., & Olmstead–Rumsey, J. (2023). *Understanding the economic impact of COVID–19 on women*. Brookings Institute. https://www.brookings.edu/articles/understanding–the–economic–impact–of–covid–19–on–women/

Goleman, D. (2005). *Emotional intelligence: Why it can matter more than IQ*. Bantam Books.

González–Pérez, S., Mateos de Cabo, R., & Sáinz, M. (2020). Girls in STEM: Is it a female role–model thing? *Frontiers in Psychology*, *11*, 2204. https://doi.org/10.3389/fpsyg.2020.02204

Goon, C., Bruce, T. A., Lun, J., Lai, G. Y., Chu, S., & Le, P. T. (2022). Examining the Asian American leadership gap and inclusion issues with federal employee data: Recommendations for inclusive workforce analytic practices. *Frontiers in Research Metrics and Analytics*, *7*, 958750. https://doi.org/10.3389/frma.2022.958750

Gorichanaz, T., Latham, K .F., & Wood, E. (2018). Lifeworld as “unit of analysis.” *Journal of Documentation*, *74*(4), 880–893. https://doi.org/10.1108/JD–12–2017–0174

Gottfried, M., & Bozick, R. (2016). Supporting the STEM pipeline: Linking applied STEM course–taking in high school to declaring a STEM major in college. *Education Finance and Policy*, *11*(2), 177–202. https://eric.ed.gov/?id=EJ1096373

Gottlieb, M., Chan, T. M., Zaver, F., & Ellaway, R. (2022). Confidence-competence alignment and the role of self-confidence in medical education: A conceptual review. *Medical Education,* 56(1), 37–47. https://doi.org/10.1111/medu.14592

Grauerholz, E. (1989). Sexual harassment of women professors by students: Exploring the dynamics of power, authority, and gender in a university setting. *Sex Roles*, *21*(11–12), 789–801. https://doi.org/10.1007/BF00289809

Gray, A. (2019). The bias of ‘professionalism’ standards. *Stanford Social Innovation Review*. https://doi.org/10.48558/TDWC–4756

Green, E., Bennett, H., Brayne, C., & Matthews, F. E. (2018). Exploring patterns of response across the lifespan: The Cambridge centre for ageing and neuroscience (Cam–CAN) study. *BMC Public Health*, *18*(1), 760. https://doi.org/10.1186/s12889–018–5663–7

Green, W. M. (2018). Employee resource groups as learning communities. *Equality, Diversity and Inclusion: An International Journal*, *37*(7), 634–648. https://doi.org/10.1108/EDI–11–2016–0085

Greene, J., & Podolsky, S. (2012). Reform, regulation, and pharmaceuticals: The Kefauver–Harris Amendments at 50. *New England Journal of Medicine*, *367*, 1481–83. https://doi.org/10.1056/NEJMp1210007

Greer, W. (2018). The 50–year history of the Common Core. *The Journal of Educational Foundations 31*(3 & 4). https://files.eric.ed.gov/fulltext/EJ1212104.pdf

Gregor, M., Dunn, M., Campbell–Halfaker, D., Martin–Fernandez, J., Ferrer, A., & Robinson, S. (2023). Plugging the leaky pipeline: A qualitative investigation of untenured female faculty in STEM. *Journal of Career Development, 50*(2), 425–444. https://doi.org/10.1177/08948453221101588

Greifenhagen, C. (2008). Where do the limits of experience lie? Abandoning the dualism of objectivity and subjectivity. *History of the Human Sciences, 21*(3), 70–93. https://doi.org/10.1177/0952695108093954

Griffith, E. E., & Dasgupta, N. (2018). How the demographic composition of academic science and engineering departments influences workplace culture, faculty experience, and retention risk. *Social Sciences, 7*(5), 71. https://doi.org/10.3390/socsci7050071

Groenewald, T. (2004). A phenomenological research design illustrated. *International Journal of Qualitative Methods*, *3*(1), 42–55. https://doi.org/10.1177/160940690400300104

Grogan, K. (2019). How the entire scientific community can confront gender bias in the workplace. *Nature Ecology & Evolution, 3*, 3–6. https://doi.org/10.1038/s41559–018–0747–4

Guenaga, M., Eguíluz, A., Garaizar, P., & Mimenza, A. (2022). The impact of female role models leading a group mentoring program to promote STEM vocations among young girls. *Sustainability, 14*(3), 1420. https://doi.org/10.3390/su14031420

Guest, G., Bunce, A., & Johnson, L. (2006). How many interviews are enough? An experiment with data saturation and variability. *Field Methods*, *18*(1), 59–82. https://doi.org/10.1177/1525822X05279903

Guevara-Ramírez, P., Ruiz-Pozo, V. A., Cadena-Ullauri, S., Salazar-Navas, G., Bedón, A. A., V-Vázquez, J. F., & Zambrano, A. K. (2022). Ten simple rules for empowering women in STEM. *PLoS Computational Biology*, *18*(12), 1–19. https://doi.org/10.1371/journal.pcbi.1010731

Gumpertz, M., Durodoye, R., Griffith, E., & Wilson, A. (2017). Retention and promotion of women and underrepresented minority faculty in science and engineering at four large land grant institutions. *PLoS One*, *12*(11). https://doi.org/10.1371/journal.pone.0187285

Gurchiek, K. (2021). *Report: most companies are 'going through the motions' of DE&I*. Society for Human Resources Management. https://www.shrm.org/resourcesandtools/hr–topics/behavioral–competencies/global–and–cultural–effectiveness/pages/report–most–companies–are–going–through–the–motions–of–dei.aspx

Haar, J., & de Jong, K. (2023). Is the dark triad always detrimental to firm performance? Testing different performance outcomes and the moderating effects of competitive rivalry. *Frontiers in Psychology*, *14*, 1–15. https://doi.org/10.3389/fpsyg.2023.1061698

Hacohen, R., Davidson, S., Roy–Chowdhury, V., Bogiatzis–Gibbons, D., Burd, H., & Likki, T. (2020). *Changing the default: A field trial with Zurich Insurance to advertise all jobs as part–time.* The Government Equalities Office, United Kingdom Government. https://assets.publishing.service.gov.uk/media/60a7a372e90e071b589e9c41/Zurich_trial.pdf

Haines, K. M., Boyer, C. R., Giovanazzi, C., & Galupo, M. P. (2018). "Not a real family": Microaggressions directed toward LGBTQ families. *Journal of Homosexuality*, *65*(9), 1138–1151. https://doi.org/10.1080/00918369.2017.1406217

Hall, A. R., Nishina, A., & Lewis, J. A. (2017). Discrimination, friendship diversity, and STEM–related outcomes for incoming ethnic minority college students. *Journal of Vocational Behavior, 103,* 76. https://doi.org/10.1016/j.jvb.2017.08.010

Hall, W., Toni, S., Inness, M., & Croft, E. (2022). Climate change: An increase in norms for inclusion predicts greater fit and commitment for women in STEM. *Group Processes & Intergroup Relations*, *25*(7), 1781–1796. https://doi.org/10.1177/13684302211035438

Halpern, D. F., & LaMay, M. L. (2000). The smarter sex: A critical review of sex differences in intelligence. *Educational Psychology Review*, *12*(2), 229–246. http://www.jstor.org/stable/23363516

Halsey, S. J., Strickland, L. R., & Scott–Richardson, M. (2020). Elevate, don't assimilate, to revolutionize the experience of scientists who are Black, Indigenous and people of colour. *Nature Ecology and Evolution, 4,* 1291–1293. https://doi.org/10.1038/s41559–020–01297–9

Hamilton, J., Alagna, S., King, L., & Lloyd, C. (1987). The emotional consequences of gender–based abuse in the workplace: New counseling programs for sex discrimination. *Women & Therapy*, *6*(1–2), 155–182. https://doi.org/10.1300/J015V06N01_13

Hammersley, M. (2023). Are there assessment criteria for qualitative findings? A challenge facing mixed methods research. *Forum: Qualitative Social Research, 24*(1), 1–15. https://doi.org/10.17169/fqs–24.1.3935

Hämmig, O. (2017). Health and well-being at work: The key role of supervisor support. *SSM - Population Health*, *3,* 393–402. https://doi.org/10.1016/j.ssmph.2017.04.002.

Han, S., Capraro, R., & Capraro, M. M. (2015). How science, technology, engineering, and mathematics (STEM) project–based learning (PBL) affects high, middle, and low achievers differently: The impact of student factors on achievement. *International Journal of Science and Mathematics Education*, *13*(5), 1089–1113. https://www.researchgate.net/publication/271658486

Han, X., Stocking, G., Gebbie, M. A., & Appelbaum, R. P. (2015). Will they stay or will they go? International graduate students and their decisions to stay or leave the U.S. upon graduation. *PloS One*, *10*(3), e0118183. https://doi.org/10.1371/journal.pone.0118183

Hanauer, D. I., Graham, M. J., Jacobs–Sera, D., Garlena, R. A., Russell, D. A., Sivanathan, V., Asai, D. J., & Hatfull, G. F. (2022). Broadening access to STEM through the community college: Investigating the role of course–based research experiences (CREs). *CBE – Life Sciences Education*, *21*(2). https://doi.org/10.1187/cbe.21–08–0203

Haney, T. J., & Barber, K. (2022). The extreme gendering of COVID−19: Household tasks and division of labour satisfaction during the pandemic. *Canadian Review Sociology*, *59*(1), 26–47. https://doi.org/10.1111/cars.12391

Hans, J. (2001). *The phenomenon of life: Toward a philosophical biology*. Northwestern University Press.

Hansen, M. J., Palakal, M. J., & White, L. (2023, May 23). The importance of STEM sense of belonging and academic hope in enhancing persistence for low–income, underrepresented STEM students. *Journal for STEM Education Research*, 1–26. https://doi.org/10.1007/s41979–023–00096–8

Hanson, M. (2023). *U.S. public education spending statistics*. EducationData.org. Retrieved October 14, 2023, from https://educationdata.org/public–education–spending–statistics

Harkiolakis, T., & Komodromos, M. (2023). Supporting knowledge workers' health and well–being in the post–lockdown era. *Administrative Sciences*, *13*(2), 49. https://doi.org/10.3390/admsci13020049

Harrington, C. (2021). What is "toxic masculinity" and why does it matter? *Men and Masculinities*, *24*(2), 345–352. https://doi.org/10.1177/1097184X20943254

Harris, P. J. (2003). Gatekeeping and remaking: The politics of respectability in African American women's history and Black feminism. *Journal of Women's History*, *15*(1), 212–220. https://doi.org/10.1353/jowh.2003.0025.

Harter, S. (1990). Self and identity development. In S. Feldman & G. Elliot (Eds.), *At the threshold: The developing adolescent* (pp. 352–387). Harvard University Press.

Hartling, L., Hamm, M., & Milne, A. (2012). *Validity and inter–rater reliability testing of quality assessment instruments.* Agency for Healthcare Research and Quality. https://www.ncbi.nlm.nih.gov/books/NBK92281/

Haugen, E. (1953). *The Norwegian language in America, a study in bilingual behavior* (Vol. 2): *The American dialects of Norwegian*. University of Pennsylvania Press. http://www.jstor.org/stable/j.ctv512w76

Hayward, N. (2018). *Susan B. Anthony*. National Women's History Museum. https://www.womenshistory.org/education-resources/biographies/susan-b-anthony

Heggeness, M. L. (2020). Estimating the immediate impact of the COVID–19 shock on parental attachment to the labor market and the double bind of mothers. *Review of Economic Household, 18*, 1053–1078. https://doi.org/10.1007/s11150–020–09514–x

Heggeness, M. L., & Fields, J. M. (2020). *Working moms bear brunt of home schooling while working during COVID–19*. U.S. Census Bureau. https://www.census.gov/library/stories/2020/08/parents–juggle–work–and–child–care–during–pandemic.html

Heggeness, M. L., Fields, J., Trejo, Y. A., & Schulzetenberg, A. (2021). *Tracking job losses for mothers of school–age children during a health crisis. America counts: Stories behind the numbers.* U.S. Census Bureau. www.census.gov/library/stories/2021/03/moms–work–and–the–pandemic.html.

Heidegger, M. (1996). *Being and time: A translation of Sein und Zeit.* SUNY Press. (Original work published 1927)

Heifetz, R. A., Linsky, M., & Grashow, A. (2009). *The practice of adaptive leadership*. Harvard Business Review Press.

Heilman, M. E., & Haynes, M. C. (2005). No credit where credit is due: Attributional rationalization of women's success in male-female teams. *Journal of Applied Psychology*, 90(5), 905. doi:10.1037/0021-9010.90.5.905

Hennein, R., Bonumwezi, J., Max Jordan, N. T., Tineo, P., & Lowe, S. R. (2021). Racial and gender discrimination predict mental health outcomes among healthcare workers beyond pandemic–related stressors: Findings from a cross–sectional survey. *International Journal of Environmental Research and Public Health*, *18*(17), 9235. https://doi.org/10.3390/ijerph18179235

Heo, S., Chan, A. Y., Diaz Peralta, P., Jin, L., Pereira Nunes, C. R., & Bell, M. L. (2022a). Impacts of the COVID–19 pandemic on scientists' productivity in science, technology, engineering, mathematics (STEM), and medicine fields. *Humanities & Social Sciences Communications*, *9*(1), 1–11. https://doi.org/10.1057/s41599–022–01466–0

Heo, S., Diaz Peralta, P., Jin, L., Pereira Nunes, C. R., & Bell, M. L. (2022b). Disparities in COVID–19 impacts on work hours and career satisfaction by gender and race among scientists in the U.S. *Social Sciences*, *11*(12), 577. https://doi.org/10.3390/socsci11120577

Herman, A. (2019). America's STEM crisis threatens our national security. *American Affairs Journal*, *3*(1), 128–148. https://americanaffairsjournal.org/2019/02/americas–stem–crisis–threatens–our–national–security/

Hernandez, P. R., Estrada, M., Woodcock, A., & Schultz, P. W. (2017). Mentor qualities that matter: The importance of perceived (not demographic) similarity. *Journal of Experimental Education*, *85*(3), 450–468. https://doi.org/10.1080/00220973.2016.1246405

Herrera, T. A., & Owens, D. T. (2001). The "New Bionomies Math"? Two reform movements in mathematics education. *Theory Into Practice*, *40*(2), 84–92. http://www.jstor.org/stable/1477269

Hewlett, S. (2007). *Off–ramps and on–ramps: keeping talented women on the road to success.* Harvard Business Review Press.

Hillebrandt, A., & Barclay, L. J. (2017). Observing others' anger and guilt can make you feel unfairly treated: The interpersonal effects of emotions on justice–related reactions. *Social Justice Research*, *30*(3), 238–269. https://doi.org/10.1007/s11211–017–0290–5

Hilmer, M. J. (1998). Post–secondary fees and the decision to attend a university or a community college. *Journal of Public Economics*, *67*(3), 329–348. https://doi.org/10. 1016/S0047–2727(97)00075–3

Hilz, A., Guill, K., Roloff, J., Sommerhoff, D., & Aldrup, K. (2023). How to continue? New approaches to investigating the effects of adaptive math learning programs on students' performance, self–concept, and anxiety. *Journal of Intelligence*, *11*(108), 1–22. https://doi.org/10.3390/jintelligence11060108

Hinton, A., & Lambert, W. M. (2022). Moving diversity, equity, and inclusion from opinion to evidence. *Cell Reports Medicine*, *3*(4), 100619. https://doi.org/10.1016/j.xcrm.2022.100619

Hirschi, A. (2018). The fourth industrial revolution: Issues and implications for career research and practice. *The Career Development Quarterly*, *66*(3), 192–204. https://doi.org/10.1002/cdq.12142

Hirschi, A., & Koen, J. (2021). Contemporary career orientations and career self-management: A review and integration. *Journal of Vocational Behavior*, *126*, (103505), 1–17. https://doi.org/10.1016/j.jvb.2020.103505

Hispanic Heritage Foundation. (2020). *Hispanics and STEM Report*. Student Research Foundation. https://www.studentresearchfoundation.org/wp–content/uploads/2020/04/Hispanics_STEM_Report_Final–1.pdf

Hite, R. L., & Spott, J. L. (2022). Improving parents' and teachers' perceptions of girls' STEM activities and interests before and after an informal STEM intervention. *Journal of STEM Outreach*, *5*(1). https://doi.org/10.15695/jstem/v5i1.01

Hockings, S., DeAngelis, K., & Frey, R. (2008). Peer–led team learning in general chemistry: Implementation and evaluation. *Journal of Chemistry Education, (85)*7, 990–996. https://bpb-us-w2.wpmucdn.com/sites.wustl.edu/dist/e/1431/files/2018/06/Hockings-et-al-2008-1lno7md.pdf

Hodge, E. M., Gabriel, R., & Chenelle, S. (2020). Beyond fact–checking: An examination of research use in the appendix to the Common Core State Standards. *Elementary School Journal*, *121*(1), 75–99. https://doi.org/10.1086/709982

Hoel, H., & Cooper, C. L. (2000). *Destructive conflict and bullying at work*. British Occupational Health Research Foundation, Manchester School of Management, UMIST.

Høffding, S., Martiny, K., & Roepstorff, A. (2022). Can we trust the phenomenological interview? Metaphysical, epistemological, and methodological objections. *Phenomenology and the Cognitive Science, 21*, 33–51. https://doi.org/10.1007/s11097–021–09744–z

Hoffmann, F., & Oreopoulos, P. (2007). A professor like me: The influence of instructor gender on college achievement. *Journal of Human Resources*, *44*(2), 1–30. http://www.nber.org/papers/w13182

Hollis, L. P. (2017). Workplace bullying in the United States and Canada: Organizational accountability required in higher education. *Comparative Civilizations Review*, *76*(76), 117–125.

Hollis, L. P. (2022). Universal declaration of human rights: An Argument for higher education to prohibit workplace bullying. *Policy Futures in Education*, *20*(2), 234–239. https://doi.org/10.1177/14782103211032093

Holloway, E. L., & Kusy, M. E. (2010). Disruptive and toxic behaviors in healthcare: Zero tolerance, the bottom line, and what to do about it. *Journal of Medical Practice Management, 25*(6), 335-40.

Holm, K., Torkelson, E., & Bäckström, M. (2022). Workplace incivility as a risk factor for workplace bullying and psychological well–being: A longitudinal study of targets and bystanders in a sample of Swedish engineers. *BMC Psychology*, *10*, 299. https://doi.org/10.1186/s40359–022–00996–1

Holman, L., Stuart–Fox, D., & Hauser, C. E. (2018). The gender gap in science: How long until women are equally represented? *PLoS Biology*, *16*(4), 1–20. https://doi.org/10.1371/journal.pbio.2004956

Holmlund, T.D., Lesseig, K., & Slavit, D. (2018). Making sense of "STEM education" in K-12 contexts. *International Journal of STEM Education, 5*(1), 32. https://doi.org/10.1186/s40594-018-0127-2

Holter, O. G., Goforth, A. N., Pyke-Pierce, K., Aguilar, L. N., & Belcourt, A. (2023). School-based racial microaggressions and depression among Indigenous young adults. *Psychology in the Schools, 60*(1), 255–274. https://doi.org/10.1002/pits.22775

Holtzblatt, K., & Marsden, N. (2022). *Retaining women in tech: Shifting the paradigm*. Springer International Publishing AG.

Holtzer, H., & Lerman, R. (2007). *Americas forgotten middle skills jobs: Education and training requirements in the next decade and beyond*. The Workforce Alliance.

Hong, C. L., Nguyen, V. H., & Tien, L. N. (2023). Integrated STEM approaches and associated outcomes of K–12 student learning: A systematic review. *Education Sciences, 13*(3), 297. https://doi.org/10.3390/educsci13030297 hooks, b. (2000). *Feminism is for everybody: Passionate politics*. South End Press.

hooks, b. (2013). Dig deep: Beyond lean in. *The Feminist Wire*, 1–15. https://thefeministwire.com/2013/10/17973/

Hornblum, A. M. (1998). *Acres of skin: Human experiments at Holmesburg prison: A true story of abuse and exploitation in the name of medical science.* Routledge.

Horowitz, J., Igielnik, R., & Parker, K. (2018). *Views on leadership traits and competencies and how they intersect with gender.* Pew Research Center. https://www.pewresearch.org/social–trends/2018/09/20/2–views–on–leadership–traits–and–competencies–and–how–they–intersect–with–gender/

Hourigan, R. M., & Edgar, S. N. (2020). The foundations of phenomenology: Epistemology, methodology, and analysis. In *Approaches to qualitative research: An Oxford handbook of qualitative research in American music education*, (Vol. 1), 110.

