UNIVERSITY OF OKLAHOMA

GRADUATE COLLEGE

REFRAMING PERSISTENCE: THE ROLE OF GENDER AND ACADEMIC ADVISING IN BUILDING SELF-EFFICACY AMONG WOMEN STEM STUDENTS

A DISSERTATION

SUBMITTED TO THE GRADUATE FACULTY

in partial fulfillment of the requirements for the

Degree of

DOCTOR OF PHILOSOPHY

By MEGAN NICHOLE DENNEY
Norman, Oklahoma
2025

REFRAMING PERSISTENCE: THE ROLE OF GENDER AND ACADEMIC ADVISING

IN BUILDING SELF-EFFICACY AMONG WOMEN STEM STUDENTS

A DISSERTATION APPROVED FOR THE
DEPARTMENT OF EDUCATIONAL LEADERSHIP AND POLICY STUDIES

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Acknowledgements

So many people supported me along this journey and were incredibly patient as I navigated this process. I would like to first thank the co-chairs of my committee, Dr. Junghee Choi and Dr. Kait Pericak, for their dedication and support that helped me to achieve this goal. Dr. Choi helped me build realistic and reasonable timelines that kept me on track and assisted me with making substantial progress from 2024 to 2025. Dr. Pericak met with me practically every week of the 2025 calendar year – even over the summer of 2025 with a seven-hour time difference. I am eternally grateful for her mentorship, guidance, encouragement, and low-key therapy sessions that made a world of difference and helped me to make it through the final stretch of this marathon. Additionally, I would like to thank my committee members Dr. Jenny Sperling, Dr. Ann Beutel, and Dr. Meta Carstarphen for the guidance and feedback they provided. I am also grateful to my previous advisors, Dr. Kirsten Edwards, Dr. Kirsten Hextrum, and Dr. Siduri Haslerig. Each had an important role over the course of my experience as a doctoral student/candidate for which I am very grateful. Equally deserving of appreciation are the women STEM students who participated in this study – this would not have been possible without their willingness to share about their experiences. I would also like to extend gratitude to Mr. Mike Jenkins and Mr. Lincoln Torrey who helped with several administrative tasks and always made sure I was aware of all the Graduate College's deadlines, processes, and all the forms that needed to be completed.

I am endlessly grateful for my boss, colleague, mentor, and friend Dr. Randa Shehab. It made a difference that she took an interest in my work and supported me as I concluded my dissertation. I am also thankful to my sister Dr. Meredith Mouser, brother-in-law Dr. James Mouser, and niece Eleanor Mouser for their unwavering support. I must also thank my loyal pal,

Buster. He spent many hours at my side as I read and wrote and did the best job reminding me to take breaks to go for walks. Furthermore, several colleagues provided consistent check-ins and inquiries about my progress along the way and listened to my thoughts about the direction I wanted to take this study. I am truly grateful to all who provided supportive feedback and contributed to my success.

Finally, this journey – this long, agonizing climb – the one I never thought I would take, yet I have now concluded. It was not easy, but usually the things in life that are the most important, the worthiest, and the most formative never are. **I will never regret this.**

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Abstract

The underrepresentation of women in STEM disciplines has negative consequences (Hill et al., 2010; Margolis & Fisher, 2002) and the persistence of women in this field does not fix the underlying systemic and relational factors shaping their experiences. A gap remains in understanding how women's interactions with academic advisors influence their self-efficacy, a primary component of academic persistence, within these fields. To address this gap, this study employs a general interpretive qualitative approach (Merriam & Tisdell, 2016) to explore the persistence and self-efficacy building of women (n=20) in STEM programs. and the role of academic advisors. Grounded in Bandura's (1977, 1986, 1997) self-efficacy as a conceptual framework, this study examines how women build self-efficacy in masculinized STEM spaces through key personal and academic interactions. Drawing on in-depth interviews, the data reveals that individual accomplishment, parental and peer influence, sense of community and belonging, and institutional support are factors in shaping academic self-efficacy. Interestingly, for most of the participants in the study, the role of the academic advisor came secondary to these other influences. This study contributes to the broader understanding of women's persistence in STEM and highlights their perceptions of the academic advisors' role in building self-efficacy. In examining how academic self-efficacy was built and maintained for the participants, I was able to see the salient autonomous and social sources of academic self-efficacy and how interactions with academic advisors are perceived in building academic self-efficacy. Based on these findings, recommendations are offered for academic advisors and academic advising administrators to address structural barriers that create challenges to formulating holistic interactions for women STEM students, which may assist in building academic self-efficacy.

Chapter 1: Introduction

In this chapter, I provide the problem statement, purpose statement, and research question for this study. Following this is a contextualization of science, technology, engineering, and mathematics (STEM) including the importance of studying the persistence and retention of women in STEM majors. Finally, I review the evolution of academic advising in postsecondary education.

Problem Statement

The lack of women in STEM disciplines results in negative consequences for innovation, creativity, and competitiveness (Hill et al., 2010). When women are not involved in the processes of developing innovations or designs, then the needs and desires that are specific to women can be unaccounted for and neglected (Hill et al., 2010). Margolis and Fisher (2002) provided examples of how innovation and creativity are stifled within STEM fields because of the low number or absence of women. The examples range from mundane, everyday items and activities to more serious and potentially life-threatening. One example of the mundane centered on early voice-recognition and video-conference systems that literally did not hear or see women. These early systems were calibrated to a deeper-toned voice, or what would be considered a typical voice tone for a man (Margolis & Fisher, 2002). An example of a dire consequence involves what was intended to be a safety innovation that ended up having deadly consequences – automotive airbags. A group comprised mostly of male engineers customized the first design of automotive airbags for adult male bodies and did not make design considerations for women and children, which resulted in unnecessary fatalities. The persistence of women in STEM fields could have implications for greater and broader representation, as well as better innovations and designs that affect women daily.

Additionally, the lack of women in these disciplines has implications for the ability of the United States to compete in a global economy (Hill et al., 2010). Through the late 1990s and especially into the 2000s, several government offices and agencies expressed concerns about STEM majors that have been identified as areas of national need (Goan et al., 2006). By 2017, little progress was made in increasing these areas, especially with women, as the United States Department of Commerce reported that women accounted for 24% of STEM workers (Noonan, 2017).

Problematic perspectives associated with gender and gender roles do not vanish when women persist in STEM majors, as expectations associated with essential characteristics of femininity remain relevant. For instance, when Astronaut Sally Ride was training for the STS-7 mission to be the first American woman in space she was approached by a group of NASA engineers, composed mostly of men, to determine what items were critical to include in a makeup kit for this historic mission. Ride recounted this experience in an interview that was part of the Johnson Space Center Oral History Project:

> So, they came to me, figuring that I could give them advice. It was about the last thing in the world that I wanted to be spending my time in training on. So, I didn't spend much time on it at all. But there were a couple of other female astronauts, who were given the job of determining what should go in the makeup kit, and how many tampons should fly as part of a flight kit. I remember the engineers trying to decide how many tampons should fly on a one-week flight; they asked, 'Is 100 the right number?' 'No. That would not be the right number.' They said, 'Well, we want to be safe.' I said, 'Well, you can cut that in half with no problem at all.' [Laughter] (Ride, 2002)

From this we can see how women in STEM are held to meeting a standard of femininity or checking boxes of what society determines is appropriate for women.

In contrast, Banchefsky et al. (2016) found that women who have what is considered to be a feminine appearance are less likely to be perceived as scientists and more likely to be perceived to work as teachers or journalists than as scientists. As this counters Sally Ride's experience, it demonstrates that women seemingly cannot win in masculinized spaces – they either need normative aspects of femininity added to exist as a woman in a masculinized field or they are too feminine to be taken seriously in STEM. Even though these examples may represent extremes, they demonstrate how STEM fields are further complicated terrain for women to navigate.

Within STEM spaces in higher education, gender essentialism remains pervasive. A common approach has been and continues to be attempts to make these disciplines more appealing to women by feminizing the fields or "pinkwashing" (Heybach & Pickup, 2017). "Pinkwashing" relies on misconceptions of gender and uses what society has conceived to be normative interests for women to make a masculinized field appear more woman friendly. This is not to say that women in STEM cannot be interested in or like things that are considered feminine (such as makeup or the color pink); however, it is to confront the problematic idea that retention and persistence can be addressed by adding these elements to STEM in the hopes that these elements will make the field appealing to women. This approach does little, if anything at all, to adequately address the issues that are deeply embedded within the institutional structures of STEM and furthers wedges women STEM students into social norms for their gender.

In the same way that the statistics representing women in the overall workforce contrast with those of women in the STEM workforce, the overall number of women pursuing post-

secondary education continues to drastically differ from the number of women pursuing degrees in STEM fields. According to the United States Bureau of Labor Statistics, women made up 56.8% of the labor force in 2022, yet in the same year women accounted for 26% of the STEM workforce. Additionally, the number of women pursuing higher education has and continues to outnumber men as 9.2 million women versus 6.6 million men were enrolled in degree-granting institutions of higher education (National Center for Education Statistics, 2022). This fact was at the center of a controversial statement made by then-President of Purdue University Mitch Daniels in February 2022 (Flaherty, 2022). In an annual open letter to the Purdue University community, Daniels (2022) attempted to address the gender gap in overall enrollments and stated that the university was contributing to keeping the higher education gender gap suppressed with a rough average of 57% men in the undergraduate population compared to other schools that were at 40% or lower. For context, Purdue University is considered a leading institution of higher education in STEM, specifically engineering. Daniels added, "There is no intention behind this against the trend position, and no mystery about the reasons. Young men and women select into various disciplines at very different rates, and the STEM subjects which are relatively predominant at Purdue tend to attract men" (Daniels, 2022, p. 7). This statement drew criticism in the form of an open letter originally signed by over 1,250 members of the engineering community as well as allies at Purdue as it stood as an example of how the experiences of women in STEM are misunderstood and even invalidated (Open Letter from Purdue women faculty in engineering to Pres. Daniels, 2022). Additionally, Daniel's statement reflected a problematic perspective regarding how academic disciplines and career fields remain perceived as feminine or masculine.

Furthermore, women are shown to have lower self-efficacy beliefs in STEM academic areas (MacPhee et al., 2013). Self-efficacy is a person's belief in their ability to complete tasks to achieve a goal (Bandura, 1977, 1986, 1997). The absence or lack of self-efficacy puts women STEM students at a greater risk for attrition (Heilbronner, 2013). The role of self-efficacy in the persistence of women STEM students is reviewed further in the following chapter.

To demonstrate how academic advising can fit into the persistence or departure of women from STEM disciplines, we look to the recollection of Liz, a meteorologist, who on February 15, 2023, used a Facebook post to commemorate the issuance of her first severe thunderstorm watch, which was also the first watch issued by a woman at the National Weather Service Storm Prediction Center. Beyond this historic occurrence, Liz also shared that the academic advisor she interacted with as a first-year student directed her to change her major and suggested that she would not make it in the meteorology program at the university she attended (Leitman, 2023). While Liz persisted in the meteorology major, earned a degree, and became a professional meteorologist, her example highlights how interactions with an academic advisor can be pivotal. Furthermore, whether or not her academic advisor used those precise words is also of little consequence as it is the understanding and meaning derived from the interaction that had the potential to influence her persistence in or departure from a STEM discipline.

Purpose Statement

Empirical research explicitly connecting academic advising to retention is lacking (Young-Jones et al., 2013). As Young-Jones et al. (2013) pointed out, several studies focus on student satisfaction with the advising process (Campbell & Nutt, 2008; Hemwall & Trachte, 2003; Light, 2001; Propp & Rhodes, 2006) rather than studying connections between academic advising and student success. Many of these same studies also connected satisfaction with the

advising process to student retention and persistence; therefore, suggesting that a student's satisfaction with their academic advisor or advising processes at their institution is linked to student retention. This perspective discounts numerous aspects of advisor/student interactions and relationships. Furthermore, much of the empirical research (Tippetts et al., 2020; Levinstein, 2020; Young-Jones et al., 2013) that does attempt to measure the influence of academic advising has on student retention and persistence is conducted using quantitative methods. Because of the nature of quantitative research, a gap persists in exploring and understanding the interactions that the student has with their academic advisor, as quantitative research seeks to establish and measure relationships between variables and does not allow for the emergence of understanding to formulate from the exploration of multiple meanings of individual interaction or experiences. Additionally, the students' experiences that shape their perceptions of their academic advisor's influence on their persistence are missing from studies that employ quantitative approaches. A qualitative study allows for further understanding and exploration of women STEM students' perspectives of their interactions with their academic advisors and how those interactions may or may not have been perceived to influence their persistence within STEM majors. Moreover, much of the literature (Creamer, 1980; Cuseo, n.d.; Drake, 2011; Habley, 1981; Kuh, 2001; Kuh et al., 2005; Nutt, 2003; Pascarella & Terenzini, 1980; Tinto, 1987, 1993, 2012, 2016) concerning student retention and persistence is concerned with the topic at the institutional level. While institutional retention and persistence, and ultimately degree attainment are important, studies at the macro level do not address the nuances concerning the retention and persistence of women in STEM disciplines.

The purpose of this study is to understand the perceptions that women STEM students at a public, four-year research university located in the south-central region of the United States

have concerning their academic advisor's influence on their persistence in STEM disciplines. Their academic advisor(s) could be a primary role academic advisor, a faculty advisor, or a combination of the two. A study of this kind could offer academic advisors who work with women STEM students the opportunity to reflect on their interactions with these students and consider how those interactions are perceived to be influential for women STEM students' persistence decisions. This study also offers insight for advisors concerning how their interactions with women STEM majors are perceived to influence aspects of major persistence, which could encourage the evaluation of practices and approaches in academic advising. Furthermore, this study is also relevant for advising administrators who develop strategic plans and policies concerning academic advising within the higher education system.

Research Question

As mentioned, the goal of this research is to explore and understand the perceptions women STEM students have concerning their academic advisor's influence on major persistence based on interactions with their academic advisor.[1] From this, the research question for this study is: Within the scope of academic major persistence, how are key academic and personal interactions, such as those with an academic advisor, perceived by women STEM students?

The study is significant for two primary reasons. First, this study provides insight into a primary component of persistence for women in STEM and explores the how key academic and personal interactions are perceived to influence this component. Second, it adds to the existing literature and provides a qualitative understanding of the academic advising experience and interactions of women STEM students. Furthermore, the results of this study could influence advising practices and thereby affect the retention of women in STEM majors. For these reasons,

[1] Consistent with Tinto (2012), the word "persistence" will be used when exploring the student's view and "retention" for the institution's view.

this study has the potential to be meaningful for those who hold an academic advising role, advising administrators, and women students pursuing STEM majors and careers.

STEM Context

STEM is an acronym used to group academic disciplines related to science, technology, engineering, and mathematics. According to the American Association of University Women (AAUW), STEM includes the "physical, biological, and agricultural sciences; computer and information sciences; engineering and engineering technologies; and mathematics" (Hill et al., 2010, p. 2). When defining STEM, the specific disciplines that constitute science, technology, engineering, and mathematics tend to depend on the agency, institution, or organization making the determination. For this study, I adhere to a definition of STEM that mirrors the disciplines recognized by the National Center for Education Statistics and excludes social, behavioral, or economic sciences. The areas of biological and biomedical sciences, computer and information sciences, engineering and engineering technologies, mathematics and statistics, and physical sciences and science technology are both general and specific enough to account for the inclusion of an array of STEM disciplines within this study's site and allow for a more focused exploration of the experiences of undergraduate women students who are pursuing majors that are masculinized and dominated by male students and faculty.

Persistence and Retention of Women in STEM

Even though the number of men and women participating and performing well in STEM disciplines in primary and secondary school settings is essentially equal, women do not pursue and complete STEM degrees at the same level as men (Hill et al., 2010). Here it is important to clarify that STEM areas are not a monolith. The experiences of women students in the specific academic areas that comprise STEM can be varied based on numerous factors, such as

representation. For example, according to Hill et al. (2010), the biological sciences experience greater gender parity than other STEM areas. However, this does not take away from this importance of examining the persistence of women in STEM but highlights the nuance of the broad academic and professional categorization of STEM.

Shaw and Barbuti (2010), examined patterns of persistence in intended college majors with particular attention on STEM disciplines and observed that women were not as likely to persist in STEM majors as men. More recent data from the National Center for Education Statistics displays the lopsidedness related to gender, as women made up 38% of the number of STEM (biological and biomedical sciences, computer and information sciences, engineering and engineering technologies, mathematics and statistics, and physical sciences and science technologies) bachelor's degrees/certificates conferred in 2020-2021.[2] While there is data that present similar retention rates for men and women in undergraduate STEM majors (U.S. Department of Education, National Center for Education Statistics, 2000, Xie & Shauman, 2003 as cited in Hill et al., 2010), retention rates alone cannot correct the disproportional representation, given that women comprise a smaller portion of STEM students by the time students have declared a major (Hill et al., 2010). To put this into numbers, a retention rate of 80% is not the same number if there are 400 men and 100 women. Further, departure from STEM pathways typically occurs during the second year of college (Brainard & Carlin, 1998) and could center around a misalignment of perceptions of confidence in ability and performance.

Colleges and universities are ultimately where students become scientists, engineers, and mathematicians (Hill et al., 2010). A portion of time at colleges and universities involves

[2] Represents post-secondary institutions from all 50 states and the District of Columbia that participate in Title IV federal financial aid programs.

interacting with academic advisors, which could potentially affect student success and has the potential to influence the persistence decisions of women pursuing a degree in a STEM discipline.

Evolution of Academic Advising

Academic advising has a longstanding presence within higher education and in some form or fashion has been evident since early American higher education institutions came into existence. According to Gordon (1994) "academic advising has played an important role in higher education since the time of the colonial colleges" (p. ix). Cook (2001) shows that in the 17th and 18th centuries, college presidents and faculty held the responsibility of advising students concerning "extracurricular activities, their moral life, and intellectual habits" and these administrators acted *in loco parentis*, or in the place of parents. In the late 1820s, the first known formal system of academic advising in which each student had a faculty member who served as their academic advisor was introduced at Kenyon College (Cook, 2001). The role of academic advising continued to evolve and expand over time, but more than a century passed before academic advising became a defined and examined activity within higher education (Cook, 2001). With the evolution of higher education, academic advising also broadened in both scope and function (Gordon, 1994). As academic advising became a more defined practice within higher education and began to emerge as a profession, especially with the birth of a professional association, formal definitions of academic advising followed.

Many definitions exist for academic advising, and each definition provides direction for practice and demonstrates the importance of academic advising in postsecondary education. Habley (1981) defined academic advising as creating a mediation to alleviate the tension that exists between a student's expectations and the realities of the educational environment. Kuhn

(2008) defined the practice of academic advising as an institutional agent providing perspective or guidance to a college student concerning academic, social, and/or personal matters. An academic advisor may provide direction to inform, counseling, mentoring, and/or teaching. In 2006, NACADA: The Global Community for Academic Advising introduced a Concept of Academic Advising that focuses on three components of academic advising: curriculum, pedagogy, and student learning outcomes.[3] In summation, the NACADA Concept of Academic Advising states:

> Academic advising, based in the teaching and learning mission of higher education, is a series of intentional interactions with a curriculum, a pedagogy, and a set of student learning outcomes. Academic advising synthesizes and contextualizes students' educational experiences within the frameworks of their aspirations, abilities and lives to extend learning beyond campus boundaries and timeframes (NACADA: The Global Community for Academic Advising, 2006).

