EXPLORING HOW MAJOR-FOCUSED STUDENT ORGANIZATIONS SHAPE FEMALE STEM STUDENTS' ACADEMIC EXPERIENCES IN RELATION TO SENSE OF BELONGING, ACADEMIC PERSISTENCE, AND RETENTION

by

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(Under the Direction of Lindy K. Parker)

ABSTRACT

This qualitative study aimed to explore the experiences of female students pursuing STEM degrees and actively participating in student organizations focused on their majors and how their involvement has shaped their sense of belonging, academic persistence, and retention in STEM majors. Each participant shared their experiences as a female student pursuing a STEM degree while involved in a major-focused student organization. The findings demonstrate the importance of major-focused student organizations for females in STEM. These organizations provided the participants with a community of peers they could go to for guidance and find a sense of belonging by sharing similar interests. Many shared how major-focused organizations offer great opportunities for networking and career development, which led to affirming their passion for their chosen STEM field. Their involvement has assisted their persistence in male-dominated fields by allowing many to see females in leadership roles, thus providing female

representation. Their experiences shared how beneficial involvement in this form of organization aids their sense of belonging, major persistence, and retention.

INDEX WORDS: Major-Focused Student Organizations, Student Organizations, STEM majors, Sense of Belonging, Academic Persistence, Academic Retention, Gender Minority

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B.S., Florida Gulf Coast University, 2016

M.A., Florida Gulf Coast University, 2019

A Dissertation Submitted to the Graduate Faculty of The University of Georgia in Partial Fulfillment of the Requirements for the Degree

DOCTOR OF EDUCATION

ATHENS, GEORGIA

2025

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May 2025

ACKNOWLEDGEMENTS

I would like to express my gratitude to those who have supported me through this journey. To my incredible family and friends, thank you for your unwavering love and support. You have encouraged, motivated, and celebrated all of my accomplishments along the way. I could not have done this without you cheering me on.

I would like to thank the ten incredible women who took the time to share their experiences in hopes of helping future women in STEM. To my incredible committee, thank you for your guidance, feedback, and constant support. A special thank you to my committee chair for her patience and willingness to answer my endless questions and keep me on track throughout this experience. Your encouragement throughout this journey has brought me to where I am today. I am so grateful for this dream team.

Lastly, to my cohort members, thank you. We have been through so much over the past few years growing into the scholars we are today. Together, we have studied, stressed, laughed, and celebrated. I didn't know how important a cohort could be until I met all of you.

I will forever be grateful to have had an incredible support system by my side! P.S. You got this!

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CHAPTER 1

INTRODUCTION

Despite increases in the number of science, technology, engineering, and mathematics (STEM) undergraduate majors and degree programs now available in colleges and universities throughout the United States — as well as exponential increases in post-graduation opportunities for employment in STEM careers — there has been a decline in STEM undergraduate major enrollment and career interest among college students nationwide (Gamse et al., 2017; Rodriguez & Blaney, 2021; Goan & Cunningham, 2006; Rothwell, 2013). Among the declining number of students who do enroll, female student enrollment in undergraduate college STEM programs is being surpassed by male enrollment (Edzie & Alahmad, 2013; Koch et al., 2022), and the relatively small number of female students pursuing STEM majors do not graduate with a STEM degree (Gonzalez-Perez et al., 2022) due to lack of support in the STEM majors (Cohoon, 2002). As a result, many STEM majors in higher education and post-graduation careers continue to be very male-dominated.

Noting the gender gap and imbalance in enrollment and the "high financial reward associated with STEM careers" that are widely available, Rodriguez and Blaney (2021) stated, "Postsecondary institutions have a responsibility to ensure that the potential STEM workforce is representative of the nation's population and that they are expanding opportunities and creating equitable learning environments for all students because doing so has important implications for equity within society" (p. 441). Creating a more

equitable learning environment is a significant step colleges and universities can take to support their students regardless of their chosen major.

According to Hartman and Hartman (2023), students who are more involved in organized student life, including student organizations, are happier with their collegiate experience overall and have a stronger sense of belonging. A sense of belonging in college has been linked to retention and academic achievement, according to research (Freeman et al., 2007; Pittman & Richmond, 2008; Rodriguez & Blaney, 2021). Nolen et al., 2021 found that participation in major-focused student organizations benefits a student's overall growth and development and is vital for student enjoyment and persistence in the major. Rodriguez and Blaney (2021) recommend that future research investigate if "microenvironments" impact female student growth, development, and sense of belonging in the individual STEM disciplines (p. 452). This study aims to explore the experiences of female STEM students' involvement in STEM major-focused student organizations, particularly how participation in those major-focused organizations impacts their sense of belonging in their STEM major and their academic persistence and retention in the STEM major.

Background of the Problem

Research around the academic experiences of female college students within STEM majors, particularly disaggregated by the STEM disciplines, is still underdeveloped (Rodriguez & Blaney, 2021). Women's unequal involvement in STEM majors is a long-standing problem that persists today despite decades of research and more significant efforts to overcome the gender disparity (Kanny et al., 2014). More studies that center around female students in STEM can assist in alleviating these

disparities and closing the gap while also hoping to benefit female students' overall experiences throughout their collegiate journeys.

Institutions of higher learning require research-informed tactics to boost students' engagement and persistence — particularly female student engagement and persistence — in the declining STEM majors (Rodriguez & Blaney, 2021). Beyond the STEM majors and more generally, research has shown that the more a student is involved in campus activities during their collegiate experience — the more time they spend on campus, engage in extracurricular activities, and communicate with faculty and other students — the more learning and personal development they gain (Astin, 1984). Many college experiences that connect to desired outcomes are ones that involve students' engagement in educationally intentional student organizations and activities (Kuh, 2009). These experiences include students investing time and effort into their studies, getting involved in student organizations, as well as interacting with faculty and peers (Astin, 1999). Student involvement not only guides students through their collegiate careers but can also provide them with resources for after graduation.

There are major-focused organizations that center around support within majors and networking skills for later on in their careers (Hartman & Hartman, 2003). Student organizations sponsored by academic departments or schools and related to their academic majors, such as the American Medical Student Association or the Student Engineers' Council, are referred to as academic- or major-focused student organizations (Holzweiss et al., 2007). These types of student organizations allow for students who share the same majors and similar interests to build a community in support of these academic interests and more. Research has demonstrated that increased involvement in

campus groups beyond the classroom but still related to a student's major is linked to higher persistence in that major (Meyers et al., 2012). Student organizations centered around academic majors provide students not only with programs related to their major but can also help them build social connections and deeper relationships with students and faculty who share the same interests (Nolen et al., 2021).

Since engagement with major-focused student organizations helps shape and foster informal peer and faculty connections and support for students as a whole, regardless of gender (Gamse et al., 2017), perhaps it is possible that the involvement of female students, specifically in STEM-focused student organization groups could enhance the major experience for them and have an impact on retention choices. They can also counteract or prevent some of the negative experiences female STEM students reported in earlier studies. STEM major-focused student organizations could facilitate friendships and social interactions between students with similar interests, forming smaller communities inside their college and major environments that may help underrepresented female students better understand how they fit in (Nolen et al., 2021).

Problem Statement

Prior research has attempted to explain how the gender gap in STEM majors has evolved over time (Kanny et al., 2014). Studies have found that the gender gap is partially due to prospective student perceptions that STEM majors are predominately male-dominated fields (Rainey et al., 2018) and that a significant number of female students in STEM fields have felt alienated and a lack of belonging from their peers and male instructors, and that they have felt excluded from informal, out-of-class conversations (Johnson, 2012). These negative interactions can cause female students to feel a disconnect from their STEM programs of study. Female STEM students may not

have the support that they need when they are one of two females in their STEM classes, and they also may feel intimidated due to being a gender minority in a male-dominated space, leaving them feeling unsure if they can persist through their STEM programs of study (Rainey et al., 2018). Ultimately, female students in STEM have experienced a degradation in terms of performance and confidence throughout their STEM studies (Meyers et al., 2012). Some of the challenge's female students in STEM face regarding their academic experiences include finding a sense of belonging and persisting in a setting where females are the gender minority (Rainey et al., 2018).

According to Rainey et al. (2018), women experience a more encouraging and welcoming environment within the STEM majors that have larger female enrollment and representation, and they continue in STEM majors at higher rates than at universities where fewer women are enrolled in STEM majors. The representation of women within the STEM majors and STEM-focused student organizations serves as a bellwether of the extent to which women feel welcome in the STEM fields on campus and can also play a role in their persistence within their desired major (Bowman et al., 2022). Like the faculty and institutions that offer the majors, numerous STEM-focused student groups have been working to increase the participation of female members despite a history of not being receptive to female students in the past (Hartman & Hartman, 2003).

Researchers must look more closely at the ways that extracurricular activities like major-focused student organizations or clubs within the STEM majors help female students feel like they belong, see larger female representation, and stay enrolled in their STEM majors as higher education professionals work to boost the enrollment and persistence of women in their STEM programs of study. Women who partake in a major-

related organization are more committed to their major than those who are not involved (Hartman & Hartman, 2003).

This study investigated the experiences of female students' involvement in STEM-related student organizations through a qualitative lens and their perceptions of whether the organizations provided them with a sense of belonging to their STEM major, increased their perceptions of female representation, and perhaps helped motivate them to continue with their STEM degrees. Astin's (1984) Theory of Student Involvement allowed the study to look more in-depth at female students' involvement in content-based organizations. Hausmann et al. (2007) found that involvement in student organizations likely leads to persistence in science majors (as cited in Nolen et al., 2021). However, Nolen et al. (2021) determined it would be beneficial to establish if this is also linked to involvement and participation in content-based or major-specific student organizations. This study also added to the scholarly literature on female students in STEM and whether their involvement and participation in a STEM major-related student organization impacted their sense of belonging and academic persistence and retention in the related major. Sense of belonging in this study refers to having a sense of being accepted, valued, and connected to others in the major (Strayhorn, 2019), and it will be considered because a sense of belonging can play an important role in whether a student decides to persist with their degree (Sax et al., 2018). Findings from this research could inform efforts to increase female representation within the STEM majors and their academic persistence to the STEM workforce.

Purpose of the Study

This study aimed to explore how STEM student organizations shape STEM female undergraduate students' overall academic experience with their major in regard to their sense of belonging and major persistence. Female undergraduate students seeking STEM degrees and those who opted to participate in major-related student organizations serve as the driving forces behind this study. Limited research has been conducted to determine if major-related organizations for females only aid in female academic experiences compared to gender-neutral organizations. Banda & Flowers (2016) found inconsistent results that some female students preferred to join student organizations that were females only as it allowed them to connect to other females while others did not want to isolate themselves based on their gender. Holzweiss et al. (2007) found that students who participated in academic organizations noted that the activities of their organization motivated them to do well academically and served as a reminder of their future ambitions. While this has shown that these organizations motivate students to do well in classes, it is still unknown if they also motivate females in male-dominated majors to persist and perform well academically. It is also unknown if female students pursuing male-dominated degrees join organizations to find a sense of belonging or whether they shape their desire to stay and persist with their programs of study. Institutions must take a student-centered approach, comprehend how students' motivation is shaped, and know what interventions or actions may be taken to increase this motivation (Gonzalez-Perez et al., 2022). To understand the influence that major-related organizations have on these student's sense of belonging, this study explored their experiences through their involvement in said organizations. It is also essential to explore

the relationship between female students' participation in major-related student organizations and their persistence to stay with their STEM major to determine if there is a sense of belonging. This study could also lead to further research into the structure and objectives of undergraduate major-focused organizations.

Research Questions

This study is be guided by three research questions:

RQ1. What are the experiences of female STEM students involved in major-focused student organizations?

RQ2. How do female STEM students perceive the impact their involvement in major-focused organizations has had on their sense of belonging?

RQ3. How, if at all, do female STEM students perceive any impact their involvement in major-focused organizations has had on their academic retention and persistence in the STEM major?

The research questions guided the study by exploring how female STEM students' academic experiences in relation to the sense of belonging and major persistence are shaped by their involvement and participation in major-focused organizations. Learning these female STEM students' lived experiences through the theoretical lens of Astin's (1984) Student Involvement Theory, Strayhorn's (2019) Sense of Belonging Model, and Tinto's (1993) Theory of Student Departure, the study can explore the influence this type of involvement has on their experiences in their education and overall collegiate journey.

Theoretical Framework

For a deeper comprehension of the academic experiences of female STEM students in major-focused organizations, the researcher will use Astin's (1984) theory of

student involvement to guide their qualitative research. The theory of student involvement centers more on the behavioral mechanisms or processes that advance student development (Astin, 1999). This research topic focuses on how student organizations shape female STEM students' academic experience; thus, the theory of involvement should be a primary emphasis for the study. Astin's (1984) student involvement theory explains how, for students to maximize their growth and for learning to occur, they must actively engage with the campus and the college as a whole. Students' experience and the amount of growth and learning they will acquire during their collegiate career are strongly impacted by the time and effort devoted to their education. According to Astin (1996), a student's peer group significantly influences their development; the more they connect with their peers, the better their experiences will be. The researcher utilized Astin's (1984) student involvement theory to explain the ways in which students who participate in organizations and clubs dedicated to their majors might benefit from and influence their academic experience (e.g., persistence in their major, sense of belonging, GPA, graduation). This can be determined by how much a student is involved in their organization and how it shapes their sense of belonging, ability, and desire to continue in their chosen major.

The study was also framed through Strayhorn's Sense of Belonging Model (2019) to better understand and support sense of belonging for female STEM students participating in major-focused student organizations. Sense of belonging is a student's perception of their social support system on campus, how they feel linked to others, and how important they feel to the campus community (Strayhorn, 2019). Joining student organizations can help students feel linked to others on campus. Strayhorn (2019)

explains how the approach for sense of belonging is part of a broader motivational framework. Therefore, using this theory helped guide this study in determining how involvement in major-focused student organizations has shaped female STEM students' sense of belonging and motivation to persist with their STEM majors.