Hsu, D. H., & Tambe, P., (2021). Remote work and job applicant diversity: Evidence from technology startups. Submitted to *Management Science*, 1-44. http://dx.doi.org/10.2139/ssrn.3894404

Huang, J., Gates, A. J., Sinatra, R., & Barabási, A. (2020). Historical comparison of gender inequality in scientific careers across countries and disciplines. *PNAS, 117*(9), 4609–4616. https://doi.org/10.1073/pnas.1914221117

Huang, T. J. (2021). Negotiating the workplace: Second–generation Asian American professionals' early experiences. *Journal of Ethnic and Migration Studies, 47*(11), 2477–2496. DOI:10.1080/1369183X.2020.1778455

Huecker, M., Shreffler, J., McKeny, T., & Davis, D. (2023). *Imposter phenomenon*. National Library of Medicine. https://www.ncbi.nlm.nih.gov/books/NBK585058/

Hughes, B. S., Corrigan, M. W., Grove, D., Andersen, S. B., & Wong, J. T. (2022). Integrating arts with STEM and leading with STEAM to increase science learning with equity for emerging bilingual learners in the United States. *International Journal of STEM Education*, *9*(58),1–19. https://doi.org/10.1186/s40594–022–00375–7

Hunt, P. K., Dong, M., & Miller, C. M. (2021). A multi–year science research or engineering experience in high school gives women confidence to continue in the STEM pipeline or seek advancement in other fields: A 20–year longitudinal study. *PloS One*, *16*(11), e0258717. https://doi.org/10.1371/journal.pone.0258717

Hunt, V., Layton, D., & Prince, S. (2015). *Why diversity matters?* McKinsey & Company. https://www.mckinsey.com/business–functions/organization/our–insights/why–diversity–matters

Husserl, E. (1970). *Logical investigations* (Vol. 1) (J. Findlay, Trans.). Routledge. (Original work published 1900).

Husserl, E. (1982). *Ideas pertaining to a pure phenomenology* (F. Kersten, Trans.). Martinus Nijhoff Publishers. (Original work published 1931)

Hutto, D., & Myin, E. (2017). *Evolving enactivism*. MIT Press

Hyun, J. (2005). *Breaking the bamboo ceiling: Career strategies for Asians.* Harper Collins.

Idahosa, G., & Mkhize, Z. (2021). Intersectional experiences of Black South African female doctoral students in STEM: Participation, success and retention. *Agenda: A Journal about Women and Gender*, *35*(2), 110–122. https://doi.org/10.1080/10130950.2021.1919533

Ilișanu, G., & Andrei, V. (2018). Age stereotypes and ageism at the workplace – #ageisjustanumber. *Journal of Comparative Research in Anthropology and Sociology, Supplemental Special Issue: The Puzzle of Literature Review*, *9*(2), 23–33. http://compaso.eu/wpd/wp-content/uploads/2019/08/Compaso2018-92-Ilisanu-and-Andrei.pdf

International Monetary Fund. (2018). *Pursuing Women's Economic Empowerment.* https://www.imf.org/en/Publications/Policy–Papers/Issues/2018/05/31/pp053118pursuing–womens–economic–empowerment

Ioana, D. R., & Spengler, M. (2021). Negligible effects of birth order on selection into scientific and artistic careers, creativity, and status attainment. *European Journal of Personality, 35*(6), 775-796. https://doi.org/10.1177/0890207020969010

Ireland, D. T., Freeman, K. E., Winston–Proctor, C. E., DeLaine, K. D., McDonald Lowe, S., & Woodson, K. M. (2018). (Un) hidden figures: A synthesis of research examining the intersectional experiences of Black women and girls in STEM education. *Review of Research in Education*, *42*(1), 226–254. http://www.jstor.org/stable/44668720

Irizarry-Barreto, P., Coletta, S., & Scott, K. (2018). Using a mobile laboratory to promote college-level outreach and graduate student engagement in precollege STEM literacy. *Journal of Microbiology & Biology Education*, *19*(1), 1-6. https://doi.org/10.1128/jmbe.v19i1.1438

Isbell, L. A., Young, T. P., & Harcourt, A. H. (2012). Stag parties linger: Continued gender bias in a female–rich scientific discipline. *PloS One*, *7*(11), 1–4. https://doi.org/10.1371/journal.pone.0049682

Iyer, A. (2022). Understanding advantaged groups' opposition to diversity, equity, and inclusion (DEI) policies: The role of perceived threat. *Social and Psychology Compass*, 16(5), 1–14. https://doi.org/10.1111/spc3.12666

Jackson, D. L., Starobin, S. S., & Laanan, F. S. (2013). The shared experiences: Facilitating successful transfer of women and underrepresented minorities in STEM Fields. *New Directions for Higher Education*, (162), 69–76. https://doi.org/10.1002/he.20058

Jackson, L. A. (1992). *Physical appearance and gender: Sociological and sociocultural perspectives.* University of New York Press.

Jackson, S. E., Schwab, R. L., & Schuler, R. S. (1986). Toward an understanding of the burnout phenomenon. *Journal of Applied Psychology, 71*(4), 630–640. https://doi.org/10.1037/0021–9010.71.4.630

Jackson, S. M., Hillard, A. L., & Schneider, T. R. (2014). Using implicit bias training to improve attitudes toward women in STEM. *Social Psychology of Education: An International Journal, 17*(3), 419–438. https://doi.org/10.1007/s11218–014–9259–5

Jacobsen, J., & Levin, L. (1995). Effects of intermittent labor force attachment on women's earnings. *Monthly Labor Review, 118*(9), 14–19. https://www.BLS.gov/opub/mlr/1995/09/art2full.pdf

James, R., Fisher, J. R. B., Carlos–Grotjahn, C., Boylan, M. S., Dembereldash, B., Demissie, M. Z., Diaz De Villegas, C., Gibbs, B., Konia, R., Lyons, K., Possingham, H., Robinson, C. J., Tang, T., & Butt, N. (2023). Gender bias and inequity holds women back in their conservation careers. *Frontiers in Environmental Science, 10,* 1–16. https://doi.org/10.3389/fenvs.2022.1056751

Jamshed, S. (2014). Qualitative research method–interviewing and observation. *Journal of Basic and Clinical Pharmacy*, *5*(4), 87–88. https://doi.org/10.4103/0976–0105.141942

Janssen, J., Seaton, E., Jager, J., & Miller, C. F. (2022). Guidance or gatekeeping: An audit examination of racial discrimination in leading STEM high schools: Systems that marginalize BIPOC youth special issue: Dismantling oppression series. *Journal of Research on Adolescence, 32*(2), 625–635. https://doi.org/10.1111/jora.12722

Jaschik, S. (2005). What Larry Summers said. *Inside Higher Ed News*. https://www.insidehighered.com/news/2005/02/18/what–larry–summers–said

Jauhar, J., & Lau, V. (2018). The ‘glass ceiling’ and women’s career advancement to top management: The moderating effect of social support. *Global Business Management. Research, 10*(1), 163–178. https://www.researchgate.net/profile/Junaimah-Jauhar/publication/329363389_Special_Issue_Global_Business_and_Management_Research/links/5c04d21392851c63cab6310a/Special-Issue-Global-Business-and-Management-Research.pdf

Jirschitzka, J., Oeberst, A., & Göllner, R. (2017). Inter–rater reliability and validity of peer reviews in an interdisciplinary field. *Scientometrics*, *113*, 1059–1092. https://doi.org/10.1007/s11192–017–2516–6

Joelle, J. (2023, February 27). Should nursing be recognized as a STEM profession? *Nurse Journal*. https://nursejournal.org/articles/nursing–stem–profession/

Johnson, E. (2020). *The impact of COVID–19 on women scientists from developing countries: Results from an OWSD member survey*. Organization for Women in Science for the Developing World. https://www.owsd.net/news/news-events/impact-covid-19-women-scientists-developing-countries-results-owsd-member-survey

Johnson, V. E., Nadal, K. L., Sissoko, D. R. G., & King, R. (2021). “It’s not in your head”: Gaslighting, ‘splaining, victim blaming, and other harmful reactions to microaggressions. *Perspectives on Psychological Science, 16*(5), 1024–1036. https://doi.org/10.1177/17456916211011963

Jones, A. L, & Stapleton, M. K. (2017). 1.2 million kids and counting: Mobile science laboratories drive student interest in STEM. *PLOS Biology,15*(5). e2001692. https://10.1371/journal.pbio.2001692

Jones, J. H. (1993). *Bad blood: The Tuskegee syphilis experiment*, (Rev. ed.). Free Press.

Joseph, J. (2014). Acculturation, not socialization, for African American females in the STEM fields. *Sociological Research Online, 19*(2), 1–8. https://doi.org/10.5153%2Fsro.3313

Judge, T., Piccolo, R., Podsakoff, N., Shaw, J., & Rich, B. (2010). The relationship between pay and job satisfaction: A meta-analysis of the literature. *Journal of Vocational Behavior, 77*(2), 157–167. https://doi.org/10.1016/j.jvb.2010.04.002.

Kaatz, A., Gutierrez, B., & Carnes, M. (2014). Threats to objectivity in peer review: The case of gender. *Trends in Pharmacological Sciences 35*, 371–373. https:/ doi.org/10.1016/j.tips

Kachchaf, R., Ko, L., Hodari, A., & Ong, M. (2015). Career–life balance for women of color: Experiences in science and engineering academia. *Journal of Diversity in Higher Education, 8*(3), 175–191. https://doi.org/10.1037/a0039068

Kahn, J. R., García–Manglano, J., & Bianchi, S. M. (2014). The motherhood penalty at midlife: Long–term effects of children on women’s careers. *Journal of Marriage and the Family, 76*(1), 56–72. https://doi.org/10.1111/jomf.12086

Kalender, Z. Y., Marshman, E., Schunn, C. D., Nokes–Malach, T., & Singh, C. (2020). Damage caused by women's lower self–efficacy on physics learning. *Physical Review Physics Education Research, 16*(1), 1–15. https://doi.org/10.1103/PhysRevPhysEducRes.16.010118

Kalev, A. (2014). How you downsize is who you downsize: Biased formalization, accountability, and managerial diversity. *American Sociological Review, 79*(1), 109–135. https://journals.sagepub.com/doi/10.1177/0003122413518553

Kalogrides, D., & Grodsky, E. (2011). Something to fall back on: Community colleges as a safety net. *Social Forces, 89*(3), 853–877. https://doi.org/10.1353/sof.2011.0019

Kalter, L. (December 6, 2018). (2018). *Women comprised more than half of applicants and enrollees in 2018.* Association of American Medical Colleges. https://www.aamc.org/news/medical–schools–are–becoming–more–diverse

Kant, I. (1929). *Critique of Pure Reason* (N. Kemp Smith, Trans.). Macmillan.

Kao, G. (1999). Chapter 8, psychological well-being and educational achievement among immigrant youth. In D.J. Hernandez (Ed.), *Children of immigrants: Health, adjustment, and public assistance* (pp. 410–478). National Academies Press. https://www.ncbi.nlm.nih.gov/books/NBK224432/

Karim, D. N. (2022). Linking dark triad traits, psychological entitlement, and knowledge hiding behavior. *Heliyon*, *8*(7), 1–7. https://doi.org/10.1016/j.heliyon.2022.e09815

Kashen, J., Glynn, S., & Novello, A. (2020). How COVID–19 sent women's workforce progress backward. Congress' $64.5 billion mistake. *The Center for American Progress.* https://www.americanprogress.org/article/covid–19–sent–womens–workforce–progress–backward/

Keashly, L., & Neuman, J. (2010). Faculty experiences with bullying in higher education: causes, consequences, and management. *Administrative Theory and Praxis*, *32*(1), 48–70. DOI:10.2753/ATP1084-1806320103

Keller, E. F. (1985). *Reflections on gender and science*. Yale University Press.

Kesar, S. (2017). *Why don't European girls like science or technology?* Department of Computer Science & Information Systems, Southern Utah University. https://news.microsoft.com/europe/features/dont–european–girls–like–science–technology/

Kesar, S. (2018). *Closing the STEM Gap*. Department of Computer Science & Information Systems, Southern Utah University. Study conducted in partnership with Microsoft. https://query.prod.cms.rt.microsoft.com/cms/api/am/binary/RE1UMWz

Ketchiwou, G. F., & Lineo, W. D. (2023). Examining the impact of gender discriminatory practices on women's development and progression at work. *Businesses, 3*(2), 347. https://doi.org/10.3390/businesses3020022

Khan, F., & Bhattacharya, S. (2022). A phenomenological study to understand gender diversity and inclusion in the tech industry. *Cardiometry,* (22), 386–394. https://doi.org/10.18137/cardiometry.2022.22.3863

Kim, J. Y., & Meister, A. (2023). Microaggressions, interrupted: The experience and effects of gender microaggressions for women in STEM. *Journal of Business Ethics*, *185*(3), 513–531 https://doi.org/10.1007/s10551–022–05203–0

Kim, S., Lee, H., & Connerton, T. P. (2020). How psychological safety affects team performance: Mediating role of efficacy and learning behavior. *Frontiers in Psychology*, *11*, 1–15. https://doi.org/10.3389/fpsyg.2020.01581

King, D. D., Fattoracci, E. S. M., Hollingsworth, D. W., Stahr, E., & Nelson, M. (2023). When thriving requires effortful surviving: Delineating manifestations and resource expenditure outcomes of microaggressions for Black employees. *Journal of Applied Psychology, 108*(2), 183. https://doi.org/10.1037/apl0001016

King, G., & Rothstein, M. (2010). Resilience and leadership: The self–management of failure. In M. Rothstein & R. J. Burke (Eds.), *Self–management and leadership development* (pp. 361–394). Edward Elgar Publishing Limited.

King, M. M., & Frederickson, M. E. (2021). The pandemic penalty: The gendered effects of COVID–19 on scientific productivity. *Socius*, *7*, 1–24. https://dx.doi.org/10.1177/23780231211006977]

Kite, M., Stockdale, G., Whitley, B., & Johnson B. (2005). Attitudes toward younger and older adults: An updated meta–analytic review. *Journal of Social Issues*, *61*(2), 241–266. DOI:10.1111/j.1540–4560.2005.00404.x

Klein, D. (2003). A brief history of American k–12 mathematics education in the 20th century. In J. Royer (Ed.), *Mathematical Cognition*. Information Age Publishing.

Kleissner, V., & Jahn, G. (2021). Implicit and explicit age cues influence the evaluation of job applications. *Journal of Applied Social Psychology, 51*(2), 107–120. https://doi.org/10.1111/jasp.12720

Kleist, V. F. (2015). Women in STEM careers: What is working well: International perspectives on increasing workforce participation, advancement and leadership. *Sex Roles*, *73*(5–6), 276–278. https://doi.org/10.1007/s11199–015–0522–9

Kleven, H., Landais, C., & Søgaard, J. E. (2019). Children and gender inequality: Evidence from Denmark. *American Economic Journal Applied Economics 11*(4),181–209. DOI:10.1257/app.20180010

Kley, S., & Reimer, T. (2023). Exploring the gender gap in teleworking from home. The roles of worker's characteristics, occupational positions and gender equality in Europe. *Social Indicators Research*, *168*(1–3), 185–206. https://doi.org/10.1007/s11205–023–03133–6

Klonoff, E., & Landrine, H. (1995). The schedule of sexist events: A measure of lifetime and recent sexist discrimination in women's lives. *Psychology of Women Quarterly*, *19*(4), 439–472. https://doi.org/10.1111/j.1471–6402.1995.tb00086.x

Klotz, A. C. (2021). *The great resignation: Why people are leaving their jobs in growing numbers.* National Public Radio. https://www.npr.org/2021/10/22/1048332481/the–great–resignation–why–people–are–leaving–their–jobs–in–growing–numbers

Kockelmans, J. J. (1967). *Phenomenology*. Doubleday.

Kölln, A. K., Ongena, Y. P., & Aarts, K. (2019). The effects of sampling frame designs on nonresponse and coverage error: Evidence from the Netherlands. *Journal of Survey Statistics and Methodology, 7*(3), 422–439. https://doi.org/10.1093/jssam/smy016

Kool, D., Azevedo, N., & Avraamidou, L. (2022). The lonely heroine: Portrayal of women scientists in films. *Educational Media International, 59*(2), 150-171. doi:10.1080/09523987.2022.2101205

Korbel, J. O., & Stegle, O. (2020). Effects of the COVID–19 pandemic on life scientists. *Genome Biology, 21*(113), 1–5. https://doi.org/10.1186/s13059–020–02031–1

Korn, M., Weber, L., & Fuller, A. (2022). *Data show gender pay gap opens early: Disparities among male and female college graduates appeared within three years*. Wall Street Journal. https://lib.pepperdine.edu/login?url=https://www.proquest.com/newspapers/data–show–gender–pay–gap–opens–early–disparities/docview/2699715042/se–2

Kostøl, K. B., & Remmen, K. B. (2022). A qualitative study of teachers' and students' experiences with a context–based curriculum unit designed in collaboration with STEM professionals and science educators. *Disciplinary and Interdisciplinary Science Education Research, 4*(26), 1–14. https://doi.org/10.1186/s43031–022–00066–x

Kozlowski, D., Larivière, V., Sugimoto, C. R., & Monroe–White, T. (2022). Intersectional inequalities in science. *PNAS*, *119*(2), 1–8. https://doi.org/10.1073/pnas.2113067119

Kraemer, P., Weilbächer, R., Mechera–Ostrovsky, T., & Gluth, S. (2022). Cognitive and neural principles of a memory bias on preferential choices. *Current Research in Neurobiology*, *3*(10029), 1–11. https://doi.org/10.1016/j.crneur.2022.100029

Kramer, A., & Kramer, K. Z. (2020). The potential impact of the COVID-19 pandemic on occupational status, work from home, and occupational mobility. *Journal of Vocational Behavior*, 119, 1–4. https://doi.org/10.1016/j.jvb.2020.103442

Kray, L., Kennedy, J., & Lee, M. (2023). Now, women do ask: A call to update beliefs about the gender pay gap. *Academy of Management Discoveries*, 10(1), 2168–1007 https://doi.org/10.5465/amd.2022.0021

Krebsbach, J. M. (2022). Women in academia: Representation, tenure, and publication patterns in the STEM and social sciences fields. *Journal of International Women's Studies, 24*(5), 1–15. https://vc.bridgew.edu/cgi/viewcontent.cgi?article=2934&context=jiws

Krekula, C. (2007). The intersection of age and gender: Reworking gender theory and social gerontology. *Current Sociology*, *55*(2), 155–171. https://doi.org/10.1177/0011392107073299

Kremer, H., Villamor, I., & Ormiston, M. (2019). Princess bee effect: The reverse queen bee phenomenon. *Academy of Management Proceedings, 2019*(1), 1-6. https://doi.org/10.5465/AMBPP.2019.253

Kubala, J. (2020). Teaching “bad feminism”: Mary Daly and the legacy of ‘70s lesbian–feminism. *Feminist Formations*, *32*(1), 117–136. https://doi.org/10.1353/ff.2020.0010

Kuenzi, J. (2008). *Science, technology, engineering, and mathematics (STEM) education: Background, federal policy, and legislative action*. CRS Report for Congress. https://www.everycrsreport.com/files/20080321_RL33434_55fae8cd5ac5f731ff64a4a28d1afe5c2c52e2b4.pdf

Kuroda, S., & Yamamoto, I. (2018). Good boss, bad boss, workers’ mental health and productivity: Evidence from Japan. *Japan and the World Economy, 48*, 106–118. https://doi.org/10.1016/j.japwor.2018.08.002.

Ladimer, L. (1957). Human experimentation: Medicolegal aspects. *New England Journal of Medicine*, *257*(1), 18–24. https://doi.org/10.1056/NEJM195707042570105

Lafkas, S. M., Christensen, M., & Madsen, S. R. (2023). The impact of COVID–19 on women and work: Career advancement challenges. *Merits*, 3(1), 167–185. https://doi.org/10.3390/merits3010011

Lafortune, L., Groleau, A., & Deschênes, C. (2022). *Manifesto about women in stem: 50 positive and impactful texts*. Éditions JFD Inc. https://www.proquest.com/legacydocview/EBC/30294052?accountid=13159

Lagacé, M., Anna, R. D., Van de Beeck, L., Bergeron, C. D., Rodrigues–Rouleau, P., & St–Amour, A. (2022). Testing the shielding effect of intergenerational contact against ageism in the workplace: A Canadian study. *International Journal of Environmental Research and Public Health*, *19*(8), 4866. https://doi.org/10.3390/ijerph19084866

Lahey, J. N., & Oxley, D. R. (2021). Discrimination at the intersection of age, race, and gender: Evidence from an eye–tracking experiment. *Journal of Policy Analysis and Management*, *40*(4), 1083–1119. https://onlinelibrary.wiley.com/doi/10.1002/pam.22281

Lallukka, T., Rahkonen, O., & Lahelma, E. (2011). Workplace bullying and subsequent sleep problems – the Helsinki Health Study. *Scandinavian Journal of Work, Environment & Health*, *37*(3), 204–212. http://www.jstor.org/stable/41151544

Lambert, S., & Henly, J. (2012). Frontline managers matter: Labour flexibility practices and sustained employment in US retail jobs. In C. Tilly, C. Warhurst, F. Carre, & P. Findlay (Eds.), *Are bad jobs inevitable? Trends, determinants and responses to job quality in the twenty-first century* (pp. 143–159). Palgrave Macmillan.