Each definition demonstrates that the interaction between the academic advisor and the student is at the center of academic advising. Additionally, each definition serves to expand the perspective that the interactions between the academic advisor and student are more than simple conversations about course enrollment for the following semester and the completion of degree requirements.

Like many practices in higher education, academic advising evolved in response to the changes in the needs of students and no longer relies solely on a prescriptive approach in which it was initially established (Crockett, 1985). Based on these definitions, advising should consist of meaningful exchanges and conversations that are central to a student's growth and

[3] In 2017, the National Academic Advising Association became NACADA: The Global Community for Academic Advising.

development. Moreover, King (1993) describes academic advising as the "only structured service on our campuses that guarantees students some kind of interaction with concerned representatives of the institution" (p. 21). Furthermore, advising links students to an array of support services, and most importantly advisors have a central role in assisting students with their integration into the academic and social environments at colleges and universities (King, 1993). In addition to being concerned with student development, student support, and integration, academic advisors can also play the role of personal mentors to many of their students. According to Wade and Yoder (1995), academic advisors must build and maintain rapport and trust with their students while also focusing on the needs, development, and growth of each student.

The evolution of academic advising explains the advisor's positioning to help students in their adjustment, navigation, development, and achievement within higher education. While broadly explored and not applied to a specific major or discipline, the definitions and functions of academic advising suggest that academic advising is an important element of postsecondary education and that academic advisors are situated to influence and affect their students' collegiate experience, for better or worse. For this study, an academic advisor is either a primary-role academic advisor whose predominant job function is to advise students or a faculty advisor who serves as an academic advisor while simultaneously holding the primary responsibilities of teaching courses and/or conducting research. The provided definitions and descriptions provide a foundation for the discussion of the role that academic advisors have related to college student persistence and retention.

Considering the positionality and stated importance of academic advising in the higher education environment, this study examines the experiences and interactions of women STEM

students with their academic advisors to better understand how those relationships may or may not be perceived as influential for the persistence of women in STEM disciplines.

Chapter 2: Literature Review and Conceptual Framework

In this chapter, I provide an overview of the literature that discusses the attrition and departure of women from STEM, including the historical masculinization of STEM, the climate of STEM disciplines, self-efficacy and sense of belonging. This is followed by an orientation of the role of academic advisors in student persistence and retention at the institutional level. Next, I explore the role of the academic advisor in relation to the persistence and retention of women in STEM areas. To conclude this chapter, I outline the conceptual framework for this study.

Explanations for Attrition and Departure of Women from STEM

As indicated by Hill et al., (2010) and McGill and Woudenberg (2012), there are many apparent factors in the retention efforts of women in STEM areas. As previously mentioned, McGill and Woudenberg (2012) offered insight into the components of retention and persistence that may be relevant to interactions with academic advisors. The following is a review of elements that offer explanations for the attrition and departure of women from STEM.

Historical Masculinization of STEM

Keller (1985) illustrated the parallel of the development of modern science and the construction of gender which led to the association of men with rationality and women with nature. According to Keller (1985), it is impossible to examine modern science's development without considering how metaphors of gender appear in the evolution of the values and goals associated with science. Essential to scientific inquiry, was a complete split of subject and object and the pursuit for absolute knowledge of the natural world, which align with gendered metaphors (Keller, 1985). These metaphors demonstrate how principles of modern science evolved to be associated with masculinity (Keller, 1985). Furthermore, Keller (1985) asserted that the abundance of men in STEM fields is not a cause, but a result of the long-standing

conjoining of scientific thought and masculinity. Gendering has implications for those who are thought to be suitable for science, technology, engineering, and mathematics and determine who accesses and succeeds in these fields (Rutherford, 2020).

Furthermore, masculine defaults produce from this long-standing history that has prevailed in modern institutions and organizations. These masculine defaults privilege trite features, qualities, or actions (self-oriented, autonomous, brilliance, capable) of masculinity and distinguish them to be the standard for the field (Garr-Schultz et al., 2023). This has consequences for women in academic and professional STEM settings and has the potential to intensify biases and perceptions about women in STEM spaces.

Climate of STEM Disciplines

The concept of the chilly climate was first introduced by Hall and Sandler (1982). The report examined the climate of higher education that women experienced and concentrated on specific topics. Among those topics were "women in traditionally 'masculine' fields" (Hall & Sandler, 1982, p. 11). As part of their report, Hall and Sandler (1982) provided a list primarily composed of academic disciplines that are under the STEM umbrella to further illustrate what the authors meant by traditionally masculine fields. A primary reason Hall and Sandler (1982) attributed to the sparsity of women in these academic majors was the climate of the department. Hall and Sandler (1982) stated,

> The chilly— and sometimes hostile – climate can be especially discouraging to women students who are trying to pursue interests and develop abilities that do not coincide with current cultural norms. If these behaviors lead them to believe they are unwelcome or viewed as incapable – especially by their professors – some women may use valuable

time and energy dealing with unnecessary doubts and conflicts, and may shift toward 'softer' subspecialities, or toward traditionally female majors and career goals. (p. 12)

Focusing on faculty interactions, Hall and Sandler (1982) also highlighted that supporting faculty interactions could serve to limit attrition and strengthen the academic and professional achievements of women students in masculinized majors.

Jensen and Deemer (2019) explored the climate of STEM education in relation to expectancy-value theory and how woman-scientist interference that might affect them differently depending on the level to which they interpreted the climate to be unwelcoming. Simply put, they examined the impact of a chilly climate and woman-scientist interference on the emotional cost of academic burnout. This quantitative study found a relationship between identity interference and greater emotional exhaustion, greater cynicism, and lower academic efficacy. Additionally, a chillier climate is associated with more emotional exhaustion and cynicism for women. Overall, the results of this study were supported by Eddy's and Brownell's (2016) STEM persistence model that explained the impact of identity in combination with the campus environment can have on performance and engagement. The findings from Jensen's and Deemer's (2019) study showed that an unwelcoming or hostile academic climate can lead to emotional exhaustion and cynicism for women STEM students. Because the participants for this study identified predominately as White, Jensen and Deemer (2019) suggested that future studies assess perceptions of STEM climate from the perspective of students of different identities because perceptions of predominantly White women do not represent the experiences of all women. Furthermore, the scales used in this study focused on the experiences of gender and Jensen and Deemer (2019) suggested that future studies should assess the campus climate from a

range of identities (e.g., racial identity, first-generation) to understand how the STEM environment affects a variety of students.

In a 2011 synthesis, Shapiro and Sax reviewed the factors that shape women's interest in STEM, including the educational aspects and social and cultural influences outside of the classroom. Focusing on the gender disparities in STEM disciplines and the multifaceted economic implications resulting from this disparity, Shapiro and Sax (2011) highlight that the underrepresentation of women in STEM has consequences for the United States in terms of global competition in science and engineering. Shapiro and Sax (2011) focused on predictors of women's interest and initial pursuit of STEM majors, which were preparation at the middle and high school levels, the culture college-level STEM disciplines, including teaching methods, student interactions with faculty, and connections to peers and the curriculum. Additionally, elements beyond the classroom including self-confidence, sense of belonging in STEM, family encouragement and expectations, and connections to peers and social/cocurricular activities were emphasized as predictors of women seeking STEM degrees (Shapiro & Sax, 2011).

Shapiro and Sax (2011) used existing literature to demonstrate that faculty are situated to influence women's interest and retention in STEM majors through classroom interactions. These interactions ideally would lead to a heightened interest in STEM for women students especially if women students see the faculty member as an exemplar for their own future careers in STEM fields. While Marx and Roman (2002) suggest the impact of women role models is more positive on women's math performance than that of male role models, the scarcity of women faculty in STEM means that women students have fewer options for role models of the same gender when compared to men (Shapiro & Sax, 2011) and may communicate that STEM disciplines are to be avoided by women (Blickenstaff, 2005). Faculty and other professional role models can help to

combat this stigma and inspire women STEM students by helping them build their confidence and reassuring them of their success in STEM courses and curricula, providing opportunities to conquer negative stereotypes regarding women in STEM careers, and engaging in conversations about their personal experiences and approaches for overcoming barriers in STEM fields (Kim et al., 2009). Conversely, Shapiro and Sax (2011) point out that interactions with instructors can also have negative outcomes regarding women's interest and persistence in STEM majors. Even though Shapio's and Sax's (2011) summarization concluded with recommendations for institutional research agendas and primarily centered faculty interactions, it indicates that multiple institutional factors influence women's decision to pursue and persist in STEM majors.

Self-Efficacy

Researchers have demonstrated that self-efficacy beliefs can act as predictors for behaviors associated with engagement, perseverance, and goal attainment (Bandura, 1977, 1997; Pajares, 1996). According to Pajares (1996), self-efficacy beliefs, in the context of education, have an impact on a student's academic performance, as well as the course of action they pursue in the future. Because of the connection of self-efficacy to student persistence or attrition, Tinto (2016) recommended for institutions to not label students as not as likely to succeed as their counterparts, but to provide appropriate and timely support for students so that they can persevere when encountering academic challenges. However, according to Tinto (2016), support must precede struggles so that students' motivation is not diminished and their persistence is not impeded when they inevitably experience struggles. Research concerning self-efficacy in academic settings has been primarily focused on the association of efficacy beliefs and major and career choices, specifically in areas of science and mathematics (Pajares, 1996). Numerous studies cited by Pajares (1996) found:

> the mathematics self-efficacy of college undergraduate students is more predictive of their mathematics interest and choice of math-related courses and majors than either their prior math achievement or math outcome expectations and that male undergraduates report higher mathematics self-efficacy than do female undergraduates (p. 551).

Furthermore, Pajares (1996) cited studies related to students enrolled in science and engineering courses that showed high self-efficacy influenced the academic persistence needed to maintain high academic performance. Additional studies have focused on the role of self-efficacy on the persistence of women in STEM disciplines.

Whitcomb et al. (2020) examined the relationship between self-efficacy for men and women engineering students and final grades for foundational courses. Longitudinal survey data from three points and the final course grades of five engineering cohorts consisting of 3,923 students at a large research university in the United States provided results that in showed considerable disparities in self-efficacy and performance for men and women in engineering, physics, and mathematics courses (Whitcomb et al., 2020). Unsurprisingly, men showed to be substantially more confident than women, even when the performance was equivalent to or worse than women's (Whitcomb et al., 2020). However, in this study, women had higher grades and higher self-efficacy in chemistry (Whitcomb et al., 2020). Furthermore, Whitcomb et al. (2020) noted that the gender gap in self-efficacy closed for the subjects by the students' fourth year apart from self-efficacy in physics. This, according to Whitcomb et al. (2020), could provide an explanation for extreme lack of women in engineering disciplines for which physics is foundational and crucial.

Self-efficacy has also been associated with the types of goals students set for themselves. A study by Hsieh et al. (2007) found a relationship between self-efficacy and a student's

formulation of mastery goals. Mastery goals are defined as the pursuit of competence through development and improvements to their abilities. “Students who have high self-efficacy and adopt mastery goals tend to value effort, persist in the face of difficulty, engage in academic tasks, and have high achievement” (Linnenbrink & Pintrich, 2002 as cited in Hsieh et al. 2007). Therefore, a higher level of self-efficacy lends itself to a sense that mastery of subject material or academic skills is a process.

MacPhee et al. (2013) conducted a longitudinal study that examined the relationship between academic self-efficacy and performance of STEM majors who are underrepresented in STEM areas. The researchers assessed the performance of 175 students who were pursuing STEM degrees and were part of the McNair Scholars Program at a large, public university (MacPhee et al., 2013). The study analyzed the relationship between performance on exams and how the participants viewed the academic skills at both admission to and graduation from the McNair Scholars Program (MacPhee et al., 2013). The findings demonstrated that at admission women students’ academic self-efficacy was significantly lower to male students despite there being no significant differences in their academic performance. However, by the time of graduation, self-efficacy of the women STEM students increased substantially and reached a level that was closer to that of male students. The self-efficacy of male students remained largely unchanged from entry to and graduation from the mentoring program (MacPhee et al., 2013).

Moakler and Kim (2014) relied on freshman survey data to examine the connection between mathematics confidence and academic confidence and background variables such as gender, minority status, and parental occupation as predictors of pursuing STEM majors. Their quantitative study utilized the Social Cognitive Career Choice Model (SCCCM) developed in 1994 by Lent et al. As Moakler and Kim (2014) explained, the SCCCM is based on social

cognitive career theory (SCCT). According to Moakler and Kim (2014), Lent et al. (1994) upheld Bandura's (1986) idea that connects self-efficacy and outcome expectations to interests, as well as academic and career pursuits. As stated by Moakler and Kim (2014), "self-efficacy and outcome expectation spark academic interests, goal development, and career/academic choices. A realistic self-assessment of skills and performance could influence a student's self-efficacy and outcome expectation when making a career or academic major choice" (p. 131).

The findings from Moakler's and Kim's (2014) study showed that students with high confidence in their mathematic ability and academic ability and who had parents with STEM occupations had a higher likelihood of pursuing STEM majors; however, female students had a lower likelihood of choosing a STEM major which was a consistent across all analyses used in the study. According to the authors, the findings suggested that efforts to attract women to STEM were not working and other solutions were needed for consideration (Moakler & Kim, 2014). "The correlation of female students with low confidence in mathematics and low STEM major choice suggests that more holistic and systemic programs need to be implemented to develop female student efficacy and expectations toward STEM majors or fields" (Moakler & Kim, 2014, p. 139). The authors suggested methods to increase women's interest in pursuing STEM majors that included opportunities for the development of their self-image, interactions with women role models and mentors in STEM career fields and building confidence in mathematics by participating in group work (Moakler & Kim, 2014). As Moakler and Kim (2014) note, this did not study the persistence of women in STEM disciplines; however, this study highlights self-efficacy as an important component for women when selecting academic majors upon entry to higher education.

Sense of Belonging

A sense of belonging is central to a student's holistic collegiate experience and academic performance. Strayhorn (2012) claimed a sense of belonging is a basic human need, a motivator for human behavior, is of differing levels of importance depending on context, time, and populations, a result of mattering, experienced in different ways by individuals with intersecting identities, and promotes additional positive outcomes. A sense of belonging can be viewed in two ways. One way is to examine the factors that contribute to a sense of belonging within higher education. Another is to explore how a sense of belonging affects retention and persistence within higher education.

Strayhorn (2012) noted the association between a sense of belonging and student retention.

> Being accepted, included, welcomed, and cared about leads to positive outcomes such as integration into the academic and social realms of college life, which in turn, influences retention, whereas lack of belonging is a primary cause of such departure from college (Strayhorn, 2012, p. 64).

Strayhorn (2012) added that this not only applied to institutional retention broadly but also applies more specifically to academic disciplines like STEM fields.

The focus of Strayhorn's (2012) work on student sense of belonging was students of color, some of the findings from Strayhorn's projects speak to a sense of belonging for women in STEM. From Strayhorn's (2012) work, four primary findings surfaced. First, the significance of a sense of belonging and experiences that generate belonging. Next, in STEM fields, feeling as though they mattered helped students feel a sense of belonging. Third, students experience a sense of belonging at different levels. Finally, a sense of belonging prompts academic success,

including in STEM fields. Strayhorn (2012) found that students felt like they mattered because of encounters with faculty in which students felt care and concern were demonstrated. Those encounters included a social gathering at a faculty member's home, individual meetings, recall of specific individual information such as career goals, and outreach about academic progress in their class. "The experiences seemed particularly meaningful for students who might otherwise have felt marginalized, unprepared for, or "out of place" in STEM fields (e.g., women, people of color)" (Strayhorn, 2012, p. 69).

Smith et al. (2012) postulated that perceptions about the amount of effort it takes to succeed could influence women's sense of belonging in STEM disciplines, and thereby their motivation for persistence. The researchers conducted three studies, the first of which was designed to measure the perceived amount of effort women in STEM felt they exerted compared to their male counterparts. It was found that women perceived that they expended more effort than men to be successful in STEM areas. The perception of effort expenditure predicted a decline in sense of belonging, and thereby motivation (Smith et al., 2012). The second study tested whether a masculinized environment prompted expectations of effort. Through the creation of a fictional program, described as masculinized, the researchers found that women expected to put forth more effort, as well as decreased their intent to pursue the program (Smith et al., 2012). The third study conducted by Smith et al. (2012) found that emphasizing the expectation of effort and normalizing effort expenditure as necessary for success increased the sense of belonging of women in STEM, and thus their motivation for continued persistence.

Good et al. (2012) suggested that mindset was liked to a women's sense of belonging in STEM as she tracked women students through a calculus course. Throughout the semester, women in the course were asked to report how they felt about math, as well as their sense of

belonging in math. In the study, women with a growth mindset had a somewhat strong and sound sense of belonging. Additionally, these women were able to sustain this sense of belonging when they had to interact with faculty members who perpetuated negative stereotypes about women and their abilities with math (Good et al., 2012). In contrast, women with a fixed mindset felt their sense of belonging diminish, as did their comfort with math. As Good et al. (2012) said of women with a fixed mindset, "the stereotype of low ability was able to invade them—to define them—and take away their comfort and confidence" (p. 78). Good et al. (2012) clarified that this was not the fault of the women students who had a fixed mindset, but indicative of the larger societal problem of prejudice.

Tinto (2016) claimed that a student's sense of belonging is necessary for their persistence to degree completion. Students form a sense of belonging when they view themselves as part of a community of other students, faculty, and staff who value their membership – they feel that they matter and belong (Tinto, 2016). A student's sense of belonging often results in a commitment from which the student experiences unity with their group or community and allows the student to withstand struggles and challenges that may arise (Tinto, 2016). According to Tinto (2016), a sense of belonging is one of the most important factors in student persistence and retention.

As part of a longitudinal study, Hansen et al. (2024) examined how a sense of belonging and academic hope contributed to increased persistence toward graduation. A sense of belonging in STEM and academic hope served as significant predictors of information technology students' persistence intentions. While Hansen et al. (2024) studied how a sense of belonging in STEM and academic hope improved persistence for low-income, underrepresented STEM students, the findings reflect Strayhorn's (2012) claims and shows a relationship between a sense of belonging in STEM and aspirations to persist to graduation in STEM academic areas.

Opportunities to build self-efficacy and stabilize a sense of belonging are important and somewhat interwoven components for the persistence of women in STEM disciplines. The experiences and interactions that women STEM students have shape and fashion their perception of self-efficacy and their sense of belonging. Academic advisors are positioned to help women STEM students make sense of their experiences that contribute to these components, possibly also contribute to them, and potentially influence the persistence of women in STEM major disciplines.