Finally, this study used Tinto's (1993) student departure theory as a theoretical framework to guide the research and explore how female STEM students persist within their majors. According to Tinto's (1993) model of student departure, student involvement plays a critical role in positive outcomes for student persistence and retention. Using Tinto's (1993) theory of departure, the researcher can explain how student involvement in major-focused organizations is a critical component of female STEM students' persistence to continue with their majors. Gonzalez-Perez et al. (2022) described Tinto's (1993) model of student departure as a conceptually sound framework for analyzing student persistence, depicting an undergraduate student's transition between dropping out of school or changing their major and continuing with their decided studies. Academic and social integration are central to Vincent Tinto's (1993) student retention theory, which incorporates Astin's idea of involvement. According to Astin (1984) and Tinto (1993), higher education students learn through participation and involvement in collegiate organizations, and that academic engagement can lead to positive outcomes. Vincent Tinto (1993) explained how participation in extracurricular activities and interactions with peers and faculty favorably correlate with high-quality student work, promoting student learning and persistence. Students who take the initiative to engage in clubs and organizations are more willing to persevere with their programs of study.

Tinto (1993) also suggested that motivation, which is influenced by lower-level components of perceived worth, sense of belonging, perceived self-efficacy, and curriculum relevance, is what drives student persistence. The main way that integrative associations form is through social interactions; people need to make connections with both instructors and other students as well as other members of the institution (Tinto, 1988). This was useful in determining that involvement in major-focused organizations is a source of students' motivation and persistence to continue with their chosen majors and allowed the researcher to use this model to explore how female STEM students' interactions with their campus environment also provide them with persistence due to their interactive experiences.

I, as the researcher, can explain how student involvement in a major-focused organization is a critical component of female STEM students' sense of belonging and persistence to continue with their majors. Many students feel a sense of belonging, which is often due to the campus involvement that a student decides to partake in (Lefever, 2012). A stronger sense of community and connection to their college is often observed among students who make the most of their time there. Students who participate in organized student life are more gratified with their collegiate experience than those who do not participate (Hartman & Hartman, 2003). Beyond their academic pursuits, students who choose to participate in clubs and activities have a lot more to look forward to. Involvement allows them to build a community and a lifestyle and learn about their chosen studies. Using all theories helped to inform how female STEM students are shaped through their involvement and how this involvement shapes their sense of

belonging and ability to persist and continue with their programs of study in a male-dominated environment.

Significance of the Study

This study aimed to assist undergraduate female students in the STEM field as they are underrepresented in the workforce as well as in higher education. The underrepresentation of women in STEM fields indicates a potential loss of talent and creativity that could affect the US's capacity to compete internationally in the fields of science and engineering (Shapiro & Sax, 2011). Due to the gender gap in STEM education, it is important to learn why female students pursue STEM majors and what factors lead them to persist with their programs of study. It has provided research on how involvement in major-focused organizations influences students' sense of belonging, retention, and major persistence. This study will allow student affairs professionals to learn how to assist female students who may be having difficulty with their STEM degrees and may provide them with encouragement to join major-focused organizations to help them build a sense of community and enhance their academic experience. This study will also open up more areas of research to determine how major-focused organizations shape female STEM students' academic experiences in relation to their grades and GPA.

Definition of Terms

Major-focused student organizations or academic-focused student organizations: student organizations sponsored by academic departments or schools and related to their academic majors (Holzweiss et al., 2007).

STEM Majors: Science, Technology, Engineering, and Mathematics — also known as STEM — is an educational philosophy that unifies each of these related academic disciplines into a traditional instructional manner or through a cross-disciplinary program (Siekmann, 2016). Academic degree programs centered around science, technology, engineering, or mathematics.

Gender minority: a demographic whose gender identity is different from the majority of the community.

Sense of belonging: a student's perception of the social support they receive on campus, their sense of significance or importance, and their sense of worth from other members of the campus community (Strayhorn, 2019).

Academic Retention: a student who continues their education and enrollment at an institution without taking a gap period.

Academic Persistence: Students' capacity to complete a degree program and graduate (Lufi et al., 2003).

Summary

In higher education and the workforce, females are still underrepresented in STEM majors and career fields. Research shows this could be due to their sense of belonging, or rather not belonging, in the STEM major and field. There is also research on the importance of student involvement in higher education, thus why colleges provide various opportunities for students to engage in clubs and organizations to increase sense of belonging, and research is developing about major-specific student organizations. Yet there is limited information about the experiences of female students in major-focused organizations and how it might impact their sense of belonging and academic retention

and persistence in STEM majors; therefore, the data collected from this study will assist the field of higher education and STEM by signifying the experiences of female STEM students participating in major-focused organizations. The following chapter will provide an overview of the literature on STEM, student involvement and organizations, sense of belonging, and academic retention and persistence in STEM majors within higher education.

Chapter 2

LITERATURE REVIEW

Women's disparate enrollment in STEM majors is a persistent issue that remains today despite decades of research and increased efforts to close the gender gap (Kanny et al., 2014). Research has also shown that a sense of belonging in college predicts retention and academic success (Freeman et al., 2021). Astin's (1984) theory of student involvement suggested a highly involved student "who, for example, devotes considerable energy to studying, spends much time on campus, participates actively in student organizations, and interacts frequently with faculty members and other students" will experience higher levels of learning and development (pp. 297-298). Being involved on campus can lead students to feel a sense of belonging and increase retention and persistence within their programs of study (Webber et al., 2013). If students' engagement in various campus activities can promote positive academic experiences, one might want to explore if engagement in a major-focused student organization can aid and assist students even more, particularly women in STEM majors. Therefore, this chapter aims to explore seminal and recent literature around each of these aforementioned areas, specifically: women in STEM and their retention and major persistence, sense of belonging among college students, and student involvement in student organizations, specifically STEM major-focused student organizations. This study is focused on female STEM students' involvement in major-focused organizations and how they shape female STEM students' academic experiences in relation to sense of belonging and retention.

Science, Technology, Engineering, and Mathematics (STEM)

To ensure a steady stream of workers ready for the anticipated rise in STEM-related occupations, it is imperative to invest in STEM education (Barkatsas et al., 2018). Global demand for STEM jobs is increasing at the same time that American students' ability to fill those professions is declining (Barkatsas et al., 2018; Donnelly, 2023). The STEM fields are fundamental to our daily existence; life-saving medications, clean water, and food are just a few examples of the basic necessities they provide (Gonzalez et al., 2022). Due to this nationwide attention to the STEM field, higher education institutions are looking to increase their STEM student interest.

Women in STEM and Their Retention and Major Persistence

Despite the importance of women's contributions within the STEM field, female STEM professionals have remained invisible for a long time (Vargas-Solar, 2022). Though they made up 50.4% of the U.S. population in 2020 (U.S. Census Bureau, 2020), women comprised only 35% of people working in the STEM fields (National Center for Science and Engineering Statistics, 2023). There is an increased enrollment of females in college degree programs overall, but male enrollment in STEM programs continues to surpass female enrollment (Edzie & Alahmad, 2013). NCES found that from 2021-2022, almost half of the number of distributed STEM bachelor degrees were awarded to male students (National Center for Science and Engineering Statistics, 2023), thus showing that female students are underrepresented in STEM higher education. Many STEM majors, such as computer science (Ying et al.,2021), engineering (Gonzalez-Perez et al., 2022), mathematics, and physical sciences, tend to have a stronger male student presence compared to female students (Riegle-Crumb & Peng, 2021). Women's postsecondary

participation and success in STEM majors have been a long-standing concern (Bowman et al., 2022). According to the National Center for Science and Engineering Statistics (2023), “In 2020, women were underrepresented among degree recipients at all degree levels in physical and earth sciences, mathematics and computer sciences, and engineering” (p. 4), indicating little hope for the gender disparity in STEM to be resolved in the near future.

Shapiro and Sax (2011) found that women are hesitant to select STEM majors, and Rainey et al. (2018) cites discrimination, cultural norms, and harassment as some of the reasons for these decisions. White men are advantaged in STEM educational settings, and women are diminished and undervalued (Johnson, 2012). Women often battle cultural stereotypes, arguing that they do not fit in or even belong within the field of STEM (Stout & Blaney, 2017). Female students may not choose to pursue STEM degrees as they tend not to identify with the stereotypical view of what it supposedly means to have a career in STEM (Shapiro & Sax, 2011) in that men continue to be the main source of definitions for what it means to be an engineer (Tonso, 2006). Another possible reason for this gender gap is the number of female students dropping out of STEM education (Gonzalez-Perez et al., 2022). In STEM, female students exhibit a 23% greater dropout rate than their male peers (Isphording and Qendri, 2019, as cited in Gonzalez-Perez et al., 2022). A student’s decision to continue or leave their major may be impacted by their own personal thoughts and feelings (Savage et al., 2019). Gender disparities in persistence and degree attainment continue in STEM, even when women have the same or higher levels of previous academic achievement as males (Bowman, 2022). Societies still believe and promote that men are more suited for STEM disciplines over females

(Vargas-Solar, 2022). Students who experience a negative social experience, especially in classrooms, may experience discomfort in social settings, resulting in not feeling as though they belong, thus leading to lower rates of major persistence (Ong et al., 2017).

There is an overall concern that there are not enough female students enrolling and persisting in collegiate STEM degree programs (Edzie & Alahmad, 2013). Female students will enroll in these degrees, but they are not likely to see them through. Edzie and Alahmad (2013) found some key influential factors that influence female persistence in STEM programs, including boosting confidence in females at younger ages, educating females about STEM-related careers through employment linkage, and expanding pre-collegiate STEM exposure through extracurricular activities and academic experiences. While collegiate involvement was not discussed, STEM exposure through hobbies and academic experiences provides headway to believe that involvement in major-focused organizations and clubs can aid in female STEM student persistence with their programs of study.

The more female peer and instructor representation appears, the more improvement in STEM student performance, which can thus lead to a more significant number of female STEM degree persistence and completion (Bowman et al., 2022). Female students who are getting involved with female-only organizations have a community that shows their representation within their majors. Higher education institutions provide a supportive climate for women in STEM and the direct presence of a larger group of other women as social support (Koch et al., 2022). Female students, especially in STEM, want institutions to provide a support system and assist with persistence in male-dominated fields.

The proportion of women who are in a particular major can affect the persistence of other women (Shapiro & Sax, 2011). The more female student representation in a particular major can influence whether other female students feel supported and encouraged to continue with their degree (Rainey et al., 2018). Rodriguez and Blaney (2021) found that female students pursuing degrees in male-dominated majors found comfort in seeing more females represented in STEM majors. Female students pursuing STEM degrees have not had the advantage of experiencing a sense of belonging due to being excluded and treated as outsiders by those within the department, making it difficult for women to persevere in this field when they are not welcomed (Johnson, 2012).

Sense of Belonging

Sense of belonging refers to having a sense of being accepted, valued, and connected to others (Strayhorn, 2019), and one way to measure whether students feel as though they belong in an educational environment is through their sense of belonging (Sax et al., 2018). When there is no sense of belonging, one can feel isolated, lonely, or invisible (Strayhorn, 2019). Students want to find a sense of belonging not only to counter the feeling of isolation but to have a group of individuals who can support and validate their experiences and offer a sense of safety (Ong et al., 2017).

Citing Rainey et al. (2018), Rodriguez and Blaney (2021) stated that "interpersonal relationships, perceived competence, personal interest, and science identity contribute to a sense of belonging for STEM students" (p. 442). Rainey et al. (2018) found that interpersonal relationships are the largest determinant of a sense of belonging for female students pursuing STEM majors. STEM students have a higher chance of

feeling they belong when they are involved in supportive social environments (Johnson, 2012).

Unfortunately, women in STEM sometimes have a tough time feeling a sense of belonging due to experiencing sexism throughout their college experience (Espinosa, 2011). Since STEM degrees are male-dominated, the little to no female representation is an external cue to female students that can influence their feeling of belonging in a male-dominated field (Rainey et al., 2018). Building a sense of belonging is hard when students have no association with the people they are surrounded by and do not have a sense of comfort in their environment (Rodriguez & Blaney, 2021). The intensity that comes with the academic rigor of STEM majors can also hinder the process of female students developing meaningful connections (Johnson, 2012).

While the research cited above shows that a sense of belonging is an important outcome in itself, there may be even more positive outcomes for underrepresented groups, such as women in STEM, because a sense of belonging can play an important role in whether a student decides to persist with their degree (Sax et al., 2018). College student's sense of belonging and resilience contributes to their overall wellness, success, and retention in their programs of study (Soria et al., 2022). Finding out how significant sense of belonging is in a student's selection to pursue STEM majors is a crucial next step (Sax et al., 2018).

Student Involvement

Participating in and being involved with various out-of-class activities can enhance a student's sense of belonging while in college (Knekta & McCartney, 2018). Simmons et al. (2018) described the term out-of-class activity as any type of organized

experience, such as clubs and organizations, that students participate in outside of their instructional classroom time. The benefits of active involvement happen when students dedicate time to membership-driven groups, organizations, clubs, or teams (Kulp et al., 2019). Astin's (1984) Theory of Student Involvement explained how increased participation in campus organizations and activities leads to increased student growth, development, and success (Astin, 1984). Simmons et al. (2018) explained how both the amount of time and effort a student is willing to invest in their involvement and the number of ways in which the university provides student opportunities and engagement through accessible programs can influence overall student involvement and engagement. It is up to both the institution's creation of the environment and the opportunities for engagement and the student's decision to take advantage of them (Kuh, 2009). According to Astin's (1984) Theory of Student Involvement, the greater the student's involvement in college, the greater the learning and personal development of the student (Astin, 1999).