Landivar, L. (2013). *Disparities in STEM employment by sex, race, and Hispanic origin*. United States Census Bureau. https://www.census.gov/library/publications/2013/acs/acs–24.html

Landivar, L. C., Ruppanner, L., Scarborough, W. J., & Collins, C. (2020). Early signs indicate that COVID–19 is exacerbating gender inequality in the labor force. *Socius: Sociological Research for a Dynamic World*, *6*, 1–3. https://doi.org/10.1177/2378023120947997

Lane, T. B., Morgan, K., & Lopez, M. M. (2020). “A bridge between high school and college”: A case study of a STEM intervention program enhancing college readiness among underserved students. *Journal of College Student Retention: Research, Theory & Practice*, *22*(1), 155–179. https://doi.org/10.1177/1521025117729824

La Torre, G., De Leonardis, V., & Chiappetta, M. (2020). Technostress: How does it affect the productivity and life of an individual? Results of an observational study. *Public Health, 189*, 60–65. https://doi.org/10.1016/j.puhe.2020.09.013

Lave, J., & Wenger, E. (1998). *Communities of practice: Learning, meaning and identity*. Cambridge University Press.

Laverty, S. M. (2003). Hermeneutic phenomenology and phenomenology: A comparison of historical and methodological considerations. *International Journal of Qualitative Methods*, *2*(3), 21–35. https://doi.org/10.1177/160940690300200303

Law, F., McGuire, L., Winterbottom, M., & Rutland, A. (2021). Children's gender stereotypes in STEM following a one–shot growth mindset intervention in a science museum. *Frontiers in Psychology*, *12*, 1–10. https://doi.org/10.3389/fpsyg.2021.641695

Lawson, K. M., Barrineau, M., Woodling, C. M., Ruggles, S., & Largent, D. L. (2023). The impact of COVID–19 on U.S. computer science faculty's turnover intentions: The role of Gender. *Sex Roles, 88*(7–8), 383–396. https://doi.org/10.1007/s11199–023–01361–1

Lawson, K. M., Lee, S., Smith, C., & Thiem, K. C. (2024). Retaining U.S. STEM women faculty during the COVID-19 pandemic: The important role of family-supportive supervisor behaviors to lower work-to-life conflict. *Gender in Management, 39*(1), 52-70. https://doi.org/10.1108/GM-10-2022-0326

Leath, S., & Chavous, T. (2018). Black women's experiences of campus racial climate and stigma at predominantly white institutions: Insights from a comparative and within–group approach for STEM and non–STEM majors. *The Journal of Negro Education, 87*(2), 125–139. http://www.jstor.org/stable/10.7709/jnegroeducation.87.2.0125

Lederman, N., & Lederman, J. (2015). What is a theoretical framework? A practical answer. *Journal of Science Teacher Education 26*(7), 593–597. https://doi.org/10.1007/s10972–015–9443–2

Ledin, A., Bornmann, L., Gannon, F., & Wallon, G. (2007). A persistent problem: Traditional gender roles hold back female scientists. *EMBO reports*, *8*(11), 982–987. https://doi.org/10.1038/sj.embor.7401109

Lee, F. (2019). Asian American and Pacific Islander faculty and the bamboo ceiling: Barriers to leadership and implications for leadership development. *New Directions for Higher Education: Contemporary Issues Facing Asian Americans in Higher Education, 2019*(186), 1–102 https://doi.org/10.1002/he.20326

Lee, K., Mennerat, A., Lukas, D., Dugdale, H. L., & Culina, A. (2023). The effect of the COVID–19 pandemic on the gender gap in research productivity within academia. *eLife*, *12*(e85427), 1–18. https://doi.org/10.7554/eLife.85427

Lee, M. J., Collins, J. D., Harwood, S. A., Mendenhall, R., & Huntt, M. B. (2020). "If you aren't white, Asian or Indian, you aren't an engineer": Racial microaggressions in STEM education. *International Journal of STEM Education,7*(48), 1–16. https://doi.org/10.1186/s40594-020-00241-4

Lee, N. I. (2020). The pluralistic concept of the life–world and the various fields of the phenomenology of the life–world in Husserl. *Husserl Studies, 36,* 47–68. https://doi.org/10.1007/s10743–019–09254–6

Leu, K. (2017). *Beginning college students who change their majors within 3 years of enrollment.* National Center for Education Statistics. https://files.eric.ed.gov/fulltext/ED578434.pdf

Levesque–Lopman, L. (2000). Listen, and you will–hear: Reflections on interviewing from a feminist phenomenological perspective. In L. Fisher & L. Embree (Eds.), *Feminist Phenomenology*. *Contributions to Phenomenology* (Vol. 40). Springer. https://doi.org/10.1007/978–94–015–9488–2_7

Levitt, S. D. (2022). Rethinking math education. *Education Next, 22*(4), 66–71.

Lewis, K. L., Stout, J. G., Pollock, S. J., Finkelstein, N. D., & Ito, T. A. (2016). Fitting in or opting out: A review of key social–psychological factors influencing a sense of belonging for women in physics. *Physical Review. Physics Education Research, 12*(2), 1–10. https://doi.org/10.1103/PhysRevPhysEducRes.12.020110

Lewis, M. A., & Neighbors, C. (2005). Self–Determination and the use of self–presentation strategies. *The Journal of Social Psychology, 145*(4), 469–89. https://doi.org/10.3200/SOCP.145.4.469–490

Li, Y. L., Evans, K., & Bond, M. A. (2023). Allies as organizational change agents to promote equity and inclusion: A case study. *Equality, Diversity and Inclusion: An International Journal, 42*(1), 135–156. https://doi.org/10.1108/EDI–12–2021–0308

Lilienfeld, S. (2017). Microaggressions. *Perspectives on Psychological Science*. *12*(1), 138–169. https://www.jstor.org/stable/48591199

Lillard, A. (2018). Rethinking education: Montessori's approach. *Current Directions in Psychological Science, 27*(6), 395–400. https://doi.org/10.1177/0963721418769878

Lim, K., & Zabek, M. (2021). *Women's labor force exits during COVID19: Differences by motherhood, race, and ethnicity.* Finance and Economics Discussion Series 2021–067. Washington: Board of Governors of the Federal Reserve System, https://doi.org/10.17016/FEDS.2021.067

Lin, I. F., & Brown, S. L. (2021). The economic consequences of gray divorce for women and men. *The Journals of Gerontology. Series B, Psychological Sciences and Social Sciences*, *76*(10), 2073–2085. https://doi.org/10.1093/geronb/gbaa157

Linehan, M., & Scullion, H. (2008). The development of female global managers: The role of mentoring and networking. *Journal of Business Ethics*, *83*, 29–40. doi:10.1007/s10551–007–9657–0.

Linlin, L., Heidrun, S., & Subotnik, R. F. (2022). The influences of social agents in completing a STEM degree: An examination of female graduates of selective science high schools. *International Journal of STEM Education*, *9*(1). https://doi.org/10.1186/s40594-021-00324-w

Liu, X., Sha, Y., & Yu, X. (2022). The impact of developmental HR practices on career self-management and organizational citizenship behavior: A moderated mediation model. *Psychology Research and Behavior Management*, *15*, 1193–1208. https://doi.org/10.2147/PRBM.S355376

Loden, M. (1985). *Feminine leadership or how to succeed in business without being one of the boys*. Times Books.

Long, B. T., & Kurlaender, M. (2009). Do community colleges provide a viable pathway to a baccalaureate Degree? *Educational Evaluation and Policy Analysis*, *31*(1), 30–53. https://doi.org/10.3102/0162373708327756

Lopez, A., & Duran, P. (2021). *Implementation strategies for improving diversity in organizations: The role of mentoring on the retention of women from diverse backgrounds in STEM*. IGI Global Publishing. DOI:10.4018/978–1–7998–4745–8.ch010

Loumpourdi, M. (2023). Leadership development programs: Part of the solution or part of the problem of women's under–representation in leadership? *Gender in Management, 38*(5), 619–633. https://doi.org/10.1108/GM–01–2022–0017

Loveless, T. (2021a). *Between the state and the schoolhouse: Understanding the failure of common core* (Educational Innovations Series). Harvard Education Press.

Loveless, T. (2021b). *Why Common Core failed?* Brookings Institute. https://www.brookings.edu/articles/why-common-core-failed/

Luborsky, M. R., & Rubinstein, R. L. (1995). Sampling in qualitative research: Rationale, issues. and methods. *Research on Aging, 17*(1), 89–113. https://doi.org/10.1177/0164027595171005

Luff, D. (1999). Dialogue across the divides: Moments of rapport; and power in feminist research with anti–feminist women. *Sociology 33*(4), 687–703. https://doi.org/10.1177/S0038038599000437

Luhr, S. (2023). We're better than most: Diversity discourse in the San Francisco Bay area tech industry. *Journal of Social Problems*. https://doi.org/10.1093/socpro/spad014

Lundberg, P. (2011). *Women and mental disorders*. Praeger.

Luo, T., So, W., & Wan, Z. (2021). STEM stereotypes predict students' STEM career interest via self–efficacy and outcome expectations. *International Journal of STEM Education* 8(36), 1–13. https://doi.org/10.1186/s40594–021–00295–y

Lwamba, E., Shisler, S., Ridlehoover, W., Kupfer, M., Tshabalala, N., Nduku, P., Langer, L., Grant, S., Sonnenfeld, A., Anda, D., Eyers, J., & Snilstveit, B. (2022). Strengthening women's empowerment and gender equality in fragile contexts towards peaceful and inclusive societies: A systematic review and meta-analysis. *Campbell systematic reviews*, *18*(1), e1214. https://doi.org/10.1002/cl2.1214

Ma, Y., & Savas, G. (2014). Which is more consequential: Field of study or institutional selectivity? *Review of Higher Education 37*(2), 221–47. 10.1353/rhe.2014.0001

MacDonald, B. L., Tofel–Grehl, C., & Searle, K. A. (2022). Play, problem–solving, STEM conceptions, and efficacy in STEM: An introduction to STEM in early childhood education special issue. *Education Sciences, 12*(5), 352. https://doi.org/10.3390/educsci12050352

MacDonald, S., & Headlam, N. (2008). Research methods handbook: Introductory guide to research methods for social research. Centre for Local Economic Strategies.

Machovec, C. (2023, March 15). Working women: Data from the past, present and future report. *U.S. Department of Labor*. https://blog.dol.gov/2023/03/15/working-women-data-from-the-past-present-and-future#:~:text=For%20all%20women%2C%20the%20projected,increase%20of%202%2C309%2C000%20or%2013.2%25

Madhusudhanan, S., & Thomas, R. (2021). An investigation of the impact of occupational stress on mental health of remote working women IT professionals in urban Bangalore, India. *Journal of International Women's Studies, 22*(6), 139–149. https://vc.bridgew.edu/cgi/viewcontent.cgi?article=2488&context=jiws

Madrid, H. P., Barros, E., & Vasquez, C. (2020). The emotion regulation roots of job satisfaction. *Frontiers in Psychology, 11*, 609933, 1-8. https://www.frontiersin.org/journals/psychology/articles/10.3389/fpsyg.2020.609933

Malani, P., Kullgren, J., Solway, E., Ober Allen, J., Singer, D., & Kirch, M. (2020). *National poll on healthy aging: Everyday ageism and health*. Institute for Policy and Healthcare Innovation, University of Michigan. https://deepblue.lib.umich.edu/bitstream/handle/2027.42/156038/0192_NPHA–ageism–report_FINAL–07132020.pdf?sequence=3&isAllowed=y

Malcom, L. E., & Dowd, A. C. (2012). The impact of undergraduate debt on the graduate school enrollment of STEM baccalaureates. *The Review of Higher Education, 35*(2), 265–305. https://doi.org/10.1353/rhe.2012.0007

Malik, M. S., Sattar, S., & Yaqub, R. M. S. (2018). Mediating role of psychological contract breach between workplace bullying, organizational commitment & employee turnover intentions. *Pakistan Journal of Commerce and Social Sciences, 12*(3), 935–952. https://www.econstor.eu/bitstream/10419/193454/1/4322.pdf

Malinen, S., & Johnston, L. (2013). Workplace ageism: Discovering hidden bias. *Experimental Aging Research, 39*(4), 445–465. https://doi.org/10.1080/0361073X.2013.808111

Maloy, J., Kwapisz, M. B., & Hughes, B. E. (2022). Factors influencing retention of transgender and gender nonconforming students in undergraduate STEM majors. *CBE - Life Sciences Education*, *21*(1), 1-13. https://doi.org/10.1187/cbe.21-05-0136

Maltby, J. L., Brooks, C., Horton, M., & Morgan, H. (2016). Long-term benefits for women in a science, technology, engineering, and mathematics living–learning community. *Learning Communities Research and Practice, 4*(1), 1–19. https://files.eric.ed.gov/fulltext/EJ1112850.pdf

Manchester, C. F. (2012). General human capital and employee mobility: How tuition reimbursement increases retention through sorting and participation. *Industrial and Labor Relations Review, 65*(4), 951-974. ISSN: 0019-7939.

Mann, A., & DiPrete, T. (2013). Trends in gender segregation in the choice of science and engineering majors. *Social Science Research 42*(6), 1519–1541. https://doi.org/10.1016/j.ssresearch.2013.07.002

Maria, J. D. L. R., Aparicio, E. M., Park, H. J., Oseguera, L., & Conchas, G. Q. (2023). Applying a STEM engagement framework to examine short–term retention of Latinx and other underrepresented groups in an undergraduate STEM scholar program. *Journal of Leadership, Equity, and Research, 9*(1), 21–54. https://files.eric.ed.gov/fulltext/EJ1379309.pdf

Marín–Spiotta, E., Barnes, R. T., Berhe, A., Hastings, M. G., Mattheis, A., Schneider, B., & Williams, B. M. (2020). Hostile climates are barriers to diversifying the geosciences. *Advances in Geosciences*, *53*, 117–127. https://doi.org/10.5194/adgeo–53–117–2020

Markovic, M., & Plickert, G. (2023). The gender pay gap and high–achieving women in the legal profession. *Law & Social Inquiry*, *48*(2), 561–592. https://doi.org/10.1017/lsi.2022.7

Marcus, M., Tõugu, P., Haden, C. A., & Uttal, D. H. (2021). Advancing opportunities for children's informal STEM learning transfer through parent–child narrative reflection. *Child Development*, *92*(5), 1075–1084. https://doi.org/10.1111/cdev.13641

Marshall, A. (2022). The role of mentoring in promoting diversity equity and inclusion in STEM education and research. *Pathogens and Disease*, *80*(1), 1–7. https://doi.org/10.1093/femspd/ftac019

Martin, J. (2003). *Feminist theory and critical theory: Unexplored synergies*. In M. Alvesson & H. Willmott (Eds.), *Studying management critically* (pp. 66–91). Sage Publications.

Martin, J. (2021, April 19). *Homeworking hours, rewards and opportunities in the UK: 2011-2020*. Office for National Statistics. https://www.ons.gov.uk/employmentandlabourmarket/peopleinwork/labourproductivity/articles/homeworkinghoursrewardsandopportunitiesintheuk2011to2020/2021-04-19

Martin, K. C. (2013, October 9). The rise of the portmanbro. In *Oxford dictionaries*. Retrieved February 5, 2024. https://web.archive.org/web/20140407090803/http://blog.oxforddictionaries.com/2013/10/the-rise-of-the-portmanbro/

Martinez, A., & Christnacht, C. (2021, January 26). *Women making gains in STEM occupations but still underrepresented*. United States Census Bureau. https://www.census.gov/library/stories/2021/01/women–making–gains–in–stem–occupations–but–still–underrepresented.html

Martínez–Fierro, S., & Lechuga-Sancho, M. P. (2021). Descriptive elements and conceptual structure of glass ceiling research. *International Journal of Environmental Research and Public Health*, *18*(15), 8011. https://doi.org/10.3390/ijerph18158011

Martínez-Mesa, J., González-Chica, D. A., Duquia, R. P., Bonamigo, R. R., & Bastos, J. L. (2016). Sampling: How to select participants in my research study?. *Anais Brasileiros de Dermatologia*, *91*(3), 326–330. https://doi.org/10.1590/abd1806-4841.20165254

Maslow, A. H. (1943). A theory of human motivation. *Psychological Review, 50*(4), 370–396. https://doi.org/10.1037/h0054346

Maslow, A. H. (1964). *Religions, values, and peak–experiences.* Ohio State University Press.

Mason, M. (2010). Sample size and saturation in PhD studies using qualitative interviews. *Forum Qualitative Social Health Research*, *11*(3), 1–20. https://doi.org/10.17169/fqs-11.3.1428

Mason, M. A., & Goulden, M. (2002). Do babies matter? The effect of family formation on the lifelong careers of academic men and women. *Academe*, *88*(6), 21–27. https://doi.org/10.2307/40252436

Masser, B. M., & Abrams, D. (2004). Reinforcing the glass ceiling: The consequences of hostile sexism for female managerial candidates. *Sex Roles*, *51*(9–10), 609–615. https://doi.org/10.1007/s11199–004–5470–8

Master, A., Cheryan, S., & Meltzoff, A. (2014). Reducing adolescent girls' concerns about STEM stereotypes: When do female teachers matter? *Revue Internationale de Psychologie Sociale*, *27*(3–4), 79–102. https://www.cairn.info/revue—2014–3–page–79.htm.

Master, A., Cheryan, S., & Meltzoff, A. (2016). Computing whether she belongs: Stereotypes undermine girls' interest and sense of belonging in computer science. *Journal of Educational Psychology, 108*(3), 424–437. https://doi.org/10.1037/edu0000061

Master, A., Cheryan, S., Moscatelli, A., & Meltzoff, A. N. (2017). Programming experience promotes higher STEM motivation among first-grade girls. *Journal of Experimental Child Psychology, 160*, 92–106. doi:10.1016/j.jecp.2017.03.013

Mastroianni, A., Faden, R., & Federman, D. (Eds) (1994). *Women and health research: Ethical and legal issues of including women in clinical studies* (Vol. 1). Committee on Ethical and Legal Issues Relating to the Inclusion of Women in Clinical Studies, Institute of Medicine. The National Academies Press. https://doi.org/10.17226/2304

Mattheis, A., Marín–Spiotta, E., Nandihalli, S., Schneider, B., & Barnes, R. T. (2022). "Maybe this is just not the place for me:" Gender harassment and discrimination in the geosciences. *PLoS One, 17*(5), 1–21. https://doi.org/10.1371/journal.pone.0268562

Maume, D. J., Jr. (1999). Glass ceilings and glass escalators. Occupational segregation and race and sex differences in managerial promotions. *Work and Occupations: An International Sociological Journal, 26*(4), 483–509. DOI:10.1177/0730888499026004005

Mavin, S. (2008). Queen bees, wannabes, and afraid to bees: No more "best enemies" for women in management. *British Journal of Management, 19*, S75-S84. DOI:10.1111/j.1467-8551.2008.00573.x

Maxwell, J. (1996). *Qualitative research design, an interactive approach*. Sage Publications.

Maxwell, J. (2013). *Qualitative research design, an interactive approach*. Sage Publications.

Mayeri, S. (2023). The intersectional origins of modern feminist legal advocacy. *Yale Journal of Law and Feminism, 34*(2), 1–8. https://openyls.law.yale.edu/bitstream/handle/20.500.13051/18242/6.pdf?sequence=1&isAllowed=y

Mays, N., & Pope, C. (1996). *Qualitative research in health care.* BMJ Publishing Group.

McCarty, M., Kelly, J., & Williams, K. (2022). The impact of fleeting exposure to female exemplars of success in STEM. *Group Processes & Intergroup Relations, 25*(2), 474–488. https://doi.org/10.1177/1368430220975475

McCluney, C., Durkee, M., Smith, R., Robotham, K., & Sai–Lai Lee, S. (2021). To be, or not to be…Black: The effects of racial codeswitching on perceived professionalism in the workplace. *Journal of Experimental Social Psychology, 97*, 104199. https://doi.org/10.1016/j.jesp.2021.104199

McCullough, L. (2020). Barriers and assistance for female leaders in academic STEM in the US. *Education Sciences, 10*(264), 1–13. https://files.eric.ed.gov/fulltext/EJ1272706.pdf

McGee, E. O., Botchway, P. K., Naphan–Kingery, D. E., Brockman, A. J., Houston, S., & White, D. T. (2022). Racism camouflaged as impostorism and the impact on Black STEM doctoral students. *Race Ethnicity and Education, 25*(4), 487–507. https://doi.org/10.1080/13613324.2021.1924137

McGee, E. O., White, D. T., Jenkins, A. T., Houston, S., Bentley, L. C., Smith, W. J., & Robinson, W. H. (2016), Black engineering students' motivation for PhD attainment: Passion plus purpose. *Journal for Multicultural Education, 10*(20), 167–193. https://doi.org/10.1108/JME–01–2016–0007

McGrath, C., Palmgren, P. J., & Liljedahl, M. (2019). Twelve tips for conducting qualitative research interviews. *Med Teach, 41*(9), 1002–1006. https://doi.org/10.1080/0142159X.2018.1497149

McHugh, M. L. (2012). Interrater reliability: The kappa statistic. *Biochemia Medica, 22*(3), 276–282. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3900052/

McLaughlin, H., Uggen, C., & Blackstone, A. (2012). Sexual harassment, workplace authority, and the paradox of power. *American Sociological Review,* 77(4), 625–647.