The Academic Advisor's Role in Student Persistence and Retention

This section reviews the role of the academic advisor in student persistence and retention from an institutional level, which is necessary to situate before focusing on the academic advisor's role related to the persistence and retention of women in STEM majors.

American higher education began to experience dwindling enrollments and an increase in attrition rates in the 1970s, which led students to insist on improvements to academic advising (Cook, 2001). During this time, academic advising surfaced as an important aspect of higher education. According to Cook (2001), studies conducted in the 1970s began linking academic advising services to student retention, as academic advisors were identified to play a vital role in offering services that considered an individual student's needs and goals. Through this, academic advisors were identified as a primary group of higher education professionals who were critical to a university's retention efforts (Crockett, 1985). Concerning retention, Pascarella and Terenzini (1980) identified a student's interaction with an agent of the institution, as well as the perceived level of concern and care that individual held for the student, as the strongest factors that contributed to a student's return or departure.

Drake (2011) suggested that cultivating and maintaining relationships with students, identifying the places where they become disconnected, and assisting students with connecting [to the institution] serve as a channel to student success, retention, and persistence. According to Drake (2011), research spanning four decades consistently identified three factors that are crucial for student retention and persistence: the significance of connecting students to the institution early in their collegiate experience, intentional programming for first-year students, and quality academic advising, with academic advising precisely situated as the essential link in the retention equation. Tinto (1987) reinforced the assertion that the interactions and experiences students have after entry to higher education are critical for retention and persistence.

> It is the daily interactions of the person with other members of the college in both the formal and informal academic and social domains of the college and the person's perception or evaluation of the character of those interactions that in large measure determine decisions as to staying or leaving (Tinto, 1987, p. 127).

Cuseo (n.d.), identifies the academic advisor as the institutional agents who help students develop an awareness of their interests, talents, values, and priorities; who make it possible for students to envision links between their academic experiences and future plans; who assist students with finding their potential, purpose, and passion; who broaden and enhance students' views concerning decision for their life, and hone students' cognitive capabilities for making these decisions, including problem-solving, critical thinking, and thoughtful decision-making.

Additionally, academic advisors are in the position to determine the factors that create barriers for persistence and thereby can take action to help the student navigate those barriers. Kuh et al. (2005) stated that "advising is viewed as a way to connect students to the campus and help them feel that someone is looking out for them" (p. 214). Therefore, academic advisors, as

agents of the university, exhibit that the institution is committed to the student's success (Kuh et al., 2005). According to literature, academic advisors are situated in higher education to influence student persistence and retention in numerous ways.

The Academic Advisor's Influence on the Persistence Decisions of Women STEM Students

Women STEM students can often feel out of place and unsupported (Hill et al., 2010). Academic struggles coupled with the absence of a sense of belonging can often present feelings of incongruence and isolation (Tinto, 1993). Lacking a sense of belonging and a support system, combined with academic struggles could impact persistence decisions and lead to the attrition of women who pursue STEM majors. Shaw and Barbuti (2010) suggested that academic advisors have the potential to identify students who are susceptible to changing their major to a field outside of a STEM discipline, and because of this, academic advisors could focus their interactions with these students around persisting in STEM majors, make intentional referrals, guide students as they maneuver through obstacles and challenges, collaborate with the student to identify strategies for persisting beyond potential challenges in STEM majors, and assist the student in goal setting and attainment.

Similarly, McGill and Woudenberg (2012) identify the academic advisor as having a vital role in influencing women to remain in STEM degree programs. "…because college is the life stage at which we first start losing women in STEM areas, academic advisors have the opportunity to be on the forefront of working to keep talented women in STEM degree programs" (McGill & Woudenberg, 2012, p. 3). Recognizing the potential influence academic advisors can have during this critical time suggests the importance of the academic advisor's role in supporting the persistence of women STEM students. McGill and Woudenberg (2012) recommend that academic advisors in STEM areas make themselves aware of the climate of

masculinized fields and the effects of that environment on all their students. Additionally, maintaining knowledge and awareness of gender issues can help the academic advisor to assist students with making sense of their attitudes and experiences (McGill & Woudenberg, 2012). The work of McGill and Woudenberg (2012) underscores the importance for academic advisors to have an awareness of the climate of STEM academic department and the experiences of women students in those spaces.

Summary of the Literature

The literature contextualizes the gendered nature of STEM, as well as the factors that contribute to the persistence and retention of women in these academic disciplines. While explaining these contributing factors, the literature is not without limitations. One striking limitation of the literature is that it focuses primarily on faculty. Even though students interact with faculty at a much higher frequency than staff, the exclusion of staff, specifically academic advisors, ignores a segment of the interactions a student has over the course of their academic career. Focusing only on faculty dismisses the possibly meaningful work and interventions and actions that occur from academic advising and other higher education professional staff members.

Another limitation of the existing literature is that academic advising is identified as a practice connected to student persistence and retention primarily at the institutional level and not within an academic discipline. Furthermore, while there is an expansive selection of studies on the lack of women in STEM and the attrition of the women who do initially pursue these academic majors, many of these studies utilize quantitative approaches to study the topics. Literature that examines academic advising and the retention and persistence of women in STEM is even more limited.

This study adds to the literature in that it explores the interactions of women STEM students and their academic advisor(s) using qualitative methods. This provides more insight into what is perceived to be meaningful or not meaningful about interactions for the participants and their academic advisor(s).

Conceptual Framework

The current study draws on self-efficacy (Bandura, 1977, 1986, 1997) as a conceptual framework to examine women STEM students' perceptions of key academic and personal interactions and their influence on persistence on their academic major. Self-efficacy is a concept within Social Cognitive Theory (SCT), which provides a description for understanding human learning, motivation and behavior and posits that personal factors, behavior, and environmental conditions influence each other mutually and in a continuously iterative process (Bandura, 1986). Additionally, within SCT (Bandura, 1986), individuals are not simple recipients of external influences nor do individuals operate completely independent from their environment; instead, human agency emerges through the interpretation of experiences and the regulation of one's own actions. Self-efficacy is defined as an individual's belief and confidence in their capability to complete tasks that accomplish goals (Bandura, 1977). Furthermore, according to Bandura (1977), self-efficacy shapes how challenges are approached, levels of effort expenditure, and responses to obstacles and failures. In STEM environments, the density of the curricula combined with evaluative pressure and the effects of navigating a masculinized, and at times oppressive environment can be substantial for women students; therefore, self-efficacy becomes a key aspect of persistence. Shaped by personal beliefs and social interactions, self-efficacy provides a lens for understanding how internal and external factors influence persistence in

STEM contexts. By framing the study within a self-efficacy framework, the holistic experiences of women in STEM and the factors affecting their persistence can be examined.

Self-efficacy beliefs act as predictors of task choice, persistence, resilience, and performance (Bandura, 1977). The development of self-efficacy emerges from four key sources performance accomplishment (mastery experiences), vicarious experiences (social modeling), verbal persuasion (social persuasion), and emotional arousal (physiological or affective states) (Bandura, 1977, 1986). In Bandura's (1977) seminal work, performance accomplishment is identified as the most powerful source of self-efficacy as it comes from personal experiences of mastering a task or accomplishing a goal; however, as Bandura (1977) notes, while performance accomplishment is considered to be the strongest source, it is not the lone source from which self-efficacy is derived. Vicarious experiences are also sources of self-efficacy that allow observers to see others perform and succeed at tasks or accomplish goals with favorable results, which can help the observer to view themselves of being capable of doing the same (Bandura, 1977). Verbal persuasion is widely utilized in attempts to sway human behavior because of its convenience. People develop beliefs about their capabilities based on suggestions from others (Bandura, 1977). Like vicarious experiences, verbal persuasion is limited as it does not have the same impact as an individual's own achievements (Bandura, 1977). Finally, according to Bandura (1977), demanding and strenuous situations that bring about emotional responses can affect an individual's perceptions of their self-efficacy. These sources are connected to STEM spaces as women students navigate challenging curricula and a gendered environment.

Utilizing self-efficacy as a conceptual framework for the current study provides a lens to examine both individual capability beliefs of women STEM students' persistence and how these beliefs interact with social and environmental factors. This study acknowledges that persistence

is shaped by personal perceptions and the influence of key actors. Ultimately, self-efficacy contributes to resilience and persistence, enabling women to navigate barriers and pursue STEM pathways despite structural challenges. Additionally, self-efficacy is an important factor in retention and persistence of women STEM students and is shown to influence decisions to continue in the pursuit of STEM degrees. Furthermore, beliefs about the ability to meet the requirements of a STEM curriculum have implications for goal setting and perseverance through challenges in the pursuit of achieving goals. This framework then offers an approach to understanding the dynamic processes that affect persistence, guiding the interpretation of the findings, and informing strategies to enhance the persistence of women in STEM spaces.

Literature concerning the application of self-efficacy to the persistence of women in STEM was reviewed in the previous chapter and provided examples to illustrate how individual beliefs, social environments, and institutional structures shape women STEM student' experiences and ultimately persistence in STEM pathways.

Chapter 3: Methodology and Methods

In this chapter, I review the research design by providing a detailed overview of the methodology, methods, sampling, recruitment, data collection, participants, and data analysis. Also included in this chapter are my positionality statement and a description of the researcher-participant relationship.

Purpose Statement

This study centers women STEM students at a public, four-year research university located in the south-central region of the United States. Women who were pursuing bachelor's degrees in the biological and biomedical sciences, computer and information sciences, engineering and engineering technologies, mathematics and statistics, and physical sciences and science technologies, were admitted to the university directly from high school, are in their third year or beyond, and have experienced multiple interactions with an academic advisor and/or faculty advisor in their academic college or specific major area were recruited to participate in this study.

The purpose of this study was to understand the perceptions that women STEM students have about their academic advisor's influence on major persistence. Research connecting academic advising and student retention (Campbell & Nutt, 2008; Hemwall & Trachte, 2003; Light, 2001; Propp & Rhodes, 2006) is largely associated with student satisfaction with the academic advising process (Young-Jones et al., 2013) which can result from any number of factors and does not explore the interactions students have with academic advisors and the ways those interactions can have implications for a student's persistence or attrition. Additionally, empirical research (Levinstein, 2020; Tippetts et al., 2020; Young-Jones et al., 2013) that does attempt to measure the influence of academic advising on student retention and persistence is

quantitative. This study, conducted using qualitative methodology and methods, sought to understand and explore the meanings derived from individual interaction or experiences. A qualitative study allows for further understanding and exploration of women STEM students' perspectives of their interactions with their academic advisors and they ways that those interactions are or are not perceived to influence persistence within STEM majors. Furthermore, literature (Creamer, 1980; Cuseo, n.d.; Drake, 2011; Habley, 1981; Kuh, 2001; Kuh et al., 2005, Nutt, 2003; Pascarella & Terenzini, 1980; Tinto 1987, 1993, 2012, 2016) that have examined student retention and persistence are largely focused on the topic at the institutional level. While acknowledging the importance of retention and persistence at the institutional level, this study drills down and highlights the nuances concerning the retention and persistence of women in STEM disciplines.

From this study, practitioners can gain insight into how women STEM majors perceive interactions with their academic advisor and how those interactions are interpreted as influencing or not influencing aspects of major persistence. Such insight could provoke the examination and evaluation of practices and academic advising approaches. While this study is not meant to produce results that serve as a prescriptive checklist for practice, the results could help practitioners develop awareness and establish a deeper understanding of their role concerning the persistence of women in STEM majors. Furthermore, this study can be useful for advising administrators who develop strategic plans and policies as well as institutional assessments related to academic advising.

Research Question

As stated, the goal of this research is to explore and understand the perspectives that women STEM students have about their academic advisor's influence on their persistence in

their academic major. Following this, the research question for this study is: Within the scope of academic major persistence, how are key academic and personal interactions, such as those with an academic advisor, perceived by women STEM students?

Research Design

General Interpretive Study

This study is based on the ontological assumption that multiple realities of equal value exist, and those realities are based on how individuals experience the world. This ontological perspective is fitting as multiple individuals participated in this study, and each had their own experiences and interpretations of those experiences to share. This stance respects a primary assumption of qualitative research that reality is not universal – it tends to differ and is developed in differing ways (Anney, 2014). This ontological perspective aligns with the trademark elements of qualitative research which seeks to explore and understand how individuals or groups experience social phenomena and the ways they make meaning from their experience, and is based on the understanding that knowledge is constructed by people continuously as they engage in and make meaning of an activity, experience, or phenomenon (Creswell & Poth, 2018; Merriam & Tisdell, 2016).

The elements of qualitative research parallel the epistemological perspective of constructivism. Constructivism refers to the construction of meaning, as opposed to the discovery of meaning. That is, meaning does not have permanence in an object that is waiting for someone to find it, but meaning is formulated and built by individuals (Crotty, 1998). For this study, constructivism was important for understanding each participant's ideas of what it meant to navigate masculinized and oppressive systems, build and maintain self-efficacy, and persistence. From a methodological perspective, this study is a general interpretative study, with

the central goal of revealing and interpreting meaning (Merriam & Tisdell, 2016). While this general interpretive study does not have the additional aspects of other qualitative methodologies (phenomenology, ethnography, grounded theory, narrative, and case study), it is no less rigorous as it relies heavily on the same methods and analysis of data employed in the other methodological approaches. Furthermore, relying on a general interpretive design provided the flexibility to deviate from the established rules of other qualitative methodologies. While aspects of phenomenology, ethnography, and case study are visible in the research design, this study does not fit into the parameters of a single methodology. Therefore, a general approach allowed me to borrow aspects from each and utilize those as appropriate (Kahlke, 2014). The goal for this study was to come to an understanding of how women STEM students experience with their academic advisor and how those experiences were interpreted in terms of persistence in STEM academic disciplines.

Methods

I conducted semi-structured interviews for this study. Prior to seeking approval to begin the study, I conducted a pilot interview with a recent graduate from a STEM-adjacent major to ensure the phrasing and flow of questions made sense and measure the approximate amount of time needed to conduct the interview. To collect demographic information about each participant, I used a short questionnaire (see Appendix A) administered via Qualtrics. The use of a semi-structured interview protocol (see Appendix B) allowed for follow-up and probing questions to be asked as necessary in the course of the interview (Ravitch & Carl, 2016). I used this interview method because there were questions that needed to be asked of all participants, but semi-structured interviews allowed some variation in ordering and wording based on each participant. Therefore, I was able to adjust the wording of questions and to ask appropriate

follow-up questions as I learned more from the participants (Ravitch & Carl, 2016). Qualitative interviews are described as an endeavor to understand the participant's perspective of the world, to uncover the meaning that comes from their experiences, and to discover their world as they live it, which further aligned this method with the methodological, epistemological, and ontological perspectives that informed this study (Kvale & Brinkman, 2015).

Upon beginning each interview, I reviewed the purpose of the study, the expected amount of time that the interview would last, the participant's right to withdraw from the study at any point and plans for how the results from the interview were used (Creswell & Poth, 2018). Additionally, even though each participant completed the informed consent form as part of the demographic questionnaire, I reviewed the content of the consent forms and asked for verbal consent before the interview started. I conducted interviews through Zoom, which allowed me to be in a private setting and the participants to be in a setting they chose that accommodated their desired level of comfort concerning answering the interview questions.

Sampling

Purposeful sampling was employed to "intentionally sample a group of people that can best inform the researcher about the research problem under examination" (Creswell & Poth, 2018). According to Creswell and Poth (2018), when using purposeful sampling strategies, researchers should consider who should be selected as study participants, the exact type of sampling strategy that will be used, and the sample size. "Purposeful sampling is based on the assumption that the investigator wants to discover, understand, and gain insight and therefore must select a sample from which the most can be learned" (Merriam & Tisdell, 2016, p. 96). Patton (2015) explained that qualitative purposeful sampling is rooted in an in-depth understanding of specific cases that are information-rich cases from which one can acquire a

large number of details and insight about the primary issues related to the research purpose.

The purposeful sampling criteria for this study required each participant to identify as a woman who was pursuing an academic discipline in one (or more) of the following areas: biological and biomedical sciences, computer and information sciences, engineering and engineering technologies, mathematics and statistics, or physical sciences and science technologies[4]. Additionally, participants were to have been admitted to the university directly from high school to ensure they established familiarity with the institution and its processes, policies, and inner workings. The final criteria required participants to be in their third year or beyond at the university and have experienced interactions with an academic advisor and/or faculty advisor in their academic college or specific major area. By establishing these criteria, it was presumed that student participants had experienced more than a single interaction with an academic and/or faculty advisor who advises specifically within their department, school, or academic college.

Following the general guideline regarding sample size, I interviewed several individuals that allowed me to gather ample details about the individuals being studied (Creswell & Poth, 2018), and I reached a point of saturation or redundancy. According to numerous scholars (Ezzy, 2014; Lincoln & Guba, 1985; Merriam & Tisdell, 2016; Patton, 2015), saturation or redundancy occurs when no new information is presented by participants.

Recruitment

Once approval was obtained from the Institutional Review Board (IRB), I started the process of recruiting participants. I used three approaches to recruit student participants. Beginning on November 13, 2023, I posted flyers (see Appendix C) in campus buildings that

[4] The demographic survey gave participants the opportunity to specify if they identified as a cisgender or transgender woman.

house departments and courses aligned with science, technology, engineering, and math. Included on the flyer was a QR code that linked to the informed consent form and demographic survey. I also used publicly accessible email addresses to request that the study information be shared with the membership of specific STEM-related organizations on December 4, 2023. Additionally, I used the university's mass messaging (email) system on four separate occasions (November 16, 2023, November 29, 2023, December 7, 2023, and February 7, 2024) to strategically email students in academic colleges that oversee STEM majors. Each email included the link to the informed consent form and demographic survey. The content of these emails is included in Appendix D. An incentive of a $10 Starbucks electronic gift card was offered to those who completed the demographic survey and interview.

Upon receipt of the completed consent form and demographic survey, I followed up with each prospective participant to schedule their interview. Respondents who participated in the interview typically responded within 72 hours. Those respondents who did not reply within 72 hours received one follow-up email before I considered them unresponsive to the invitation to participate in the study. Initially 28 women STEM students completed the informed consent form and demographic survey. Of those 28, six did not respond to the invitation to schedule an interview, one withdrew from the study, and one did not attend their schedule interview time and did not respond to follow-up communication.

Data Collection

I conducted semi-structured interviews with each participant via Zoom from November 2023 to April 2024. Using Zoom provided an element of flexibility and convenience for participants, as the majority of the interviews were conducted after 5 p.m. and during the weekends, which prevented the participants from having to return to campus for the interview.

Zoom's built-in features such as screen sharing, password protection, and recording capability added to its utility and convenience (Gray et al., 2020). Furthermore, by using Zoom, participants had the opportunity to identify a space in which they were comfortable to discuss their experiences with their academic advisor(s), as they may not have been as comfortable discussing the topic in an on-campus location (Gray et al., 2020). Familiarity with Zoom grew out of its necessity during the COVID-19 pandemic, and our reliance on it continues because of its capability to allow for convenient, secure, and comfortable connection while serving the same purpose as face-to-face interaction.