Active involvement in college can provide students with the skills to communicate effectively, the ability to problem solve, and the capability to manage change (Webber et al., 2013). Many of these skills are learned by participating in organizations rather than by receiving instruction through lectures. Students who participate in clubs and organizations have the ability to take on leadership positions within their organizations, which benefits them by building confidence and skills for future careers (Blaney, 2022). Webber et al. (2013) found that higher levels of participation in student activities promote and positively influence undergraduate student's overall academic experience. The experience that these organizations provide

students with can ultimately lead to positive academic outcomes (Kulp et al., 2019). Simmons et al. (2018) argued that student involvement and engagement increase persistence and diversity in STEM fields and that the involvement can include both STEM and non-STEM-related student activities.

Student Departure Theory

According to Vincent Tinto's (1993) Model of Student Departure, student involvement plays a critical role in positive outcomes for student persistence and retention. Students join clubs and organizations in hopes of finding their sense of community, which can ultimately lead to their persistence to continue with their majors rather than changing to another. Kang et al. (2023) study suggested that various factors such as academic involvement or social acceptance may have different roles from department and college level retention as their study found that despite the fact that all of their participants in their study remained at the institution, only a few stayed in their academic department; thus, supporting the focus on department level research for future studies regarding retention and sense of belonging.

Student Organizations

Research cited above shows that involvement in collegiate activities supports college students in many ways. The more student involvement and engagement a student puts into their collegiate experience, the more they will get out of it (Webber et al., 2013). Many students seek out student organizations to gain a sense of belonging (Banda & Flowers, 2017). For the purposes of this dissertation, student organizations are defined as groups established and operated by students, typically with a faculty or staff supervisor (Jones & Giles, 2022).

There are many types of student organizations undergraduate college students can participate in, such as student government, Greek life, college athletics, honor societies, cultural and political organizations, and major-focused student organizations (Kulp et al., 2019). Many students establish new relationships with others when they choose to participate in student organizations (Smith et al.,2021). When students are able to find connections and understand how they fit within their new college or university community, this can perpetuate even more engagement through student organizations (Nolen et al.,2021).

Student organizations provide students with supportive environments outside of the classroom (Hartman & Hartman, 2003; Strayhorn, 2019). Being a part of a positive and encouraging organization can be extremely important for students attending large higher education institutions that may not be personable and very welcoming (Baker, 2008). Providing students with strong support systems can help them overcome obstacles they may face throughout their collegiate journeys (Gonzalez-Perez et al., 2022). Involvement in student organizations as an undergraduate student can provide them with a community and environment where they can grow personally as well as professionally (Kulp et al., 2021). Students can find peer support through involvement on campus that is purposeful to them and their well-being (Blaney, 2022). Participation in these organizations allows students to develop leadership skills, build community connections, and have an outlet to express themselves (Baker, 2008). Student organizations play an important role in a student's professional and personal development, assisting students in developing leadership skills and identities and improving their overall collegiate experience (Jones & Giles, 2022). Student organizations offer both social and

professional development opportunities; students can make connections while also having the option to lead and grow within the chosen activity (Cletzer et al., 2023). Student involvement in student organizations can provide female STEM students with the community and sense of belongingness that improves their collegiate journey and promotes success (Banda & Flowers, 2017). Community offers an opportunity for students to create networks and find that their presence is important to those also within their community (Meyers et al., 2012). A good community among peers means students experience a good social environment that contributes to their perseverance within a program of study (Knekta & McCartney, 2018).

STEM Major-Focused Student Organizations

Major-focused organizations within higher education institutions are student organizations specifically correlated to the student's major content. Cletzer et al. (2023) found that student involvement in an organization within their major allows students the ability to share their career interests in a chosen discipline through an out-of-class activity with their peers. Banda and Flowers (2017) found that students in major-focused organizations can connect with other students in the same major and insinuate a similar culture that only students within these same majors can comprehend. These student organizations assist the participants in relating to one another through similar interests and the ability to understand what is necessary to continue with their unique programs of study.

Student organizations specifically related to STEM majors provide students with opportunities to continue their STEM growth in an out-of-class setting (Smith et al., 2021). The relationships that are built can assist students in navigating potentially

unfriendly educational environments by forging environments that are welcoming and culturally familiar to them (Smith et al., 2021). Nolen et al. (2021) found that students who join major-focused organizations for the purpose of social interaction were also motivated to improve their feeling of inclusion within their chosen organization and with their program of study. Hartman and Hartman (2003) also found that engaging in student organizations leads to more satisfaction and enjoyment within a student's collegiate journey. Students have more to look forward to throughout their experiences and overall have a better academic experience through their involvement (Astin, 1984). Smith et al. (2021) described professional STEM organizations as an example of participatory social capital, which is the capital obtained by members through the relationships they make by participating in organizations that also facilitate networking opportunities. In other words, these experiences in STEM organizations help students build professional networks that can lead to more opportunities within their degrees and future careers.

Connecting to a major-focused organization can impact someone's personal connection to their field; in this case, a science or STEM identity can be associated with one's self (Rainey et al., 2018). Students with a sense of identity connected to their field of study can enhance their overall academic experience throughout their collegiate journey (Rainey et al., 2018) and allow them to feel connected to their peers.

Student organizations focused on both majors and intersectional, marginalized identities can break down cultural barriers to integration in various programs where the majority of students are White males (Smith et al., 2021). Students who join these organizations can feel more support when surrounded by people with identities similar to their own (Rodriguez & Blaney, 2021). These STEM-focused student organizations not

only address the social and academic needs of their student members by allowing them to interact with students in the same programs of study, but they also allow them to meet and relate to other students with shared identities (Banda & Flowers, 2017). Student involvement in these STEM major-focused student organizations can directly counter the negative experiences marginalized populations have historically encountered in the majors (Ong et al., 2017). They maximize the student's time, which might be limited by the intensity of the major (Johnson, 2012), by allowing students to gain many connections through involvement in a singular organization rather than joining multiple organizations for the same outcomes (Nolen et al., 2021).

Many women majoring in the STEM field of engineering choose to engage in engineering-related student organizations to socialize and interact with other students within their majors, gain information about opportunities in engineering, and be in a supportive learning environment (Hartman & Hartman, 2003). Smith et al. (2021) found that female students who participated in a female-only professional engineering organization reduced their feelings of gender isolation and increased their confidence in their skills as well as knowledge to succeed in their programs of study. Female students who choose to engage in educational discussions that occur in an environment outside of the classroom, such as in STEM student organizations, are more likely to continue in the field of STEM (Espinosa, 2011).

Summary

While decades of research have focused on women's representation in STEM and have attempted to explain how the gender gap in STEM majors and fields has persisted over time (Kanny et al., 2014; Rodriguez & Blaney, 2021), research around the academic

experiences of female college students within STEM majors, particularly disaggregated by the STEM disciplines including engineering, is still underdeveloped (Rodriguez & Blaney, 2021). In their study to understand how academic and social experiences influence sense of belonging for Latina undergraduate STEM students, Rodriguez and Blaney (2021) cautioned that their "findings are not meant to be generalizable to all Latina students across all demographics" but are meant to "be seen as an opportunity to generate new knowledge and encourage further work in this line of inquiry" (p. 452). After conducting their critical analysis of Latina engineers and their involvement in student organizations, Banda and Flowers (2017) recommended that future studies "examine sense of belonging within engineering student organizations to gain a better understanding of the climate that is created for students of color who attempt to join or successfully join membership in their respective organizations" (p. 374). While both authors looked at a demographic group in need of more attention in the literature, this study hopes to build upon this line of inquiry by stepping back and considering the impact of being involved in major-focused specific student organization on sense of belonging, major retention, and persistence from the voice and lens of all female STEM students regardless of ethnicity and then looking for any differences among identities that emerge from the data. While it is important to center the intersectional experiences of women in color in STEM and the inequity they encounter in research (Bruning et al., 2015; Carlone and Johnson, 2007; Rodriguez and Blaney, 2021) first considering the female STEM students' experiences in these major-focused organizations, in general, may allow for both greater generalizability now and teasing out intersectional experiences of women of color in STEM major-focused organizations.

Chapter 3

METHODOLOGY

The purpose of this study is to explore the experiences of female STEM students' involvement in major-focused student organizations. The main components I was interested in exploring are how these student organizations influence this specific group of students' sense of belonging and their academic persistence and retention in STEM majors. I wanted to explore this topic since I am interested in STEM student success through out-of-class activities and students' sense of belonging; I have previously and still work in collegiate STEM departments. Many of these STEM fields can be male-dominated, and I was curious to see if and how these organizations shape female students' experiences.

My study is guided by three research questions:

- RQ1. What are the experiences of female STEM students in major-specific student organizations?
- RQ2. How do female STEM students perceive the impact their involvement in major-specific organizations has had on their sense of belonging?
- RQ3. How, if at all, do female STEM students perceive any impact their involvement in major-specific organizations has had on their academic retention and persistence in the STEM major?

Positionality Statement

This study examined female STEM students in higher education who are involved in major-focused organizations. As I am the primary researcher for this study, I know it is important to recognize my positionality as a female student in higher education and my involvement in student organizations throughout my undergraduate experience. I felt that my involvement in student organizations helped me grow and develop and provided me with essential skills that guided me after my collegiate journey. Through my involvement in student organizations, I found a community that gave me the opportunity to feel a sense of belonging while in college. Having this connection can allow my participants to build trust as we have similar identities.

My position as a female student affairs professional working one-on-one with female STEM students provides me with the ability to use my identity and experience to inform my research better and relate with my research participants. I am able to distinguish the importance of female STEM students' involvement in major-focused organizations and how they shape their academic experiences. My positionality also provide me with insight to better connect with my participants. I have a passion for working with students and being able to connect my passion for helping students, especially female students, to whom I can relate. I, too, was involved in organizations in college and can relate my personal experience of involvement to the female participants in this study. This gives me great knowledge of campus organizations and involvement as well as an understanding of the experiences students have regarding sense of belonging due to this form of involvement.

From my experiences as a female undergraduate student who participated in student organizations and worked with STEM students, I have wondered if major-focused student organizations offer female STEM students with finding a sense of belonging and persist in a male-dominated field. Being the author of this research has allowed me to use my positionality to explore how female STEM students' experiences are shaped by their involvement in STEM-focused student organizations.

Reflexivity

Reflexive practices encourage researchers to critically examine how their positionality affects every part of the research process (Kinitz, 2022). As this study is focused on female students such as myself, it was important for me to create strategies before the study began to ensure the research was not be negatively affected by my own biases and priori assumptions. To maintain my reflexivity, I created a reflexivity journal that allowed me to reflect on my feelings, beliefs, and biases (Thurairajah, 2019). Understanding my positionality and having strategies in place helped me understand where my bias lie within the research and allowed me to use this information when addressing the limitations of the study.

Research Design

Qualitative research aims to shed light on how people perceive reality and investigate and portray reality as it occurs in context (Biddix, 2018). A qualitative research method focusing on the exploration of the lives of one or more people is narrative research (Creswell & Poth, 2024). Utilizing a narrative inquiry methodology allowed me to ask participants in-depth questions and work together to learn about their experiences as female students participating in STEM major-focused student

organizations. Narrative inquiry uses first-person narratives of experiences presented in the form of stories used as data (Merriam & Tisdell, 2015). Having a specific group of students recount their individual and personal stories and experiences participating in these student organizations was used as data for this study. For complete participation in the telling, recounting, and reliving of personal events using this research method, openness, trust, and reciprocal and true collaboration are required (Marshall et al., 2022). Using narrative inquiry provided female STEM students participating in major-focused student organizations with an opportunity to describe how they perceive their involvement in said organizations has shaped their academic experiences.

One type of narrative study is a biographical study, in which the researcher documents and writes about another person's life experiences (Creswell & Poth, 2024). Biographical inquiry is an attempt to center social and human research around people and their humanity, with a focus on personal tales (Kim, 2016). Merriam and Tisdell (2015) explained how the biological method takes the individual’s life, gender, race, and family history into account. While considering each narrative inquiry approach, this study focused on the biological method. A biographical inquiry has allowed me, as the researcher, to explore how these female STEM students interpret and tell their stories of what they experienced through their involvement in major-focused organizations. Using biographical narrative research allows the participants to be viewed as active interpreters of their own experiences (Kim, 2016). This helped the participants feel that it is a collaborative process and that they have a large role in the study. Thus, exploring whether these experiences shape these specific groups of students' academic experiences in their collegiate journeys is important.

Astin's (1984) theory of student involvement, Strayhorn's (2019) sense of belonging model, and Tinto's (1993) model of student departure are three theories that were used to help guide this study to determine the influence these specific students' involvement has on their sense of belonging, retention, and major persistence. Narrative inquiry is important for all of these theories to learn of participants' lived experiences through their involvement, as well as their lived experiences of their journeys in their chosen majors. Collaborative storytelling on people's lived experiences is made possible by narrative researchers through the process of gathering and presenting stories directly from the participants (Creswell & Poth, 2024). Participants share their experiences with the researcher, and from their interactions, a narrative is revealed (Kim, 2015). Using narrative inquiry and building trusting relationships with the participants has allowed for active collaboration with one another. Collaboration and interaction occurred through the interview process in which I, as the researcher, conducted in-depth questions, and the participants shared their personal experiences based on the questions (Kim, 2015). This allowed the participants to be willing to share their stories and experiences within these organizations and how they relate to their sense of belonging, retention, and major persistence.