McLean, M., Nation, J. M., Spina, A., Susko, T., Harlow, D., & Bianchini, J. (2020). The importance of collaborative design for narrowing the gender gap in engineering: An analysis of engineering identity development in elementary students. *Journal of Pre–College Engineering Education Research, 10*(2), 15–34. https://doi.org/10.7771/2157–9288.1210

McLeod, J. (2021, March 11). *Understanding racial terms and differences.* National Institute of Health. https://www.edi.nih.gov/blog/communities/understanding–racial–terms–and–differences

McNulty, Y., McPhail, R., Inversi, C., Dundon, T., & Nechanska, E. (2018). Employee voice mechanisms for lesbian, gay, bisexual and transgender expatriation: The role of Employee-Resource Groups (ERGs) and allies. *The International Journal of Human Resource Management*, *29*(5), 829–856. https://doi.org/10.1080/09585192.2017.1376221

McPherson, M., Smith-Lovin, L., & Cook, J. M. (2001). Birds of a feather: Homophily in social networks. *Annual Review Sociology,* 27, 415–444.

McRobbie, A. (1982). The politics of feminist research: Between talk, text and action. *Feminist Review, 12*(1), 46–57. https://doi.org/10.1057/fr.1982.29

Melaku, T. (2019). *You don't look like a lawyer: Black women and systemic gendered racism.* Rowman & Littlefield Publishers.

Melfi, T. (Director), & Schroeder, A. (Co–writer). (2016). *Hidden figures* [Film]. Fox 2000 Pictures, Chernin Entertainment, Levantine Films.

Melidona, D., Benjamin, G. C., Cassell, A., & Chessman, H. (2023). *The American college president: 2023 edition.* American Council on Education. https://www.acenet.edu/Documents/American–College–President–IX–2023.pdf

Merleau-Ponty, M. (1962). *Phenomenology of perception.* Routledge.

Merriam, S. B., & Tisdell, E. J. (2009). *Qualitative research: A guide to design and implementation*. Wiley.

Merritt, S. K., Hitti, A., Van Camp, A. R., Shaffer, E., Sanchez, M. H., & O'Brien, L. T. (2021). Maximizing the impact of exposure to scientific role models: Testing an intervention to increase science identity among adolescent girls. *Journal of Applied Social Psychology, 51*(7), 667–682. https://doi.org/10.1111/jasp.12774

Mervis, J. (2010). Better intro courses seen as key to reducing attrition of STEM majors. *Science*, *330*, 306. https://doi.org/10.1126/science.330.6002.306

Meza, E. A. (2020). *Growth in enrollment and completion of STEM community college baccalaureate degrees in Washington state* (Data note 6. New baccalaureate series). Community College Research Initiatives. https://files.eric.ed.gov/fulltext/ED608175.pdf

Miall, N., Francis, S. C., Stöckl, H., & Tucker, J. D. (2023). Working from home and intimate partner violence among cis–women during the COVID–19 pandemic: Evidence from a global, cross–sectional study. *BioMed Central Public Health Journal, 23*, 1–12. https://doi.org/10.1186/s12889–023–15785–7

Michelmore, K., & Sassler, S. (2016). Explaining the gender wage gap in STEM: Does field sex composition matter? *The Russell Sage Foundation Journal of the Social Sciences*, *2*(4), 194–215. https://doi.org/10.7758/rsf.2016.2.4.07

Miegroet, H., Glass, C., Callister, R., & Sullivan, K. (2019). Unclogging the pipeline: advancement to full professor in academic STEM. *Equality, Diversity and Inclusion: An International Journal, 38*(2), 246–264. https://doi.org/10.1108/EDI–09–2017–0180

Miles, M. L., Brockman, A. J., & Naphan–Kingery, D. (2020). Invalidated identities: The disconfirming effects of racial microaggressions on Black doctoral students in STEM. *Journal of Research in Science Teaching, 57*(10), 1608–1631. https://doi.org/10.1002/tea.21646

Miles, M., & Huberman, A. (1994). *An expanded sourcebook: Qualitative data analysis, 2nd ed*. Sage Publications.

Miller, K., & Vagins, D. (2018). *The simple truth about the gender pay gap*. American Association of University Women.

Miller, R. A., Vaccaro, A., Kimball, E. W., & Forester, R. (2021). "It's dude culture": Students with minoritized identities of sexuality and/or gender navigating STEM majors. *Journal of Diversity in Higher Education, 14*(3), 340–352. https://doi.org/10.1037/dhe0000171

Miller, T. (2018). Developing numeracy skills using interactive technology in a play–based learning environment. *International Journal of STEM Education, 5*(1), 1–11. https://doi.org/10.1186/s40594–018–0135–2

Mills, J., & Birks, M. (2014). *Qualitative methodology: A practical guide*. Sage Publications. http://dx.doi.org/10.4135/9781473920163

Milne, M. J., & Adler, R. W. (1999). Exploring the reliability of social and environmental disclosures content analysis. *Accounting, Auditing & Accountability Journal, 12*(2), 237–256. DOI:10.1108/09513579910270138

Miner, K. N., January, S. C., Dray, K. K., & Carter–Sowell, A. (2019). Is it always this cold? Chilly interpersonal climates as a barrier to the well–being of early–career women faculty in STEM. *Equality, Diversity and Inclusion: An International Journal, 38*(2), 226–245. https://doi.org/10.1108/EDI–07–2018–0127

Minnotte, K. L., & Pedersen, D. E. (2021). Turnover intentions in the STEM fields: The role of departmental factors. *Innovative Higher Education, 46*(1), 77–93. https://doi.org/10.1007/s10755–020–09524–8

Mishra, P. K., Mishra, S. K., & Sarangi, M. K. (2020). Do women's advancement and gender parity promote economic growth? Evidence from 30 Asian countries. *Millennial Asia*, *11*(1), 5–26. https://doi.org/10.1177/0976399619900603

Mitchell, A., Lott, K. H., & Tofel–Grehl, C. (2022). Cookie-jar alarms: An analysis of first–grade students' gendered conceptions of engineers following a programming design task. *Education Sciences*, *12*(110), 1–19. https://doi.org/10.3390/educsci12020110

Mkwizu, N. (2023). The role of manager on employee's satisfaction in an organization: A case of Mount Meru university and Arusha Institute of Accountancy. *Asian Journal of Education and Social Studies*, *41*, 44–52. https://hal.science/hal-04038600/document

Moakler, M., & Kim, M. (2014). College major choice in STEM: Revisiting confidence and demographic factors. *Career Development Quarterly*, *62*(2), 128–142. https://doi.org/10.1002/j.2161–0045.2014.00075.x

Moen, P., Kelly, E. L., Fan, W., Lee, S. R., Almeida, D., Kossek, E. E., & Buxton, O. M. (2016). Does a flexibility/support organizational initiative improve high–tech employees' well–being? Evidence from the work, family, and health network. *American Sociological Review*, *81*(1), 134–164. https://doi.org/10.1177/0003122415622391

Moghe, S., Baumgart, K., Shaffer, J. J., & Carlson, K. A. (2021). Female mentors positively contribute to undergraduate STEM research experiences. *PloS One, 16*(12), 1–19. https://doi.org/10.1371/journal.pone.0260646

Mohanty, J. (1997). *Phenomenology: Between essentialism and transcendental philosophy.* Northwestern University Press.

Mokgolo, M., & Barnard, A. (2019). Buridan's ass syndrome: Dilemma of the human resources practitioner in workplace bullying. *SA Journal of Human Resource Management, 17*(0), 1–11. https://doi.org/10.4102/sajhrm.v17i0.1124

Montessori, M. (1912). *The Montessori method: Scientific pedagogy as applied to child education in 'The childhood houses'* (A. George. Trans.). Frederick A. Stokes Company.

Montoya, S. L., & Kew, K. (2020). Latina superintendents in New Mexico and their glass ceilings. *School Leadership Review, 15*(1), 1–25. https://files.eric.ed.gov/fulltext/EJ1283356.pdf

Moon, M. (2009). The history and role of institutional review boards: A useful tension. *Virtual Mentor, 11*(4), 311–316. DOI:10.1001/virtualmentor.2009.11.4.pfor1–0904

Morales, A., Walker, C. L., Carroll–Smith, D. L, & Burt, M. A. (2021). Code–switching and assimilation in STEM culture, *Eos, 102*. https://doi.org/10.1029/2021EO161232.

Moreno, V. (2002). Validity issues in phenomenological research; Bridging theory and practice in a study of IT-driven radical organizational change. AMCIS 2002 Proceedings. 241. http://aisel.aisnet.org/amcis2002/241

Morse, J. M. (1995). The significance of saturation. *Qualitative Health Research, 5*(2), 147–149. DOI:10.1177/104973239500500201

Morse, J. M., Barrett, M., Mayan, M., Olson, K., & Spiers, J. (2002). Verification strategies for establishing reliability and validity in qualitative research. *International Journal of Qualitative Methods, 1*(2), 1–19. https://sites.ualberta.ca/~iiqm/backissues/1_2Final/pdf/morseetal.pdf

Mosadeghrad, A. M., & Ferdosi, M. (2013). Leadership, job satisfaction and organizational commitment in healthcare sector: Proposing and testing a model. *Materia Socio-medica*, *25*(2), 121–126. https://doi.org/10.5455/msm.2013.25.121-126

Moser, A., & Korstjens, I. (2018). Series: Practical guidance to qualitative research. Part 3: Sampling, data collection and analysis. *The European Journal of General Practice*, *24*(1), 9–18. https://doi.org/10.1080/13814788.2017.1375091

Moss, J. (2019). *Disrupting the tech profession's gender gap*. Society for Human Resources Management. https://www.shrm.org/hr–today/news/all–things–work/pages/disrupting–the–tech–profession–gender–gap.aspx

Moss, S., & Mahmoudi, M. (2021). STEM the bullying: An empirical investigation of abusive supervision in academic science. *Eclinical Medicine, 40*(101121), 1–11. http://dx.doi.org/10.2139/ssrn.3850784

Moss-Racusin, C., Sanzari, C., Caluori, N., & Rabasco, H. (2018). Gender bias produces gender gaps in STEM engagement. *Sex Roles, 79*(11–12), 651–670. https://doi.org/10.1007/s11199–018–0902–z

Moustakas, C. (1994). *Phenomenological research methods*. Sage Publications

Moyser, M. (2019). *Measuring and analyzing the gender pay gap: A conceptual and methodological overview*. Statistics Canada. https://www150.statcan.gc.ca/n1/pub/45–20–0002/452000022019001–eng.htm

Msosa, S. K., Ntshangase, B. A., & Mlambo, C. (2022). Gender parity among researchers in science, technology, engineering and mathematics. *Entrepreneurship and Sustainability Issues, 9*(4), 243–261. https://doi.org/10.9770/jesi.2022.9.4(13)

Mues, A., Birtwistle, E., Wirth, A., & Frank, N. (2021). Parental (STEM) occupations, the home numeracy environment, and kindergarten children's numerical competencies. *Education Sciences, 11*(12), 819. https://doi.org/10.3390/educsci11120819

Mulcahy, M., & Linehan, C. (2014). Females and precarious board positions: Further evidence of the glass cliff. *British Journal of Management, 25*(3), 425– 438. https://doi.org/10.1111/1467–8551.12046

Mulvey, K., Mathews, C., Knox, J., Joy, A., & Cerda–Smith, J. (2022). The role of inclusion, discrimination, and belonging for adolescent science, technology, engineering and math engagement in and out of school. *Journal of Research in Science Teaching, 59*(8), 1447–1464. https://doi.org/10.1002/tea.21762

Mulvey, K., Cerda–Smith, J., Joy, A., Mathews, C., & Ozturk, E. (2023). Factors that predict adolescents' engagement with STEM in and out of school. *Psychology in the Schools*, 60(9), 3648–3665. https://doi.org/10.1002/pits.22946

Mumporeze, N. (2020). "When a mother is employed, her children suffer": A quantitative analysis of factors influencing attitudes towards women's employment and gender roles in Rwanda. *Journal of International Women's Studies, 21*(1), 47–67. https://vc.bridgew.edu/jiws/vol21/iss1/5

Murphy, M., Callander, J. K., Dohan, D., & Grandis, J. R. (2021). Women's experiences of promotion and tenure in academic medicine and potential implications for gender disparities in career advancement: A qualitative analysis. *JAMA Network Open*, 4(9), e2125843. DOI:10.1001/jamanetworkopen.2021.25843

Murphy, M. C., Steele, C. M., & Gross, J. J. (2007). Signaling threat: How situational cues affect women in math, science, and engineering settings. *Psychological Science, 18*(10), 879–885. https://doi.org/10.1111/j.1467–9280.2007.01995.x

Mussida, C., & Patimo, R. (2021). Women's family care responsibilities, employment and health: A tale of two countries. *Journal of Family and Economic Issues*, *42*(3), 489–507. https://doi.org/10.1007/s10834–020–09742–4

Mydam, J., David, R. J., Rankin, K. M., & Collins, J. W. (2019). Low birth weight among infants born to Black Latina women in the United States. *Maternal and Child Health Journal*, *23*(4), 538–546. https://doi.org/10.1007/s10995–018–2669–9

Myers, K. R., Tham, W. Y., & Yin, Y. (2020). Unequal effects of the COVID–19 pandemic on scientists. *Nature Human Behavior*, *4*, 880–883. https://doi.org/10.1038/s41562–020–0921–y

Nadal, K. L., Whitman, C. N., Davis, L. S., Erazo, T., & Davidoff, K. C. (2016). Microaggressions toward lesbian, gay, bisexual, transgender, queer, and genderqueer people: A review of the literature. *Journal of Sex Research*, *53*(4–5), 488–508. https://doi.org/10.1080/00224499.2016.1142495

Nadella, S. (2014). *Hit refresh. Employee edition*. Harper.

Nam, S., Jeon, S., Lee, S., Ash, G., Nelson, L., & Granger, D. (2022). Real–time racial discrimination, affective states, salivary cortisol and alpha–amylase in Black adults. *PLoS One 17*(9), 1–16. https://doi.org/10.1371/journal.pone.0273081

Nash, M., Davies, A., & Moore, R. (2017). What style of leadership do women in STEMM fields perform? Findings from an international survey. *PLoS One, 12*(10), 1–16. https://doi.org/10.1371/journal.pone.0185727

Nash, M., Grant, R., Moore, R., & Winzenberg, T. (2021). Male allyship in institutional STEM gender equity initiatives. *PLoS One*, *16*(3), 1–16. https://doi.org/10.1371/journal.pone.0248373

Nation, M., & Muller, J. (2023). Empowering high school girls in a university–led STEM summer camp. *Journal of STEM Outreach*, 6(1), 1–14. https://doi.org/10.15695/jstem/v6i1.09

National Academy of Sciences. (2007). *Beyond bias and barriers: Fulfilling the potential of women in academic science and engineering*. The National Academies Press. https://nap.nationalacademies.org/catalog/11741/beyond-bias-and-barriers-fulfilling-the-potential-of-women-in

National Academy of Sciences. (2011). *Expanding underrepresented minority participation: America's science and technology talent at the crossroads*. The National Academies Press. http://hdl.voced.edu.au/10707/173219.

National Academies of Sciences, Engineering, and Medicine. (2016). *Barriers and opportunities for 2–Year and 4–Year STEM degrees: Systemic change to support students' diverse pathways*. The National Academies Press. https://doi.org/10.17226/21739

National Academies of Sciences, Engineering, and Medicine. (2018). *English learners in STEM subjects: Transforming classrooms, schools, and lives*. The National Academies Press. https://doi.org/10.17226/25182.

National Academies of Sciences, Engineering, and Medicine. (2019). Policy and global affairs. board on higher education and workforce. Committee on effective mentoring in STEMM, In: *The science of effective mentorship in STEMM*. Dahlberg ML, Byars-Winston A, (Eds). National Academies Press.

National Academies of Sciences, Engineering, and Medicine. (2020). *Promising practices for addressing the underrepresentation of women in science, engineering, and medicine: Opening doors*. The National Academies Press. https://doi.org/10.17226/25585

National Academies of Sciences, Engineering, and Medicine. (2022). U*nderstanding the aging workforce: Defining a research agenda*. Division of Behavioral and Social Sciences and Education; Committee on National Statistics; Committee on Population; Committee on Understanding the Aging Workforce and Employment at Older Ages. T. Becker & S.T. Fiske (Eds). National Academies Press (US); 2022 May 5. 6, Age Discrimination, One Source of Inequality. Available from: https://www.ncbi.nlm.nih.gov/books/NBK588538/

National Academies of Sciences, Engineering, and Medicine, Policy and Global Affairs, Committee on Women in Science, Engineering, and Medicine, Committee on the Impacts of Sexual Harassment in Academia. (2018). Benya, F. F., Widnall, S. E., & Johnson, P. A. (Eds.). S*exual harassment of women: Climate, culture, and consequences in academic sciences, engineering, and medicine*. National Academies Press.

National Center for Education Statistics. (2017). *Percentage of 2011–12 first time postsecondary students who had ever declared a major in an associate's or bachelor's degree program within 3 years of enrollment, by type of degree program and control of first institution: 2014*. Institute of Education Sciences, U.S. Department of Education. https://nces.ed.gov/datalab/tableslibrary/viewtable.aspx?tableid=11764

National Center for Education Statistics. (2019). Table 303.60. *Total Fall enrollment in degree–granting postsecondary institutions, by level of enrollment, sex of student, level and control of institution, and attendance status of student: 2018*. In Digest of Education Statistics. Retrieved August 18, 2023, from https://nces.ed.gov/programs/digest/d19/tables/dt19_303.60.asp

National Center for Education Statistics. (2022). *College affordability views and college enrollment* (NCES–2022–57). U.S. Department of Education. https://nces.ed.gov/pubs2022/2022057/index.asp

National Center for Education Statistics. (2023). *NAEP long–term trend assessment results: Reading and Mathematics*. U.S. Department of Education. https://www.nationsreportcard.gov/highlights/ltt/2023/

National Defense Education Act. (1958). *New math*. School Mathematics Study Group and National Science Foundation.

National Institute of Health. (2022). *Definition of employee resource group*. https://www.edi.nih.gov/people/resources/employee–resource–groups

National Intelligence Council's Strategic Futures Group. (2021). *The future of women's rights.* Director of National Intelligence. https://www.dni.gov/files/images/globalTrends/GT2040/NIC_2021–02488_Future_of_Womens_Rights_18nov21_UNSOURCED.pdf

National Library of Medicine, Profiles in Science. (n.d.). *Barbara McClintock.* https://profiles.nlm.nih.gov/spotlight/ll/feature/biographical–overview

National Science Board. (2016). *Science and engineering indicators 2016* (NSB–2016–1). National Science Foundation.

National Science Board. (2018). *Science and engineering indicators 2018* (NSB–2018–1). National Science Foundation. https://www.nsf.gov/statistics/indicators/

National Science Foundation. (2015). *Women, minorities, and persons with disabilities in science and engineering*. National Center for Science and Engineering Statistics. www.nsf.gov/statistics/2015/nsf15311/nsf15311.pdf

National Science Foundation. (2017). *Women, minorities, and persons with disabilities in science and engineering report*. National Center for Science and Engineering Statistics. www.nsf.gov/news/news_summ.jsp?org=NSF&cntn_id=190946&preview=false

National Science Foundation. (2021). *Diversity and STEM: Women, minorities, and people with disabilities report*. National Center for Science and Engineering Statistics. https://ncses.nsf.gov/pubs/nsf23315/report/introduction

National Science Foundation. (2022). *The state of U.S. science and engineering: U.S. S&E workforce*. National Center for Science and Engineering Statistics. https://ncses.nsf.gov/pubs/nsb20221/u–s–and–global–stem–education–and–labor–force

National Science Foundation. (2023). *Diversity and STEM: Women, minorities, and people with disabilities report*. National Center for Science and Engineering Statistics. https://ncses.nsf.gov/pubs/nsf23315/

Nazir, T., & Bt Ungku, U. N. (2016). Interrelationship of incivility, cynicism and turnover intention. *International Review of Management and Marketing, 6*(1), 146–154. https://www.econjournals.com/index.php/irmm/article/view/1797

Neidlinger, S. M., Felfe, J., & Schübbe, K. (2023). Should I stay or should I go (to the office)? Effects of working from home, autonomy, and core self–evaluations on leader health and work-life balance. *International Journal of Environmental Research and Public Health, 20*(1), 6. https://doi.org/10.3390/ijerph20010006

Nel, E. C. (2019). The impact of workplace bullying on flourishing: The moderating role of emotional intelligence. *SA Journal of Industrial Psychology*, *45*(0), 1–9. https://doi.org/10.4102/sajip.v45i0.1603

Neto, M. B. G., Grangeiro, R. R., & Esnard, C. (2022). Academic women: A study on the queen bee phenomenon. *Revista De Administração Mackenzie, 23*(2), 1-30. https://doi.org/10.1590/1678-6971/eRAMG220211.en

Neubauer, B. E., Witkop, C. T., & Varpio, L. (2019). How phenomenology can help us learn from the experiences of others. *Perspectives on Medical Education*, *8*(2), 90–97. https://doi.org/10.1007/s40037–019–0509–2

Neumark, D., Burn, I., & Button, P. (2019). Is it harder for older workers to find jobs? New and improved evidence from a field experiment. *Journal of Political Economy, 127*(2), 922–970. https://doi.org/10.1086/701029

Neusar, A. (2014). To trust or not to trust? Interpretations on qualitative research. *Human Affairs, 24*, 178–188. DOI:10.2478/s13374–014–0218–9

Newman, A., Donohue, R., & Eva, N. (2017). Psychological safety: A systematic review of the literature. *Human Resource Management Review, 2*(3), 521–535. https://doi.org/10.1016/j.hrmr.2017.01.001

Nilles, J. M. (1994). *Making telecommuting happen: A guide for telemanagers and telecommuters*. Van Nostrand Reinhold.