Once each interview concluded, I wrote notes, observations, and reflections from the interview (Ravitch & Carl, 2016). I transcribed the interviews using Microsoft Word within 24 to 48 hours of the conclusion of each interview. As mentioned, I used a brief survey to complete the informed consent and collect some demographic information about each participant. While completing the demographic survey, participants had the opportunity to determine their pseudonym for the study. All raw data was stored in password protected electronic files on a secured external hard drive and backed up on the Microsoft OneDrive.

Participants

The demographic information of the 20 participants is included in Table 1. Each participant selected their own pseudonym to protect their identity. Furthermore, the academic majors of the participants are not included as another layer of anonymity for the participants and their academic advisor(s). Interview participants ranged in age from 20-years-old to 23-years-old (11 20-year-olds, two 21-year-olds, five at 22-year-olds, and two at 23-years-olds). Instead of asking respondents for their classification, they were asked to report their year in school. This was done intentionally as some students enter college with advanced standing credit that

classifies them at a higher level upon matriculation. The responses to the year in school ranged from three to five (10 in year three, eight in year four, and two in year five). In terms of representation across STEM disciplines, the participants were pursuing degrees housed in three academic colleges at the university. Four distinct majors were represented from "College A," seven majors were represented from "College B," and one major was represented from "College C". All participants identified as cisgender women. Regarding racial/ethnic identity, 13 participants identified as White, three identified as American Indian, Native American, or Alaskan Native, three identified as Asian, Asian American, or Pacific Islander, and one identified as Hispanic or Latina. Finally, with respect to educational attainment of at least one parent/guardian, 10 participants indicated a graduate or professional degree, six reported a parent/guardian completed a bachelor's degree, two reported some college (no degree), and two responded that the completion of high school or GED was the highest level of education for at least one parent.

Data Management and Analysis

I created an inventory for the data so I could access interviews and memos based on a system that made sense to me (Merriam & Tisdell, 2016). This information was backed up electronically and stored in a secure location in case of lost or damaged files.

Data analysis started with a deductive approach using a broad list of salient topics informed by the conceptual framework and relevant literature. Initial codes include, but were not limited to "chilly climate," "assumptions based on gender," "positive interactions," "negative interactions," and "self-efficacy." NVivo software was utilized to code and analyze my data. I used an iterative process in which I reviewed interview transcripts with the initial codes in mind and as I re-examined, new codes came to light. In the next step, I determined the themes. I use

the phrase “determined” because these themes did not materialize or emerge on their own (Esposito & Evans-Winters, 2022). This was done by formulating codes into lengthier and robust phrases to demonstrate what was learned from the study (Esposito & Evans-Winters, 2022; Saldana, 2016).

Participants were asked “What influences your belief in your ability to meet the requirements of a STEM curriculum?” The subsequent interview question asked “How, if at all, has your academic advisor encouraged your self-confidence in your academic ability?” The responses to these questions served as the foundation for data analysis concerning the internal and external factors that shaped the participant’s academic self-efficacy. The former provided insight into the multiple influences that shape self-efficacy, while the latter narrowed the focus to a key interaction within the higher education environment and allowed for the exploration of academic advising interactions as either supporting or constraining the development of academic self-efficacy. Responses to these questions provided a basis for identifying themes and further understanding how self-efficacy and persistence are constructed for women students in STEM spaces.

Trustworthiness

As a qualitative study, the aim was not to produce generalizable findings. However, findings from qualitative research can be transferable to different settings (Lincoln & Guba, 1985). To achieve this end, I utilized thick descriptions and richness in detail (Merriam & Tisdell, 2016). Strategies for meeting dependability include an established audit system. For confirmability, I relied on reflexive practice when engaging in data collection and analysis.

Researcher Positionality

Researcher positionality explains potential biases, attitudes, experiences, and assumptions related to the topic and research that will be conducted (Merriam & Tisdell, 2016). Wolcott (2010) added the following about researcher positionality:

> Our readers have a right to know about us. And they do not want to know whether we played in the high school band. They want to know what prompts our interest in the topics we investigate, to whom we are reporting, and what we personally stand to gain from our study (p. 36).

My professional and educational experiences have undoubtedly informed my interest in this topic. For 10 years, I worked as a primary role academic advisor with students in a major discipline that is not categorized as a STEM field by the criteria used in my study. However, the major I advised had issues that influenced my view of the academic advisor's role in higher education. My role as an academic advisor for a major that utilized an enrollment management plan that required students to apply and attain formal admission shaped my perspective concerning an academic advisor's potential for influence and effectiveness. I engaged in numerous activities that allowed me to be associated with institutional retention efforts. Through these efforts, I was able to assist with removing obstacles to continuous enrollment, thereby impact retention. My participation in these efforts and practices allowed me to see firsthand that academic advisors have the potential to impact retention at the macro level.

Additionally, my position is informed by the three years I spent working with students in a STEM major early in my career. While I was not employed as an academic advisor during that time and therefore did not have a great deal of interactions with students, I vividly recall the representation of women in that specific STEM area was minimal, so much so that on one

occasion a student who identified as a White woman was considered diverse. Furthermore, interactions with male students and professors revealed attitudes and biases about women who pursued STEM majors. In February 2024, I became the Director of Advising for an academic college that is made up of exclusively STEM academic disciplines which further affect my viewpoint.

I would be remiss to exclude my consumption of media as an influencer of my position concerning this topic. In recent years, corporations, non-profit organizations, government agencies, and educational institutions have organized efforts and programs to increase the presence of women in STEM disciplines beyond the secondary education level and in the workforce. My attention has been drawn to television commercials and social media posts that highlighted these efforts and programs, thus reinforcing my view that this is an important topic to study.

Furthermore, my own biological sex and gender identity, influence my position concerning this research. My biological sex is female, and I identify as a woman. Gender roles and gendered institutions were concepts that I developed an awareness of fairly early in my life, even if I did not have language for it, as I was raised with three older cisgender men. Societal expectations concerning what a woman should or should not do were clearly stated on a regular basis throughout my upbringing. As a teenager, I began to think more critically about why these "rules" were in place, how they were problematic, and how they could be questioned and challenged. I also began to think about how women historically challenged societal norms and how this could expand. This has influenced my scholarly work and professional practice.

Finally, my racial presentation and identity influence my perspective. As a white woman, I experience privilege in that I do not have to consider how intersecting identities influence my

interactions and experiences in the same way that non-white women do. Because of white privilege, I have not experienced multifaceted prejudice or discrimination. This may have influenced participant recruitment in some ways as women STEM students of color may have been hesitant to participate about their interactions with academic advisors. Furthermore, my findings were generated from a white experience and perspective, which I worked to maintain an awareness of and challenged as I analyzed the data.

Researcher-Participant Relationship. Regardless of how I saw myself and my role in the research process, relationships inevitably formed with the participants (Glesne, 2005). In looking at the participant's right to privacy, it was critical to uphold the expectation of confidentiality and anonymity (Glesne, 2005). As mentioned, this was accomplished by using pseudonyms and the omission of mentioning specific majors or academic colleges of the participants (Glesne, 2005). To avoid deception, it was important that I disclosed my dual roles as a researcher and a professional academic advisor. The deliberate omission of this information could have potentially damaged my goal of establishing trust and rapport with the participants as it was possible for the participants to discover my professional role on their own, share that information with others, and ultimately diminish my reputation as a researcher and discourage others from participating. Being honest and upfront about this was not only a mechanism for building trust with the participants; it also helped me to avoid any perceptions of deception. It was an ethical approach for the situation, and I did not believe masking that aspect of my life was justified, nor would it have added any value to the data collection process. In addition to compensating participants, I also offered reciprocity through the interview process itself (Glesne, 2005). Attentive listening and showing sympathy were the simplest methods for accomplishing this (Glesne, 2005). Finally, it was important to understand cultural differences that may shape

understanding, interpretation, and the development of meaning for participants. Culture is broad, and it undoubtedly allowed different perspectives to emerge in this study, which was welcomed.

Table 1. Participant Demographics

No.	Pseudonym	College	Major	Age	Year in school	Gender Identity	Racial/Ethnic Identity	Highest education level complete by at least one parent/guardian
1	Kayleigh	A	1	20	3	Cisgender Woman	White or Caucasian	Graduate or professional degree
2	Savanna	A	1	20	3	Cisgender Woman	White or Caucasian	Graduate or professional degree
3	Anna	B	1	20	3	Cisgender Woman	White or Caucasian	Bachelor's degree
4	Eris	B	2	20	3	Cisgender Woman	American Indian, Native American, or Alaskan	Graduate or professional degree
5	Erica	A	1	22	4	Cisgender Woman	Asian, Asian American, or Pacific Islander	High school or GED
6	Madeline	B	3	20	3	Cisgender Woman	White or Caucasian	Bachelor's degree

Table 1. Participant Demographics, cont.

No.	Pseudonym	College	Major	Age	Year in school	Gender Identity	Racial/Ethnic Identity	Highest education level complete by at least one parent/guardian
7	Avery	B	4	20	3	Cisgender Woman	White or Caucasian	Bachelor's degree
8	Emma	A	2	20	3	Cisgender Woman	Asian, Asian American, or Pacific Islander	Graduate or professional degree
9	May	C	1	21	4	Cisgender Woman	White or Caucasian	Graduate or professional degree
10	Drew	A	3	20	3	Cisgender Woman	American Indian, Native American, or Alaskan Native	Graduate or professional degree
11	Tania	A	1	20	3	Cisgender Woman	American Indian, Native American, or Alaskan Native	Bachelor's degree
12	Sophia	A	4	21	4	Cisgender Woman	White or Caucasian	Some college (no degree)

Table 1. Participant Demographics, cont.

No.	Pseudonym	College	Major	Age	Year in school	Gender Identity	Racial/Ethnic Identity	Highest education level complete by at least one parent/guardian
13	Leslie	B	1	23	5	Cisgender Woman	White or Caucasian	Graduate or professional degree
14	Pinky	B	2	22	4	Cisgender Woman	White or Caucasian	Some college (no degree)
15	Christine	B	5	22	4	Cisgender Woman	White or Caucasian	Graduate or professional degree
16	Madison	B	6	23	5	Cisgender Woman	White or Caucasian	Graduate or professional degree
17	Lena	A	1	22	4	Cisgender Woman	White or Caucasian	Bachelor's degree
18	Olivia	B	7	20	4	Cisgender Woman	White or Caucasian	High school or GED

Table 1. Participant Demographics, cont.

No.	Pseudonym	College	Major	Age	Year in school	Gender Identity	Racial/Ethnic Identity	Highest education level complete by at least one parent/guardian
19	Paula	B	2	22	4	Cisgender Woman	Hispanic or Latina	Bachelor's degree
20	Bee	A	2	20	3	Cisgender Woman	Asian, Asian American, or Pacific Islander	Graduate or professional degree

Chapter 4: Findings

This chapter presents the key findings that emerged from the data surrounding academic major persistence and the role of key personal and academic interactions, including those with academic advisors. Broadly, STEM curricula include academic disciplines related to science, technology, engineering, and mathematics. For the current study, STEM disciplines included, biological and biomedical sciences, computer and information sciences, engineering and engineering technologies, mathematics and statistics, and physical sciences and science technology to account for the array of STEM disciplines offered by South Central University. While STEM encompasses science, technology, engineering, and mathematics, none of the participants in this study were pursuing a degree in mathematics; however, extensive mathematics courses are required for the academic majors represented in the current study.

One aspect of academic persistence, self-efficacy, emerged as an important component for women STEM students in the study. Self-efficacy is an individual's belief and confidence in their capability to complete activities that would lead to the achievement of a goal (Bandura, 1977). Researchers have demonstrated that self-efficacy beliefs can act as predictors for behaviors associated with engagement, perseverance, and goal attainment (Bandura, 1977, 1986, 1997; Pajares, 1996). Furthermore, self-efficacy beliefs tend to be gendered as women STEM students have been shown to have lower self-efficacy than men when entering STEM disciplines in higher education (Hsieh et al., 2007; MacPhee et al., 2013; Moakler & Kim, 2014; Whitcomb et al., 2020).

Drawing on interviews, the findings revealed that academic self-efficacy was primarily formulated through internal influence, parental and peer influence, and community, belonging, and institutional support (e.g., tutoring and mentorship), While academic advisors can influence

the academic-self efficacy and academic self-confidence of women STEM students, they were not initially regarded as such. Furthermore, the strength or fragility of the relationship between a woman STEM student and her academic advisor likely sways the degree to which an academic advisor is perceived to influence this component of academic persistence. Beyond these influences, the participants' social location such as race/ethnicity, class, gender (Moakler & Kim, 2014), as well as the association of STEM with masculinity (Keller, 1985; Rutherford, 2020; Garr-Schultz et al., 2023) shaped academic self-efficacy beliefs and affected how the participants navigated their experiences through higher education and STEM disciplines.

Internal Influence

Individuals do not simply take in external influences, nor do they operate wholly free from their environment; instead, human agency develops through the understanding of experiences and the regulation of one's own actions (Bandura, 1986). Following this line of thought, the 11 participants who responded that their belief in their ability to meet the requirements of a STEM curriculum (academic self-efficacy) in some way came from their self were likely exposed to social interactions that allowed them to create a self that was confident in their ability to meet the requirements of their respective STEM major. These findings echo similar findings by Shehab et al. (2007) regarding strategies for persistence in which personal strategies were cited with the greatest frequency by participants in that study. "Students using personal strategies typically looked internally for motivation to overcome academic struggles" (Shehab et al., 2007, p. 13).

Among the participants, Paula, a 22-year-old, third-year international student who identified as Hispanic/Latina and who had at least one parent with a bachelor's degree directly attributed her academic self-efficacy to an internal source. Paula said,

> I think, in general, when I was in high school, I was always really scared of failing. So, I never fail. And so, when I came here, that kind of kept going. But I definitely learned how to relax a little bit, and that was helpful, like definitely managing my lifestyle, but I think what kept motivating me was kind of that line setting that I put in myself. It was like you can do this and like just keep going. But I definitely think it was more of a self-motivation and not from an outside factor. I really cannot think of anybody or anything that really like push me through it. If anything, my family, but in that sense, they've always been supportive, too. So, I think it came more from me, and they were just supporting it because they knew I wanted that outcome.

While acknowledging familial support, Paula clarified that it was more universal across her life and not specific to academics. Paula describes a fear of failure that motivated her through high school and feeling that she is ultimately and solely responsible for her belief in her ability to meet the requirements of a STEM curriculum.

Eris, who also credited her parents, specifically her father, for the development of high academic self-efficacy, also acknowledged herself as a source of high academic self-efficacy. Eris said,

> I feel like, like my belief in my ability has definitely come through like doing the courses and recognizing that I excel in those areas. ... And then also just like myself, you know, just me being confident and knowing that I'm doing what I want to do in life.

Eris demonstrates that the self is constantly being shaped through experiences. In this instance, Eris developed a self that was assured by the confidence derived from completing and excelling in her STEM curriculum. Successfully meeting the requirements and thus continuing in a STEM curriculum, contributed to the formulation of strong academic self-efficacy beliefs for Eris and

allowed her to feel assured that she would be able to do what she wanted through the course of her educational and professional careers.

Drew, a 20-year-old, third-year student, who identified as Native American, and had at least one parent with a graduate or professional degree response mirrored Paula in her response as she attributed her academic self-efficacy and its continued development to herself. Drew stated,

> Confidence. Hard work. I mean, my freshman year, I remember thinking of the class...looking at the classes I'm going to take next semester and thinking I don't know if I can even get through the prerequisites for this and somehow, I'm here. So, I think it's just believing in yourself and just letting time work. I would say even last semester I was like, 'I don't know how I'm gonna do this.'

Of these 11 participants, seven participants were less direct in their responses, yet alluded to academic self-efficacy as a self-generated belief. Madeline, who was 20 years old and in her third year, for example, stated that the source of her academic self-efficacy was the connection between her previous academic performance, the pursuit of challenges, and the capability to handle challenges. Madeline, who identified as white and reported at least one parent/guardian with a bachelor's degree said, "I think I just knew that I was like pretty decent at school, and so I wanted to, like, challenge myself and, um, felt like capable to handle that challenge."

Savanna's response more directly addressed her work ethic and self-drive as the predominant source of her academic self-efficacy while simultaneously acknowledging materials such as course materials, tutoring, and access to faculty as components contributing to her academic self-efficacy. Like other participants, Savanna was also 20 years old, in her third year,

identified as white, and reported to have at least one parent with a graduate or professional degree. Savanna said,

> Um, I, I've talked about this with a lot of people, but I think it's just personally for me it's a lot of just self-drive. Um, and I mean, obviously I think that I've had the experience of the people around me being very accepting of no matter what I do, they'll be okay with it, and I think that's kind of driven me to be a lot more just pushing myself to do what I can. Um, I think that I also have been given the materials to be successful. I know a lot of people have issues with, you know, keeping up with a STEM curriculum but in reality, like in my opinion, I'm not someone that just understands things and is able to just get good grades. My work ethic is something that I do take pride in because that's really the main reason that I am successful and I just think that besides, you know, the support around me when it comes to professors, I think that the materials that I've been given by my pre-med advisor, my professors, things like that, I, um, am able to do the work and I know that, I, the results that I've been given and thus far have been probably the main reason why I feel that I can succeed long term.

May, a white, 21-year-old student in her fourth year and who responded that at least one parent earned a graduate or professional degree, shared three elements that she believed contributed to the development of her high academic self-efficacy. Those elements were earning good grades in her STEM classes, positive experiences associated with research such as attending conferences and conducting poster presentations about her research, and moments in her classes when the content made sense. Comparable to May's response, Christine also shared that academic performance had a significant role in building her academic self-efficacy. Like

May, Christine was also in her fourth year at age 22, identified as white, and had at least one parent who completed a graduate or professional degree. Christine stated,

> Yeah, um, definitely past academic performance is a huge one. If I had not done well in STEM classes in high school and I hadn't been supported in those classes, I definitely would not have thought I would be good in a STEM field. I think my ability to problem solve ... having had experiences being kind of the only woman in the room was, has been reassuring and going into a STEM field, especially going into the [industry], which is what I'm doing. Like, that's a pretty rough and tumble atmosphere. So, my ability to lead and have a lot of self-confidence, um, in my own work and in my own like knowledgeability has been huge.

Bee a 20-year-old, third year student who identified as Asian and at least one parent with a graduate or professional degree, also responded that her academic track record served as a source for building and maintaining academic self-efficacy in a STEM major, specifically in the progressive manner of the curriculum. "Primarily just being able to say like, 'I got that A in that class, so I should be able to succeed well enough in this class that's coming next.'"

While May and Christine do not say the word "self" in a direct sense, the attribution to the self is present in that these elements (grades/academic performance, research experiences, in-class understanding, and problem solving) can be thought of as individualized and personal to a strong degree. Christine's statement uses phrases of possession (my own work, my own knowledgeability), which is a way of saying "self".