Research Paradigm

This study focuses on the influence of major-focused organizations on female STEM students' academic experiences and is guided by a constructivist paradigm. Paradigms are made up of specific conceptual presumptions that direct and influence behavior (Mertens, 2021). Using this paradigm allowed me to explore the lived experiences of this group of students participating in this specific type of student

organization. A constructivist lens helped me learn how these students make meaning from their participation and journey within the organizations. Ontology is considered the structure of reality (Jones et al., 2014), and from it, we can assume that reality is socially constructed or produced (Mertens, 2021). The ontology dimension of the constructivist paradigm can be investigated through the stories and experiences of these female STEM students' involvement in a major-focused organization and how their involvement creates reality based on their lived experiences. Constructivist epistemology is when the inquirer and inquired-into are linked in a reciprocal process; both have an impact on the other and, from a constructivist lens, will require an interactive method of gathering data (Mertens, 2021). Through this lens, I connected with the female students participating in STEM organizations to explore their journey in their participation and together construct an understanding of their experience of sense of belonging and major persistence through their involvement. Open-ended questions lead to seeing how this form of involvement influences their sense of belonging and persistence. Axiology explains that individual values are respected, and the constructivist lens focuses on the symmetrical depiction of views, such as inclusive participation of all who are involved in the study process (Mertens, 2021). As the researcher of this study, I recruited participants across a broad range of STEM-focused student organizations to ensure fairness and inclusive representation. Making meaning of the students experiences and determining their values in relation to their involvement in major-focused student organizations has been explored in this study. Exploring the lived experiences of these female students' involvement can provide an inclusive representation of their journey in their chosen major-focused

organizations. The participants were able to establish the representation of their reality and how involvement in these organizations has shaped their collegiate experience.

Sampling and Recruitment

Choosing the type of sampling method for a study is an extremely important step. Purposeful criterion sampling is for information-rich experiences that provide a wealth of information about the topic of interest (Jones et al., 2022). Cases with rich information can teach many topics crucial to the investigation's goal (Patton, 2002). I chose to use a purposeful sample for this study by intentionally recruiting participants who are current undergraduate female students majoring in a STEM field. Due to Astin's (1984) student involvement theory, intentionally choosing STEM major-focused organizations and students who are actively involved members of their STEM major-focused organizations is important for this study as I intended to discover how the students perceive their involvement and participation in these organizations have shaped their sense of belonging and major persistence. Using a purposeful sampling approach is also important to discover Tinto's (1993) constructs regarding social and academic integration through female STEM students' involvement in these organizations, which led to a robust participation selection and data collection.

The research site for this study was a 4-year public institution located in the southeastern region of the United States. This higher education institution is classified as a large Research 1 institution. Diversity is disproportionately found outside of R1 universities in the path of STEM academic careers (Jayabalan et al., 2021). I chose to focus on a Research 1 institution to help with the exploration of females in STEM. Focusing on research a 1 institution allowed me to recruit a robust population of students

pursuing STEM majors and to narrow my participant pool; therefore, conducting a study across a specific population of students. The target population consisted of female undergraduate students currently pursuing degrees within the STEM field and those who are members of organizations and/or clubs specific to their chosen major. The exact characteristics, attributes, and experiences that exceptional individuals must have to be considered are outlined in the sampling criteria (Jones et al., 2022). The students who participated in this study needed to meet the following criteria: (a) must be enrolled in a STEM major or recently enrolled STEM major (who graduated within the last three years), (b) identify as female, (c) be a full-time undergraduate student currently or have been a full-time undergraduate student during their STEM major enrollment, and (d) must be a member of an organization and/or club within their major department and the organization must be centered on the students major. Based on the purpose of this study of exploring how involvement in major-focused organizations shape female STEM students' academic experience, the sample size goal was to consist of 8-12 participants. Subedi (2021) states that compared to other forms of qualitative research, narrative inquiry uses a small sample size. Using a narrative inquiry approach allowed for this range of participants to provide a high-quality sample size to support the purpose of the study in exploring the lived experiences of female students participating in major-focused organizations. This sample size provided a good amount of information to determine how these specific students perceive their lived experiences of their involvement in relation to their academic experiences. It a good number of participants as females participating in STEM organizations is a niche group. Another way to determine if this is a quality sample size was by reaching saturation. Saturation occurs when newly collected

interview data either confirm or are redundant with findings from previously collected data without producing new information (Kim, 2015). I was able to interview 10 undergraduate students. Once each student had completed the initial screening survey and agreed to participate, I provided them with an informed consent form (see Appendix C); their identities remained confidential throughout this study. If saturation were not initially met with the original sample size, sampling would continue until saturation occurred (Gutterman, 2015). Saturation was met with all 10 final participants.

As the researcher of this study, I recruited my participants through the specific student clubs and organization group involvement sites on the institution's involvement network and hard copy flyers (see Appendix A) placed on announcement boards within the department buildings and by contacting the club/organization's presidents and/or faculty advisors to assist with recruiting female STEM students (see Appendix A). I created a flyer to distribute to the designated department buildings where these students have many major-focused classes. I also shared the flyer with student affairs professionals within these departments to pass out to their students through physical flyers and incorporate into their newsletters. For a more personal form of recruitment, I contacted many of the major-focused organization's presidents and/or faculty advisors using the contact information on their club web pages, requesting them to share my recruitment interest with their specific organizations. I also requested to come in as a guest speaker to provide more information to recruit participants. This was a very beneficial way to recruit participants as they could see who I am and hear how and why I think this study is important for them and future female STEM students. I believe this type of visibility helped recruit a quality participant group. Each recruitment method had

a screening survey link to screen for applicants and allow me to collect and record demographic information (see Appendix B). My recruitment also included a $10 Amazon gift card to any students who participated in the entirety of the study.

Data Collection

The study was conducted through one semi-structured interview with an intensive variation for each participant (see Appendix D). This intensive variation uses gently facilitated one-sided interviews to explore research participants' perspectives on their individual experiences with the research topic (Charmaz, 2014, as cited in Jones et al., 2022, p. 174). Each interview was about 30-60 minutes long and occurred in person or via video calls via Zoom, whichever the participant preferred. Both in-person and virtual interviews were recorded via Zoom through my UGA Zoom account. Virtual data collection methods make it easier for participants living in different locations to still participate in the study (Jones et al., 2022). Allowing for a combo of modalities helped reduce challenges in data collection in determining what is doable for both the researcher and the participant (Jones et al., 2022). Once the interviews were completed, I had access to the recordings and had them transcribed for the analysis portion of the study.

The interview questions in this study connect to the study's research questions. The questions allowed the participants to discuss their experiences participating in their chosen major-focused organizations and how it has influenced their sense of belonging and persistence in their majors. Being adaptable and receptive during an interview is crucial as it allows for sharing unexpected information, fosters a positive relationship, and builds trust between the researcher and interviewee (Kim, 2015). Participants were asked to share their stories and elaborate on their experiences for this data collection

process. A few sample questions in the data collection process are: “What has led you to enroll at the university, and what was most important to you in your decision-making?”; “How would you describe your experience as a female pursuing a STEM major?”; “Can you tell me some of the challenges you encountered as a female in STEM?”; “How has being involved in this student organization affected your decision to continue with your chosen major?”

Data Analysis

In qualitative research, data collection and analysis processes should occur concurrently as the analysis intensifies and as the study advances (Merriam & Tisdell, 2018). Data analysis often involves looking over raw data, breaking them down into themes using coding and recoding procedures, and presenting the data as narratives, figures, and tables in a final study paper (Kim, 2015). Emergent themes or concepts should be reflected in the data's analysis and interpretation in order for the phenomenon to become apparent (Jones et al., 2022). Once the interviews were concluded, all recordings were transcribed, and the data was then analyzed by identifying themes and patterns. Completing an analysis allowed the data to be categorized into themes, allowing me to interpret the data more easily and make meaning of the information described by the participants.

The data for this study was analyzed using a combination of deductive and inductive approaches. A deductive analysis approach uses elements from the theoretical framework and literature to support the analysis, while an inductive approach centers on the unknown and how data analysis is used to understand the problem or issue (Jones et al., 2022). As I used a combination of the two approaches to support the analysis, I

utilized both the theoretical framework and literature review for this study as they provide support for how student involvement benefits a sense of belonging and major persistence in higher education. The theoretical framework and literature review have also guided the study when creating the research questions (Jones et al., 2022) in supporting the purpose of the study.

In qualitative research, a code generally refers to a word or short phrase designating a summative, salient, essence-capturing, and/or evocative characteristic symbolically representing a portion of textual or visual data (Saldaña, 2013). My first round of coding for this study was open coding. Open coding is a technique that divides data into manageable portions and enables the investigator to examine the concepts included in the many facets of the data (Kim, 2015). I looked for words or phrases connecting specifically to sense of belonging, involvement, retention, and major persistence. The open coding method involves attentively examining the corpus of data to determine the meaning being conveyed (Marshall et al., 2022). The second round focused on constant comparison. I compared the data line-by-line to look for patterns and discrepancies and form an interpretation of the data. I also determined what is noteworthy and how it expands on what has been found from the theoretical framework, what challenges it, and what provides new information on this study's topic. I chose to use the software program MaxQDA to organize my coding. From the data that was found, I determined the collective story of the participants of this study. These codings allowed me to understand the participant's experiences in their chosen organizations, getting an overall interpretation of their sense of belonging and major persistence due to their involvement.

Trustworthiness

In qualitative research, validity and reliability are ensured by conducting the study in an ethical manner (Merriam & Tisdell, 2015). To ensure credibility within the study, I utilized three methods to check the accuracy of my findings. My first method was through member checks by returning my preliminary analysis to each of my participants to check and see if my interpretation was correct (Merriam & Tisdell, 2015). This method allowed the participants to ensure that I accurately portrayed their experiences and perspectives. The next form of credibility I utilized was peer debriefing, where I asked three colleagues to examine the data and assess my findings to determine if they were plausible. Each colleague was a higher education professional who works directly with undergraduate students and has or is currently completing a graduate degree. The third method I used is reflexivity to explain my biases, dispositions, and assumptions concerning the research of this study (Merriam & Tisdell, 2015). Critically examining the entire research process can be accomplished through reflexivity (Jones et al., 2022). Utilizing these three methods helped ensure that this study is credible and has trustworthiness.

Conclusion

In this chapter, I discussed how I used a qualitative methodology. I explained how this study was guided by a constructivist paradigm using narrative inquiry and why this was an appropriate choice. I explained my positionality as a female who has worked in a STEM department and who was involved in undergraduate student organizations. I provided details as to how this study took place, the form of sampling, and how participants were recruited. I included details regarding the procedures that were used for

data collection through an interview process and how the data obtained was analyzed. After the data had been analyzed, I was able to use the data to help determine how involvement in major-focused organizations influenced female STEM students' academic experiences in relation to sense of belonging, major persistence, and retention.

Chapter 4

FINDINGS

This chapter focuses on the stories of each participant sharing their experiences as females pursuing STEM majors and being involved in major-focused student organizations. Using narrative inquiry, the participants shared their personal experiences and feelings about their collegiate journey thus far. In this chapter, the participants discussed their decisions to attend this specific college, how they chose their major, and how they decided to join their major-focused student organization. They then went on to share their experiences in their organizations, being a female in STEM, their sense of belonging, major persistence, and overall thoughts of other females joining major-focused student organizations. The chapter continues on to detail the themes and commonalities found across the narratives. The themes are presented to represent the participants through their experiences and in their own words.

Participant Profiles and Experiences

The ten participants in this study are all undergraduate students at the same higher education institution pursuing a STEM major. Among the ten participants, four are pursuing a civil engineering major, two are pursuing a mechanical engineering major, one is pursuing and atmospheric sciences major, one is pursuing astrophysics major, one is pursuing fisheries and wildlife major, and one is pursuing management information systems major. While each participant is a STEM major, and some have similar majors and are involved in the same clubs, the individual life experiences have their own

qualities and uniqueness. To ensure confidentiality, each participant was assigned a pseudonym.

Table 1

Participants

Participant	Year	Major	Organization
Participate 10 - Abigail	Junior	Management Information Systems	Society for Management Information Systems
Participant 9 - Bailey	Third Year	Fisheries and Wildlife	The Wildlife Society
Participant 8 - Carrie	Fourth Year	Mechanical Engineering	Biotechnology Club
Participant 7 - Debra	Third Year	Civil Engineering	American Society of Civil Engineers
Participant 6 - Erica	Fourth Year	Civil Engineering	American Society of Civil Engineers
Participant 5 - Fran	Third Year	Mechanical Engineering	Biotechnology Club
Participant 4 - Giana	Third Year	Civil Engineering	American Society of Civil Engineers
Participant 3- Hannah	Fourth Year	Atmospheric Sciences	American Meteorological Society [University] Chapter
Participant 2 - Izzy	Third Year	Civil Engineering	American Society of Civil Engineers
Participant 1 - Jessica	Senior Year	Astrophysics	Physics Club

Abigail

Abigail is a third-year student pursuing a bachelor's degree in management information systems and is a member of the Society for Management Information Systems. She is from New Jersey, but when she found out she was admitted to the university used as the site for this study, one of her top schools, she decided to tour the

campus and ended up choosing to study at the university used as the site for this study for a few reasons:

> I toured, I loved it. It was like so fun. And then, when I got my acceptance, it was always kind of like one of my top schools, and so when I got my acceptance, I was like, I can't like imagine myself anywhere else. I liked how there was like a big football scene, and it obviously has great academics, and it was a really competitive school to get into, so I was like, super proud of myself for that.