Nishii, L. (2013). The benefits of climate for inclusion for gender–diverse groups. *Academy of Management Journal, (56*)6, 1754–1774. http://dx.doi.org/10.5465/amj.2009.0823

Nkrumah, T., & Scott, K. A. (2022). Mentoring in STEM higher education: A synthesis of the literature to (re)present the excluded women of color. *International Journal of STEM Education, 9*(1), 1–23. https://doi.org/10.1186/s40594–022–00367–7

No Child Left Behind Act of 2001, Pub. L. No. 107–110, § 101, Stat. 1425 (2002). https://www2.ed.gov/nclb/landing.jhtml

Norman, M. K., Mayowski, C. A., Wendell, S. K., Forlenza, M. J., Proulx, C. N., & Rubio, D. M. (2021). Delivering what we promised: Outcomes of a coaching and leadership fellowship for mentors of underrepresented mentees. *International Journal of Environmental Research and Public Health, 18*(9), 4793. https://doi.org/10.3390/ijerph18094793

North, M. S., & Fiske, S.T. (2012). An inconvenienced youth? Ageism and its potential intergenerational roots. *Psychological Bulletin, 138*(5), 982–997. https://doi.org/10.1037/a0027843

Oakley, A. (1981). Interviewing women: A contradiction in terms? In H. Roberts (Ed.), *Doing Feminist Research* (pp. 30–61). Routledge and Kegan Paul. https://criticalphysio.files.wordpress.com/2015/05/interviewing-women-a-contradi.pdf

Oakley, A. (2016). Interviewing women again: Power, time and the gift. *Sociology, 50*(1), 195–213. https://doi.org/10.1177/0038038515580253

O'Brien, B. C., Harris, I. B., Beckman, T. J., Reed, D. A., & Cook, D. A. (2014). Standards for reporting qualitative research: A synthesis of recommendations. *Academy Medicine, Journal of the Association of American Medical Colleges, 89*(9), 1245–1251. https://doi.org/10.1097/ACM.0000000000000388

O'Connell, C. E., & Korabik, K. (2000). Sexual harassment: The relationship of personal vulnerability, work context, perpetrator status, and type of harassment to outcomes. *Journal of Vocational Behavior, 56*(3), 299–329. https://doi.org/10.1006/jvbe.1999.1717

O'Connell, C., & McKinnon, M. (2021). Perceptions of barriers to career progression for academic women in STEM. *Societies*, *11*(2), 27. https://doi.org/10.3390/soc11020027

O'Dea, R. E., Lagisz, M., Jennions, M. D., & Nakagawa, S. (2018). Gender differences in individual variation in academic grades fail to fit expected patterns for STEM. *Nature Communication, 9*(1), 3777. doi:10.1038/s41467-018-06292-0

O'Dorchai, S., Meulders, D., Crippa, F., & Margherita, A. (2009). *She figures – 2009 statistics and indicators on gender equality in science*. Publications Office of the European Union.

Office of Military Government for Germany (US). (1946). *Nuremberg Military Tribunals: Indictments*. Library of Congress. https://www.loc.gov/item/2011525463/

Officer, A., & de la Fuente–Núñez, V. (2018). A global campaign to combat ageism. *Bulletin of the World Health Organization*, *96*(4), 295–296. https://doi.org/10.2471/BLT.17.202424

Ohlott, P. J., Ruderman, M. N., & McCauley, C. D. (1994). Gender differences in managers' developmental job experiences. *Academy of Management Journal, 37*(1), 46–67. https://doi.org/10.2307/256769

Okrent, A., & Burke, A. (2021). *Participation of demographic groups in STEM*. National Science Board. https://ncses.nsf.gov/pubs/nsb20212/participation–of–demographic–groups–in–stem

O'Leary, E. S., Shapiro, C., Toma, S., Sayson, H. W., Levis–Fitzgerald, M., Johnson, T., & Sork, V. L. (2020). Creating inclusive classrooms by engaging STEM faculty in culturally responsive teaching workshops. *International Journal of STEM Education, 7*(32), 1–15. https://doi.org/10.1186/s40594–020–00230–7

Oosten, E., Buse, K., & Bilimoria, D. (2017). The leadership lab for women: Advancing and retaining women in STEM through professional development. *Frontiers in Psychology, 8,* 1–5. https://doi.org/10.3389/fpsyg.2017.02138

Opdenakker, R. (2006). Advantages and disadvantages of four interview techniques in qualitative research. *Forum*: *Qualitative Social Research, 7*(10), 1–14. http://www.qualitativeresearch.net/index.php/fqs/article/view/175/39

Opfer, V. D., Kaufman, J., Pane, J., & Thompson, L. (2018). *Aligned curricula and implementation of Common Core State Mathematics Standards: Findings from the American teacher panel*. RAND Corporation. https://www.rand.org/pubs/research_reports/RR2487.html.

Ortiz–Martínez, G., Vázquez–Villegas, P., & Ruiz-Cantisani, M. I. (2023). Analysis of the retention of women in higher education STEM programs. *Humanities and Social Sciences Communication, 10*(101), 1–14. https://doi.org/10.1057/s41599–023–01588–z

Oseguera, L., Rios, J. D. L., Park, H. J., Aparicio, E. M., & Rao, S. (2022). Understanding who stays in a STEM scholar program for underrepresented students: High–achieving scholars and short–term program retention. *Journal of College Student Retention: Research, Theory & Practice*, *24*(3), 773–809. https://doi.org/10.1177/1521025120950693

Østergaard, C., Timmermans, B., & Kristinsson K. (2011). Does a different view create something new? The effect of employee diversity on innovation. *Research Policy, 40*(3), 500–509. https://doi.org/10.1016/j.respol.2010.11.004

Pabilonia, S. W., & Vernon, V. (2023). Who is doing the chores and childcare in dual–earner couples during the COVID–19 era of working from home? *Review of Economics of the Household, 21*(2), 519–565. https://doi.org/10.1007/s11150–022–09642–6

Pal, I., & Waldfogel, J. (2016). The family gap in pay: New evidence for 1967 to 2013. *Journal of the Social Sciences*, *2*(4), 104-127. https://muse.jhu.edu/pub/207/article/630322/pdf

Palid, O., Cashdollar, S., Deangelo, S., Chu, C., & Bates, M. (2023). Inclusion in practice: a systematic review of diversity–focused STEM programming in the United States. *International Journal of STEM Education, 10*(1), 2. https://doi.org/10.1186/s40594–022–00387–3

Palinkas, L. A., Horwitz. S. M., & Green, C. A. (2015). Purposeful sampling for qualitative data collection and analysis in mixed method implementation research. *Administration and Policy in Mental Health and Mental Health Services Research 42*(5), 533–544. https://doi.org/10.1007/s10488-013-0528-y

Palmer, R. T., Maramba, D. C., & Dancy, T. E. (2011). A qualitative investigation of factors promoting the retention and persistence of students of color in stem. *The Journal of Negro Education, 80*(4), 491-504. http://www.jstor.org/stable/41341155

Paludi, M. (2012). *Managing diversity in today's workplace: Strategies for employees and employers*. Praeger Publishing.

Pannucci, C. J., & Wilkins, E. G. (2010). Identifying and avoiding bias in research. *Plastic and reconstructive surgery, 126*(2), 619–625. https://doi.org/10.1097/PRS.0b013e3181de24bc

Park, H., Behrman, J. R., & Choi, J. (2018). Do single–sex schools enhance students' STEM outcomes? *Economics of Education Review, 62*, 35–47. https://doi.org/10.1016/j.econedurev.2017.10.007

Park, J. J., Kim, Y. K., Salazar, C., & Hayes, S. (2020). Student–faculty interaction and discrimination from faculty in STEM: The link with retention. *Research in Higher Education, 61*(3), 330–356. https://doi.org/10.1007/s11162–019–09564–w

Park–John, J., & Carnoy, M. (2019). The case of computer science education, employment, gender, and race/ethnicity in Silicon Valley, 1980–2015. *Journal of Education and Work, 32*(5), 421–435. doi:10.1080/13639080.2019.1679728

Park–Taylor, J., Wing, H. M., & Aladin, M. (2022). STEM pathways for Black and Latinx middle and high school students. *Urban Review, 54,* 595–623. https://doi.org/10.1007/s11256–021–00631–0

Parker, J. (2023, February 1). *Tech layoffs are accelerating in 2023 – here's what's happening*. TechWire. https://wraltechwire.com/2023/02/01/netapp–which–has–big–rtp–campus–is–cutting–8–of–workforce–paypall–cutting–2000–jobs/

Parker, P., Kram, K., & Hall, D. (2014). *Peer coaching: An untapped resource for development. Organizational Dynamics, 43*(2), 122–129. doi:10.1016/j.orgdyn.2014.03.006

Patton, M. Q. (1999). Enhancing the quality and credibility of qualitative analysis. *Health Services Research*, *34*(5 Pt 2), 1189–1208. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC1089059/

Patton, M. Q. (2014). *Qualitative research & evaluation methods: Integrating theory and practice.* Sage Publications.

Pechac, S., & Slantcheva–Durst, S. (2021). Coaching toward completion: Academic coaching factors influencing community college student success. *Journal of College Student Retention: Research, Theory & Practice, 23*(3), 722–746. https://doi.org/10.1177/1521025119869849

Pell, A. (1996). Fixing the leaky pipeline: Women scientists in academia. *Journal of Animal Science*, *74*(11), 2843–2848. DOI:10.2527/1996.74112843x

Pepperdine University. (n.d.). *Human subject research.* http://services.pepperdine.edu/irb/

Pepperdine University. (n.d.). *Institutional review board*. https://community.pepperdine.edu/irb/

Peralta, C., Caspary, M., & Boothe, D. (2013). Success factors impacting Latina/o persistence in higher education leading to STEM opportunities. *Cultural Studies of Science Education, 8*(4), 905–918. https://doi.org/10.1007/s11422–013–9520–9

Perez–Felkner, L., Thomas, K., Nix, S., Hopkins, J., & D'Sa, M. (2019). Are 2–year colleges the key? Institutional variation and the gender gap in undergraduate STEM degrees. *The Journal of Higher Education, 90*(2), 181–209. https://doi.org/10.1080/00221546.2018.1486641

Perna, L. W., & Titus, M. A. (2005). The relationship between parental involvement as social capital and college enrollment: An examination of racial/ethnic group differences. *Journal of Higher Education, 76*(5), 34–485. DOI:10.1353/jhe.2005.0036

Petersen, S., Pearson, B. Z., & Moriarty, M. A. (2020). Amplifying voices: Investigating a cross–institutional, mutual mentoring program for URM women in STEM. *Innovative Higher Education*, *45*(4), 317–332. https://doi.org/10.1007/s10755–020–09506–w

Petroff, A., & Fierro, J. (2023). Crowd work in STEM-related fields: A window of opportunity from a gender perspective? *Sociology Compass, 17*(3), 1–17. https://doi.org/10.1111/soc4.13058

Petzel, Z. W., & Casad, B. J. (2022). Take a chance on STEM: Risk–taking buffers negative effects of stereotype threat. *Journal of Experimental Education*, *90*(3), 656–672. https://doi.org/10.1080/00220973.2020.1848766

Pew Research Center. (2015). *Public and scientists' views on science and society*. https://www.pewresearch.org/science/2015/01/29/public–and–scientists–views–on–science–and–society/

Pfister, I. B., Jacobshagen, N., Kälin, W., & Semmer, N. K. (2020). How does appreciation lead to higher job satisfaction? *Journal of Managerial Psychology*, 35(6), 465–479. https://doi.org/10.1108/JMP-12-2018-0555

Pfitzner, N., Fitz–Gibbon, K., & True, J. (2022). When staying home isn't safe: Australian practitioner experiences of responding to intimate partner violence during COVID–19 restrictions. *Journal of Gender–Based Violence, 6*(2), 297–314. DOI:10.1332/239868021X16420024310873

Pheko, M. M. (2018). Rumors and gossip as tools of social undermining and social dominance in workplace bullying and mobbing practices: A closer look at perceived perpetrator motives. *Journal of Human Behavior in the Social Environment, 28*(4), 449–465. https://doi.org/10.1080/10911359.2017.1421111

Philipp, S. B., Tretter, T. R., & Rich, C. V. (2016). Development of undergraduate teaching assistants as effective instructors in STEM courses. *Journal of College Science Teaching*, *45*(3), 74–82. https://eric.ed.gov/?redir=http%3a%2f%2fwww.nsta.org%2fstore%2fproduct_detail.aspx%3fid%3d10.2505%2f4%2fjcst16_045_03_74

Phillips, C. J. (2014). The New Math and midcentury American politics. *The Journal of American History, 101*(2), 454–479. http://www.jstor.org/stable/44287703

Piaget, J. (1964). Cognitive development in children development and learning. *Journal of Research in Science Teaching, (2)*, 176–186. http://dx.doi.org/10.1002/tea.3660020306

Piaget, J. (1971). The theory of stages in cognitive development. In D. Green, M. Ford, & G. Flamer (Eds.), *Measurement and Piaget* (pp. 1–11). McGraw–Hill.

Pierce, C. (1970). Offensive mechanisms. In F. Barbour, (Ed.), *In the Black seventies* (pp. 265–282). Porter Sargent.

Pinheiro, D. L., Melkers, J., & Newton, S. (2017). Take me where I want to go: Institutional prestige, advisor sponsorship, and academic career placement preferences. *PLoS One, 12*(5), 1–24. https://doi.org/10.1371/journal.pone.0176977

Pitts, B. (2021). “Uneasy Lies the Head that Wears a Crown”: A Critical Race Analysis of the CROWN Act. *Journal of Black Studies*, *52*(7), 716–735. https://doi.org/10.1177/00219347211021096

Player, A., Randsley de Moura, G., Leite, A. C., Abrams, D., & Tresh, F. (2019). Overlooked leadership potential: The preference for leadership potential in job candidates who are men vs. women. *Frontiers in Psychology*, *10*(755), 1–14. https://doi.org/10.3389/fpsyg.2019.00755

Pluut, H., & Wonders, J. (2020). Not able to lead a healthy life when you need it the most: Dual role of lifestyle behaviors in the association of blurred work-life boundaries with well-being. *Frontiers in Psychology*, *11*, 607294, 1–15. https://doi.org/10.3389/fpsyg.2020.607294

Polikoff, M. S., Petrilli, M. J., & Loveless, T. (2020). A decade on, assessing the impact of national standards has Common Core failed? *Education Next*, *20*(2), 72–81. https://www.educationnext.org/common-core-has-not-worked-forum-decade-on-has-common-core-failed/

Porter, C., & Munn, K. (2019). Forging a path to the 19th amendment: Understanding women's suffrage. *Social Education, 83*(5), 248. https://www.socialstudies.org/social-education/83/5/forging-path-19th-amendment-understanding-womens-suffrage

Porter, E. J. (1999). Defining the eligible, accessible population for a phenomenological study. *Western Journal of Nursing Research*, *21*(6), 796–804. DOI:10.1177/01939459922044207

Power, K. (2020). The COVID–19 pandemic has increased the care burden of women and families. *Sustainability: Science, Practice and Policy*, *16*(1), 67–73. https://doi.org/10.1080/15487733.2020.1776561

Prasad, A., Centeno, A., Rhodes, C., Muhammad, A. N., Taylor, S., Tienari, J., & Ozan, N. A. (2021). What are men's roles and responsibilities in the feminist project for gender egalitarianism? *Gender, Work and Organization*, *28*(4), 1579–1599. https://doi.org/10.1111/gwao.12573

Pratama, R. A., Pratiwi, I. M., Saputra, M. A., & Sumargono, (2022). Integration of STEM education in history learning. *International Journal of Evaluation and Research in Education, 11*(1), 313–320. http://files.eric.ed.gov/fulltext/EJ1341096.pdf

President's Council of Advisors on Science and Technology. (2012). *Engage to excel: producing one million additional college graduates with degrees in science, technology, engineering, and mathematics.* Obama White House. https://obamawhitehouse.archives.gov/administration/eop/ostp/pcast/docsreports

Prieto–Rodriguez, E., Sincock, K., & Berretta, R. (2022). A study of factors affecting women's lived experiences in STEM. *Humanities and Social Sciences Communication, 9*(1), 1–12. https://doi.org/10.1057/s41599–022–01136–1

Pugliesi, K. (1999). The consequences of emotional labor: Effects on work stress, job satisfaction, and well–being. *Motivation & Emotion, 23*(2), 125–154. https://doi.org/10.1023/A:1021329112679

Pula, B. (2022). Does phenomenology (still) matter? Three phenomenological traditions and sociological theory. *International Journal of Politics, Culture, and Society, 35*(3), 411–431. https://doi.org/10.1007/s10767–021–09404–9

Quinn, S. (1996). *Marie Curie: A life (Radcliffe biography series).* Da Capo Press.

Quiroz–Guitierrez, M. (2021, October 29). *Not FAANG but MAMAA: Jim Cramer reveals new acronym for the 5 largest tech giants*. Fortune. https://fortune.com/2021/10/29/faang–mamaa–jim–cramer–tech–facebook–meta/

Rafalska-Łasocha, A. (2018). About Marie Skłodowska-Curie on the occasion of her 150th anniversary of the birth. *Studia Historiae Scientiarum,* (17), 501–521. https://doi.org/10.4467/2543702XSHS.18.018.9338

Rahming, S. (2022). The STEM glass ceiling: The influence of immigration status on STEM trajectories of Afro–Caribbean women (A narrative approach). *Journal of International Students, 12*(1), 156–174. https://doi.org/10.32674/jis.v12i1.3367

Rainey, K., Dancy, M., Mickelson, R., Stearns, E., & Moller, S. (2018). Race and gender differences in how sense of belonging influences decisions to major in STEM. *International Journal of STEM Education*, *5*(1), 1–14. https://doi.org/10.1186/s40594–018–0115–6

Rask, K. (2010). Attrition in STEM fields at a liberal arts college: The importance of grades and pre–collegiate preferences. *Economics of Education Review*, *29*(6), 892–900. https://doi.org/10.1016/j.econedurev.2010.06.013

Reidy, D. E., Salazar, L. F., Baumler, E., Wood, L., & Daigle, L. E. (2023). Sexual violence against women in stem: A test of backlash theory among undergraduate women. *Journal of Interpersonal Violence*, *38*(13-14), 8357-8376. https://doi.org/10.1177/08862605231155124

Reilly, D., Neumann, D. L., & Andrews, G. (2022). Gender differences in self–estimated intelligence: Exploring the male hubris, female humility problem. *Frontiers in Psychology*, *13*, 1–6. https://doi.org/10.3389/fpsyg.2022.812483

Reinking, A., & Martin, B. (2018). The gender gap in STEM fields: Theories, movements, and ideas to engage girls in STEM. *Journal of New Approaches in Educational Research, 7*(2), 148–153. https://doi.org/10.7821/naer.2018.7.271

Rennane, S., Acheson–Field, H., Edwards, K. A., Gahlon, G., & Zaber, M. A. (2022). Leak or link? The overrepresentation of women in non–tenure–track academic positions in STEM. *PLoS One 17*(6), 1–16. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC9176805/

Reuben, E., Sapienz, P., & Zingales, L. (2014). How stereotypes impair women's careers in science. *PNAS, 111*(12), 4403–4408. https://doi.org/10.1073/pnas. 1314788111, PMID: 24616490

Reverby, S. M. (2012). Ethical failures and history lessons: The U.S. Public Health Service research studies in Tuskegee and Guatemala. *Public Health Reviews 34*(1), 13. https://doi.org/10.1007/BF03391665

Ribbens, J. (1989). Interviewing – An 'unnatural situation'? *Women's Studies International Forum, 12*(6), 579–592. https://doi.org/10.1016/0277–5395(89)90002–2

Richards, L., & Morse, J. (2013). *Read me first for a user's guide to qualitative methods* (3rd ed.). Sage Publications.