Tania, a 20-year-old Native American student in her third year with at least one parent who earned a bachelor's degree, provided a response that demonstrates that academic self-efficacy in STEM is not always a consequence of academic performance but can be connected to

interest in the topic. It stands to reason that students connect with and engage on a deeper level with material when they are interested in it. “Well, my interest for one. Um, if I’m interested in the topic, I’m more likely to, like, put my, um, more effort into it.”

Erica, a 22-year-old student in her fourth year who identified as Asian and reported at least one parent who completed high school or a GED, answered this question linking her academic self-efficacy with her ability to connect the content of each class and progress through the curriculum. Building a foundational understanding and comprehending the material to be able to confidently progress to advanced courses in the curriculum was a central element of Erica’s response. Erica said,

> Um, definitely the amount of like recall and ability I have to function within the major and be educated in it. So, if I can go from different classes that have overlapping material, um, and sit there and go, ‘no, I know exactly what this means,’ and I know the inner depths and the inner workings of it, and of course grades as well. But you can’t take grades out a STEM major, um, but all of those things combined kind of like contribute to it--because like having been like taking physiology and then physics and taking biochemistry, I know how they all kind of like interact with each other and how like everything will mention each other and like kind of seeing like the--this sort of working together of all of these classes together is really what’s like made me understand that like if I can recall these things and if I can understand these things still and I can apply them to things around me, I’ve been doing pretty well, not phenomenal, of course, because I could be doing better, always doing better in STEM. But I have made a great impact over the years is what I could say.

Similarly, academic motivation, resource utilization, and goal attainment were important elements for Emma's academic self-efficacy. Emma reported being 20 years old and in her third year. She identified as Asian and at least one of her parents had a graduate or professional degree. Emma stated, "Every time […] I have a hard class, like, I will always put my best effort in knowing that I can talk to professors or other things for resources for that." Additionally, for Emma, experiencing success in prior challenging coursework and finding a balance between school with other aspects of life provided her with a sense of academic self-efficacy. Emma stated,

> So just like I think, for me, having that kind of like evidence that like, 'Okay, you've done this, you remember those times that were really hard classes so you can get through any other hard classes that come your way.' And then I think lastly, just knowing that college is about managing, like, lots of different aspects of life and so having a strong sense for academics, but not making that your entire like life really helps to balance everything out and knowing that I can still succeed in what I want to do, but like, have time for myself and do things that I want to do as well.

While attributing academic self-efficacy to oneself does not eliminate the influence of external factors, it does subtly suggest that other factors were not influential. This individualist perspective is not necessarily surprising in examining influences of academic self-efficacy, especially given that mastery experiences are personal and therefore be more powerful sources of self-efficacy. Even when acknowledging the role of support structures and resources, the emphasis is still on individual decision and action.

Parental Influence

Parents are primary socializers (Berger & Luckmann, 1966) and have a central role in teaching their children about societal norms, as well as in shaping their child's self-efficacy (Bandura, 1977). Five participants gave credit to their parents for influencing their academic self-efficacy in some way, while also crediting additional influences.

Eris, a 20-year-old third year student who identified as Native American and reported that at least one parent completed a graduate or professional degree, identified her parents and her course performance as sources for her academic self-efficacy. In terms of parental influence, Eris shared in her interview that her father's profession in the same STEM discipline she pursued influenced part of her academic self-efficacy. Eris said, "Definitely my parents too, because my dad was a[n] [profession] and you know, he definitely helped me understand that I do have what it takes to be a[n] [profession]." Eris's example shows the influence of vicarious experiences, as well as social persuasion on academic self-efficacy beliefs.

Pinky, a 22-year-old, white, third year student whose parents completed some college, also highlighted the influence of her parents on her academic self-efficacy, especially in terms of her work ethic. Pinky stated,

> I think, uh, definitely one thing that's so...my parents are...my dad's a firefighter, and my mom's a police officer, but she was like, she was a police officer in the 90s, like a woman cop and like, that was never, you know, that wasn't a huge thing. And but my parents just always, like, instilled hard work in me. And so, I think that's just been a big thing is like my parents influencing me to work hard and that, you know, they've always just taught me that you can do whatever you, whatever you put your mind to, you just work hard at it.

Pinky's mother worked as a police officer, which, like STEM, is also a masculinized field. Arguably, this symbolic modeling helped Pinky to formulate a sense of belonging for herself in a masculinized space, which helped her to develop strong academic self-efficacy beliefs. Further, Pinky's response draws a connection between blue-collar professions and work ethic and brings attention to the perception that manual labor often associated with blue-collar professions equates to a stronger work ethic and a stronger work ethic translates to achievement and success.

The effect of parental influence on academic self-efficacy also appeared in Avery's response. Avery identified as a white, 20-year-old student and reported she was in her third year of college. The highest level of education for at least one of her parents or guardians was a bachelor's degree. In her response to what factors contribute to academic self-efficacy, Avery explained that her parents shared supportive messages that encouraged her to pursue whatever she wanted, which reinforces the myth of meritocracy, the idea that success is determined by solely hard work and individual effort. While the messages Avery received from her parents were meaningful to her experience and demonstrate the role of verbal persuasion as a source of academic self-efficacy, by attributing the development of her academic self-efficacy solely to merit, Avery is disregarding the impact of the social connections she had to individuals associated with STEM. Resembling Pinky's example, Avery's mother's profession influenced her academic pursuits. "My mom was a math teacher, so she encouraged a lot of, like, STEM work and stuff. So, I think that definitely influenced me a lot." In addition to her mother, Avery also underscored the importance of her high school calculus teacher, also a woman. "And then I also had this calculus teacher in high school, and she was also female. And I feel like she like really helped me and like kind of was the reason why I wanted to go into [academic area]." While the positive messages she received from her parents undoubtedly influence Avery's belief

in her ability to succeed in a STEM discipline, the women role models that Avery had were critical to the development of her academic self-efficacy and self-image and pursuit of a STEM academic major.

Like Avery, Anna also credited her mother as a primary role model that influenced her academic pursuits and academic self-efficacy, while also crediting her high school teachers for supporting her goals. Anna, a 20-year-old, white, third year student, and who had at least one parent with a bachelor's degree, stated,

> Um, so, as I said before, my mom is also a[n] [profession], and she's also been, always been, my, my main support system, super empowering, things like that. And then also teachers in high school were super, um, also just supportive and things like that, um, always asking like what I wanted to go into and encouraging me and things like that. Um, I would say that those were the main reasons that I chose [major].

Anna's response echoes previous responses concerning role models and support systems, especially family. Like Eris, Anna observed a parent, in this case her mother, holding a profession in a STEM field and chose to follow her mother's career path. The potential of vicarious experiences and social persuasion as sources of academic self-efficacy are present in Anna's example. Furthermore, Anna's experience also highlights that pre-collegiate role models, such as a parent or high school teacher, can be salient for women beginning on STEM pathways.

Sophia's response provided a perspective of the role of parental influence that differed from the other participants. Sophia, who demographically mirrored the other participants as a 21-year-old, white student in her fourth year, shared that as the child of a single mother who completed some college but no degree, she felt she had no other options, since her mother prioritized her going to college. However, Sophia shared that she was not pressured to pursue a

STEM major specifically, and it was her experience of attending a STEM-oriented high school that prompted her to pursue a STEM discipline in college. Sophia's response demonstrates the strength of parental influence in college-aged students' pursuit of higher education (verbal persuasion), yet her major choice was more influenced by pervious experiences (performance accomplishment). While Sophia was inclined to pursue a STEM discipline based on her earlier experiences and preparation, many other students have different levels of exposure and preparation and at times select their major based on what their parents direct them towards or, in some cases, decide for them. In Sophia's case, being raised by a single mother who did not complete a college degree, and witnessing the challenges that came with this, led her to view a college education to create a different life from her mother's. From this, From Sophia's perspective, her mother's priority for her to go to college was a driving force behind her academic self-efficacy; however, there is an implication that her mother wanted Sophia to assure a level of self-reliance for herself as completing a college degree is viewed to gain upward mobility. It is plausible that Sophia's example demonstrates the role of emotional arousal and verbal persuasion as sources of academic self-efficacy. Additionally, Sophia's situation reflects a longstanding trend of messaging in the United States that connects prospective earning potential and the completion of a bachelor's degree. Interestingly, earnings are not necessarily equivalent across STEM professions and inequality in salaries continue for men and women in STEM professions.

The experiences of the participants examined in this section provide examples of the ways parents influence academic self-efficacy, though that looked different for each participant. Here we see that the development and maintenance of academic self-efficacy can be deeply

rooted in the child/parent relationship through vicarious experiences, verbal persuasion, and emotional arousal.

Peer Influence

Peers act as secondary socializers (Berger & Luckmann, 1966) and are another important factor in shaping academic self-efficacy. Three participants, Lena, Kayleigh, and Madison, discussed the ways in which their peers and peer interactions fostered their academic self-efficacy.

Lena, a 22-year-old student in her fourth year, who identified as white, and responded that at least one parent completed a bachelor's degree provided a response that gave much of the credit for her academic self-efficacy to her peers, especially other women in STEM. To see women peers and classmates succeed in STEM programs provided her with confidence, particularly as she identified qualities that she had in common with these women STEM students. Lena said,

> I think looking and watching my peers and classmates, and how other women in STEM have gone through the program and done well, I think I look at them as an example and compare myself to that and see similar qualities. So that's what I guess has led me to feel confident in my ability to get through the STEM program.

By drawing parallels between herself and successful women STEM students, Lena was able to develop a self-image that contributed to a high academic self-efficacy. Lena's response demonstrates that vicarious experiences through peers can have an impact on the development of strong academic self-efficacy beliefs.

Kayleigh, a twenty-year-old, third-year student, who identified as white, and reported at least one parent who completed graduate or professional school, attributed her academic self-

efficacy to the people around her and the support she received from others. “Um, being a STEM major is very hard and there’s definitely been times where I like … rethought about, rethought it. But I’ve always had the people around me to kind of help motivate me and tell me that I could do it.” Kayleigh’s response demonstrates the importance of women STEM students having support from the people in their social groups and how that support can encourage high academic self-efficacy, another form of social persuasion.

Madison, a 23-year-old in her fifth year who identified as white and responded that at least one parent who completed graduate or professional school, answered that she derived confidence from working in teams and accentuated the importance of an encouraging environment. Team or group work is a regular occurrence in the courses that comprise STEM majors; therefore, this is something Madison would have frequently encountered. Developing academic self-efficacy from working in teams implies that Madison’s experiences were positive, and her peers helped to create an encouraging environment in which Madison was able to thrive. Madison’s experience provides an example of how peer interactions are pivotal in socializing individuals and influencing self-efficacy beliefs.

Like parents, peer influence is an important component of socialization. Whether the support is direct or indirect, the participants found value in these connections to influence their academic self-efficacy. The experiences of this set of participants demonstrates how the peers of women STEM students are valuable in the development of high academic self-efficacy.

Community, Belonging, and Institutional Support

The support of a community and a sense of belonging can be generated from institutional support. Institutional support often involves built-in mechanisms designed to support academic success (e.g., tutoring) but includes faculty, staff, and peers, who act as agents of the institution.

While academic advisors often hold staff and/or faculty roles, for the purposes of the current study they are viewed separately from the staff and/or faculty who interact with students in capacities other than academic advising. Further, institutional support can include other mechanisms that offer students a sense of community and belonging, which includes ambassador programs that allow student the opportunity to represent their academic college and university and bond with their peers. Olivia's and Anna's responses provided insight into the ways community, belonging, and institutional support influenced their academic self-efficacy.

In her response, Olivia, a 20-year-old student in her fourth year who identified as white and reported high school or GED completion for at least one parent, identified several factors, including her advisor, friends, professors, and parents. While Olivia mentioned several factors and referred to her academic advisor, much of her explanation emphasized the role of her professors. Olivia stated,

> The handful of really good professors that I've had and have, like, I'm really close to, not really close, I stay really close, but I just emailed them for like a reference or something. I've had really two really good math professors that have been like male and they've...they always love to hear from me. They always want to, like, I reach out to one for like a reference, and he was like, 'Oh my gosh, so good to hear from you. Like, hope you're doing well. I would absolutely love to do this for you. Like, you were one of my, like, favorite students. And like, I would love to do this for you,' you know? Just kind of like that, um, is really nice, I guess.

Olivia eventually gave credit to herself, "I guess myself; I've always been really driven and when I want something, I get it, you know?" Additionally, goal achievement was an element Olivia added as a source of her academic self-efficacy. "Like I've dreamed of being a

[profession] forever and here I am a year and a half away from it, you know? So really just myself and my own motivation and dreams and goals." Finally, for Olivia, the educational environment played a role in her academic self-efficacy. "And, and just the environment. [institution] is a really, overall, [institution] is a really positive like...that's why I wanted to come here because I felt like I belonged. Like, it felt that they wanted me, and they wanted to see me succeed and stuff."

Olivia's academic self-efficacy was developed in-part by the encouragement of her math professors who invested in her endeavors beyond their class by enthusiastically serving as a reference for an opportunity Olivia pursued. Interestingly, Olivia's experience seems to prioritize emotional arousal as a source of her academic self-efficacy over her own drive and motivation.

As mentioned in the previous section, Anna's decision to seek a STEM major was primarily influenced by her mother and a high school teacher, however she attributed her persistence in a STEM discipline and the belief that she could complete the requirement of a STEM curriculum to the bonds she formed with other students through her student recruitment position, as well as student organizations within her academic college. Anna said,

> … staying in [major] has been like the people that I've met. Um, I'm in student recruiting, so I've met a lot of people through [academic college] student recruiting, as well as, like I said, the student organizations, um, and just I guess having people to study with and keep you going is super helpful.

Remaining on a STEM pathway can be influenced by building a community or support network and developing a sense of belonging, which is shown to be important to Anna's persistence and her belief in her ability to succeed in a STEM discipline. The formation of bonds and building community with like-minded students who share similar experiences could very well open the

door for instances of vicarious experiences, verbal persuasion, and emotional arousal to influence academic self-efficacy. While Anna did not provide specific examples that can be classified as any of these sources, it is safe to presume that interactions occurred that represent these sources of self-efficacy.

The Explicit Role of the Academic Advisor in Self-Efficacy Beliefs

Fascinatingly, when asked the more general question regarding factors that influenced academic self-efficacy, Leslie was the only participant to voluntarily acknowledge her academic advisor's role, which was in stark contrast to the other participants' responses. As other participants attributed their academic self-efficacy to individual influences, parents, peers, and community, belonging, and institutional support, Leslie's response highlights the importance of the academic advisor's role in helping her to navigate options, make sense of setbacks, and identify resources. Leslie was one of the more established participants at 23 years old and in her fifth year of college. Further, she identified as white and reported that at least one of her parents completed a graduate or professional degree. During her interview, Leslie shared that she primarily discussed credits and scheduling with her academic advisor after experiencing some academic challenges after returning to campus from the COVID-19 pandemic. "I was like barely passing, had to withdraw classes, and so like mainly our conversations revolve around the, uh, like flow of my classes..." In her response Leslie identified external elements such as support services provided by the institution and specifically acknowledged her academic advisor as an influence on her academic self-efficacy. Leslie said,

> I would say that institutional support, obviously through my advisor, you know, let me know what classes I could take to help me, you know, like very easy to, you know, not pass one class and then decide, you know, 'Time to leave college or just to do

> something.' You know, very different. It's very easy to take a hit like that and, you know, back away. So obviously it's support from my advisor. You know, I tell her my problems and she's not instantly like, 'Oh, I need to, like, leave.' Like, obviously, that's like...and her encouraging me through that process was obviously very...I'd say like my self-esteem is the biggest factor. But what feeds that is the support from the institution. Like they believe in me, and they have seen students, many, many students go through the same thing, and so, you know, they have all the data, they're the professionals, and you know, they're saying this is possible, so I should trust them. And so far, that trust has been, you know, rewarded, you know. I'm doing good. I'm still pursuing my degree. I haven't left [major], and I love it. This is truly like; I cannot imagine doing anything else besides [major].

Leslie also shared how her academic advisor made her feel supportive and safe as she faced challenges with the course. Leslie stated,

> I did have a time period where my grades were poor and I was really scared, and it didn't feel good. But, when I went into my advisor's office, I didn't feel like I was in trouble [...] And again, feeling safe to bring up like, 'I need to withdraw from this class. It's going to kill my GPA. Like I am just not going to like pull through on this.' [...] You know, she's like, 'No, you have been through this before, you can do this one as well.' [...] And so they would help me differentiate what is realistic, what is a realistic worry or concern that would change my college career path and what is just me talking myself down...

Leslie's interaction with her academic advisor shows how previous experiences with success can be leveraged through verbal persuasion to influence academic self-efficacy beliefs. Even as she

experienced adversity and setbacks, this interaction with her academic advisors was one in which Leslie felt she was reassured of her capability to meet the requirements of her specific STEM discipline.

The Implicit Role of the Academic Advisor in Self-Efficacy Beliefs

Once asked how, if at all, their academic advisor encouraged their self-confidence, participants shared varied experiences of interactions that were not as direct as Leslie's previous example yet supported the development of academic self-efficacy for some of the participants. Three participants, Leslie, Olivia, and Drew, praised their academic advisor's encouragement and provided details about what their advisor did to encourage their self-confidence in their academic ability. Leslie focused on her academic advisor's positivity and outlook on challenging courses. Leslie said, "Well, obviously, you know, in our meetings, like, just being very positive, you know, and even if the class was going to be challenging, um, they didn't make it seem challenging." This speaks to how academic advisors frame classes, especially those in a STEM curriculum, when interacting with women students, which could have implications for how women students approach the classes and their outlook on their performance, as well as their interpretation of whether their interactions with their academic advisor is positive or negative.

Olivia emphasized that her academic advisor provided her with reminders of the challenges and obstacles she previously navigated and conquered, which helped her to formulate a positive outlook on her current and future challenges. Olivia stated,

> She's so good at it! I don't know how she does it! Again, just like I said, like, she reiterates everything I've gone through, and everything just challenges I've overcome. And, yeah, I mean that's, that's literally, it's, it's simple because she literally just tells me what I've overcome and I'm like, 'Oh, my god, you're right. I forgot I can do it.'

Highlighting previous experiences, especially those in which the student prevailed through a challenging course, again demonstrates how mastery experiences coupled with verbal persuasion can be effective sources of academic self-efficacy.

Drew shared that her academic advisor encouraged her to not worry much beyond planning enough time for a specific lab course. For Drew, this was a meaningful form of encouragement related to her academic self-confidence as Drew said,

> I think deep down as a student, all you want to hear is just somebody telling you, 'Hey, you've got it. I know it doesn't feel like it, but you've got it. Just keep going.' I mean, I think she's an empathetic person. She's very sweet. So, I don't know. If I was an academic advisor, I would tell my students that because that's what I want to hear. Like every time we, every time my advisor says that she believes in me. I'm like, 'yes!' So, that's, that's how I feel. I think she knows what it's like.