Abigail knew she wanted to go into business. She originally wanted to pursue marketing, but then, after some research, she found an interest in management information systems (MIS):

> I like had no idea what MIS was or like management information systems. And then I did some research, and it seemed to be like a very high in demand major for like jobs after I was like, I want to have the easiest time possible trying to find a job after college. This is the place to go. And I also I really like statistics and like math in high school and I wanted to do something. If I was going to do marketing. I wanted to do like the analytical side of marketing. So. But, then, after researching and whatever I was like, I may as well just pick this stick with it. See what happens. And I've really liked it so far.

When asked about her career aspirations, Abigail talked about her current career interests but is unsure what she wants to do after graduating. She plans to use internship opportunities to see firsthand what she is or is not interested in.

> Right now, I think I want to do something in like the tech advisory route. I'm like this summer, I'm interning in Atlanta with this as a as a tech advisory intern. So

> hopefully, something. If all works out crossing fingers, I'll get a return offer, and we'll see what happens after that. But something about like tech implementation or something. We'll see.

Abigail's major requires a second application process after being admitted into the university. She was recently admitted to the MIS major last semester and started her STEM major courses this semester. She touched on her experience in her first semester, explaining how different it has been from the generic courses she took her first two years:

> I got into [College of Business] last semester. I'm in my junior year. So, I got into [College of Business] last semester. And then, I started my classes this past fall semester. So, it's definitely a step up from my generic courses. I took our basic Intro to [College of Business] courses, so like the finance, marketing, and management classes. and those were all nice. And then I took my first MIS class, which was like an intro to coding sequel class. And that was really interesting. I haven't coded before besides, like day of code in elementary school. So, it was definitely a big step up, and I learned a lot, and it was a lot of work, but I liked it so far.

Abigail found the coding course to be challenging and had to study a lot. She entered her MIS course not knowing anyone in the course but was able to meet a few females who were pursuing the same major as her. When asked if she knew anybody in the class, she responded:

> Not going into it, but I met a few girls who were also MIS majors, and well just like, thank goodness, because there's not that many like MIS girls or girls who are MIS majors that I had known going into it, so finding that little group of girls who

> I'm like now, able to talk to and like, talk about the classes we're taking next semester and like, figure out our scheduling wise and like what we're doing outside of class and whatnot. It's really nice to have that kind of like community going in now, going into it.

When asked about her experience as a female in STEM, Abigail mentioned how she noticed more males in her courses. However, overall, it has been a positive experience thus far:

> So far, it's so good… It's definitely, definitely, I think, more male-dominated than there is, than there are girls just like in the classes that I've seen.

Abigail attended a college meet-up event at the beginning of the year and noticed that there were "a lot more guys than girls," but she has not experienced much negativity in her short time in the major.

One challenge Abigail has experienced is trouble finding a community of women in the MIS major:

> From what I've noticed, I just think it's been a lot more like just like finding that like community and group of people who are also women who are in MIS has been like definitely a journey in itself. I'm part of like a sorority, and like in our sorority, we have these, like major bigs and littles that help out with your major and stuff and like help you through the path and there's like there was no one who was a management information systems major. So, I was like trying to figure out what classes to take and like what steps I should be taking next, and like finding an internship was definitely difficult. But that was kind of the only big like a hump in the road or bump in the road.

Abigail found that with fewer females in her class, it was more difficult to make connections in the beginning. She noticed the males had an easier time making connections, and it took her a few weeks to feel comfortable enough to introduce herself to people. For Abigail, making connections and developing relationships with the women in her class stood out as a positive experience for her in her STEM major:

> I think just like developing like that relationship with the group of girls that I now have has been really helpful and positive… I've been able to text them about like my classes next semester, and we worked on this project together, and like having that kind of community has been a super positive part of the major so far.

Abigail is a member of the Society for Management Information Systems. When asked how she decided to join this STEM organization, she explained how, in her first year, she joined a mentor program and was matched with an older female majoring in MIS who was a member of the club and recommended that she apply to be on the general committee for the club. She explained how intended MIS students could join the club prior to being admitted to the major, which led her to apply to be on the general committee. After being admitted to her major, Abigail applied to be an executive board member.

Involvement in the Society for Management Information Systems has helped Abigail persist with her major by giving her the opportunity to hear from companies that come speak at club meetings and talk about career opportunities. Hearing about what pathways she can have in the future has helped motivate her. She talks about one in specific:

> There was a meeting last in the spring. Last year. One of the companies that had come in to come in and speak. They invited me out to like this like dinner, with like future, like applicants and people who are also interested in the company, and I talked to two girls at that dinner who were MIS and accounting majors who worked there. They were super-duper, like inspiring and motivating. And I was like, I want to be exactly like them when I'm older. They're so cool. And I think that definitely helped push me. And that was like a specific moment. I remember, like after the dinner I like called my dad. Oh, my gosh, this is, they're so cool like this is who I want to be like. They're amazing.

Having these opportunities through the organization also motivated her to persist even when she found her coding course challenging.

Being a student organization member has also provided her with a community within her major. There was a specific dinner with the student organization's executive board where she felt a true sense of belonging:

> At the dinner, we were talking about like our personal lives, and like more of like the social side of it, and like having people that I know that I can talk to about like more of like the business MIS side versus also, like them care about my personal life, and like asking me questions about where I'm from and like all this stuff, it was a good, it felt like there was a good balance between it and that like helped me, helped shape my sense of belonging, and, like the professional side of it.

Having this sense of belonging has solidified her choice to major in MIS. "It's made me realize that I've picked the right path for me."

Not only has her involvement helped with her sense of belonging, but it has also helped her progress in her degree. Involvement has provided her with people to talk to, such as professors and friends, for tips and advice on her major. Having this support has "felt like a weight off my shoulders." She has gained support from these connections and older members of the organization, which has aided her in continuing to work hard in her major.

Along with many other participants, Abigail feels that it is important to have a support system for females pursuing STEM degrees:

> It's super-duper important just to have like people to talk to about your classes and about like future internships because if you're going through it, like all by yourself, it's impossible… I don't know if I would be able to get through this major if it wasn't for like having like people to talk to and ask questions to and like, look up to and figure out like what path they were on, and like mimicking it to my own like, to my own extent.

Through her STEM involvement, Abigail found an internship this summer and made friends in her major.

> I just think being involved in like something with your major is so important and just to like, have those connections, and, like that community around a major was like vital for my college experience.

Her experience would have been "completely different if it was not for this organization."

Bailey

Bailey is a third-year undergraduate student who is pursuing a bachelor's degree majoring in fisheries and wildlife science with an emphasis in wildlife sciences. She is a

member of the Wildlife Society at the university and is also an officer for the student organization. Science and math have always been an interest of Bailey's as she went to a STEM high school and enjoyed the challenge of it. When asked why she chose to study at this institution, she explained:

> I'm a wildlife sciences major, which is a very like niche part of [the university]. And so, I was applied to the [university] because I wanted to go to the [university's] School of Forestry and Natural Resources, and that's one of the top schools in the nation for my major and my career choices.

Bailey's ultimate career aspiration is to become a government wildlife biologist or work in research and become a professor at a university.

When asked about her first-semester experience in her STEM degree, Bailey talked about how it was a welcoming environment due to the department being small and everyone already knowing each other:

> Everyone already knew each other and I kind of just was able to integrate myself into that little like [School of Forestry and Natural Resources] family. It was really nice to have like smaller class sizes, because I got to know my professors really well. And it felt like…there's like only four majors offered in the college. And so, like each group of majors, kind of like forms their own little group…So I, as a wildlife major felt like I belonged with the wildlife majors.

While Bailey felt welcomed being a wildlife major, she has had some mixed feelings being a female pursuing a STEM degree:

> So specifically, as a female, it has been a little bit interesting. Surprisingly at the [School of Forestry and Natural Resources], the Wildlife major itself is

> predominantly female, but overall, the school is predominantly male, because there's a lot of male forestry majors. And then, in general, in the wildlife field there's a pretty good mix of male and female. But It definitely has felt like there's been some prejudice against females, especially in like field work aspects so like a lot of times men say that, like women, aren't best suited to like, go hiking outdoors and like go and collect samples and carry heavy equipment and stuff like that, and especially at [the School of Forestry and Natural Resources]. There's a lot of people that hunt and fish. and there has been some like judgment where, like, men think, oh, women can't hunt, or women can't fish.

According to Bailey, her college has done an excellent job of encouraging inclusivity and diversity. She has had the opportunity to participate in a hunting program that teaches women how to hunt. Bailey mentioned that most of the prejudice she has experienced was out working in the field or working with professionals and has felt that she has had to prove herself to others:

> We were out in the field, and we had to carry these big bags of corn to go and like, put them at a feeder, and then, like men, would say something like, oh, like implying that I'm like weak, too weak to carry the heavy stuff, or like that's a man's job to carry the heavy stuff or even. It's kind of just like sometimes it's not even said, but you just like, get the feeling that you're not welcome.

She does feel that as more females are getting involved in STEM, that it is starting to change in a more positive direction.

When asked if she could talk about a time when she experienced a challenge being a female in STEM, she explained how she would need to think about it as, overall,

she has had a really good experience at the university. Then, when asked if she could speak about a positive time in her STEM degree, Bailey spoke more about the hunting program and how it is becoming more accepting and open to females:

> So, I have lots of positive stories. So, one example is like this hunting program has really enforced that, like, they want women to be able to have the same opportunities as men. So, they've been really good about, like encouraging more women to go out and hunt, and more women to learn how to fish and get into these male-dominated hobbies of a sort and really like just encouraging women to like become, have a bigger voice in the wildlife and conservation fields.

Bailey shared another experience through her involvement in the Wildlife Society and attending a large national conference:

> We had a really big national conference with the National Wildlife Society and at this conference they had a special networking night that was specifically to promote women and then diversity and inclusion.

When asked how she decided to join this specific organization, she explained attending the university engagement fair and specifically looking for a club related to her major.

> So, I remember when I was a freshman I was at the [university] engagement fair, so we were just looking at all the clubs and because I was a wildlife major, I was looking for something wildlife related. And then this club is called the Wildlife Society, and I think they had like a turtle at their table. So, I went over to see why they had a turtle, and so I was like, this is perfect. It's the Wildlife Society, I'm a wildlife major. So, I went to their meetings and it was basically just like learning about different types of wildlife professionals in the field. We got to do a couple

> of different activities and like interact with other students and professionals that also do stuff with wildlife.

When Bailey first joined the organization, she felt intimated as there were many upperclassmen in the club. It was when she started attending regular meetings did she feel comfortable and realized how much she enjoyed being a member:

> It actually felt really nice to have like an organization that I belong to, because then it was something I was regularly going to and seeing the same people at, and they recognized me and would like check up on me as an underclassman, and it was nice to connect with individuals that had similar interests as well.

Being a member of the Wildlife Society helped to reinforce her passion to study wildlife:

> It had a lot of upperclassmen that had taken the same classes that I was going to be taking. It was very encouraging that they would be like, oh, you can get through this class, or here's some tips to get through this professor and stuff like that. And then also meeting professionals through this organization was really nice to like, reinforce my career goals and kind of like figure out what opportunities there are out there for me.

When talking about belonging, Bailey expressed how, through activities in the club, she has felt “wanted and welcome” and has a place where she enjoys the same activities as others. One specific time when she felt like she belonged in her organization was when she was able to share a common interest:

> This organization is for all wildlife. So there's people who like deer, who people who like snakes and so, specifically, we had a speaker come in and talk about falconry and show us some birds and just seeing that other people also like took

> interest in something that I was really passionate about really made me feel like I belonged there, and that it's not just a club, for like it's a club for everyone, and also like meets all of our individual needs at the same time.

Belonging to this organization has “reinforced her sense of self” and made her feel confident that she belongs to this major. She has also been able to make connections being a female in STEM:

> So, this organization is like the student chapter of the Wildlife Society and then there's also we fall under the [state] chapter of the Wildlife Society, and the [state] chapter's president is also female. And so, she’s been a really cool, like female mentor and like a person role model to look up to. She helps us organize a lot of our events, she's helped sponsor some of our trips that we've gone on, and she's just been like a really cool role model. She's come to talk about what she does as a career. And like really inspired students, that, like women, can be girl bosses, too. It's like really cool.

Bailey expressed how encouraging it is to see females represented in positions of power.

Not only has being involved in this organization helped Bailey feel belonging, but it has also reinforced her confidence in pursuing this STEM major. It has helped her feel more prepared for her major courses and provided her opportunities to hear from professors and professionals in the field, which has helped her learn more about the pathways she has after she graduates. As a board member, she has been able to participate in and help promote field-based activities in the club:

> So, we've started doing things like we take all of the club members out. And we were looking for snakes and salamanders, and next semester we're going to go out

> looking for frogs, and then we're trying to do one where we go out and look for birds. And we did one where we toured our deer research facility. So, they both got to like, see live deer and also learn about the research that we do at [the university].

When asked if she would recommend joining a major-focused student organization to other female students, she mentioned:

> So, with any organization, if it's related to your major, it definitely like reinforces the things that you like about your major. It also helps you connect with other students that have similar interests or are of the same major, which can both help you with your classes and also help with like your sense of belonging to that major, and you can have. I've had so many friends from this organization that, like just reinforced that we're all interested in wildlife, and so like, that's kind of bonded us together in a sense.

Bailey enjoys being in an academic organization overall. It allows her to participate in activities she enjoys while also learning about research and networking with professionals.

Carrie

Carrie is pursuing a bachelor's degree and is a third-year student majoring in Mechanical Engineering, and is also an executive board member of the Biotechnology Club. Living in California, she decided to go to school out of state. She randomly picked the state of the university being used as the site for this study and applied to the university. After touring colleges with her dad, she visited the campus of the university used as the site for this study and felt it was right:

> I got the feeling and was like, “Oh my gosh! It’s love at first sight.” The vibe, which I didn't think was gonna actually happen until I came to [the state]. And then it like did happen. I was like, Oh, my gosh! It was like this, like something in the back of my head telling me like, this is like, gonna be okay if you come here. It was scary. I didn't want to leave my family like especially going that far away. But I applied, like everywhere, not in California, to like incentivize moving because that's like I knew something I wanted to do.