Richardson, R. L. S., Guy, B. S., & Perkins, K. S. (2019). "I am committed to engineering": The role of ego identity in Black women's engineering career persistence. *The Journal of Negro Education, 88*(3), 281–296,421–423. DOI:10.7709/jnegroeducation.88.3.0281

Rivara, F., Adhia, A., Lyons, V., Massey, A., Mills, B., Morgan, E., Simckes, M., & Rowhani–Rahbar, A. (2019). The effects of violence on health. *Health Affairs, 38*(10), 1622–1629. https://doi.org/10.1377/hlthaff.2019.00480

Rivera, A., & Scholar, J. (2020). Traditional masculinity: A review of toxicity rooted in social norms and gender socialization. *Advances in Nursing Science, 43*(1), E1–E10. https://doi.org/10.1097/ANS.0000000000000284

Roberts, T., Jackson, C., Mohr–Schroeder, M., Bush, S. B., Maiorca, C., Cavalcanti, M., Schroeder, D. C., Delaney, A., Putnam, L., & Cremeans, C. (2018). Students' perceptions of STEM learning after participating in a summer informal learning experience. *International Journal of STEM Education*, *5*(1), 1–14. https://doi.org/10.1186/s40594-018-0133-4

Robst, J., Keil, J., & Russo, D. (1998). The effect of gender composition of faculty on student retention. *Economics of Education Review*, *17*(4), 429–439. https://doi.org/10.1016/S0272-7757(97)00049-6

Rodriguez, R. (2021). *Employee resource group excellence: Grow high performing ERGs to enhance diversity, equality, belonging, and business impact*. Wiley.

Rodríguez-Modroño, P., & López-Igual, P. (2021). Job quality and work–life balance of teleworkers. *International Journal of Environmental Research and Public Health, 18*(6), 3239. https://doi.org/10.3390/ijerph18063239

Rogers, A. A., McKay, B., Cook, R. E., & Allen, E. (2021). School connectedness and STEM orientation in adolescent girls: The role of perceived gender discrimination and implicit gender–science stereotypes. *Sex Roles, 85*(7–8), 405–421. https://doi.org/10.1007/s11199–021–01224–7

Rogoza, R., & Cieciuch, J. (2020). Dark Triad traits and their structure: An empirical approach. *Current Psycholo*gy, *39*, 1287–1302. https://doi.org/10.1007/s12144-018-9834-6

Rosa, K., & Moore-Mensah, F. (2016). Educational pathways of Black women physicists: Stories of experiencing and overcoming obstacles in life. *Physical Review: Physics Education Research*, *12*(2), 1–15. https://doi.org/10.1103/PhysRevPhysEducRes.12.020113

Rosenfeld, M. J. (2017). Who wants the breakup? Gender and breakup in heterosexual couples. In D. F. Alwin, D. Felmlee, & D. Kreager (Eds.), *Social networks and the life course* (pp. 221–243).

Ross, M. B., Glennon, B. M., Murciano-Goroff, R., Berkes, E., Weinberg, B., & Lane, J. (2022). Women are credited less in science than men. *Nature, 608*, 135–145. https://doi.org/10.1038/s41586–022–04966–w

Rosse, H. (2018). The gender wage gap: How does having children affect the wage gap? *The Park Place Economist*, *26*(1), 1–10. https://digitalcommons.iwu.edu/parkplace/vol26/iss1/18

Rossiter, M. W. (1993). The Matthew Matilda effect in science. *Social Studies Science 23*(2), 325–341. https://www.jstor.org/stable/285482

Rotman, A., & Mandel, H. (2023). Gender–specific wage structure and the gender wage gap in the U.S. labor market. *Social Indicators Research, 165*(2), 585–606. https://doi.org/10.1007/s11205–022–03030–4

Roulson, L. H. (2022). What can the effects of COVID reveal about lingering obstacles to retention for women in STEM? *Fisheries*, *47*(2), 51–52. https://doi.org/10.1002/fsh.10728

Rubin, R. S. (1979). Flexitime: Its implementation in the public sector. *Public Administration Review*, *39*(3), 277–282. https://doi.org/10.2307/975953

Ruijs, N. (2017). The effects of Montessori education: Evidence from admission lotteries. *Economics of Education Review*, *61*, 19–34. https://doi.org/10.1016/j.econedurev.2017.09.001

Ryan, M., & Haslam, S. (2005). The glass cliff: Evidence that women are over–represented in precarious leadership positions. *British Journal of Management, 16*(2), 81–90. https://doi.org/10.1111/j.1467-8551.2005.00433.x

Sadler, P., Sonnert, G., Hazari, Z., & Tai, R. (2012). Stability and volatility of STEM career interest in high school: A gender study. *Science Education*. *96*(3), 411–427. DOI:10.1002/sce.21007

Sadowski, E., & Schrager, S. (2016). Achieving career satisfaction: Personal goal setting and prioritizing for the clinician educator. *Journal of Graduate Medical Education*, *8*(4), 494–497. https://doi.org/10.4300/JGME-D-15-00304.1

Sahin, A., Almus, K., & Willson, V. (2017). Comparisons of state test performances of public schools and a charter school system in old and new testing in Texas. *Journal of STEM Education: Innovations and Research, 18*(4), 5–16. https://eric.ed.gov/?redir=http%3a%2f%2fwww.jstem.org%2findex.php%3fjournal%3dJSTEM%26page%3darticle%26op%3ddownload%26path%255B%255D%3d2189%26path%255B%255D%3d1879

Saldaña, J. (2015). *The coding manual for qualitative researcher.* Sage Publications.

Salomone, M., & Kling, T. (2017). Required peer–cooperative learning improves retention of STEM majors. *International Journal of STEM Education, 4*(1), 1–12. https://doi.org/10.1186/s40594–017–0082–3

Salzman, H., & Van Noy, M. (2014). Crossing the boundaries: STEM students in four–year and community colleges. In barriers and opportunities in completing 2– and 4–year STEM degrees. National Academy of Sciences, Engineering, and Medicine. https://doi.org/10.7282/T38W3GCD

Samanta, S. (2018). The American community college as “stepping stone”: Opportunity, agency, and family in Asian and Asian American women’s educational histories. *Journal of Asian American Studies*, *21*(3), 367–393. https://doi.org/10.1353/jaas.2018.0024

Sandberg, S. (2013). *Lean in*. W. H. Allen.

Sandelowski, M. (1995). Sample size in qualitative research. *Research in Nursing and Health*, *18*(2), 179–83. https://doi.org/10.1002/nur.4770180211

Sansone, D., & Carpenter, C. S. (2020). Turing’s children: Representation of sexual minorities in STEM. *Public Library of Science One, 15*(11), 1-17. DOI:10.1371/journal.pone.0241596

Sargeant, J. (2012). Qualitative research part II: Participants, analysis, and quality assurance. *Journal of Graduate Medical Education*, *4*(1), 1–3. https://doi.org/10.4300/JGME–D–11–00307.1

Sartre, J. P., Elkaïm-Sartre, A., & Webber, J. (2004). *The imaginary: A phenomenological psychology of the imagination*. Routledge. (Original work published 1940)

Sassler, S., Glass, J., Levitte, Y., & Michelmore, K. (2011, September 19). *The missing women in STEM? Accounting for gender differences in entrance into science, technology, engineering, and math occupations* [Paper presentation]. 2012 Population Association of America, Washington, D.C., United States.

Saunders, B., Sim, J., Kingstone, T., Baker, S., Waterfield, J., Bartlam, B., Burroughs, H., & Jinks, C. (2018). Saturation in qualitative research: Exploring its conceptualization and operationalization. *Quality & Quantity*, *52*(4), 1893–1907. https://doi.org/10.1007/s11135–017–0574–8

Schacter, D. L. (1999). The seven sins of memory: Insights from psychology and cognitive neuroscience. *American Psychologist, 54*(3), 182–203. DOI:10.1037//0003-066X.54.3.182

Schein, E. H., & Bennis, W. (1965). *Personal and organizational change through group methods*. Wiley.

Schieder, J., & Gould, E. (2016). *Women's work and the gender pay gap*. Economic Policy Institute. https://www.epi.org/publication/womens-work-and-the-gender-pay-gap-how-discrimination-societal-norms-and-other-forces-affect-womens-occupational-choices-and-their-pay/

Schermuly, C. C., Deller, J., & Busch, V. (2014). A research note on age discrimination and the desire to retire: The mediating effect of psychological empowerment. *Research on Aging, 36*(3), 382–393. https://doi.org/10.1177/0164027513508288

Schloegel, U., Stegmann, S., Maedche, A., & Dick, R. (2018). Age stereotypes in agile software development – An empirical study of performance expectations. *Information Technology & People, 31*(1), 41–62. doi:10.1108/ITP–07–2015–0186

Schmidt, L. (2022). *Antisexist: Challenge sexism, champion women's rights, and create equality*. Bobo Publishing.

Schneider, K., Pryor, J., & Fitzgerald, L. (2011). Sexual harassment research in the United States. In S. Einarsen, H. Hoel, D. Zapf, & C. Cooper, (Eds.), *Bullying and harassment in the workplace* (2nd ed.) (pp. 245–266). CRC Press.

Schochet, L. (2019). The child care crisis is keeping women out of the workforce. *Center for American Progress*. www.americanprogress.org/issues/early-childhood/reports/2019/03/28/467488/child-care-crisis-keeping-women-workforce/

Schwartz, L. P., Liénard, J. F., & David, S. V. (2022). Impact of gender on the formation and outcome of formal mentoring relationships in the life sciences. *PLoS Biology*, *20*(9), 1–24. https://doi.org/10.1371/journal.pbio.3001771

Schwiegershausen, E. (2013, October 9). Exploring the etymology of 'Bro'. *New York*. http://nymag.com/thecut/2013/10/exploring-the-etymology-of-bro.html

Schwitzgebel, E. (2008). The unreliability of naive introspection. *The Philosophical Review*, *117*(2), 245–273. http://www.jstor.org/stable/40606018

Sehoya, C., Jeno, L. M., Walker, J. D., Jørgensen, C., & Vigdis, V. (2020). Gender gaps in the performance of Norwegian biology students: The roles of test anxiety and science confidence. *International Journal of STEM Education, 7*(1), 1–10. https://doi.org/10.1186/s40594–020–00252–1

Settles, I. H., Cortina, L. M., Malley, J., & Stewart, A. J. (2006). The climate for women in academic science: The good, the bad, and the changeable. *Psychology of Women Quarterly*, *30*(1), 47–58. https://doi.org/10.1111/j.1471–6402.2006.00261.x

Sevilla, A., & Smith, S. (2021). Baby steps: The gender division of childcare during the COVID–19 Pandemic. *Oxford Rev Econ Policy, 36*(1), S169–S186. https://doi.org/10.1093/oxrep/graa027

Shadding, C. R., Whittington, D., Wallace, L. E., Wandu, W. S., & Wilson, R. K. (2016). Cost–effective recruitment strategies that attract underrepresented minority undergraduates who persist to STEM doctorates. *SAGE Open*, *6*(3), 1–15. https://doi.org/10.1177/2158244016657143

Shaffer, E. S., Marx, D. M., & Prislin, R. (2013). Mind the gap: Framing of women's success and representation in STEM affects women's math performance under threat. *Sex Roles: A Journal of Research, 68*(7–8), 454–463. https://doi.org/10.1007/s11199–012–0252–1

Shapiro, M., Rivera–Beckstrom, M., Ingols, C., Blake–Beard, S., Gao, L., O'Neill, R., & Van Dam, E. (2022). What's power got to do with it? Seeking gender–equity in organizations through male ally initiatives. *Advancing Women in Leadership, 41*(1), 1–15. https://awl-ojs-tamu.tdl.org/awl/article/view/346

Sheily, F., & McCarthy, M. (2019). The effect of small group tutors on student engagement in the computer laboratory. *Journal of the Scholarship of Teaching and Learning, 19*(2), 141–171. https://files.eric.ed.gov/fulltext/EJ1214064.pdf

Shen, H. (2016). Why women earn less: Just two factors explain post–PhD pay gap. *Nature, 20,* 1–2. https://doi.org/10.1038/nature.2016.19950

Shonk, K. (2014, November 4). *After job dealmaking advice, a retraction from Microsoft CEO Satya Nadella.* Harvard Law School. https://www.pon.harvard.edu/daily/dealmaking–daily/after–job–dealmaking–advice–a–retraction–from–microsoft–ceo–satya–nadella/

Siani, A., & Harris, J. (2023). Self–confidence and STEM career propensity: Lessons from an all–girls secondary school. *Open Education Studies, 5*(1), 1–10. https://doi.org/10.1515/edu–2022–0180

Sidelil, L. T., Spark, C., & Cuthbert, D. (2023). 'Being in science and at the same time being a woman is difficult': Academic women's experiences of gender inequalities in STEM academia in Ethiopia. *Women's Studies International Forum, 98,* 1–9. https://doi.org/10.1016/j.wsif.2023.102717

Sigursteinsdottir, H., & Karlsdottir, F. B. (2022). Does social support matter in the workplace? Social support, job satisfaction, bullying and harassment in the workplace during COVID-19. *International Journal of Environmental Research and Public Health*, *19*(8), 1-14. https://doi.org/10.3390/ijerph19084724

Silbert, A., Punty, M., & Brodbine-Ghoniem, E. (2022). *The women's power gap at elite universities scaling the ivory tower*. American Association of University Women and EOS Foundation, Report. https://www.womenspowergap.org/wp-content/uploads/2022/01/WPG-Power-Gap-at-Elite-Universities-v17.pdf

Silver, J. K. (2023). Six practical strategies to mentor and sponsor women in academic medicine. *Journal of Medical Internet Research*, *25*, e47799. https://doi.org/10.2196/47799

Simpson, A., McCann, J., & Miroff, L. (2023). Learners' perspectives on ARCH + STEM: Integration of archaeology and indigenous knowledges with western knowledges of STEM. *Education Sciences*, *13*(5), 450. https://doi.org/10.3390/educsci13050450

Simundić, A. M. (2013). Bias in research. *Biochemia Medica*, *23*(1), 12–15. https://doi.org/10.11613/bm.2013.003

Siregar, N. C., Rosli, R., & Nite, S. (2023). Students' interest in science, technology, engineering, and mathematics based on parental education and gender factors. *International Electronic Journal of Mathematics Education, 18*(2), 1–8. https://doi.org/10.29333/iejme/13060

Smith, M., Wood, W., Adams, W., Wieman, C., Knight, J., Guild, N., & Su, T. (2009). Why peer discussion improves student performance on in–class concept questions. *Science* *323*(5910), 122– 124. http://science.sciencemag.org/content/323/5910/122.abstract

Smyth, F. L., & Nosek, B. A. (2015). On the gender–science stereotypes held by scientists: Explicit accord with gender–ratios, implicit accord with scientific identity. *Frontiers in Psychology*, *6*, Article 415. doi:10.3389/fpsyg.2015.00415

Snyder, H. (2019). Literature review as a research methodology: An overview and guidelines. *Journal of Business Research, 104*(2019), 333–339. https://doi.org/10.1016/j.jbusres.2019.07.039

Society of Women Engineers. (2019). *Women in engineering by the numbers report*. https://alltogether.swe.org/2019/11/swe–research–update–women–in–engineering–by–the–numbers–nov–2019/#:~:text=Only%2013%25%20of%20engineers%20are%20women.&text=Only%2026%25%20of%20computer%20scientists%20are%20women.&text=Female%20engineers%20earn%2010%25%20less%20than%20male%20engineers

Solanki, S. M., & Xu, D. (2018). Looking beyond academic performance: The influence of instructor gender on student motivation in STEM fields. *American Educational Research Journal*, 55(4), 801–835. https://www.jstor.org/stable/26643550

Sorn, M. K., Fienena, A. R. L., Ali, Y., Rafay, M., & Fu, G. H. (2023) The effectiveness of compensation in maintaining employee retention. *Open Access Library Journal*, *10*(7), 1–14. DOI:10.4236/oalib.1110394

Spaulding, D. T., Kennedy, J. A., Rózsavölgyi, A., & Colón, W. (2020). Differences in outcomes by gender for peer mentors participating in a STEM persistence program for first–year students. *Journal of STEM Education: Innovations and Research*, *21*(1), 5–10. https://www.jstem.org/jstem/index.php/JSTEM/article/view/2368

Spencer, B., Artis, S., Shavers, M., LeSure, S., & Joshi, A. (2022). To code–switch or not to code–switch: The psychosocial ramifications of being resilient Black women engineering and computing doctoral students. *Sociological Focus, 55*(2), 130–150. doi:10.1080/00380237.2022.2054482

Spiegelberg, H. (1978). *The phenomenological movement. A historical introduction* (2nd ed.). Martinus Nijhoff.

Stark, L. (2012). *Behind closed doors: IRBs and the making of ethical research.* University of Chicago Press.

Starr, C. R. (2018). "I'm Not a Science Nerd!": STEM stereotypes, identity, and motivation among undergraduate women. *Psychology of Women Quarterly, 42*(4), 489-503. https://doi.org/10.1177/0361684318793848

Starr, C. R., Tulagan, N., & Simpkins, S. D. (2022). Black and Latinx adolescents' STEM motivational beliefs: A systematic review of the literature on parent STEM support. *Educational Psychology Review, 34*(4), 1877–1917. https://doi.org/10.1007/s10648–022–09700–6

Statista Research Department. (2023). *Biggest tech startup layoffs worldwide as of January 2023, by number of job cuts*. Statista. https://www.statista.com/statistics/1127080/worldwide–tech–layoffs–covid–19–biggest/

Steckler, A., McLeroy, K. R., Goodman, R. M., Bird, S. T., & McGormick, L. (1992). Toward integrating qualitative and quantitative methods, an introduction. *Health Education Quarterly, 19*(1), 1–8. https://doi.org/10.1177/109019819201900101

Steeves, K. A., Bernhardt, P. E., Burns, J. P., & Lombard, M. K. (2009). Transforming American educational identity after Sputnik. *American Educational History Journal*, *36*(1), 71–87. https://link.gale.com/apps/doc/A252849377/AONE?u=anon~9e3c3e1b&sid=googleScholar&xid=3839518e

Steinem, G. (1969, April 7). A*fter Black power, women's liberation*. New York Magazine. https://jwa.org/sites/default/files/jwa067a.pdf

Stergiou-Kita, M., Mansfield, E., Bezo, R., Colantonio, A., Garritano, E., Lafrance, M., Lewko, J., Mantis, S., Moody, J., Power, N., Theberge, N., Westwood, E., & Travers, K. (2015). Danger zone: Men, masculinity and occupational health and safety in high-risk occupations. *Safety Science*, *80*, 213–220. https://doi.org/10.1016/j.ssci.2015.07.029

Sterk, N., Meeussen, L., & Van Laar, C. (2018). Perpetuating inequality: Junior women do not see queen bee behavior as negative but are nonetheless negatively affected by it. *Frontiers in Psychology*, *9*(1690),1–12. https://doi.org/10.3389/fpsyg.2018.01690

Sterling, A., Thompson, M., Kusimo, A., Gilmartin, S., Sheppard, S., & Wang, S. (2021). The confidence gap predicts the gender pay gap among STEM graduates. *PNAS, 117*(48), 30303–30308. https://doi.org/10.1073/pnas.2010269117

Stitt, R. L., & Happel-Parkins, A. (2019). "Sounds like something a white man should be doing": The shared experiences of Black women engineering students. *The Journal of Negro Education*, *88*(1), 62–74. https://www.muse.jhu.edu/article/802611

Stockley, P., & Campbell, A. (2013). Female competition and aggression: Interdisciplinary perspectives. *Philosophical transactions of the Royal Society of London. Series B, Biological Sciences*, *368*(1631), 1–11. https://doi.org/10.1098/rstb.2013.0073

Stoeger, H., Debatin, T., Heilemann, M., Schirner, S., & Ziegler, A. (2023). Online mentoring for girls in secondary education to increase participation rates of women in STEM: A long–term follow–up study on later university major and career choices. *Annals of New York Academic Science*, *1523*(1), 62–73. https://doi.org/10.1111/nyas.14989

Stoller, S. (2009). Phenomenology and the post–structural critique of experience. *International Journal of Philosophical Studies*, *17*(5), 707–737, doi:10.1080/09672550903301762

Stroh, L. K., Brett, J. M, & Reilly, A. H. (1996). Family structure, glass ceiling, and traditional explanations for the differential rate of turnover of female and male managers. *Journal of Vocational Behavior*, *49*(1), 99–118. https://doi.org/10.1006/jvbe.1996.0036

Suárez–Orozco, C., Casanova, S., Martin, M., Katsiaficas, D., Cuellar, V., Smith, N. A., & Dias, S. I. (2015). Toxic rain in class: Classroom interpersonal microaggressions. *Educational Researcher*, *44*(3),151–160. https://doi.org/10.3102/0013189X15580314

Sublett, C., & Plasman, J. S. (2017). How does applied STEM coursework relate to mathematics and science self-efficacy among high school students? Evidence from a national sample. *Journal of Career and Technical Education, 32*(1), 29– 50. https://doi.org/10.21061/jcte.v32i1.1589

Su, X., & Bozeman, B. (2016). Family friendly policies in STEM departments: Awareness and determinants. Research in higher education. *Journal of the Association for Institutional Research, 57*(8), 990–1009. doi:10.1007/s11162–016–9412–4.