Academic Advisor – Situational Encouragement

Five participants gave answers that reflected situational encouragement related to courseload and academic achievement, specifically grade point average. According to Madeline, her academic advisor contributed to her academic self-efficacy beliefs through trusting that she could not only handle the courses she was taking at the time but also enroll in a heavier courseload of 19 credit hours, the maximum allowed enrollment at South Central University. Madeline said,

> They've been like very, um, like intentional in being like actually show me that like if I believe in myself, um, because obviously if you're not able to like handle 19 credit hours or something like that, you shouldn't do that, and they actually even like reference that…they're, they kind of in a sense warn me. But they're also, like, if I want to take it,

> they're like very like helpful and like understanding that I believe that I'm able to achieve that and since…in that sense they're like helping me.

Christine's experience echoed Madeline's in that her academic advisor recommended a heavy courseload for her sophomore year. Christine said,

> Going into my sophomore year, uh, they did suggest I have a super heavy load of classes to, to get ahead which, um, it was flattering to think I could do that, but it was...it was a bit much. I did not end up taking that recommendation.

While Christine was flattered by her academic advisor's belief that she could manage a heavy courseload, she added that she did not consider subsequent experiences and interactions with her academic advisor to be encouraging.

Emma shared that she viewed her academic advisor as encouraging academic self-efficacy based on subtle comments made by her academic advisor that recognized her high academic achievement, especially in challenging classes. "… but recognizing that like, 'Hey, I see that you are really committed to your classes and you're doing well despite them being hard.' So, I think that's always encouraging." While Emma further clarified that her academic advisor's comments were indirect, Emma clearly found even a subtle acknowledgement of her academic performance by her academic advisor to be a meaningful contribution to her academic self-efficacy. In a similar way, May also highlighted that her academic advisor pointed to her previous academic performance when May felt she was not doing too well in classes. Finally, Bee also reported that her academic advisor complimented her academic performance and remarked on her 4.0 grade point average but made little contribution to her academic self-efficacy beyond that.

Academic Advisor – General Encouragement

Five participants provided accounts of general encouragement or no specific examples of encouragement of their academic self-confidence. For instance, Anna did not have any specific encounters to share that illustrated encouragement of academic self-confidence but reported that her academic advisor always helped her with developing a plan when she was struggling. Anna added that her academic advisor never doubted her abilities when she needed to adjust her plans and felt that her academic advisor's help in this process was a source of encouragement. Additionally, Avery's description did not include any specific examples of encouragement, "They tell me like that I'm like, doing a good job, and I'm like…I don't know. I guess they just like encourage me and just told me to keep it up, I guess."

Tania, Paula, and Pinky also recounted examples of their academic advisors encouraging them in a general sense regarding class pairings, being on track, or reflectively. For example, Tania recalled that she found her academic advisor's approach to be encouraging for her academic self-confidence. Tania said,

> Well, she has a really calming demeanor. She says, she usually says, 'Take things at your own pace if you need to,' which I've taken that pretty well. She gives you what classes that you should take, how many hours, um, suggests like, 'Hey, these would probably be better for you at this time,' which is very, like, uplifting about it. Um, if you're not feeling confident in the class, she'll be like, 'Well, you'll just probably have to – need to retake it.' She doesn't like, put you down for feeling stupid or anything like that.

Paula emphasized that receiving reassurance that she was on track with progress in her degree program or her academic advisor helping her figure out how to stay on track when she needed to drop a course was a source of encouragement for her academic self-confidence. Paula added,

> Yeah, I think it would be more of like a self-assurance of somebody that I know was an expert telling me, 'Yeah, you're still on track.' And then, even when I drop my courses, something that I really appreciate is that I felt like they never looked at me like, 'Oh, you're dropping a course...' like they were actually ... not encouraging it, but they were like, 'Yeah, that makes sense. That's okay, you can stay on track, like, you're able to still fulfill...' or like 'Let's see what we can work out so that you don't fall behind.' Or like, I never felt like...to put it into words, like I never felt like I was dumb, or I was doing something that I wasn't supposed to. They just like, I guess, encouraged that decision.

Pinky explained that there was encouragement of a reflective nature from her academic self-confidence during her senior year as she approached graduation, "… being like, 'Yeah, … you did good. Like you get all your stuff set up to graduate and you're in a good spot with your grades.' You know that kind of like feedback."

Academic Advisor – Mixed Encouragement

One participant, Erica, responded that her experience included both discouragement and encouragement depending on the situation. Erica recalled a time when she wanted to change her major, which was met with what Erica felt was discouragement from her academic advisor. For Erica, this discouragement had implications for her confidence as she continued with coursework. However, Erica shared that other academic advisors she encountered complimented her previous academic performance and used it as a basis for encouraging her.

Academic Advisor – No Encouragement

Six participants said they had no specific examples to provide; their advisor had not encouraged them, or they did not have the rapport with their academic advisor from which they could find encouragement. In terms of their academic advisor encouraging academic self-

confidence, Kayleigh and Sophia could not present any specific examples, whereas Eris, Madison, and Lena asserted their academic advisor had not encouraged their academic self-efficacy. Eris's interactions with her academic advisor, a man, left her often feeling dismissed and that her concerns were minimized.

> [...] with my experiences with the specific advisor -- there was one instance where I was about to -- because for [major] you have to have a [grade] in your prereqs, otherwise you'll have to retake the class and all of your prereqs are required for specific introductory course for [major] and I was on the verge of getting a low [grade]. And I went into the advisor's office, and I was like, 'Hey, help!' And he just looked at me and said, 'You seem very stressed. You should try mindfulness.'

As Eris recalled, this occurred in one of her first interactions with her academic advisor for her major and thus their advisor/advisee relationship was built on an unstable foundation. As a result, Eris's academic advisor could not encourage academic self-confidence during this nor in future interactions. Drawing attention to the gender of the academic advisor in this situation does not imply that male academic advisors are incapable taking seriously the concerns and experiences of women STEM students; however, it shows the extent to which the academic advisor's responses and approaches can significantly impact student's perceptions about their role and the extent to which they feel supported.

Finally, Savanna reported that she never developed the rapport or connection with any of her academic advisors that would allow her to feel encouraged by them. Savanna reported having up to four different advisors during her undergraduate experience because of the departure of academic advisors for her major at South Central University. This created a barrier to forming a relationship with an academic advisor and led Savanna to opt for email advising to receive

guidance for future enrollment and get her advising hold removed. Additionally, Savanna reported that trust with academic advisors was weakened because of the quantity of academic advisors she encountered because of the multiple changes with academic advisors. Savanna said,

> ... but at this point I don't really trust them with what I need to be doing, um, with my future just because I've had a bad…I've had too much of a bad experience because it really has, you know, affected my long-term goals and future.

Like Eris's experience, the details Savanna shared demonstrates that a fragile, or in this case non-existent, relationship between a woman STEM student and her academic advisor means there is not much, if any, prospect of the academic advisor contributing to a woman STEM student's academic self-confidence.

This chapter discussed the factors shaping academic self-efficacy of women STEM students at South Central University. Participants indicated that their belief in their ability to meet the requirements of a STEM curriculum was shaped by internal influences, parents, peers, and/or a sense of community and belonging combined with institutional support. The role of the academic advisor was also explored, and the participants revealed their perceptions concerning how their academic advisor did or did not encourage academic self-efficacy beliefs.

Chapter 5: Discussion and Conclusions

Women pursue STEM majors at a lower rate than their male counterparts which makes the attrition of women from STEM majors a troubling matter. This study examined women STEM students' perspectives of their interactions with their academic advisor(s) and found that academic self-efficacy is an important component for the persistence of women in STEM disciplines. However, for the participants in this study, the development and sustainability of high academic self-efficacy was influenced by many factors including internal influences, parents, peers, and community, belonging, and institutional support (e.g., tutoring and mentorship. Although academic advisors are positioned to have the opportunity to foster the growth of academic self-efficacy for all students, they were not initially identified by most of the participants as contributors to academic-self efficacy beliefs. Once prompted, the participants' responses were mixed, showing that perceptions of an academic advisor's influence on academic self-efficacy and self-confidence are associated with the strength of the student/advisor relationship.

Contributions to the Literature

Factors such as advisor turnover and weak connections between the academic advisor and student all contributed to situations in which women STEM students felt their academic advisor did not contribute to their academic self-efficacy. This reflects important concepts from Drake's (2011) work, which highlighted the need for academic advisors to form and maintain relationships with students, recognize disconnections occur for students, and provide support to students for generating connections to the institution all which serve to build better pathways for student success, retention, and persistence. Academic advising is identified as a critical practice within higher education; yet there is little information on how students perceive their interactions

with academic advisors. Student satisfaction survey results (Campbell & Nutt, 2008; Hemwall & Trachte, 2003; Light, 2001; Propp & Rhodes, 2006) that offer a small glimpse into the student/academic advisor relationship are difficult to generalize due to low response rates and do not explore the multitude of factors that can contribute to a student' satisfaction or dissatisfaction with their academic advisor[5]. Even though this study did not set out to explore satisfaction or dissatisfaction with academic advisors, those sentiments came through at times when participants recalled their interactions. This study adds to the literature by explicitly exploring the interactions of women STEM students and their academic advisor to further understand how those interactions are perceived. By presenting findings associated with academic self-efficacy, an earlier reviewed key component of the persistence of women in STEM majors, this study shows the predominate influential factors that encourage the development of academic self-efficacy for the participants, while also providing an understanding of the perceptions the participants held of how academic advisors did or did not contribute to the development of academic self-efficacy.

The findings from this study are aligned with previous research (Bandura, 1997; Pajares 1996) that show that self-efficacy beliefs can act as a predictor for behaviors associated with engagement, perseverance, and goal attainment. Cultivating academic self-efficacy helps women STEM students to grow their self-image as students and professionals in STEM disciplines and professions, which have been and continue to be masculinized fields.

Theoretical Implications

Academic self-efficacy is built and maintained in various ways by women STEM students and constructed, at least in part, by a person's past and current experiences. The

[5] South Central University's response rate for Student Satisfaction Surveys conducted between 2015 and 2019 ranged from 15% to 25.5% of the total undergraduate population.

participants in this study shared the factors that contributed to their academic self-efficacy. Academic self-efficacy beliefs are largely tied to an individual's self-confidence, which is often derived from previous successes. Self-efficacy is also associated with the perspective an individual constructs themselves based on their experiences and socialization. Even though most of the participants attributed their academic self-efficacy to internal influences, they are also somewhat attribute it to other external factors. The mere presence of an individualistic, internal source suggests adoption with masculinized characteristics regarding ability and success in STEM. This suggests that perhaps women STEM student have adopted this perspective as a means of survival in a masculinized field and could be an attempt to present a counter to the misogyny that is often present in masculinized spaces. This also results in women STEM students not only adopting but inadvertently reinforcing these masculinized ways of being. Undoubtedly, these participants worked hard to meet the requirements of a STEM curriculum, and self-reliance was only a portion of their success. For this reason, it comes as no surprise that previous success or mastery experiences were such a dominant factor in influencing the academic self-efficacy beliefs of the participants. In utilizing Bandura's (1977, 1986, 1997) self-efficacy as a conceptual framework, it becomes clear that there are various internal and external factors that affect self-efficacy beliefs and persistence in STEM for women students.

Parental influence, often through vicarious experiences, verbal persuasion, and emotional arousal, was meaningful for the development of academic self-efficacy for some of the participants and influenced how they saw themselves in these masculinized spaces. For instance, Pinky saw her mother working as a police officer, which would have normalized women in masculinized spaces and contributed to Pinky's confidence when she also entered a masculinized space.

In developing academic self-efficacy, it was also important for women STEM students to see their peers (i.e., other women in STEM) succeed, as with Lena's experience. Lena found that seeing similar qualities in herself and other women in STEM who had performed well academically helped her to build confidence. For Lena to compare herself to other women in STEM demonstrates how women excelling in masculinized spaces can generate self-efficacy beliefs for future generations of women in STEM. Further, being that STEM is a masculinized field, finding community among other women is a way to occupy space in STEM that differs from finding community among women outside of STEM. This community could also help to mitigate the chilly climate that causes women to feel unwelcome and unsupported in STEM disciplines.

The experiences of women once they enter STEM spaces can either support or undermine the development of academic self-efficacy. Institutional support programs that are well meaning, for example, may reinforce gender stereotypes through women in STEM programs that utilize pink washing approaches. At times, these programs use hyper feminine portrayals of women to overtly communicate that they are spaces for women in STEM seemingly without considering how these things reinforce stereotypes about women. Programs that support and promote community, belonging, and institutional support for women in STEM are important for persistence. Creating these spaces without utilizing stereotypical hyper-feminine imagery helps women STEM students develop a community that allows for acceptance rather than assimilation and contests the idea that to challenge the historic and ongoing masculinization of STEM requires hyper-feminized endeavors. Additionally, it is important to emphasize that like STEM curricula, women are not a monolith. Programming that promotes such may give women who are not hyper-feminine the idea that they do not belong and could counter efforts for women STEM

students to build their self-efficacy and self-image as a scientist, mathematician, or engineering. The experiences of Olivia and Anna demonstrate that community and belonging can be formulated for women in STEM without the utilization of prevalent stereotypes about women. For example, Olivia found belonging and support that generated academic self-efficacy through her connections with professors.

Faculty interactions happen in a multitude of ways and at varying frequencies; however, just as with academic advisors, positive and supportive interactions are meaningful to the experiences of women STEM students. When faculty, regardless of their gender, support the academic, social, and professional growth of women students in STEM, they are engaging in actions that promote self-efficacy. This is not to say that faculty should prioritize the support of women and women-identifying students over students of other gender presentation and identities but should be cognizant of how their interactions both inside and outside the classroom do or do not contribute what may already be an uncertain climate for women STEM students.

Anna's experience demonstrates that community and belonging can be found among a group of women and men students through avenues such as ambassador programs and student organizations. Interestingly, Anna's student recruiter position was social in nature and thus removed technical aspects that speak to the gendered nature of STEM. However, it can be presumed that the student's Anna interacted with though the ambassador program shared similar experiences which can provoke self-efficacy through vicarious experiences, social persuasion, and emotional arousal. Perhaps, for Anna, support and connection were easier to come by in this venue because gender dynamics were not as apparent in this sub-environment of STEM.

While academic advisors were not initially identified as contributors to the academic self-efficacy of the participants, with Leslie's experience being the exception, it remains important to

examine how self-efficacy beliefs were encouraged or not encouraged through interactions with academic advisors. Leslie's and Eris's examples demonstrate opposing experiences with their academic advisors when expressing struggles in coursework and serves to illustrate how academic advisor can shape perceptions and act as a force to strengthen or weaken academic self-efficacy for women STEM students. In Leslie's experience, she felt heard and supported, and her responses conveyed that her advisor utilized strategies to remind her of previous successes, thus generating positive self-efficacy beliefs for Leslie. Conversely, Eris felt her concerns were invalidated, and she was not taken seriously when discussing her academic performance. From Eris's example, it could be said that her academic advisors responded in a way that reflects the historical masculinization of STEM, as well as masculinity as the default in STEM spaces. As Eris shared, instead of working through the situation with practical solutions, her academic advisor responded in a way that reinforced gender stereotypes about women. As a result, Eris perceived that her academic advisor would not take her seriously and did not seek their counsel for such matters in the future.

Following Bandura (1977, 1986, 1997), both internal and external factors must be acknowledged to holistically advise students. Instead of determining that women STEM students fit into some kind of criteria, academic advisors should concern themselves with learning about the array of experiences women students in STEM encounter, as well as their pre-collegiate endeavors that influenced their pursuit of an academic major in a STEM area. When women STEM students feel comfortable enough to share about their experiences, academic advisors should consider how their responses may work to encourage or enhance academic self-efficacy beliefs. Because academic advisors are not the experts in the experiences of women STEM students, they should be mindful of how interactions can be interpreted while also adopting

practices that show interest and understanding of these experiences. They should also maintain a perspective that recognizes that what is important to the student needs to be met with understanding and a commitment of care. Women STEM students should not have to feel that they cannot share their experiences because their academic advisor will respond in accordance with a gender stereotype. Likewise, they should not have to wonder if their concerns and experiences are invalidated while those of their male counterparts are taken seriously.

Practical Implications and Recommendations

Academic advising approaches and structures differ by institution. Some institutions, such as South Central University, require academic advising for students each semester, these mandated interactions may give more opportunities for meaningful conversations to occur, but they do not necessarily guarantee that the conversation goes beyond discussing enrollment recommendations for the subsequent semester. While equality is central to academic advising interactions, it is also critical for academic advisors to build and demonstrate awareness for how these interactions may reinforce gender stereotypes and thus impact the relationship between women STEM students and their academic advisor.

Academic advisors should strive to make the most of the time they have to interact with students, especially those who are underrepresented and marginalized in STEM spaces. Showing interest in the lived experiences of women STEM students is an action step academic advisors could take to enhance their interactions and build stronger relationships with these students. Seeking to know more about the experiences of these students allows for rapport and trust to form and demonstrates to the student that they can bring their concerns to their academic advisor. In terms of contributions to academic self-efficacy, academic advisors can convey that effort is normal for success in STEM majors which may help women STEM students feel less abnormal

in masculinized spaces. Asking questions about extra- and co-curricular involvement and experiences, their sense of belonging, interactions with peers and faculty, and how they are experiencing and utilizing resources could produce quality conversations that go beyond providing a list of classes for the following semester's enrollment and also prompt the advisor to make quality referrals for additional resources and programs offered in the student's academic college or by the university. While academic advisors would not want to operate their conversations around a checklist of items, they also do not want to leave the student-advisor relationship to chance. This line of communication would not necessarily be limited to women STEM students; however, it would demonstrate a greater degree of support and interest and formulate stronger connections. Furthermore, academic advisors can make themselves aware of and promote potential peer, academic, or professional mentoring opportunities for their women students in STEM.

The quality of the relationship between the student and their academic advisor seems to be connected to an academic advisor's potential for influencing major persistence. Therefore, this suggests that it is not ideal for students to have a different academic advisor over multiple interactions. Administrators should consider the retention and support of academic advisors. This includes the number of majors and the size of the advising caseload the advisor must maintain. Furthermore, the work academic advisors conduct goes well beyond meeting with students for enrollment advising and includes a number of administrative tasks. Often, administrative expectations for advisors include making referrals, responding to emails in a timely manner, completing specialized forms, being privy to the nuances of academic majors (e.g., substitutions, exceptions, etc.), engaging in additional activities that are perhaps tangential to their profession, and completing a host of additional duties. As this is, the availability and opportunity to

participate in meaningful professional development is scarce. Identifying meaningful ways to support academic advisors and reprieve from some of the administrative duties could reduce advisor turnover, thereby providing benefits to all students.