Carrie was initially interested in chemistry and quickly changed her mind after doing much research on what a chemist does on a daily basis. “I took AP chemistry in high school and loved it. I wanted to be a chemistry major, but then did some research, and most chemistry majors become teachers or researchers or end up making shampoo for companies. I was like oh, I don’t know if I want to do that.” Carrie then started college as a biochemical engineer but switched her major to mechanical engineering in her second semester.

Carrie had a great summer internship that showed her what area of engineering she is interested in working in after graduation.

> Right now, I want to work as a manufacturing engineer for like aerospace technologies. So, I worked at Boeing over the summer. It was a lot of fun, and I worked on, like, the F18, which is like, the Navy fighter jet, and I worked on the 15, which was a lot of fun. I wouldn't mind like translating that to something more like general production. But I really, I was glad I got the taste of like, because that's the engineer that like talks, and like they talk to the shop floor and like the operators, cause like they need that like liaison.

Carrie's first semester pursuing her STEM degree was more challenging than she expected, not due to the difficulty but due to how new everything was. She had to learn how to adjust to having a social life and pursuing a STEM major. She took 13 credit hours due to her academic advisor's suggestion, and it was a blessing in disguise. Overall, the change of being in college and taking calculus, physics, and an engineering course was a bit overwhelming with trying to balance a social life, "I think I just hung out with people in the dorm way too much like just wanted to make friends. I was really desperate to like have that community that I had in high school."

Carrie has found that being a female in STEM is not that bad. She feels the university and engineering department do a great job developing engineering students who are "very good at group work, very good at communication." Carrie has felt that it is stereotypical for guys to want females when it comes to group work as they will do all the work:

> I feel like I'm more desired in group work because I do more work, and I think that's a stereotype that is true. I think females do like in the group projects I think they carry. I think they're the leaders. I think they do everything they section it out, they do whatever and like I know that's true, because all my friends say that because, like they're like, I always want a girl in the group.

Carrie shared a specific experience of being the only female in a group and how the males in the group were. She came up with a great idea for their project and was immediately shut down.

> I had this really good idea, but I was in a group, and my group was with 3 other boys, and my idea was like cause you had to like pull a string, and then it would

> release it… I was like, this is gonna work because we can load it up, like, stick that through, and then launch it. And it's gonna go shoom, you know. And I don't know what it was, but it was like, “No, that's not gonna work.” I was like “No, no, no, like it would work.” I don't know. I felt like very dismissed.

This left Carrie feeling ignored and that her ideas weren’t valid: "They were shooting down my ideas because they think they’re not good.”

There have been classes where Carrie has been the only female but has felt part of a community. Through her STEM major, Carrie has met most of her friends.

> Through my STEM major, I've met like most of my friends, I like I joined the Biotech Club, and I like met… like a bunch of people. And a lot of them are mechanicals, too, and I don't know if that's like causation or like correlation, like we all talked about it so they all joined. But, like I’d say, I built my little community in the STEM area.

Carrie was first introduced to the Biotechnology Club by a friend who was a club member in her first semester but turned down the offer to go to a meeting as she was struggling in her classes. During her second semester, she decided she was ready to join and really enjoyed it: “I went, and then I had the best conversation ever about like radiation and like outer space, and like the little like, you know, the little like Tartars.”

Joining the Biotech Club gave Carrie a sense of community. While the Biotechnology club is not only for students in STEM majors, she has found a group of people with “similar ideas” who became fast friends. Members often check in when she misses a meeting or sends words of encouragement during finals. “It was just like the sense of community I felt in that.” Carrie really enjoys the ethical debates in the club:

“It's really interesting to see all the different people's like opinions, and like you could have like a civil ethics conversation without like attacking anyone.” She has found that she also spends time with many members outside the club. When Carrie is having a difficult time with classes, she looks to Biotech Club members for support and to talk her out of negative thoughts:

> The people that are in the club that are also in my major, where I'm like, “Dang, like it would just be so easy to switch into business,” but they're like, no, you don't want to like look at this like you made this slide show for something that doesn't matter. Like you love this kind of work… I guess it's just the people being like, no, you're just acting silly. You're acting crazy right now like; just because you have an exam doesn't mean you need to drop out. I was like, that's so true.

When asked about a time when being involved has shaped her feelings of belonging, Carrie brought up another instance when she had imposter syndrome and felt like she was not cut out for her major until a friend from the Biotechnology Club came into the room and talked her through it:

> I was having a little bit of imposter syndrome right at that moment I was like, why did I choose this major?... And then (name redacted), another girl that's in the one of the groups she was like in there. So, she like she tapped into the room, and she was like, “Oh, my gosh like this is so terrible. But like, whatever, this is just what you gotta do.” I was like. “Yeah, that's so right. It's just what I gotta do.” It was just like her being like “Man this sucks, but oh, well.” And I was like, “Shoot yeah, you're right. Oh, well.” And then then I went back to being like, yeah, that's right like I'm pretty smart and I do good in my group work, and I'll probably get

> like a not below a 70 like, I'll be fine like. Then I was like, it was like her, no, it's okay. I gotta do this to my like, yeah, wait. I can do this. And then I remembered all the things I was good at.

Carrie has also felt a sense of belonging by having conversations about specific topics that interest her. “All these people are into the same things that I am.” She can be herself around this group of people, and they accept her:

> I guess I have the same ability to like nerd out on something that's like nerdy, like accepting the fact that we could, we could be like “This is so cool,” even though, like most people, would not think that's cool at all.

These experiences have also helped her with her progression towards her degree. In moments of self-doubt, she runs into a club member, and they help her remember why she is pursuing this degree, “Reaffirmed the fact that I liked engineering, and that I like STEM and like this is something I want to pursue.” She has also found that her passion for her club has also influenced her:

> The Biotech club has had like a decent impact on like, why I haven't changed my major or why I haven't like gone to like something that could be easier. And I think it's really just because, like. I have so much respect for everyone in there, we have so much fun together. I'm like I can't, I couldn't imagine, not... I guess I could still be involved if I wasn't in STEM, but like, I feel like it would feel different.

Carrie has been able to have a similar class schedule to other club members, which has positively impacted her persistence with her major. She has been able to form a community that has helped her continue with engineering:

> I would say that being involved in the Biotech Club has made me continue to pursue my engineering degree, because without that sense of like community and the people that I see, because not every we don't get the same people every week, because it always transfers out and moves around. But like, you see, someone once a month, and then you're like, Oh, my gosh! So, like I don't know. I would say yes, yes, it has impacted my urge to pursue my degree.

Carrie feels that while she is a confident person, being a female in STEM is not difficult for her, but she can see how it can be tough for other females: “I wouldn't wanna be in a major or be somewhere where, like, I constantly feel like I'm fighting to prove that I'm worth it.” Carrie is not sure if the Biotech Club would be for everyone, but she does feel a club would be beneficial in helping females in STEM find community. When asked if she would or would not recommend joining a major-focused student organization to other females in STEM, Carrie talked about the community she has made from her involvement and having people who understand the challenges of pursuing a STEM degree. “Having like these people that like understand.” She also mentioned mentoring younger members and providing tips and advice for their major.

Debra

Debra is a third-year civil engineering major of her bachelor’s degree and a member of the American Society of Civil Engineers and on the executive board. Debra enrolled at the university for many reasons “It is close to where I live, it has my major, and because of the environment.” Debra is strong in math, which led to her interest in civil engineering and the many opportunities this career path will provide her. Debra is most interested in the transportation side of civil engineering.

When asked about her experience during her first semester in her STEM degree, she talked about how it was difficult as she transferred to the university that is the site of this study a year prior and felt that it was a tough transition. It was “definitely a lot of work.” One challenge she experienced being a female in STEM occurred at her internship:

> At an internship, I was kind of told because I worked in construction for this one period, and I guess I was kind of told that like being a woman in engineering, construction specifically that its people might like the men, would, might not take me as serious. And so therefore, I had to kind of like, have thick skin in that in that aspect of engineering. So that would be a I mean, yeah, I was just an intern. So, I didn't really do that. Not many like tasks, tasks. But that's something that I could probably foresee a challenge if I pursued it.

Hearing this made her feel discouraged, but she continued with her engineering degree.

Engineering is a STEM major that students must apply to after being admitted into the larger university in order to continue with the major, and one positive experience Debra shared was being admitted to the College of Engineering. She also shared how getting a position on the executive board for her student organization was a positive experience where she felt happy and thankful even though it does take up a lot of her time.

When asked how she decided to join this organization Debra explained how she was interested in being social and getting involved:

> So, when I got to [the university] I think like a semester the semester after I decided it was good to join to be like social and to get involved. And so, I don't

> remember exactly how I saw the ASCE having a general body meeting, but I did see that the ASCE was like a bigger club, and that a lot of people went to it and that they do a lot of connections… they connect with a lot of companies. And so, I was like, I wanted to be part of something big and that ASCE for me felt like that like that was a big organization. So, I decided, just as I decided to join just as a member, and then, now I'm an executive board team member.

Debra explained how joining this student organization pushes her to stay on the path to her degree and how great it feels to be involved. She emphasized how being a member of the executive team helps her persist with her degree:

> I really think just like hanging out with them being with them, being with the team, with the executive board team and they're positive outlooks, and in life.

Debra explained how her feelings of belonging are due to a competition challenge with other females in her organization and the connections she made:

> It was like last year at a symposium where we were building a bridge. And it was me, and like some of my friends who are women who are in ASCE, and we were like trying to hold up the bridge, and of course you're a little not as strong as like some of the men there, but I felt like me and me and my friends in the ASCE. I mean, we felt I mean, we felt like the same way there. So, it's like I felt like a connection there, I guess I don't know and then I guess I'm kind of describing just times where we had fun and where I felt like connection. We also re…. We also like rode on the concrete canoe last year. That was really fun as well. When we all like we're trying to work as a team to beat. to beat the other chapters or colleges. so that that made me feel like belong belonging with them as well.

Her involvement in her organization has helped her progress in her degree by providing her with opportunities to hear from companies first-hand and learn what she is and is not interested in.

> Having these general body meetings and hearing the advice and of the people who work at the company telling me, telling me like what kind of things help them, or like they enjoy kind of give me some a perspective on, on where I should go to next or like if I should stay on this specific route for engineering,

Participating in her organization also led to an internship, during which she made connections and gained positive experience.

Overall, Debra feels it is good for anyone to join a major-focused student organization to build connections and network with companies. As for women, it is especially good to join if there are any doubts that they cannot pursue this field:

> As for women. yeah, I mean, I feel like, if you have any doubts that that maybe like a oh, you're not able to go far because you're a woman in an engineering degree. I know we're like under underrepresented, it it's good to be with other women as well to not focus so much on like being a woman in engineering, but instead of instead of like focusing on like, oh, I mean the good things and the bad things about being a woman engineer. You can kind of just focus on what like your work ethic And I think it's just good to be in a club where there's men and women, you know we're having the same work ethics.

Erica

Erica is from a small town in southern part of the state where this study was located. She is a fourth-year civil engineer major of her bachelor's degree, and an executive board member of the American Society of Civil Engineers (ASCE).

> All my friends were going to [another in-state school near her small town], and I just for some reason, I just wanted to be a little different and go somewhere by myself to get just the real college experience, I guess. So, that was my main reason for coming to [the university used for this study].

When asked about how she chose her major, she explained:

> So, my dad played a big role in me choosing this major. Growing up, I would always, he's a diesel mechanic, so I would always go with him to do different things that most little girls probably didn't do growing up. And yeah, he was just my main inspiration to do engineering. And then, I just looked into the different types of engineering, and civil stood out to me the most.

After graduating, Erica wants to work in construction or civil site design. She narrowed down her career interests through internships, which involved "trial and error."

Erica talked about how her first semester pursuing her STEM degree was a big change, not knowing how to study properly and coming to a large university. She talked about being a female in STEM and not knowing anyone:

> It was very different because, especially at the beginning, I didn't know many other girls in my major. I didn't really know many girls in engineering at all. So, it was just an adjustment, really, especially coming from high school, you know everyone. You're all mixed together and then coming. You're divided by your major. So, it was just really different. Took some getting used to, I guess.

Erica mentioned how it was a scary experience at first, especially after noticing how few girls there were. One challenge she experienced as a female in STEM and being told females should not do engineering:

> Obviously not everyone's like this, but you know there's a couple of instances I've had where people are like, “Oh, girls shouldn't be engineers. Girls shouldn't be in STEM.” And me and one of our other friends that’s a girl we had this experience with one guy in our class. He kind of made a comment one time about girls in engineering, I guess.

While this was upsetting for Erica, she chose not to listen and not to let it affect her schooling. One positive experience that impacted her was having a professor believe in her:

> He's had a big impact on me, and he just always tells me to go for go for it, and he always believes in me, and he's just really a big contributor to why I'm still here.

Erica is on the executive board for ASCE. She mentioned how she found the organization through the university involvement network by searching “civil engineering.” At first, she felt scared joining the organization as she did not know anyone, but then felt very welcomed and was even encouraged to participate, join a team, and go to conference, which positively affected her choice of major:

> It definitely helped me meet more people in my major and you know, you find people you can do schoolwork with, you can study for tests with. It was just a good way to find other people in my specific major.

Her involvement in this organization also helped her persist in her STEM major. Being a part of the executive board, she was able to go to conference and be a part of a concrete

canoe team. Through this experience, she connected with her teammates and participated in hands-on learning experiences related to her major. “Ever since then, like we'll study together, we'll hang out outside of class. It was just very, very helpful to me.” She was able to make connections with members of the executive board that shaped her feelings of belonging.