Sue, D., Capodilupo, C., Torino, G., Bucceri, J., Holder, A., Nadal, K., & Esquilin, M. (2007). Racial microaggressions in everyday life: Implications for clinical practice. *The American Psychologist*. *62*(4), 271–86. doi:10.1037/0003–066x.62.4.271

Sunil, J. (2022). Why mentoring is essential in creating support systems for women. *Journal of International Women's Studies, 24*(7), 1–7. https://vc.bridgew.edu/jiws/vol24/iss7/6

Sutton, J., & Austin, Z. (2015). Qualitative research: Data collection, analysis, and Management. *The Canadian Journal of Hospital Pharmacy*, *68*(3), 226–231. https://doi.org/10.4212/cjhp.v68i3.1456

Suveren, Y. (2022). Unconscious bias: Definition and significance. *Current Approaches in Psychiatry, 14*(3), 414–426. https://doi.org/10.18863/pgy.1026607

Svoboda, R. C., Rozek, C. S., Hyde, J. S., Harackiewicz, J. M., & Destin, M. (2016). Understanding the relationship between parental education and STEM course taking through identity-based and expectancy-value theories of motivation. *AERA Open*, *2*(3), 1-13.

Swafford, M., & Anderson, R. (2020). Addressing the gender gap: Women's perceived barriers to pursuing STEM careers. *Journal of Research in Technical Careers, 4*(1), 61–74. http://files.eric.ed.gov/fulltext/EJ1254004.pdf

Szanto, T. (2020). Phenomenology and social theory. In P. Kivisto (Ed.), *The Cambridge Handbook of Social Theory* (pp. 292–316). Cambridge University Press. DOI:10.1017/9781316677445.016

Takaki, J., Taniguchi, T., & Hirokawa, K. (2013). Associations of workplace bullying and harassment with pain. *International Journal of Environmental Research and Public Health, 10*(10), 4560–70. doi:10.3390/ijerph10104560

Talley, K. G., & Martinez Ortiz, A. (2017). Women's interest development and motivations to persist as college students in STEM: A mixed methods analysis of views and voices from a Hispanic–Serving Institution. *International Journal of STEM Education, 4*(1), 1–24. https://doi.org/10.1186/s40594–017–0059–2

Tartaglia, A. (2019). "Zero Tolerance" for disruptive health work behaviors. *Einstein*, *17*(4), 1–2, eCE5306. https://doi.org/10.31744/einstein_journal/2019CE5306

Täuber, S., & Mahmoudi, M. (2022). How bullying becomes a career tool. *Nature Human Behavior, 6*, 475. https://doi.org/10.1038/s41562–022–01311–z

Teaching Institute for Excellence in STEM. (2010). *What is STEM Education?* http://www.tiesteach.org/stem-education.aspx

Teherani, A., Martimianakis, T., Stenfors-Hayes, T., Wadhwa, A., & Varpio, L. (2015). Choosing a qualitative research approach. *Journal of Graduate Medical Education*, *7*(4), 669–670. https://doi.org/10.4300/JGME-D-15-00414.1

Tekbıyık, A., Bulut, D., & Sandalcı, Y. (2022). Effects of a summer robotics camp on students' STEM career interest and knowledge structure. *Journal of Pedagogical Research, 6*(2), 91–109. https://files.eric.ed.gov/fulltext/EJ1339705.pdf

Testa, M., Livingston, J. A., & VanZile-Tamsen, C. (2011). Advancing the study of violence against women using mixed methods: Integrating qualitative methods into a quantitative research program. *Violence Against Women*, *17*(2), 236–250. https://doi.org/10.1177/1077801210397744

Thirsk, L. M., & Clark, A. M. (2017). Using qualitative research for complex interventions: The contributions of hermeneutics. *International Journal of Qualitative Methods, 16*(1). https://doi.org/10.1177/1609406917721068

Tinsley, H. E., & Weiss, D. J. (1975). Interrater reliability and agreement of subjective judgments. *Journal of Counseling Psychology, 22*(4), 358–376. https://doi.org/10.1037/h0076640

Thomas, H. (2022). *Historical women in STEM*. Library of Congress. https://blogs.loc.gov/headlinesandheroes/2022/03/historical–women–in–stem/

Thomas, R., Hardy, C., Cutcher, L., & Ainsworth, S. (2014). What's age got to do with it? On the critical analysis of age and organizations. *Organization Studies, 35*(11), 1569–1584. https://doi.org/10.1177/0170840614554363

Thompson, K. V., & Verdino, J. (2019). An exploratory study of self–efficacy in community college students. *Community College Journal of Research and Practice, 43*(6), 476–479. https://doi.org/10.1080/10668926.2018.1504701

Tikkanen, L., Anttila, H., Pyhältö, K., Soini, T., & Pietarinen, J. (2022). The role of empathy between peers in upper secondary students' study engagement and burnout. *Frontiers in Psychology, 13*(978546), 1-11. https://doi.org/10.3389/fpsyg.2022.978546

Tobbell, D. A. (2011). Pills, power, and policy: The struggle for drug reform in Cold War American and its consequences. University of California Press.

Toven–Lindsey, B., Lewis–Fitzgerald, M., Barber, P. H., & Hasson, T. (2015). Increasing persistence in undergraduate science majors: A model for institutional support of underrepresented students. *CBE–Life Sciences Education, 14*(2), 1–12. https://doi.10.1187/cbe.14– 05–0082

Townsend, B. K., & Dever, J. T. (1999). What do we know about reverse transfer students*? New Directions for Community Colleges, 1999*(106), 5–14. https://doi.org/10.1002/cc.10601

Tran, K. T., Nguyen, P. V., Dang, T. T. U., & Ton, T. N. B. (2018). The impacts of the high-quality workplace relationships on job performance: A perspective on staff nurses in Vietnam. *Behavioral Sciences*, *8*(12), 109. https://doi.org/10.3390/bs8120109

Travis, D.J., & Thorpe-Moscon, J. (2018). Day-to-day experiences of emotional tax among men and women of colour in the workplace. *Catalyst*. https://www.catalyst.org/wp-content/uploads/2019/02/emotionaltax.pdf

Truth, S. (1851, June 21). Ain't I a Woman? *Antislavery Bugle, 6*, 160. https://chroniclingamerica.loc.gov/lccn/sn83035487/1851–06–21/ed–1/seq–4/

Tufford, L., & Newman, P. (2012). Bracketing in qualitative research. *Qualitative Social Work 11*(1), 80–96. DOI:10.1177/1473325010368316

United Nations. (2015). *Transforming our world: The 2030 Agenda for Sustainable Development*. United Nations Department of Economic and Social Affairs. https://sdgs.un.org/2030agenda

United Nations. (2020). *Policy brief on impact of COVID on women*. https://www.un.org/sites/un2.un.org/files/policy_brief_on_covid_impact_on_women_9_apr_2020_updated.pdf

United Nations. (2023). *Jobs and pay for women, barely improved in 20 years*. United Nations Labor Agency. https://news.un.org/en/story/2023/03/1134232

United States Bureau of Labor Statistics. (2018). *Standard operational classifications*. https://www.BLS.gov/soc/

United States Bureau of Labor Statistics. (2020). *Highlights of women's earnings in 2019*. https://www.BLS.gov/opub/reports/womens–earnings/2019/pdf/home.pdf

United States Bureau of Labor Statistics. (2022). *Employment in STEM occupations*. Retrieved July 13, 2023 from https://www.BLS.gov/emp/tables/stem–employment.htm

United States Bureau of Labor Statistics. (2023a). *Civilian labor force participation rate*. https://www.BLS.gov/charts/employment–situation/civilian–labor–force–participation–rate.htm

United States Bureau of Labor Statistics. (2023b). *Employment level – Men* [LNS12000001]. Retrieved July 2, 2023 from FRED, Federal Reserve Bank of St. Louis. https://fred.stlouisfed.org/series/LNS12000001

United States Bureau of Labor Statistics. (2023c). *Employment level – Women* [LNS12000002]. Retrieved July 2, 2023 from FRED, Federal Reserve Bank of St. Louis. https://fred.stlouisfed.org/series/LNS12000002

United States Bureau of Labor Statistics. (2023d). *Table 2. Median weekly earnings of full-time wage and salary workers by union affiliation and selected characteristics.* https://www.U.S. BLS.gov/news.release/union2.t02.htm

United States Bureau of Labor Statistics. (2024a). *Employment projections*. Retrieved May, 15, 2024 from https://www.BLS.gov/emp/

United States Bureau of Labor Statistics. (2024b). *Occupational employment and wage statistics*. Retrieved May, 15, 2024 from https://www.BLS.gov/oes/notices/2023/occupational-employment-and-wage-statistics-oews.htm

United States Census Bureau. (2016). *Asian/Pacific American heritage month: May 2016*. Department of Commerce. https://www.census.gov/newsroom/facts-for-features/2016/cb16-ff07.html

United States Census Bureau. (2019). *Table 1. Educational attainment of the population 18 years and over, by age, sex, race, and Hispanic origin: 2019*. Retrieved August 7, 2023 from https://www.census.gov/topics/education/educational–attainment.html

United States Census Bureau. (2022). *North American Classification System*. U.S. Department of Commerce. Retrieved July 14, 2023 from https://www.census.gov/naics/?58967?yearbck=2022

United States Census Bureau. (2023). *American Community Survey, 5–year data (2009–2021)*. U.S. Department of Commerce. Retrieved August 7, 2023 from https://www.census.gov/data/developers/data–sets/acs–5year.html

U.S. Const. amend. XIX.

United States Department of Health and Human Services. (1979). Belmont report: Ethical principles and guidelines for the protection of human subjects of research, report of the National Commission for the Protection of Human Subjects of Biomedical and Behavioral Research. https://www.hhs.gov/ohrp/regulations–and–policy/belmont–report/index.html

United States Department of Health and Human Services. (2009, January 15). *Protection of human subjects.* https://www.hhs.gov/ohrp/sites/default/files/ohrp/humansubjects/regbook2013.pdf.pdf

United States Department of Health and Human Services. (2023, June 16). Frequently asked questions: Limited institutional review board review and related exemptions. Retrieved November 9, 2023, from https://www.hhs.gov/ohrp/regulations-and-policy/requests-for-comments/draft-guidance-frequently-asked-questions-limited-institutional-review-board-review-related-exemptions/index.html#iiia

United States Department of Homeland Security. (2012). *The Menlo report*. https://www.dhs.gov/sites/default/files/publications/CSD–MenloPrinciplesCORE–20120803_1.pdf

United States Department of Labor. (1995). *Federal glass ceiling commission. Solid investments: Making full use of the nation's human capital*. https://hdl.handle.net/1813/79349

United States Equal Employment Opportunity Commission. (2019). *Annual report on the federal workforce. Special topic: Women in STEM*. https://www.eeoc.gov/sites/default/files/2022–07/Women%20in%20STEM%20Special%20Topics%20Report%20FY%2020%20Final.pdf

United States Government Accountability Office. (2023). *Women in the workforce: Underrepresentation in management positions persists, and the gender pay gap varies by industry and demographics.* https://www.gao.gov/products/gao–23–106320

Urquijo, I., Extremera, N., & Solabarrieta, J. (2019). Connecting emotion regulation to career outcomes: Do proactivity and job search self-efficacy mediate this link? *Psychology Research and Behavior Management, 12*, 1109–1120. https://doi.org/10.2147/PRBM.S220677

Valenzuela, A. (2020). STEM diversity and student Latina/o resilience: A reflection. *International Journal of Qualitative Studies in Education (QSE), 33*(8), 898–904. https://doi.org/10.1080/09518398.2020.1786188

Valerie, G. H., Furst–Holloway, S., Kallen, R., & Jacquez, F. (2019). It's complicated: a multi–method approach to broadening participation in STEM. *Equality, Diversity and Inclusion: An International Journal, 38*(3), 349–361. https://doi.org/10.1108/EDI–09–2017–0200

van Manen, M. (1990). *Researching lived experience: Human science for an action sensitive pedagogy.* State University of New York Press.

Van Nieuwerburgh, S. (2023). The remote work revolution: Impact on real estate values and the urban environment. *Real Estate Economics*, 1–42. https://doi.org/10.1111/1540-6229.12422

Van Noy, M., & Zeidenberg, M. (2014). *Hidden STEM knowledge producers: Community colleges' multiple contributions to STEM education and workforce development.* National Research Council.

Varlejs, J., & Stec, E. (2014). Factors affecting students' information literacy as they transition from high school to college. *School Library Research, 17*, 1–23. https://files.eric.ed.gov/fulltext/EJ1022549.pdf

Varty, A. K. (2022). Promoting achievement for community college STEM students through equity–minded practices. *CBE – Life Sciences Education, 21*(2), 1–10. https://doi.org/10.1187/cbe.21–09–0237

Vasileiou, K., Barnett, J., Thorpe, S., & Young, T. (2018). Characterizing and justifying sample size sufficiency in interview–based studies: Systematic analysis of qualitative health research over a 15–year period. *BMC Medical Research Methodology, 18*(148), 1–18. https://doi.org/10.1186/s12874–018–0594–7

Venezia, A., & Jaeger, L. (2013). Transitions from high school to college. *Future of Children, 23*(1), 117–136. https://files.eric.ed.gov/fulltext/EJ1015237.pdf

Vera–Gajardo, A. (2021). Belonging and masculinities: Proposal of a conceptual framework to study the reasons behind the gender gap in engineering. *Sustainability, 13*(20), 1–15. https://doi.org/10.3390/su132011157

Verhoef, M. J., & Casebeer, A. L. (1997). Broadening horizons: Integrating quantitative and qualitative research. *The Canadian Journal of Infectious Diseases, 8*(2), 65–66. https://doi.org/10.1155/1997/349145

Vial, A. C., & Cowgill, C. M. (2022). Heavier lies her crown: Gendered patterns of leader emotional labor and their downstream effects. *Frontiers of Psychology, 13,* 1–18. doi:10.3389/fpsyg.2022.849566

Voorhees, N., Ortagus, J. C., & Marti, E. (2023). Give it a swirl? An examination of the influence of 4-year students taking entry-level math courses at the local community college. *Research in Higher Education, 64*(1), 147-173. https://doi.org/10.1007/s11162-022-09694-8

Walker, L. H., & Sherman, H. J. (2017). Common Core and STEM opportunities. *The Mathematics Enthusiast, 14*(1), 23. https://doi.org/10.54870/1551–3440.1405

Walsh, L. C., Boehm, J. K., & Lyubomirsky, S. (2018). Does happiness promote career success? Revisiting the evidence. *Journal of Career Assessment, 26*(2), 199-219. https://doi.org/10.1177/1069072717751441

Walters, C. H. (2001). Assumptions of qualitative research methods. *Perspectives in Learning, 2*(1), 60–61. http://csuepress.columbusstate.edu/pil/vol2/iss1/14

Wang, J. (2009). Networking in the workplace: Implications for women's career development. *New Directions for Adults and Continuing Education*, 122, 33–42.

Wang, X., Chan, H. Y., Soffa, S. J., & Nachman, B. R. (2017). A nuanced look at women in STEM fields at two–year colleges: Factors that shape female students' transfer intent. *Frontiers in Psychology*, *8*(146), 1–15. https://doi.org/10.3389/fpsyg.2017.00146

Wang, X., Lee, Y., & Wickersham, K. (2019). The role of community college attendance in shaping baccalaureate recipients' access to graduate and professional education. *Educational Researcher*, *48*(2), 84–100. https://doi.org/10.3102/0013189X19825659

Ward, J., DiNapoli, J., & Monahan, K. (2022). Instructional perseverance in early–childhood classrooms: Supporting children's development of STEM reasoning in a social justice context. *Education Science*, *12*(3), 1–19. https://dx.doi.org/10.3390/educsci12030159

Warren, M. A., Bordoloi, S. D., & Warren, M. T. (2021). Good for the goose and good for the gander: Examining positive psychological benefits of male allyship for men and women. *Psychology of Men & Masculinities, 22* (4), 723–731. https://doi.org/10.1037/men0000355

Washington, E. (2022). *The necessary journey: Making real progress on equity and inclusion.* Harvard Business Press Review.

Washington, J., & Evans, N. J. (1991). Becoming an ally. In N.J. Evans & V.A. Wall (Eds.), *Beyond tolerance: Gays, lesbians and bisexuals on campus* (pp. 194–204). American College Personnel Association.

Watkins, J. M., Mohr, B., & Kelly, R. (2011). *Appreciative inquiry: Change at the speed of imagination* (2nd ed.). Wiley and Sons.

Weatherford, J., & Maitra, D. (2019). How online students approach bracketing: A survey research study. *Educational Research: Theory and Practice*, *30*(2), 91–102. https://files.eric.ed.gov/fulltext/EJ1248413.pdf

Weir, K. (2023). Ageism is one of the last socially acceptable prejudices. Psychologists are working to change that. *American Psychological Association*, *54*(2), 36. https://www.apa.org/monitor/2023/03/cover–new–concept–of–aging

Weindling, P. (2001). The origins of informed consent: The International Scientific Commission on Medical War Crimes and the Nuremberg Code. *Bulletin of the History of Medicine* 75(1), 37–71. https://doi.org/10.1353/bhm.2001.0049

Weinhardt, F. (2017). *Cause of lack of women in STEM professions? Girls underestimate their math skills as early as fifth grade.* DIW–Wochenbericht.

Welbourne, T., Schlachter, S., & Rolf, S. (2015). Employee resource groups: An introduction, review and research agenda. *Academy of Management Proceedings*, (1). https://doi.org/10.5465/ambpp.2015.15661abstract

Welch, J. L., Jimenez, H. L., Walthall, J., & Allen, S. E. (2012). The women in emergency medicine mentoring program: An innovative approach to mentoring. *Journal of Graduate Medical Education*, *4*(3), 362–366. https://doi.org/10.4300/JGME–D–11–00267.1

Wenneras, C., & Wold, A. (1997). Nepotism and sexism in peer–review. *Nature*, *387*(6631), 341–343. https://doi.org/10.1038/387341a0

White, M. G. (2020). Why human subjects research protection is important. *The Ochsner Journal*, *20*(1), 16–33. https://doi.org/10.31486/toj.20.5012

White, M. L. (2023, April 29). *Maryam Mirzakhani*. *Encyclopedia Britannica*. https://www.britannica.com/biography/Maryam–Mirzakhani

Wilde, E., Batchelder, L., & Ellwood, D. (2010). *The mommy track divides: The impact of childbearing on wages of women of differing skill levels* [Working Paper]. National Bureau of Economic Research. https://www.nber.org/system/files/working_papers/w16582/w16582.pdf

Wilkins–Yel, K., Arnold, A., Bekki, J., Madison, N., Bernstein, B., & Randall, A. K. (2022). "I can't push off my own mental health": Chilly STEM climates, mental health, and STEM persistence among Black, Latina, and White graduate women. *Sex Roles, 86*(3–4), 208–232. https://doi.org/10.1007/s11199–021–01262–1

Williams, J., Phillips, K., & Hall, E. (2016). Tools for change: Boosting the retention of women in the STEM pipeline. *Journal of Research in Gender Studies, 6*(1), 11–75. https://www.researchgate.net/publication/311929127_Tools_for_change_Boosting_the_retention_of_women_in_the_stem_pipeline#fullTextFileContent

Williams, M. (2020). Psychology cannot afford to ignore the many harms caused by microaggressions. *Perspectives on Psychological Science, 15*(1), 38–43. https://doi.org/10.1177/1745691619893362

Williams, M. T., Skinta, M. D., Kanter, J. W., Martin–Willett, R., Mier–Chairez, J., Debreaux, M., & Rosen, D. C. (2020). A qualitative study of microaggressions against African Americans on predominantly White campuses. *BMC Psychology*, *8*(1), 111. https://doi.org/10.1186/s40359–020–00472–8

Williams, R. (2006). *Leadership accountability in a globalizing world.* Palgrave Macmillan.

Wilson, K. D. (1975). Kant on intuition. *The Philosophical Quarterly (1950–), 25*(100), 247–265. https://doi.org/10.2307/2217756

Wittgenstein, L. (1958). *Philosophical investigations*. Blackwell.

Wolf, M., & Terrell, D. (2016). The high–tech industry, what is it and why it matters to our economic future. *Beyond the Numbers: Employment & Unemployment*, *5*(8). U.S. Bureau of Labor Statistics. https://www.U.S. BLS.gov/opub/btn/volume–5/the–high–tech–industry–what–is–it–and–why–it–matters–to–our–economic–future.htm.

Wollstonecraft, M. (1792). *Rights of woman: With strictures on political and moral subjects*. Peter Edes for Thomas and Andrews publisher.