Legislation and executive orders in several states prevent the establishment of specialized academic advising for women STEM students; however, additional training could enhance academic advising in a way that is inclusive of all students. For example, helping academic advisors to build awareness of how to respond to students concerns without making the student feel dismissed is a skill that could be useful for preparing to interact with undergraduate students at all levels and across disciplines regardless of their gender. Furthermore, building knowledge of the generation of students who are currently transversing the higher education landscape is important for academic advisors so that they can come to an understanding of the group as a collective. However, this understanding cannot be limited to generalizations based on the larger group as academic advisors must be responsive to the needs of the individual student; therefore, additional training could focus on balancing understanding of the collective while responding to the needs of the individuals.

Limitations and Future Research

This study adds to the literature about the experiences of women STEM students but also has numerous limitations. One limitation is that I did not conduct interviews with academic advisors, which means I cannot consider how they view their interactions with women STEM students. An additional limitation is that mathematics is not represented as a discipline as there were no participants pursuing that academic major. This did not come as a surprise as the mathematics major at South Central University is overwhelmingly comprised by male students; therefore, the small population of women students in that major did not lend itself to the major

being represented in this study. Furthermore, the Institutional Review Board did not approve the use of participants' majors to protect the identities of academic advisors. While protecting the identities of academic advisors is understandable, especially since academic advisors' major assignments are often shared in public spaces, such as websites, it does present a limitation in that I could not associate any of the findings with specific academic advising practices for the academic colleges or majors and had to present findings about academic advising for STEM majors as a collective. Additionally, because I was aware of this limitation prior to beginning data collection, I did not strive for a consistent number of students from specific STEM majors or academic colleges.

Moreover, most participants in the study (13) identified as white, which mirrors the student population at South Central University; however, this presents a limitation in understanding the experiences of women STEM students from minoritized populations. Ideally, the study would include a more diverse sample to allow us to gain more insight about the experiences of all women in STEM. Similarly, all participants in this study identified as cisgender women, meaning that the perspectives of transgender women and individuals who identify as non-binary are missing from this account.

An additional limitation of the study is that data was collected prior to the dissolution of South Central University's first year academic advising unit. At the conclusion of the spring 2025 semester, first-year academic advisors were reassigned to academic college advising offices across South Central University. This change to the advising structure is intended to allow first-year students to build stronger connections with their academic colleges from the beginning. Ideally, students will work with the same academic advisor from the time they start the pursuit of their degree until graduation. Now that the academic advising structure at South Central

University is different from the way it looked when data was collected, it would be interesting to learn how perceptions of academic advising interactions between women STEM students compare to those of the participants in this study.

As stated in the previous section, political factors, such as bans on programs based on gender, have been instituted through either executive orders or legislation in numerous states, including the state in which South Central University is located. These mandates and laws go beyond changing the landscape of how services and programs are conducted on college campuses – they also required the removal of any mention of diversity, equity, and inclusion (or anything that could be deemed as such) from websites, literature, and other resources. This presents a limitation in that data was collected in late 2023 and early 2024 and coincided with the announcement of the executive order, and data analysis occurred during the time that the executive order went into effect.

Finally, while conducting interviews, there were times in which I could have asked follow-up questions that I did not. For example, during Madison's interview, she shared that she felt her academic advisor would not care about her experiences as a woman in STEM. Follow-up questions to explore the reasons Madison perceived that her academic advisor would not care about her experiences may have provided more insight into how Madison came to that belief through her previous interactions. Based on the brevity of many of Madison's answers, it seemed some of the questions were not only prompting a series of similar negative responses but may have been annoying to Madison. This is not to say the questions themselves were annoying, but perhaps having to recall her interactions with her academic advisor brought feelings of annoyance to the surface for Madison. Likely out of fear that Madison would end the interview prior to its conclusion, I decided not to probe too much.

Furthermore, in terms of overall experiences in STEM, some participants shared that they experienced aspects of the chilly climate with their male classmates, as opposed to faculty or staff. This would have been an interesting topic to further explore with the participants who recalled these interactions during their interviews. However, the intention was to focus the study on interactions with external factors, including academic advisors, and to be cautious of staying within the projected timeframe of the interview, I did not ask follow-up questions for these responses. Further research regarding the interactions that occur in different groups within STEM spaces could enhance our understanding of the experiences of women students pursuing academic majors in STEM.

Given the findings that there are internal and multiple external factors that influence self-efficacy beliefs and persistence in STEM, future research is also needed to fully explore the range of external factors that shape students' persistence, beyond what was found in this study. For example, the role of media, especially social media, as an external influence impacting self-efficacy beliefs can be examined. Engaging in this research would deepen the application of Bandura's (1977, 1986, 1997) concept of self-efficacy and inform targeted interventions to best support women students to persist in STEM.

Conclusion

The fact that women are less likely to select STEM majors is intensified by the high attrition rates of those who do seek STEM majors and remains an area of concern within higher education. Instead of taking measures that may inadvertently reinforce gender stereotypes, further exploration and examination of the experiences of women in STEM would allow for a richer understanding of where STEM pathways become broken.

Women pursue higher education at a higher rate than men, yet the number of men who seek and complete degrees in STEM fields continues to outweigh the number of women. Women

STEM students must navigate environments that were not designed for them and in which masculinity remains the default. An important component of the persistence of women in STEM is, in part, self-efficacy. Self-efficacy beliefs are derived through different sources and key interactions, including those with academic advisors. For academic advisors to make the most of their touchpoints with students, it is important that they recognize their role but also understand that other interactions are at play in the development and maintenance of self-efficacy beliefs of women STEM students. Leveraging the previous successes of women STEM students is a way academic advisors can contribute to the academic self-efficacy beliefs of women STEM students, but this also requires that academic advisors have interactions that allow them to get to know their students in meaningful ways.

In conclusion, reframing persistence through Bandura's (1977, 1986, 1997) concept of self-efficacy highlights the importance of understanding persistence as more than an individual outcome; it is a dynamic process shaped by multiple interconnected factors. The findings from the study demonstrated that there were both internal and a range of external factors that contribute to the development of self-efficacy beliefs, and in turn, persistence. Rather than viewing persistence as a fixed internal motivation or as the result of a single external factor, this reframing acknowledges how various external influences (parents, peers, community, belonging, institutional support, and the academic advisor) interact with individuals' beliefs in their own capabilities. Self-efficacy then becomes both a driver and a result of these dynamic processes. Thus, the reframing of persistence then emphasizes a more holistic understanding that acknowledges the internal and multiple external factors that shape a person's ability to persist.

References

Anney, V. N. (2014). Ensuring the quality of findings of qualitative research: Looking at trustworthiness criteria. *Journal of Emerging Trends in Educational Research and Policy Studies, 5*(2), 271-281.

Banchefsky, S., Westfall, J., Park, B., & Judd, C.M. (2016). But you don't look like a scientist!: Women scientists with feminine appearance are deemed less likely to be scientists. *Sex Roles, 75*, 95-109. https://doi.org/10.1007/s11199-016-0586-1

Bandura, A. (1977). Self-efficacy: Toward a unifying theory of behavior change. *Psychological Review, 84*(2), 191-215. https://doi.org/10.1037/0033-295X.84.2.191

Bandura, A. (1986). *Social foundations of thought and action: A social cognitive theory*. Prentice-Hall.

Bandura, A. (1997). *Self-efficacy: The exercise of control*. Freeman.

Berger, P. L., & Luckmann, T. (1966). *The social construction of reality: A treatise in the sociology of knowledge*. Anchor Books.

Blickenstaff, J. C. (2005). Women and Science Careers: Leaky pipeline or gender filter?. *Gender and Education*, *17*(2), 369–386. https://doi.org/10.1080/09540250500145072

Brainard, S. G., & Carlin, L. (1998). A Six-Year Longitudinal Study of Undergraduate Women in Engineering and Science. *Journal of Engineering Education*, *87*, 369-375. https://doi.org/10.1002/j.2168-9830.1998.tb00367.x

Bureau of Labor Statistics. (2025). Labor Force Statistics from the Current Population Survey. 2022 data files. United States Department of Labor. https://data.bls.gov/timeseries/LNS11300002.

Campbell, S. M., & Nutt, C. (2008). Academic advising in the new global century: Supporting student engagement and learning outcomes. Retrieved from

https://emas.illinoisstate.edu/downloads/aac/academic%20advising%20in%20new%20global%20century.pdf

Cook, S. C. (2001). A chronology of academic advising in America. *The Mentor: An Academic Advising Journal, 3*, 1-6.

Creamer, D. G. (1980). Educational advising for student retention: An institutional perspective. *Community College Review*, *7*(4), 11-18. http://doi.org/10.1177/009155218000700402

Creswell, J. W., & Poth, C. N. (2018). *Qualitative inquiry & research design: Choosing among five approaches.* Sage Publications.

Crockett, D. S. (1985). *Academic Advising* (L. Noel, R.S. Levitz, D. Saluri, U. Delworth, & G. R. Hanson, Eds.). Jossey-Bass.

Crotty, M. (1998). *The foundations of social research: Meaning and perspective in the research process.* Sage Publications.

Cuseo, J. (n.d.). *Academic advisement and student retention: Empirical connections & systemic interventions*. Retrieved from https://www.uwc.edu/sites/uwc.edu/files/imce-uploads/employees/academic-resources/esfy/_files/academic_advisement_and_student_retention.pdf

Daniels, M. (2022, January 5). Annual Open Letter to the People of Purdue from Mitch Daniels [open letter]. Purdue University Office of the President. https://www.purdue.edu/president/mitch-daniels/messages/annual-open-letters/2201-med-openletter-full.php

Drake, J. K. (2011). The role of academic advising in student retention and persistence. *About Campus*, *16,* 8-12. http://doi.org/10.1002/abc.20062

Esposito, J., & Evans-Winters, V. (2022). *Introduction to intersectional qualitative research.* Sage Publications.

Ezzy, D. (2002). *Qualitative analysis: Practice and innovation*. Allen & Unwin.

Falk, N. A., Rottinghaus, P. J., Casanova, T. N., Borgen, F. H., & Betz, N. E. (2016). Expanding women's participation in STEM: Insights from parallel measures of self-efficacy and interests. *Journal of Career Assessment*, *25*(4), 571-584. https://doi.org/10.1177/1069072716665822

Flaherty, C. (2022). A Presidential Misstep on Higher Ed's Missing Men. *Inside Higher Ed*. https://www.insidehighered.com/news/2022/02/17/purdue-president-missteps-comments-missing-college-men

Garr-Schultz, A., Muragishi, G. A., Mortejo, T. A., & Cheryan, S. (2023). Masculine defaults in academic science, technology, engineering, and mathematics (STEM) fields. *Psychological Science in the Public Interest*, *24*(1), 1-9. https://doi.org/10.1177/15291006231170829

Goan, S., Cunningham, A., & Carroll, C. (2006). Degree Completions in Areas of National Need, 1996-97 and 2001-02. Resource document. Washington, D.C.: National Center for Education Statistics, 2006. https://nces.ed.gov/pubs2006/2006154.pdf. Accessed April 11, 2023.

Good, C., Rattan, A., & Dweck, C. S. (2012). Why do women opt out? Sense of belonging and women's representation in mathematics. *Journal of Personality and Social Psychology*, *102*(4), 700-710. https://doi.org/10.1037/a0026659

Glesne, C. (2005). *Becoming qualitative researchers: An introduction*. Pearson.

Gordon, V. N. (1994). *Academic advising: An annotated bibliography*. Greenwood Press.

Gray, L. M., Wong-Wylie, G., Rempel, G. R., & Cook, K. (2020). Expanding qualitative research interviewing strategies: Zoom video communications. *The Qualitative Report*, *25*(5), 1292-1301. https://doi.org/10.46743/2160-3715/2020.4212

Hall, R. M., & Sandler, B. R. (1982). *The classroom climate: A chilly one for women?* Washington, DC: Project on the Status and Education of Women, Association of American Colleges.

Habley, W. R. (1981). Academic advisement: The critical link in student retention. *NASPA Journal*, *18*(4), 45-50. https://doi.org/10.1080/00220973.1981.11071797

Hansen, M. J., Palakal, M. J., & White, L. (2024). The importance of STEM sense of belonging and academic hope in enhancing persistence for low-income, underrepresented STEM students. *Journal of STEM Education Research, 7*, 155-180. https://doi.org/10.1007/s41979-023-00096-8

Heilbronner, N. N. (2013). The STEM pathway for women: What has changed? *Gifted Child Quarterly*, *57*(1), 39-55. https://doi.org/10.1177/0016986212460085

Hemwall, M. K. & Trachte, K. C. (2003), *Learning at the core: Theory and practice of academic advising in small colleges and universities.* (M. K. Hemwall & K. Trachte, Eds.). NACADA.

Heybach, J., & Pickup, A. (2017). Whose STEM? Disrupting the gender crisis within STEM. *Educational Studies*, *53*(6), 614-627. https://doi.org/10.1080/00131946.2017.1369085

Hill, C., Corbett, C. & St. Rose, A. (2010). Why so few? Women in science, technology, engineering, and mathematics. Washington, DC: American Association of University Women.

Hsieh, P., Sullivan, J. R., & Guerra, N. S. (2007). A closer look at college students: Self-efficacy and goal orientation. *Journal of Advanced Academics*, *18*(3), 454-476. https://doi.org/10.4219/jaa-2007-500

Jensen, L. E., & Deemer, E. D. (2019). Identity, campus climate, and burnout among undergraduate women in STEM fields. *The Career Development Quarterly*, *67*, 96-109. https://doi.org/10.1002/cdq.12174

Kahlke R. M. (2014). Generic qualitative approaches: Pitfalls and benefits of methodological mixology. *International Journal of Qualitative* Methods, *13*, 37-52. https://doi.org/10.1177/160940691401300119

Keller, E. F. (1985). *Reflections of Gender and Science.* Yale University Press.

Kim, K., Fann, A., & Misa-Escalante, K. (2009). Engaging women in computer science and engineering: Insights from a national study of undergraduate research experiences. University of California Los Angeles Center for Embedded Network Sensing.

King, M. C. (1993). *Academic advising, retention, and transfer* (M. C. King, Ed.), Jossey-Bass.

Kuh, G. D. (2001). *Student success in college: Creating conditions that matter.* Jossey-Bass.

Kuh, G. D., Kinzie, J., Schuh, J. H., & Whitt, E. J. (2005). Assessing conditions to enhance student success: How six campuses got started. *About Campus*, *13*(3), 9-18. https://doi.org/10.1002/abc.253

Kuhn. T. L. (2008). *Historical foundations of academic advising* (V. N. Gordon, W. R. Habley, & T. J. Grites, Eds.), Jossey-Bass.

Kvale, S., & Brinkmann, S. (2015). *Interviews: Learning the craft of qualitative research interviewing*. Sage Publications.

Leitman, L. (2023, February 15). Facebook. Retrieved February 16, 2023 from https://www.facebook.com/lizleitman/

Lent, R. W., Brown, S. D., Gore, P. A. (1997). Discriminant and predictive validity of academic self-concept, academic self-efficacy, and mathematics-specifics self-efficacy. *Journal of Counseling Psychology*, *44*(3), 307-315. https://doi.org/10.1037/0022-0167.44.3.307

Levinstein, M. (2021). Examining the role of the student-advisor relationship in a holistic, intrusive advising approach for student retention. *Journal of Access, Retention, and Inclusion in Higher Education*, *3*(1). Retrieved from https://digitalcommons.wcupa.edu/jarihe/vol3/iss1/4

Light, R. (2001). *Making the most of college: Students speak their minds*. Harvard University Press.

Lincoln, Y. S., & Guba, E. G. (1985). *Naturalistic Inquiry.* Sage Publications.

Margolis, J., & Fisher, A. (2002). *Unlocking the clubhouse: Women in computing.* The MIT Press.

MacPhee, D., Farro, S., & Canetto, S. S. (2013). Academic self-efficacy and performance of underrepresented STEM majors: Gender, ethnic, and social class patterns. *Analyses of Social Issues and Public Policy*, *13*(1), 347-369. https://doi.org/10.1111/asap.12033

Marx, D. M., & Roman, J. S. (2002). Female role models: Protecting women's math test performance. *Personality and Social Psychology Bulletin*, *28*(9), 1183-1193. https://doi.org/10.1177/01461672022812004

McGill, C. M., & Woudenberg, D. L. (2012). Gender matters in STEM majors!. Retrieved from the *NACADA Clearinghouse of Academic Advising Resources* Web

site: https://www.nacada.ksu.edu/Resources/Clearinghouse/View-Articles/Gender-issues-in-STEM-majors.aspx

Merriam, S. B., & Tisdell, E. J. (2016). *Qualitative research: A guide to design and implementation*. Jossey-Bass.

Moakler Jr., M. W., & Kim, M. M. (2014). College major choice in STEM: Revisiting confidence and demographic factors. *The Career Development Quarterly*, *62*(2), 128-142. https://doi.org/10.1002/j.2161-0045.2014.00075.x

NACADA: The Global Community for Academic Advising. (2006). NACADA concept of academic advising. Retrieved from https://www.nacada.ksu.edu/Resources/Pillars/Concept.aspx

National Center for Education Statistics. (2022). Undergraduate Enrollment. *Condition of Education*. U.S. Department of Education, Institute of Education Sciences. Retrieved July 8, 2022, from https://nces.ed.gov/programs/coe/indicator/cha

National Center for Education Statistics. (2023, February). Table 318.45. Number and percentage distribution of science, technology, engineering, and mathematics (STEM) degrees/certificates conferred by postsecondary institutions, by race/ethnicity, level of degree/certificate, and sex of student: Academic years 2020-21 [Data table]. Retrieved from https://nces.ed.gov/fastfacts/display.asp?id=899

Noonan, R. (2017). Women in STEM: 2017 Update. ESA Brief #06-17. Research report. Washington, D.C.: US Department of Commerce, 2017. https://files.eric.ed.gov/fulltext/ED590906.pdf. Accessed April 11, 2023

Nutt, C. L. (2003). Academic advising and student retention and persistence. Retrieved from *NACADA Clearinghouse of Academic Advising Resources* Website

http://www.nacada.ksu.edu/Resources/Clearinghouse/View-Articles/Advising-and-Student-Retention-article.aspx

Open Letter from Purdue women faculty in engineering to Pres. Daniels (2022, January 12). Google Doc. https://docs.google.com/document/d/e/2PACX-1vQKMWZp7moeuz5n-mVCC5PMb-4vSuV6BnKj_rRylqLe7u7_kkBr8r2cV9hJEc1oevQB_haddikjIP56/pub

Pajares, F. (1996). Self-efficacy beliefs in academic settings. *Review of Educational Research*, *66*(4), 543-578. https://doi.org/10.3102/00346543066004543

Pascarella, E. T., & Terenzini, P. T. (1980). Predicting freshman persistence and voluntary dropout decisions from a theoretical model. *Journal of Higher Education*, *51*(1), 60-75. https://doi.org/10.2307/1981125

Patton, M. (2015). *Qualitative research and evaluation methods*. Sage Publications.