There was one specific instance where she was new to the executive board, and they were asked to attend a gala. She did not know anyone but reached out to ask for a ride to the event and ended up having a great time, spending the entire day with them. This made her feel good about the future and being on the board with them. Another experience similar to this, she needed a ride to an event and felt belonging:

> So, when I went to the conference I was, we had like this sheet of sign up like where who you could ride with, and I don't know if I was late to the meeting, or missed a meeting or something, but, like all the spots were filled up, so I just had to like ride with someone again I didn't really know very well. I don't know how this kept happening to me. But they were really nice. There was only like one other. It was me and just one other girl in the car. But even the guys. They're so welcoming. And do not mind you tagging along at all and treat you like you're no different than one of them.

Erica was able to make connections through her involvement in this organization that helped her progression in her STEM degree:

> After joining and meeting different people, I was having trouble with one of my classes. I believe it was strengths I was struggling with, so I asked someone in the club that had already taken it for like some advice, and they helped me through

> that they gave me some tips for the professor that I was gonna have, and they just really helped me be able to get through the class… it helped me understand that you can't do this, major on your own. You have to have you have to collaborate with others, and you can't. You can't just go through it by yourself.

She also mentioned how this organization connects students with employers, which helped her understand much more about her major and career pathways:

> So, going into the meetings every week, seeing the people every week, and every week we have a different employer come speak to us about different things you can do in the field. And like I said, I'm from a very small town, and I didn't really even honestly know much about engineering at all when I came to college, much less civil engineering, I just really didn't know much about it. And because I didn't know an engineer I had no one to ask, but seeing the different employers at these different meetings, helped me understand more like, Oh, there's so much you can do with this, major, and you're not stuck in one place. So that helped me go through with the major.

Erica would recommend joining a major-focused student organization to other females pursuing STEM degrees for many reasons:

> I would recommend it because it well its, number one, it looks good on your resume. But besides that, it it's a very good way to meet people. Either in your specific major or people that relate to you and help you feel a sense of belonging within such a large college. It's just to find that smaller group of people you can connect with and find people you can study with people you can hang out with outside of class like just many reasons.

As a female in STEM, Erica mentioned that sometimes it can be challenging seeing many males, but being a member of this organization and seeing more women is uplifting for her. Her involvement has made her feel more confident in her major choice:

> I had changed my major the beginning of college, and I just knew my first major. I chose. I just knew I didn't belong there at all, but as soon as I switched to civil [engineering] and I joined this club I didn't have that feeling at all like I knew that I had chosen the right major, especially after the people I had met and the women I had met in the club. I knew it was definitely possible to do it as a woman.

Fran

Fran is from state where this study occurred and is in her third year at the university. Fran is pursuing a bachelor's degree, majoring in mechanical engineering and is a member of the Biotechnology Club. Fran explained why she chose to come to the university:

> I came to [the university] mainly because I'm in state and I really wanted to go to [another in-state school]. But I got like the like conditional offer where it's like you can transfer after semester. So, I figured, I'd decide to come to [the university], since it's like the cheapest option, and then I can always transfer to [the other in-state school]. However, obviously, I stayed because I really liked [the university] then.

For Fran, tuition costs and the campus environment were important in her decision-making:

> I guess it was just money for like that, like reason why. But also, I really like [the university's] campus. And I've always I like grew up a [other in-state school] fan,

> so I always hated [the university] and never wanted to go there like I literally applied on a bet. So, I was like, okay, might as well give it a shot like I can always transfer so it can't hurt. Plus, I knew a lot of people that were going. So, I was like it won't be the worst if I don't like it.

When applying to colleges, Fran was unsure what she wanted to major in. She was leaning towards business but realized she wanted to take science and math classes. Fran was also influenced by her dad being an engineer:

> My Dad's a civil engineer, so he's always been like big into engineering and trying to get one of his kids to do engineering. So, I was like, okay, might as well try it. And I really liked it so I just I like the math and science aspect, and I really like that it's like a like a more difficult major, because I like being challenged sometimes, like the business stuff's too easy for me.

As of now, Fran is not sure exactly what she wants to do after graduating, but she is open to everything.

When asked about her first-semester experience in STEM, Fran talked about only having one engineering course that semester. It was an honors class, which made it a very small class size, but she really enjoyed it. Similar to other participants, Fran talked about being one of the few females in most of her major courses:

> In engineering, I definitely like last semester, I was one of like three girls in my class of 50 people. So that was kind of crazy, but I don't really mind it. I like I don't really mind it. A lot of people like Oh, my gosh, that's crazy. But a lot of my like friends that I've made through engineering are guys. So, it's like, I didn't

> really care. But it's kind of crazy to think that, like I was like only one of three girls in the class.

Fran has felt that being one of the only females has some advantages and has not negatively impacted her:

> There's almost kind of like a benefit to applying to jobs and stuff. I feel like they give you more of a benefit of the doubt if you're a girl, just because I feel like that's a more like rare candidate, maybe, or I don't know if that's actually true. Obviously, this is just from my side of things, but I feel like in like that type of situation. Maybe it's like a slight benefit to be a woman in STEM. But in classes like I mean there's not many girls. So, it's kind of weird. But I don't know, I don't think it's, like, too badly affected, like any aspect. But I mean, I'm in a in addition to a biotech, I mean, that has a lot of girls in it. But I'm in like a social engineering club. So, like it's like, I've met a lot of the girls that are in engineering. So that's kind of nice.

Even though Fran feels there are advantages to being a female in a male-dominated field, she talks about the challenge of being one of three females in her class:

> Well, in that one class where it was like one of the three girls. We were doing, it was like a group project-based class. And I was, I mean, obviously I was the only girl in my group. But the guys definitely weren't as driven. Maybe that's just like a personality thing. It doesn't necessarily have to be a gender thing, but like there was like a part of the project where we had to like make a magazine, and then like the design part of it, and I like they, I mean, they just kind of like made me do the whole design part. I ended up having to do like the rest of it, because none of

> them did it, but like to begin with, it was just like, oh, like Fran can do design, like she'll make it look pretty. which like is fine. I don't mind that, because I ended up like doing more work than any of them anyways. Which like is, I don't know, I'm I like being that like the team player that will do it all, even though it's like that.

Fran was annoyed by this situation and felt that they did not listen to her. This led to another experience where working with males in her classes led to her being frustrated and needing to prove herself:

> And then in another class, we had like a building project where we had to like build a catapult. And I mean I grew up, my dad is like a huge workshop in our basement and everything. So, I've grown up like building a lot of things. So, it was like kind of funny when we were in like the in the Fab Lab building it that it was like kind of funny, because I was like, okay, like I'll go cut the wood. And they were like, no, like, you don't know how to do it. And I was like, no like, actually, you don't know how to do it. I do, though. But thank you very much like you're actually doing that wrong. And they're like, Oh, does anyone know how to do this? And I was like, Yeah, why don't we do this or like, no, no, it's okay. So, it's like a little bit of backlash. But I mean, that also could be like an ego thing. But obviously, I feel like, guys have a higher ego in that type of stuff to begin with.

One positive experience Fran shared while pursuing her STEM degree was having to argue about the grade she received on a quiz from an instructor. She was proud to have the confidence to stand up for herself, knowing she had earned a higher grade than what

she had received. Knowing her teacher was willing and wanting to help her with her feelings of continuing with her major, “They want you to pass like they actually care about you as a student, was neat to see.”

Fran joined the Biotechnology Club her sophomore year when she met the club president through a mutual friend. Fran found the club to be a fun organization to be a part of and explained how joining it made her feel:

> I really liked it. It's like a…. It's a very not exclusive, but like very like tight-knit, like kind of like our meetings are really fun, because we have, like an open conversation about, like all the different topics which is nice and like everyone's very respectful of, like, everyone's like opinions and stuff. So, it's I mean, I really enjoyed being in it.

She mentioned how they plan activities that allow members to bond with one another and become “friends outside the club.”

Fran has found that the people she has met through the club have helped her persist in her STEM major. She was able to meet members who were upperclassmen with the same major and ask for advice:

> It's nice like having someone older than you in your major. One of the girls that's in it, and also the president, they're both like my major. So, it’s nice to like, get to like talk about like classes like oh, like, Hey, like I need advice on like this, which is nice. And then also, like they can like help me with like projects or something, because they’ve already like done them. And also, like some of the like topics that we like talk about in the club really makes you like interested. I'm not, I mean, none of us are like biotechnology or bio anything majors, really. So, it's kind of

> funny that we're like in this club. But it's nice to get to talk about those topics. There's like an elective we can take as mechanical engineers that is like biotechnology focused. So, I definitely want to take that. So just maybe like more interested in like those types of things like think outside like the box and stuff, which is cool.

Fran feels this organization is a great place for females who may feel like they cannot voice their opinions, share ideas, and have a place to go. She feels it is a great group to meet people and share their interests:

> I think if someone feels like well, it's like very like, I said earlier, very like respectful group towards each other. So, if someone is feeling like they're like, always being over spoken about or over spoken. Yeah. Spoken over, anyway. Yeah, it's like, if they want to like talk about like their classes, or like really anything, even if they're not interested in biotechnology, is like a great opportunity to like meet people that do like want to hear your opinions. If anyone's feeling like they're being like overshadowed, or anything like, it's nice to have a place that they can go to like talk about their field.

Besides being able to share interests, Fran feels it is “a nice break from all the like hustle of like classes and stuff when it's like competing for the teacher's correct answer.”

Fran shared how being involved in this organization has shaped her feelings of belonging when she had to miss a meeting and was checked on to see why show:

> So, like last semester, there always be a lot of people. So, I was like, Oh, like, I don't necessarily have to go today. But then, like, if I didn't show up like someone was like, someone usually texted me and asked where I was. So it was like kind of

> cool to know that like they like wanted me there and that I belong there, which was nice.

She also expressed how she feels belonging by the respect she is shown when voicing her opinion and sharing an idea:

> I mean, no one is ever like oh, like, that's a wrong opinion. It's always like, Oh, that's interesting, like idea. Like, let's think about that more type of thing. So, it's kinda nice to like, just feel like everything that you say or do is like respected.

In describing a specific time where she felt that she belonged, Fran shared:

> So, we did like elections sort of for the club last semester. I'm technically the vice president of finance, but we don't have any dues. So, it's kind of like a made-up position. But when we were doing it I didn't want to be like president or vice president. Anything I was like, I just don't have time every week. But then they're like, “Oh, Fran, like, you need a position like you can be this.” So it's kind of nice to be like. Oh, like I do want to be there like and they want me to be there, which is nice.

Fran talks about how the support from the friends she has formed has impacted her major persistence:

> I guess it's nice to like always have like a friend. And I'm like, Oh, like, I got a bad test grade and they’re like, Oh, no, it's okay, like I did that on that test, too, like you'll do better on the next one. I guess if that sort of makes sense like just having like that like reassurance in your major and stuff because it can be like hard. So that's definitely been a nice thing.

Due to the support, she has received from her peers, and how it has impacted her, she feels she can pass this along to newer members in the future.

Along with feeling like she has a place she belongs, her involvement in the club has provided her with opportunities she was unaware of that has helped her progress with her degree:

> Well, like one of the people I met in the club. She had this like project she was doing for her research, which is cool. So I got to go and like into her lab and like, look at it and everything which is cool, because I never like thought about doing that. And then I've since like applied to that lab position. I didn't get it, but it was cool to like see like all these different opportunities. It made me like, think more about like other I guess options I could do like within my major, which was cool to hear.

Fran feels that everyone should get involved in a major-focused student organization. She has found that having people to go to within the club can provide reassurance and guidance. Fran also felt if you don't want to be involved outside of your classes, you may not be fully interested in this field:

> If you don't want to do something in your major like outside classes, you're not, you might not want to work in your major like your whole life then if you aren't willing to like get involved outside. So it's like, always recommend it that way, you know, like, truly if this is something you're interested in, or whether or not you just like the class, or like the topic like you have to actually be able to know if you want to spend more than just the minimum on your degree.

As for females in STEM, Fran feels joining a major-focused organization is especially important to find a community:

> I definitely think it's important to everyone anyone, but especially in STEM. There's definitely like less girls so it's nicer. If you are like a girl's girl type of thing, or like you want to like meet friends that you like may feel like more comfortable with if they are females like. It's nice during clubs, because maybe at [the university] the girls, maybe, are a little slightly more social I've seen, so it's like they are more likely to be in those clubs compared to like your classes or study groups. And I think that's like a great way to like to meet other like girls, and also just like there are like so many women-led STEM clubs like SWE and other ones. So it's nice to like meet that, because then there's other opportunities besides just like meeting people that they like offer for females, which is nice.

All in all, Fran has enjoyed joining her major-focused organization and has gained confidence through her involvement.

Giana

Giana is an undergraduate student pursuing a bachelor's degree in civil engineering. Giana knew she wanted to stay in-state when applying to colleges, and having in-state tuition as well as scholarships influenced her university decision. She chose the university where this study was conducted because she "wanted to get away from her parents a little." Giana is a third-year student and a member of the American Society of Civil Engineers. When asked why she decided to pursue her STEM major, she said:

> I applied to [the university] with undecided engineering, switched it during orientation to bio pre-med, and then switched it back. I just didn't want to be in school that long and I really like the math and science so like engineering kind of just fit.

When asked about her career aspirations, she mentioned wanting to stay in the field of civil engineering:

> I would say transportation or structural. I really am passionate about like walkable cities, sustainability, high speed rail, like connecting people and communities.