Won, S., Lee, S.–Y., & Bong, M. (2017). Social persuasion by teachers as a source of student self–efficacy: The moderating role of perceived teacher credibility. *Psychology in the Schools*, *54*(5), 532–547. https://doi.org/10.1002/pits.22009

Woodwark, M., Wood, A., & Schnarr, K. (2021). Standing on the shoulders of giantesses: How women technology founders use single and mixed gender networks for success and change. *International Journal of Gender and Entrepreneurship, 13*(4), 420–448. https://doi.org/10.1108/IJGE–10–2020–0159

Woolston, C. (2019). PhDs: The tortuous truth. *Nature*, *575*, 403–406. https://link.gale.com/apps/doc/A641313178/AONE?u=anon~cf893145&sid=googleScholar&xid=cbdb2abe

Working Group on Community College Workforce Education. (2020). *The indispensable institution: Reimagining community college*. Opportunity America. https://opportunityamericaonline.org/wp–content/uploads/2020/06/Indispensable_Inst_FullReport.pdf

World Economic Forum. (2017). *The global gender gap report.* https:www3.weforum.org/docs/WEF_GGGR_2017.pdf

World Economic Forum. (2023). *The global gender gap report*. https://www3.weforum.org/docs/WEF_GGGR_2023.pdf

World Health Organization. (2021). *Question and answers: Ageism*. https://www.who.int/news–room/questions–and–answers/item/ageing–ageism

Worthen, M. (2021). The young and the prejudiced? Millennial men, "dude bro" disposition, and LGBTQ negativity in a US national sample. *Sexuality Research & Social Policy, 18*(2), 290–308. https://doi.org/10.1007/s13178–020–00458–6

Wright, N. L., Longerbeam, S. D., & Alagaraja, M. (2022). Chronic codeswitching: Shaping Black/White multiracial student sense of belonging. *Genealogy, 6*(3), 75. https://doi.org/10.3390/genealogy6030075

Wu, D. J., Thiem, K. C., & Dasgupta, N. (2022). Female peer mentors early in college have lasting positive impacts on female engineering students that persist beyond graduation. *Nature Communications, 13*(6837), 1–12. https://doi.org/10.1038/s41467–022–34508–x

Wynn, A. T., & Correll, S. J. (2017). Gendered perceptions of cultural and skill alignment in technology companies. *Social Sciences, 6*(2), 45. https://doi.org/10.3390/socsci6020045

Xie, Y., Fang, M., & Shauman, K. (2015). Stem education. *Annual Review of Sociology, 41*(1), 331–357. https://doi.org/10.1146/annurev–soc–071312–145659

Xiong, A., Tao, J., Li, H., & Westlund, H. (2022). Will female managers support gender equality? The study of "Queen Bee" syndrome in China. *Asian Journal of Social Psychology, 25*(3), 544-555. https://doi.org/10.1111/ajsp.12517

Xiong, A., Xia, S., He, Q., Ameen, N., Yan, J., & Jones, P. (2023). When will employees accept remote working? The impact of gender and internet skills. *Journal of Innovation & Knowledge, 8*(3), 1–8. https://doi.org/10.1016/j.jik.2023.100402

Xu, W., & Ouyang, F. (2022). The application of AI technologies in STEM education: A systematic review from 2011 to 2021. *International Journal of STEM Education, 9*(1), 1–20. https://doi.org/10.1186/s40594–022–00377–5

Xu, Y. J. (2017). Attrition of women in STEM: Examining job/major congruence in the career choices of college graduates. *Journal of Career Development*, *44*(1), 3–19. https://doi.org/10.1177/0894845316633787

Xue, B., & McMunn, A. (2021). Gender differences in unpaid care work and psychological distress in the UK COVID–19 lockdown. *PLoS One*, *16*(3), 1–15. https://doi.org/10.1371/journal.pone.0247959

Yang, D., Kelly, E. L., Kubzansky, L. D., & Berkman, L. (2023). Working from home and worker well–being: New evidence from Germany. *Industrial and Labor Relations Review*, *76*(3), 504–531. https://doi.org/10.1177/00197939221148716

Yang, J., & Katz, B. (2020). *Promising practices for addressing harassment in the STEM workplace.* Center on Labor, Human Services and Populations. https://www.urban.org/sites/default/files/publication/102045/promising-practices-for-addressing-harassment-in-the-stem-workplace.pdf

Yang, Y., & Carroll, D. W. (2018). Gendered microaggressions in science, technology, engineering, and mathematics. *Leadership and Research in Education, 4*, 28–45. https://files.eric.ed.gov/fulltext/EJ1174441.pdf

Yang, Z., Yang, X., Wang, K., Zhang, Y., Pei, G., & Xu, B. (2021). The emergence of mathematical understanding: Connecting to the closest superordinate and convertible concepts. *Frontiers in Psychology, 12*, 1–13. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8645560/pdf/fpsyg–12–525493.pdf

Yanow, D., & Schwartz–Shea, P. (2008). Reforming institutional review board policy: Issues in implementation and field research. *Political Science & Politics*, *41*(3), 483–494. https://doi.org/10.1017/S1049096508080864

Yavuz, Ü., & Yildiz Duban, N. (2021). Primary school students' interests on professions and opinions on STEM implementations. *International Technology and Education Journal*, *5*(1), 21–31. https://files.eric.ed.gov/fulltext/EJ1312892.pdf

Yildirim, B., Öcal, E., & Şahin-Topalcengiz, E. (2021). STEM in movies: Female preservice teachers' perspectives on movie "Hidden Figures." *Journal of Baltic Science Education*, *20*(5), 740–758. https://doi.org/10.33225/jbse/21.20.740

Yildirim, F., & Yildirim, S. (2016). Effects of cynicism on empowerment in organizations. *Journal of Human Sciences*, *13*(3), 5740–5750. DOI:10.14687/jhs.v13i3.4124

Yoo, S. Y., & Hye, Y. A. (2020). Nurses' workplace bullying experiences, responses, and ways of coping. *International Journal of Environmental Research and Public Health*, *17*(19), 7052. https://doi.org/10.3390/ijerph17197052

Yosso, T. J., Smith, W. A., Ceja, M., & Solorzano, D. G. (2009). Critical race theory, racial microaggressions, and campus racial climate for Latina/o undergraduates. *Harvard Educational Review*, *79*(4), 659–690. https://doi.org/10.17763/haer.79.4.m6867014157m707l

Young, D. M., Rudman, L. A., Buettner, H. M., & McLean, M. C. (2013). The influence of female role models on women's implicit science cognitions. *Psychology of Women Quarterly*, *37*(3), 283–292. https://doi.org/10.1177/0361684313482109

Young, K., Anderson, M., & Stewart, S. (2015). Hierarchical microaggressions in higher education. *Journal of Diversity in Higher Education, 8*(1), 61–71. https://doi.org/10.1037/a0038464

Zahavi, D. (2021). Applied phenomenology: Why it is safe to ignore the epoché. *Continental Philosophy Review*, *54*, 259–273. https://doi.org/10.1007/s11007–019–09463–y

Zahra, B. T., Vivake, A., Qureshi, M. N., & Shah Syed, S. A. (2022). The role of perceived organizational support: Evidences from the horizontal and vertical workplace bullying. *Employee Responsibilities and Rights Journal*, *34*(1), 41–54. https://doi.org/10.1007/s10672–021–09378–y

Zander, L., Hohne, E., Harms, S., Pfost, M., & Hornsey, M. (2020). When grades are high but self–efficacy is low: Unpacking the confidence gap between girls and boys in mathematics. *Frontiers in Psychology*, *11*, 1–14. https://doi.org/10.3389/fpsyg.2020.552355

Zehnter, M., Manzi, F., Shrout, P., & Heilman, M. (2021). Belief in sexism shift: Defining a new form of contemporary sexism and introducing the belief in sexism shift scale (BSS scale). *PLoS ONE 16*(3), 1–22. https://doi.org/10.1371/journal. pone.0248374

Zeldin, A., & Pajares, F. (2000). Against the odds: Self–efficacy beliefs of women in mathematical, scientific, and technological careers. *American Educational Research Journal*, *37*(1), 215–46. http://www.jstor.org/stable/1163477

Zeldin, A. L., Britner, S., & Pajares, F. (2008). A comparative study of the self–efficacy beliefs of successful men and women in mathematics, science, and technology careers. *Journal of Research in Science Teaching 45*(9), 1036–1058. https://doi.org/10.1002/tea.20195

Zhan, Z., Li, Y., Mei, H., & Lyu, S. (2023). Key competencies acquired from STEM education: Gender-differentiated parental expectations. *Humanities & Social Sciences Communications, 10*(1), 464. https://doi.org/10.1057/s41599-023-01946-x

Zhang, J., Torchet, R., & Hanna, J. (2023). Gender–based disparities and biases in science: An observational study of a virtual conference. *PLoS One, 18*(6), 1–18. https://doi.org/10.1371/journal.pone.0286811

Zhang, Y. L. (2022). Early academic momentum: Factors contributing to community college transfer students' STEM degree attainment. *Journal of College Student Retention: Research, Theory & Practice, 23*(4), 873–902. https://doi.org/10.1177/1521025119881130

Zheng, H., & Weeden, K. (2023). How gender segregation in higher education contributes to gender segregation in the U.S. labor market. *Demography*, *60*(3), 761–784. https://doi.org/10.1215/00703370–10653728

APPENDIX A

Recruitment Script

Hi LinkedIn Network,

My name is Karin Moore, and I am a doctoral candidate in the Graduate School of Education and Psychology at Pepperdine University. I am conducting a research study for my PhD on the topic of Success Strategies and Barriers for Women in STEM. I am looking for volunteer study participants and would greatly appreciate your help. You are invited to participate in this study if you are a woman and have worked for at least five years in STEM professions.

If you decide to participate, you will be invited to a one-hour online interview. In that conversation, you will have an opportunity to discuss your experience as a Woman in STEM. Participation in this study is voluntary. Your identity as a participant will remain confidential during and after the study. Confidentiality will be maintained using a series of security measures, including using Pepperdine University's firewall protections, and deidentification of data using pseudonyms. Only the transcripts of the study will be used for research. Your video will not be recorded. Your audio will be recorded using Otter.ai transcription tool. The call will take place on Zoom.

If you are willing and able to participate in the study, please reach out to me. The interviews will be taking place between February 1 - February 15, 2024.

If you have questions, please contact me at Karin.Moore@pepperdine.edu or (425) 891-8776.

Thank you for your consideration.

Best Regards,

Karin K. Moore, MBA
Doctoral Candidate
Pepperdine University Graduate School of Education and Psychology

APPENDIX B

IRB Informed Consent Form

Graduate School of Education and Psychology

PEPPERDINE UNIVERSITY

IRB #: 23-09-2242 (Karin Moore)

Participant Study Title:

Women in STEM Success Strategies and Barriers

Formal Study Title:

Karin Moore PHD - Women in STEM Success Strategies and Barriers

Authorized Study Personnel

Principal Investigator: Karin Moore, (425) 891-8776

Faculty/Chair/Sponsor: Dr. Gabriella Miramontes, (310) 568-5645

Key Personnel: Drs. Maria Brahme, Theresa Dawson, and Kelly Sullenberger

Invitation

You are invited to take part in this research study. The information in this form is meant to help you decide whether or not to participate. If you have any questions, please ask.

Why are you being asked to be in this research study?

You are invited to participate in a research study conducted by Karin Moore, a doctoral candidate in the Graduate School of Education and Psychology at Pepperdine University. You have been carefully selected because of your experience in STEM fields. Your participation is voluntary. Please read the information below and ask questions about anything that you do not understand, before deciding whether to participate. Please take as much time as you need to read the consent form. You may also decide to discuss participation with your family or friends. If you decide to participate, you will be asked to sign this form. You will also be given a copy of this form for your records.

What is the reason for doing this research study?

This study aims to illuminate success strategies deployed by seasoned women in STEM to persist in their careers, and expose barriers they have faced as they navigate their careers in STEM industries. Some barriers may be well-known and researched, for which decades of knowledge exist in scholarly literature. Other barriers and success strategies may be more nuanced and teased out only in interviews with those who have collectively experienced the phenomenon of working as women in STEM (Creswell & Creswell, 2018). For the younger generation of STEM women early in their careers, this study can serve as a guide for what to expect and how to leverage the experience of the study participants. For mid-career women, this study can validate and provide comfort in knowing that they are not alone. Systemic forces greater than them, such as racism, ageism, and sexism, are at play (NASEM, 2018). In addition to teasing out success strategies and barriers, the study aims to provide tangible recommendations on how to persist and thrive as a woman in STEM whether in their academic pursuits or in her career.

What will be done during this research study?

If you volunteer to participate in this study, you will be asked to participate in an interview. It should take no more than 60 minutes to complete.

Success Strategies and Barriers for Women in STEM

Questions

There are five sections to the interview. Each section will have its own interview questions.

1) Providing your demographics data. Examples are age range, schooling, marital status etc.
2) What are the challenges faced by women in STEM in ascending to leadership positions?
3) What strategies/best practices are used by women in STEM to overcome the challenges they face?
4) How do women in STEM define, measure, and track their career success?
5) What recommendations do women leaders in STEM have for aspiring female leaders?

How will my data be used?

Your answers during the interview will be captured by the Otter.ai tool. A transcript of your interview will be coded for themes. The audio transcript will be immediately destroyed upon completion of the coding. Any personal information that could identify you will be removed before coding begins.

What are the possible risks of being in this research study?

The potential and foreseeable risks associated with participation in this study include are no more than minimum risks involved in day-to-day activities

What are the possible benefits to you?

While there are no direct benefits to the study participants, there are several anticipated benefits to society which include:

1. The compilation of results of the study will be beneficial to the learning and practitioner communities at large.
2. The findings of the study will shed light and inform parents, employers, policy-makers, scholars and practitioners regarding success strategies and barriers for women in STEM. In addition, upon your request, a completed copy of this study will be provided to you

What are the alternatives to being in this research study?

The alternative to participation in the study is not participating or completing only the items which you feel comfortable. Should you choose this alternative, your relationship with your employer will not be affected whether you participate or not in this study.

What will being in this research study cost you?

There is no cost to you for being a participant in this research study.

Will you be compensated for being in this research study?

There is no compensation for participating in this study.

What should you do if you have a problem during this research study?

Your welfare is the major concern of every member of the research team. If you have a problem as a direct result of being in this study, you should immediately contact one of the people listed at the beginning of this consent form.

If you have a problem or experience harm as a direct result of being in this study, you should immediately contact one of the people listed at the beginning of this consent form. If needed, seek immediate emergency care for this problem. Please note, it is the policy of Pepperdine University not to pay for any required care. Agreeing to this does not mean you have given up any of your legal rights.

How will information about you be protected?

Reasonable steps will be taken to protect your privacy and the confidentiality of your study data.

The data of your audio recording as transcribed by Otter.ai will be stored on the investigator's computer which is password protected, and will only be seen by the Principal

Investigator and deleted immediately after coding. The Principal Investigator’s notes will be deleted within three years of completion of PhD.

That data will be stored electronically through a secure server and will only be seen by the research team during the study and for three years after the study is complete.

The only persons who will have access to your research records are the study personnel, the Institutional Review Board (IRB) of Pepperdine University, and any other person, agency, or sponsor as required by law. The information from this study may be published in scientific journals or presented at scientific meetings but the data will be reported as group or summarized data and your identity will be kept strictly confidential.

What are your rights as a research subject?

You may ask any questions concerning this research and have those questions answered before agreeing to participate in or during the study.

For study related questions, please contact the investigator(s) listed at the beginning of this form.

For questions concerning your rights or complaints about the research contact the Institutional Review Board (IRB):

Phone: 1(310)568-2305

Email: gpsirb@pepperdine.edu

What will happen if you decide not to be in this research study or decide to stop participating once you start?

You can decide not to be in this research study, or you can stop being in this research study (“withdraw’) at any time before, during, or after the research begins for any reason. Deciding not to be in this research study or deciding to withdraw will not affect your relationship with the investigator or with Pepperdine University.

You will not lose any benefits to which you are entitled.

Documentation of informed consent

You are voluntarily making a decision whether or not to be in this research study. Signing this form means that (1) you have read and understood this consent form, (2) you have had the consent form explained to you, (3) you have had your questions answered and (4) you have decided to be in the research study. You will be given a copy of this consent form to keep.

Participant Name:

____

Name of Participant: Please Print

Participant Signature:

____ ________________

Signature of Research Participant Date

AUDIO/VIDEO/PHOTOGRAPHS

Audio transcripts of your interview will be recorded using Otter.ai. These transcripts will be immediately destroyed upon completion of the coding of the data.

□ I agree to be audio-recorded.

□ I do not want to be audio-recorded.

Investigator certification:

My signature certifies that all elements of informed consent described on this consent form have been explained fully to the subject. In my judgment, the participant possesses the capacity to give informed consent to participate in this research and is voluntarily and knowingly giving informed consent to participate.

____ ________________

Signature of Person Obtaining Consent Date

APPENDIX C

Peer Reviewer Form

Dear Reviewer:

Thank you for agreeing to participate in my research study. The table below is designed to ensure that may research questions for the study are properly addressed with corresponding interview questions.

In the table below, please review each research question and the corresponding interview questions. For each interview question, consider how well the interview question addresses the research question. If the interview question is directly relevant to the research question, please mark “Keep as stated”. If the interview question is irrelevant to the research question, please mark “Delete it”. Finally, if the interview question can be modified to best fit with the research question, please suggest your modifications in the space provided. You may also recommend additional interview questions you deem necessary.

Once you have completed your analysis, please return the completed form to me via email to Karin.Moore@pepperdine.edu. Thank you again for your participation.

Research Question	Corresponding Interview Question
Demographic Questions	1. Industries served – public, private, healthcare, software et 2. Your level (director, VP, etc) 3. Age range? (?) 4. Public versus Private college or none attended 5. Degree level (BS, MS etc) 6. Type of degree (Eng, chemistry, et) 7. Do you have any children? 8. Do you have a spouse?
RQ1: What are the challenges faced by women in STEM in ascending to leadership positions?	1. When you look at your career what is the single most difficult obstacle(s) you have faced? 2. What other challenges have you faced? 3. Are you aware of other challenges that other women have faced? 4. How has your background impacted your experience?

Research Question	Corresponding Interview Question
RQ2: What strategies/best practices are used by women in STEM to overcome the challenges they face?	5. How did you overcome it (whatever they stated in IQ1)? 6. How did you overcome it/them (the second/third or next challenge)? 7. How did they overcome it (related to IQ3)?
RQ3: How do women in STEM define, measure, and track their career success?	8. What are the metrics you track to measure success in developing your career? (limit them to 3-5 if they went long) 9. What outcome (s) are you willing to accept? 10. What assistance does your organization give you in measuring and tracking your career development? 11. What factors would you like to measure and track but are unable to do so?

Research Question	Corresponding Interview Question
RQ4: What recommendations do women leaders in STEM have for aspiring female leaders?	12. What lessons have you as a STEM leader learned that we have not covered in this interview? 13. What would you not do again?

APPENDIX D

Citi Certificate

CITI PROGRAM

Completion Date 05-Sep-2021
Expiration Date 04-Sep-2026
Record ID 44783478

This is to certify that:

Karin Moore

Has completed the following CITI Program course:

Not valid for renewal of certification through CME.

GSEP Education Division
(Curriculum Group)
GSEP Education Division - Social-Behavioral-Educational (SBE)
(Course Learner Group)
1 - Basic Course
(Stage)

Under requirements set by:

Pepperdine University

CITI
Collaborative Institutional Training Initiative

Verify at www.citiprogram.org/verify/?wd84e7595-f65b-404a-ad88-dc1ebfa7a8d7-44783478

APPENDIX E

IRB Approval Notice

eProtocol

24255 Pacific Coast Highway

Malibu, CA 90263

TEL: 310-506-4000

NOTICE OF APPROVAL FOR HUMAN RESEARCH

Date: January 31, 2024

Protocol Investigator Name: Karin Moore

Protocol #: 23-09-2242

Project Title: Karin Moore PHD - Women in STEM Success Strategies and Barriers

School: Graduate School of Education and Psychology

Dear Karin Moore:

Thank you for submitting your application for exempt review to Pepperdine University's Institutional Review Board (IRB). We appreciate the work you have done on your proposal. The IRB has reviewed your submitted IRB application and all ancillary materials. Upon review, the IRB has determined that the above entitled project meets the requirements for exemption under the federal regulations 45 CFR 46.101 that govern the protections of human subjects.

Your research must be conducted according to the proposal that was submitted to the IRB. If changes to the approved protocol occur, a revised protocol must be reviewed and approved by the IRB before implementation. For any proposed changes in your research protocol, please submit an amendment to the IRB. Since your study falls under exemption, there is no requirement for continuing IRB review of your project. Please be aware that changes to your protocol may prevent the research from qualifying for exemption from 45 CFR 46.101 and require submission of a new IRB application or other materials to the IRB.

A goal of the IRB is to prevent negative occurrences during any research study. However, despite the best intent, unforeseen circumstances or events may arise during the research. If an unexpected situation or adverse event happens during your investigation, please notify the IRB as soon as possible. We will ask for a complete written explanation of the event and your written response. Other actions also may be required depending on the nature of the event. Details regarding the timeframe in which adverse events must be reported to the IRB and documenting the adverse event can be found in the Pepperdine University Protection of Human Participants in Research: Policies and Procedures Manual at community.pepperdine.edu/irb.

Please refer to the protocol number denoted above in all communication or correspondence related to your application and this approval. Should you have additional questions or require clarification of the contents of this letter, please contact the IRB Office. On behalf of the IRB, I wish you success in this scholarly pursuit.

Sincerely,

Judy Ho, Ph.D., IRB Chair

cc: Mrs. Katy Carr, Assistant Provost for Research