Propp, K. M., & Rhodes, S. C. (2006). Informing, apprising, guiding, and mentoring: Constructs underlying upperclassmen expectations for advising. *NACADA Journal*, *26*(1), 46-55. https://doi.org/10.12930/0271-9517-26.1.46

Ravitch, S., & Carl, N. M. (2016). *Qualitative research: Bridging the conceptual, theoretical, and methodological*. Sage Publications.

Rutherford, A. (2020). Doing science, doing gender: Using history in the present. *Journal of Theoretical and Philosophical Psychology*, *40*(1), 21-31. https://dx.doi.org/10.1037/teo0000134

Saldana, J. (2016). *The coding manual for qualitative researchers*. Sage Publications.

Shapiro, C. A., & Sax, L. J. (2011), Major selection and persistence for women in STEM. *New Directions for Institutional Research*, *2011*(152), 5-18. https://doi.org/10.1002/ir.404

Shaw, E. J., & Barbuti, S. (2010). Patterns of persistence in intended college major with a focus on STEM majors. *NACADA Journal*, *30*(2), 19-34. https://doi.org/10.12930/0271-9517-30.2.19

Shehab, R. L., Murphy, T. J., Davidson, J., Foor, C. E., Reed, T., Trytten, D. A., & Walden, S. E. (2007). Academic struggles and strategies: How minority students persist. American Society for Engineering Education Annual Conference and Exposition. https://www.researchgate.net/publication/278021961_Academic_Struggles_and_Strategies_How_Minority_Students_Persist

Smith, J. L., Lewis, K. L, Hawthorn, L., & Hodges, S. D. (2012). When trying hard isn't natural: Women's belonging with and motivation for male-dominated STEM fields as a function of effort expenditure concerns. *Personality and Social Psychology Bulletin*, *39*(2), 131-143. https://doi.org/10.1177/0146167212468332

Strayhorn, T. L. (2012). *College students' sense of belonging: A key to educational success for all students.* Routledge.

Tinto, V. (1987). *Leaving college: Rethinking the causes and cures of student attrition*. University of Chicago Press.

Tinto, V. (1993). *Leaving college: Rethinking the causes and cures of student attrition*. University of Chicago Press.

Tinto, V. (2012). *Completing college: Rethinking institutional action*. University of Chicago Press.

Tinto, V. (2016). From retention to persistence. Retrieved from *Inside Higher Ed* Website https://www.insidehighered.com/views/2016/09/26/how-improve-student-persistence-and-completion-essay

Tippetts, M. M., Brandley, A. T., Metro, J., King, M., Ogren, C, & Zick, C. D. (2020). Promoting Persistence: The role of academic advisors. *Journal of College Student Retention: Research, Theory & Practice*, *24*(2), 526-547. https://doi.org/10.1177/1521025120924804

U. S. Department of Education National Center for Education Statistics. (2009). *Students who study science, technology, engineering, and mathematics (STEM) in postsecondary education* (Publication No. NCES 2009-161). Washington, DC: U. S. Department of Education.

U. S. Department of Labor (2025). Percentage of women workers in science, technology, engineering, and math (STEM). U. S. Department of Labor, Women's Bureau. https://www.dol.gov/agencies/wb/data/occupations-stem

Wade, B. K., & Yoder, E. P. (1995). The professional status of teachers and academic advisers: It matters. Teaching through academic advising. *New Directions for Community Colleges*, *62.* Josey-Bass. https://doi.org/10.1002/tl.37219956214

Whitcomb, K. M., Kalender, Z. Y., Nokes-Malach, T. J., Schunn, C. D., & Singh, C. (2020). A mismatch between self-efficacy and performance: Undergraduate women in engineering tend to have lower self-efficacy despite earning higher grades than men. *International Journal of Engineering Education*, *36*(4), 1996-2014. https://doi.org/10.48550/arXiv.2003.06006

Wolcott, H. F. (2010). *Ethnography lessons: A primer*. Left Coast Press.

Wright, R. (2022 October 22). Sally K. Ride. NASA Johnson Space Center Oral History Project. https://historycollection.jsc.nasa.gov/JSCHistoryPortal/history/oral_histories/RideSK/RideSK_12-6-02.htm

Young-Jones, A. D., Burt, T. D., Dixon, S., & Hawthorne, M. J. (2013). Academic advising: Does it really impact student success?. *Quality Assurance in Education, 21*(1), 7-20. https://doi.org/10.1108/09684881311293034

Appendix A

Informed Consent and Demographic Questionnaire

Standard: Consent and conditions (11 Questions)
Branch: New Branch **If** **If Are you 18 years of age or older? No (if no - cannot participate) Is Selected** **Or Is your academic major in one of the following science, technology, engineering, or mathematics [... No (if no - cannot participate) Is Selected** **Or Is your academic major Health and Exercise Science? Yes (if yes - cannot participate) Is Selected** **Or Do you identify as a woman (including cisgender and transgender women)? No (if no - cannot participate) Is Selected** **Or Are you an undergraduate student? No (if no - cannot participate) Is Selected** **Or Are you in your third year or beyond at the university? No (if no - cannot participate) Is Selected** **Or Are you classified as a transfer student by the university? Yes (if yes - cannot participate) Is Selected**
EndSurvey: Advanced
Block: Questionnaire (13 Questions)
EndSurvey: Advanced

Page Break

Start of Block: Consent and conditions

Consent to Participate in Research

University of Oklahoma

You are invited to participate in research about undergraduate women STEM students' experiences with academic advisors. If you agree to participate, you will complete a 5 to 10 minute survey and a 30 to 60 minute interview and will be audio and/or video recorded.

You may experience these risks by participating in this research:

Audio or video recorded data collection: There is a risk of accidental data release if we collect your data using audio and video recordings. If this occurred, your identity and the statements you made could become known to people who are not on the research team. To minimize this risk, the researchers will transfer data to, and store your data on, a secure platform approved by the University's Information Technology Office.

Collection of demographic or geographic location data that could lead to deductive re-identification: You will be asked to provide demographic information that describes you. We may also gather information about your geographic location in this research. Different combinations of personal and geographic information may make it possible for your identity to be guessed by someone who was given, or gained access, to our research records. To minimize the risk of deductive re-identification, we will not combine identifying variables, nor analyze and report results for small groups of people with specific demographic characteristics.

Data collected online or by a device and transmitted electronically: You will be asked to complete an online survey as part of this research. The organization hosting the data collection platform has its own privacy and security policies for keeping your information confidential. There is a risk that the external organization, which is not part of the research team, may gain access to, or retain your data or your IP address which could be used to re-identify you. No assurance can be made as to their use of the data you provide for purposes other than this research.

There are no benefits for participating in this research.

If you participate, you will receive this compensation: One (1) Starbucks gift card in the amount of ten dollars ($10).

Your participation is voluntary and your responses will be confidential.

We might share your de-identified data with other researchers or use it in future research without obtaining additional permission from you.

Even if you choose to participate now, you may stop participating at any time and for any reason.

If you have questions about this research, please contact:
Megan Denney, mdenney@ou.edu or 405-596-5123 and Junghee Choi, Ph.D., jchoi@ou.edu or 405-325-4202.

You can also contact the University of Oklahoma – Norman Campus Institutional Review Board at 405-325-8110 or irb@ou.edu with questions, concerns or complaints about your rights as a research participant, or if you don't want to talk to the researcher.

Please print this document for your records. By providing information to the researcher(s), I am agreeing to participate in this research.

Your name and email address will be deidentified, but are needed to follow up with you.

First and last name

_____

Email address

_____

Are you 18 years of age or older?

Yes

No (if no - cannot participate)

Is your academic major in one of the following science, technology, engineering, or mathematics [STEM] areas: biological and biomedical sciences, computer and information sciences,

engineering and engineering technologies, mathematics and statistics, physical sciences, and science technologies?

Yes

No (if no - cannot participate)

Is your academic major Health and Exercise Science?

Yes (if yes - cannot participate)

No

Do you identify as a woman (including cisgender and transgender women)?

Yes

No (if no - cannot participate)

Are you an undergraduate student?

Yes

No (if no - cannot participate)

Are you classified as a transfer student by the university?

Yes (if yes - cannot participate)

No

Are you in your third year or beyond at the university?

Yes

No (if no - cannot participate)

End of Block: Consent and conditions

Start of Block: Questionnaire

Instructions: Please complete the following questions by either typing in the correct information or selecting the answer that best describes you.

What would you like your pseudonym/alias to be for this study?
(Please select a name that is different from your first, middle, and last names.)

_____

What is your academic major?

_____

Which of the following gender identities describes you?

Cisgender woman

Transgender woman

Prefer not to answer

Which of the following races and ethnicities describe you?
(Choose all that apply.)

American Indian, Native American, or Alaskan Native

Asian, Asian American, or Pacific Islander

Black or African American

Hispanic or Latina

Middle Eastern

White or Caucasian

Prefer not to answer

A race/ethnicity not on this list (please specify in the space below)

_____

What is your current age?

_____

What is your current year at the university?
(For example, third, fourth, fifth.)

_____

From what high school did you graduate and where was it located?

High school name _____

City and state _____

Did your high school offer any STEM advanced placement (AP) courses?

Yes

No

Unsure

Skip To: Q6 If Did your high school offer any STEM advanced placement (AP) courses? = No

Skip To: Q6 If Did your high school offer any STEM advanced placement (AP) courses? = Unsure

Skip To: Q26 If Did your high school offer any STEM advanced placement (AP) courses? = Yes

Did you take any STEM advanced placement (AP) courses in high school?

Yes

No

Are you eligible to or do you receive Federal Pell Grants?

- Yes
- No
- Unsure

OKLAHOMA RESIDENTS ONLY

Do you use Oklahoma's Promise or the university-based program that provides free tuition and average student fees for qualifying Oklahoma residents?

- Yes
- No
- I am not an Oklahoma resident

What is the highest level of education completed of any of your parents/guardians?

- Less than high school
- High school or GED
- Skilled trade, vocational program
- Some college (no degree)
- Associate degree
- Bachelor's degree
- Some graduate or professional school (but no graduate or professional degree)
- Graduate or professional degree

End of Block: Questionnaire

Appendix B

Interview Protocol

Introduction: I appreciate your time and willingness to participate in this interview. As you know, I am interested in understanding your experiences with your academic advisor as an undergraduate woman in a STEM major. The interview should take about 30 to 60 minutes. If the questions are general, then you may volunteer any details you wish. You can also ask for clarification with any question and you have the option to decline to answer any of the questions. You have signed the consent form and reviewed your rights as a participant. With your consent, I will record your interview to ensure accuracy. Data from this interview will remain confidential and any responses will be attributed to your chosen pseudonym. You may choose to terminate this interview at any time. Do you have any questions before we begin? May I start recording?

Thank you again for participating. Before we get started with the interview, do you have any questions about the consent form or the interview process?

Okay, let's get started with some questions about your interactions with your academic advisor.

1. How would you describe your interactions with your first-year academic advisor? (probe as necessary)
   - 1.1. Was your first-year academic advisor knowledgeable about STEM? If so, how was that demonstrated in your interactions them? (probe as necessary)
   - 1.2. How did they help you? (probe as necessary)
   - 1.3. How could they have been more helpful? (probe as necessary)
   - 1.4. How have academic advising interactions changed during your time as a student? (probe as necessary)
   - 1.5. Have you been working with the same academic advisor since your second year? (probe as necessary)

2. How would you describe your interactions with your current academic advisor? (probe as necessary)
   - 2.1. How often do you interact with your academic advisor in formal scheduled academic advising meetings? (probe as necessary)
     - 2.1.1. Can you describe what it is like meeting with your academic advisor? (probe as necessary)
     - 2.1.2. What are topics do you discuss during your meetings with your academic advisor? (probe as necessary)
     - 2.1.3. During these meetings, is your academic advisor personable (for example, appropriate self-disclosure) or all business (for example, course, policies, and procedures only)? (probe as necessary)
     - 2.1.4. How do you feel when you leave a meeting with your academic advisor? (probe as necessary)
   - 2.2. How often and in what other ways, if at all, do you interact with your academic advisor? (probe as necessary)
   - 2.3. How would you describe your relationship with your academic advisor? (probe as necessary)

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3. Does your academic advisor encourage you to pursue activities outside of academics (for example, co-curricular, extracurricular activities, and/or campus engagement opportunities)? (probe as necessary)
   3.1. If so, how did they approach that? (probe as necessary)
   3.2. If not, what could they have done to encourage you to pursue these activities? (probe as necessary)

4. How has your academic advisor been effective? (probe as necessary)

5. How, if at all, has your academic advisor helped you to develop or maintain a growth mindset? (probe as necessary)

6. Have you had any experiences with your academic advisor in which they have advocated for you with administration or faculty? (probe as necessary)
   6.1. IF YES: Can you tell me more about that experience and the outcome? (probe as necessary)
   6.2. IF NO: Can you recall any times when your academic advisor's advocacy would have been helpful? (probe as necessary)

7. Has there ever been a time when you felt discouraged by your academic advisor? (probe as necessary)

8. Beyond discussing courses required for your major or degree, does your academic advisor discuss course content or share what other students have reported about courses with you? (probe as necessary)
   8.1. IF YES: Which courses and how do they describe them? (probe as necessary)
   8.2. IF NO: How do you get information about what to expect in a course? (probe as necessary)

9. Have you brought up academic challenges with your academic advisor? (probe as necessary)
   9.1. IF YES: How does your academic advisor respond when you bring up academic challenges in STEM classes? (probe as necessary)
   9.2. IF NO: Have you not had any academic challenges or have you not shared them with your academic advisor? (probe as necessary)
      9.2.1. If you haven't shared your academic challenges with your academic advisor, can you go into a little detail about why you did not? (probe as necessary)

10. Have you brought up personal challenges with your academic advisor? (probe as necessary)
    10.1. IF YES: How does you academic advisor respond when you bring up personal challenges? (probe as necessary)
    10.2. IF NO: Have you not had any personal challenges or have you not shared them with your academic advisor? (probe as necessary)
       10.2.1. If you haven't shared your personal challenges with your academic advisor, can you go into a little detail about why you did not? (probe as necessary)
11. How, if at all, does your academic advisor assist you with navigating institutional obstacles or barriers? (probe as necessary)

11.1. IF YES: What did that look like and what was the outcome (probe as necessary)
11.2. IF NO: Have you not experienced any institutional obstacles or barriers or have you not shared them with your academic advisor? (probe as necessary)
11.2.1. If you haven't shared your experiences with institutional obstacles or barriers with your academic advisor, can you go into a little detail about why you did not? (probe as necessary)

Transition: Okay. We're now going to transition to the next section of the interview and I'm going to ask you some questions about aspects of your identity.

12. Are there any specific social identities that are meaningful to your experience? Social identities include age, race, gender, ability, religion/irreligion, socio-economic status, sexual orientation. (probe as necessary)
    12.1. If so, what are those identities? (probe as necessary)
    12.2. How have they impacted your experience, if at all? (probe as necessary)

13. How, if at all, do you think your racial identity affects your interactions with your academic advisor? (probe as necessary)

14. How, if at all, do you think your socio-economic status affects your interactions with your academic advisor? (probe as necessary)

15. How, if at all, do you think your gender affects your interactions with your academic advisor? (probe as necessary)

16. I know you addressed this a little, but is there anything else you want to add about your gender? (probe as necessary)

Transition: Okay. The following set of questions will focus on your overall experience as a woman pursuing a STEM major, as well as how that experience relates to interactions with your academic advisor.

17. How would you feel about sharing situations that are specific to being a woman in a STEM major with your academic advisor? (probe as necessary)

18. Is being a woman in STEM something you bring up in conversations with your academic advisor? (probe as necessary)
    18.1. Has your academic advisor brought it up? (probe as necessary)
    18.2. Do you get the sense that your academic advisor is invested in your experience as a woman in STEM? (probe as necessary)

19. Do you feel a sense of belonging as a woman in STEM? (probe as necessary)
    19.1. How, if at all, has your academic advisor contributed to your sense of belonging as a woman in a STEM major? (probe as necessary)
    19.2. Have other things contributed to your sense of belonging as a woman in STEM? (probe as necessary)

20. What influences your belief in your ability to meet the requirements of a STEM curriculum? (probe as necessary)

21. How, if at all, has your academic advisor encouraged your self-confidence in your academic ability? (probe as necessary)

22. Has there been a time when you considered changing your major to a non-STEM discipline? (probe as necessary)
    22.1. IF YES: What made you consider doing that? What made you stay? (probe as necessary)
    22.2. IF NO: Why do you think it was not something you considered? (probe as necessary)

23. How, if at all, has your academic advisor encouraged your belief in what you are capable of in the future? (probe as necessary)

24. How could your academic advisor improve your experience as a woman in a STEM major? (probe as necessary)

25. How are you feeling as a woman in STEM at this point in your undergraduate career? (probe as necessary)

26. Are there any ways you hope the academic advising experiences of future women in STEM majors might be different? (probe as necessary)

Conclusion: Is there anything else you would like for me to know about your interactions with your academic advisor or your experiences as a woman pursuing a degree in a STEM field?

Thank you again for taking the time to participate in this interview. Do you have any questions about anything? Would it be okay to follow up with you if additional questions come up or if clarification is necessary?

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Appendix C

Recruitment Flyer

RESEARCH PARTICIPANTS NEEDED

for a dissertation study about

Undergraduate Women STEM Students' Experiences With Academic Advisors

Eligibility Requirements

- Identify as a woman
- Be in at least the 3rd year as an undergraduate student
- Admitted directly from high school; cannot be a classified as a transfer student
- Declared a STEM major* during first year and remain in the same major

*Includes majors in the areas of biological and biomedical sciences, computer and information sciences, engineering and engineering technologies, mathematics and statistics, physical sciences, and science technologies

If you are interested in participating, scan the QR code below to complete the survey or email Megan Denney at mdenney@ou.edu.

Receive a $10 Starbucks gift card for participating in a 5 to 10 minute survey AND a 30 to 60 minute interview on Zoom.

The identity of participants and interviews will remain confidential.

IRB NUMBER: 16618
IRB APPROVAL DATE: 11/12/2023

Appendix D

Recruitment Email

TO: All Women Undergraduate STEM Students

Hello, my name is Megan Denney and I am a PhD candidate in the Department of Educational Leadership and Policy Studies. I am currently interviewing women undergraduate STEM students about their experiences with academic advisors. If you are in at least your third year at the university, not a transfer student, and you identify as a woman, then you are invited to participate!

Participation in this research includes completing informed consent and a 5-10 minute demographic questionnaire, as well as a 30-60 minute interview via Zoom. Participants will be compensated with a $10 Starbucks gift card. The identity of participants and interviews will remain confidential.

If you would like to participate, please complete the survey at https://ousurvey.qualtrics.com/jfe/form/SV_3jRTDHj0numULZQ or contact Megan Denney at 405-596-5123 or mdenney@ou.edu.

Thank you!

Megan Denney

The University of Oklahoma is an equal opportunity institution

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