When asked about her first semester pursuing her STEM degree, Giana disliked her chemistry course. After switching to engineering, she "enjoyed the classes and people a lot more." One experience in her first semester that stuck out to her the most was an engineering course with a hands-on assignment:

> I got paid to play with Legos. So, our teacher would give us Lego pieces and like have a competition, and I've won like all of them. So, I made like I think, five dollars off of that class… and then we made concrete in that class as well. That really stuck with me.

Having hands-on assignments was something Giana really enjoyed being able to do in her first semester.

Giana mentioned that a good number of females are pursuing engineering at her institution. It is majority male, but there were a lot more females than she expected. She has found that it being majority male has made her internship experiences difficult:

> I'd say it's hard, like my internships. I was like one of the few females in all of my internships, so. Definitely a need for more females in that like role. But I mean.

> it's hard because, like, I know, a lot of women like, have kids and like and are married and like, that's kind of their role. And it's hard to be a full-time mother, full-time wife, along with being a full-time engineer. So that's what like I've noticed in the workforce.

Along with the challenge of female representation in her internships, she has been treated differently due to being a female and her race.

> Being sexualized is a problem as well on top of everything. because, you know, men. It's hard being in a male-dominated field and having all those credentials and yet not being put into the positions that you necessarily feel like. What's the word I'm looking for? Almost like they baby, you in a sense.

While Giana spoke of these challenges, she likes to try to make the best of her situation by staying positive. Giana expresses how the connections she has made and the opportunities she has had have positively affected her:

> I have a lot of good friends in the field, lots of good experiences, lots of great teachers and mentors. So that's definitely helped shape who I am and shape my career path… If I didn't choose to come to [the university]. If I didn't choose the specific classes didn't choose that time slot, I might have never met some of my best friends.

Giana was introduced to the American Society of Civil Engineers by a friend who was involved in another club with her. When expressing her frustration with her classes in her first semester, she talked about only enjoying her engineering course. He recommended she look into civil engineering, which pushed her to switch majors, and invited her to attend a general body meeting for ASCE:

> He said, come out to a general body meeting, there's free food. I was like “Free food? Say less.” So, I went and really enjoyed the people I met, really enjoyed like the guest speaker and like the company. And I was like, okay, I think this is what I want to do so I got involved. So that was really fun.

After getting more involved in the organization, Giana decided to run for a position on the executive board. Her involvement made her feel “more prepared to be a civil engineer.”

Along with feeling more prepared, her involvement in her organization helped her find internships. When asked how her involvement in this organization helped her persist, she mentioned: “I'd say, getting my internships. I wouldn't have gotten them without the club, and like the hands-on experience I've had throughout.” Her internships helped reaffirm that this is the field she wants to pursue and are helping her determine what she wants to do career-wise within it. Giana feels this organization can help other females in STEM by providing a community, networking, and opportunities to gain “technical hands-on skills that you can’t really learn in class.”

When it comes to feeling like she belongs, Giana felt this through her involvement and being part of a group, “working hard towards the same goal.” One specific time she felt like she belonged in her organization was when she got to attend a conference, and her team had to build and ride in a concrete canoe:

> I'd just say like a conference because conferences are a ton of mass-organized chaos, and it's a long day. It's a hard day, so much time and effort would be like put into it. But at the end of the day y'all are like teammates.

This experience was very rewarding and a great way to show the technical skills she has learned. Giana has also felt that this organization has impacted her progression toward her degree through the connections she has made:

> I'd say it definitely helped a lot with like professionalism. And like I said, networking is so important these days. Definitely helped me gain some invaluable mentors and valuable connections. for sure because, like I said, I wouldn't have been able to be at my internship without ASCE. I wouldn't have chosen that major without ASCE. So definitely very grateful to be part of an organization that allowed me to figure out what I'm passionate about and like where I want to go in life because I definitely did not have the slightest inkling of that when I was bio pre-med, I was just like, I'm just gonna do this because that's what I was kind of told to do type vibe.

Her friends have also encouraged her to succeed, thus impacting her persistence in her major.

Giana would recommend joining a major-focused student organization to other females in STEM as it has helped her find a community, learn new skills to enhance their resume, and gain networking opportunities. She has also found excitement in being a female in a male-dominated field:

> It makes me excited because I'm like, Oh, I'm doing something that not everyone can say that they've, you know, trailblazing, per se, you know. Just like so many women before me and so many women behind me, I know, and I'm leading the way for the future generation of the next women in STEM. So it's exciting at the same time sad, so kind of bittersweet, because I know there are a lot more women

> engineers now than they were before. But we've got a long way to go still. In my opinion.

Hannah

Hannah is a first-generation college student in her fourth year of pursuing her bachelor's degree, majoring in atmospheric sciences. She is on the executive board of the American Meteorological Society (AMS) at the university. Hannah chose to study at the university because she wanted to stay in-state, and "It was one of the few schools in [the state] that offered atmospheric sciences as a major." When asked how she decided to pursue this STEM major, Hannah explained:

> So really, all my life I've always wanted to be a scientist. Something I've always been interested in. For quite or more specifically, I was always interested in meteorology and studying weather from like a very young age, so decided to go into the STEM field. However, on top of that. It's because of my background. I was raised in a black slash. Asian household. Mom is Indian. Dad is black, so they kind of. They kind of steer me towards doing STEM because, you know, they're like, Oh, you make more money in STEM. It's good for you in the long run. So I feel like it was just like those outside influences of my parents, societal aspects, and just me being interested in science in general. That kind of led me into a STEM field.

Hannah's career aspirations are to become a meteorology researcher, get her Ph.D., and eventually become a professor at a university.

While Hannah loves science, she has struggled with math. When she talked about her first semester in her STEM major, she mentioned not enjoying it much due to the math component:

> So, my first semester was not so fun because I didn't realize how many math classes I would have to take with meteorology and how math-based they were. And then, on top of that I had moved two hours away from home, didn't really know anyone that went here besides, like a friend from high school. So it was, it was really challenging my first semester and just being able to adjust with everything.

Hannah felt lonely in her first semester and felt that college was a big transition that was a very new experience for her. “I was really shy when I first came here, really shy coming out of high school didn't really talk to many people, so I spent a lot of time alone.” Although college was a big transition, Hannah says her experience as a female pursuing a STEM degree has been a mix of emotions:

> I would say it is very empowering but also, at times, uncomfortable. because you do get those moments where you feel different and you stand out. And when you try to express those, those feelings you're called overdramatic, you're called sensitive. You're brought down, and it's the empowering part comes with knowing that you're one of the few. And there's so many women role models, female role models. And throughout history who have shown the path and shown the way, and they're the trailblazers, and you're following with them.

While she feels empowered, there have been times when males have undermined her. “I've had plenty of times where male classmates, or whatever say things that really just

tear you down, and they don't think anything of it because they don't care to put themselves in your shoes."

Hannah shared two challenges she had experienced with professors. One of the instances she experienced due to being a female in STEM:

> I got really sick in the beginning of the year. I went to a conference, and then I ended up getting really sick, and when I came back, I had to take like four different exams that I missed, and my teachers really didn't give me much time to even study for them. So, not only did I like miss those two weeks I also had to like took three days to catch up on all this material, so, of course, when I took the exam I didn't pass. And I wasn't surprised, so I was like, what could I have done to do better on the next exam. And usually I like to go to my professors and go to office hours to like check over my answers and talk about ways to improve. So I go to his office hours, and instead of like helping me, he just sat there insulting me. He was like, you're not very smart, he said this verbatim, he said, "You're not very smart. You don't know algebra. You need to go back to high school with those type of skills." And then he asked me, "What is your major?" And I was like "Atmospheric sciences." He goes "Well you need to start studying more if you really want to be successful in that field." I was like, "Oh. Okay." Like, I said, I didn't think anything of it. I didn't think it was anything sexist like that. But when I told my advisor about it, because he asked me like, "What do you think about this Professor?" So I was like, "Oh, let me tell you about this experience I had with him." He goes, he's like, "I've had multiple female students come to me saying the same issue about him." He thinks it's a sexist type thing. He's like "I've

> only been hearing it from female students." So he's like "It might be something wrong with him in that aspect."

This interaction caused Hannah to feel discouraged, "like a failure." She added:

> There's often times where you feel imposter syndrome, like you don't belong there, and especially within my major, both being a woman and being a woman of color have made me feel very out of place many times. And so, having been told that by a professor just made me feel like, Wow, I really just don't belong here. I'm not even intelligent enough to be here. So why even continue pursuing this major?

Hannah also shared a positive experience in her STEM major that involved her participation in the American Meteorological Society. When she first joined her organization, there was much disconnect, which pushed her to run for president and work to build an organization that fosters community:

> So, coming into my program there was a lot of disconnect. Even though we're a really small program. No one really talked to each other. Everyone was kind of separated. And so when I ran for president I came with like the goal of I want to bring everyone together. Right? So me and my friends are the other officers who all got it like on Exec board with like, okay, this is our goal this year. This is what we want to see. And so we spent all last year. This is my second term being president. But we spent all last year doing things to try to really bring people together, not only in classes, but like outside of classes, even outside of like our meetings and everything like that.

All of the hard work Hannah and the rest of the board paid off with the affirmations she was receiving:

> And I think the most heartwarming thing was to come back this year and for people to be like. We appreciate all the effort that you guys put into to bringing our program together. You guys have created a sense of community for us. And like, I love coming to the meetings. Now, I love getting to talk to people like I've made good friends here, and they thanked us for that. I wasn't expecting anyone to actually come up and thank us for that like I was expecting people to just be happy. But people, multiple people actively came up and told us, you guys have made a change with our program, and we appreciate you all for it.

Having her hard work recognized impacted her and made her feel accomplished:

> We could actually see the results, and others could see it as well, which just made it feel more real it blew my mind, made me so happy, made me feel more motivated to keep on setting this tone of community within our program.

Hannah explained how she first got involved in this organization from her advisor. Her advisor encouraged her to get involved and connected to her major:

> I was told by my advisor to join it when I was a sophomore. and at the time, like I said there was, there was a lot of disconnection, and there weren't a lot of clubs. This is the only club that focuses on meteorology. So my advisor was like, “Oh if you want to get more connected with the program.” Not my sophomore year, it was my freshman year, but he was like, “If you want to get more connected with the major, you should totally like join this club.” So I was like, “Okay.” So I decided to join it.

When Hannah first joined, she was not happy with her experience. She mentioned being nervous and walked in late to the first meeting. She felt everyone gave her a “weird look,” so she left and did not go back that entire year. Her sophomore year was when she made friends and became more involved.

Hannah has found that her involvement in her organization has helped her persist with her STEM major due to career development and exposure to meteorology:

> It's a local chapter of a national organization. And they focus a lot on career development and just really helping you as a student, even on into your career field just being exposed to meteorology, sharing your research sharing your work, and I absolutely love it. I would say for me personally, it helped me realize that this is what I wanted to study.

Getting more involved has also shaped her feelings of belonging, forcing her to talk to people and be more confident:

> Taking the leap in going and being more involved with this club and forcing myself to like go for a leadership type thing has like kind of forced me to talk to people more and connect with people more. And that really helped with my sense of belonging.

One specific event where she felt a sense of belonging was at her first meeting in her junior year. She entered the meeting and sat alone; her advisor introduced her to some students. Soon after, it became a large group, and she was enjoying herself and connecting with her peers:

> We're making the same jokes like there's things that other people won't understand, like we understand each other. I feel like I'm finally part, I'm finally

> understood, and I'm finally heard. And it was really it was a really nice experience.

Hannah's friends are a big reason for her persistence in her major. They are a huge support system. They help each other by providing feedback, assistance with homework, and sharing opportunities:

> It started with the study group. It started off with me and two other friends, and we've eventually made this big ole study group thing where every day at the science library, we invite all these students to come and study with us, doesn't matter what we're studying. We'll just study together. And that's really helped me academically and just like growing academically and in this field.

She has been able to progress towards her degree as well:

> Yes, I think like the opportunities that's given or provided with this program really has set me up for or helped me set me up for success, especially in what I want to do. For example, they do a national conference every year for the AMS annual meeting. So last year I had the honor of presenting there. and like I said I wanted to be. I want to be a researcher. So, I got to present my research while I was there. I got to connect to tons of students and professors like global on a global scale.

This experience motivated her to continue with her challenging major and to stick with it.

Hannah recommends joining a major-focused student organization for other females in the STEM field. She has found support in being introduced to people with similar interests, finding a community, and exposure to learning that can help with career development.

Izzy

Izzy is a third-year bachelor's degree student pursuing her major in civil engineering and is a member of the American Society of Civil Engineers (ASCE), serving on the executive board. She is originally from the state where this study was conducted and received state scholarships, which influenced her decision to choose an in-state university. However, she initially wanted to go to a different institution:

> I used to want to go to (another in-state school) like this out of nowhere like I didn't really have a reason behind it. I was like, "Oh, like engineering, you know, like [city of other in-state school) should be good," but then I toured it, hated it. But then, [the university]! I came, and I was like, I feel like this is going to be a much more well-rounded experience. And I like that because I want to do engineering. I wanted to pick a school where engineering was smaller in a bigger university, not the whole university was engineering. So that's pretty much why I would say I saw, like, the small college within the big university, which I really liked, and I saw that I had a lot more opportunity to be well rounded because I'm, I'd like to be well rounded.

Izzy always had an interest in math and physics and knew she wanted to go into engineering since high school. As for her career, Izzy realized through her time in college what specific area of engineering interested her the most:

> So I've just started kind of figuring out specifically, because there's so many different disciplines of civil. I've just started realizing how interested I am in like the water aspect of it. So I'm taking a class right now, fluid mechanics and I, it's like the first class where I'm like really like, wow! I want to go talk to [instructor-

> name redacted]. I like, want to ask her questions about stuff. I'm like wanting to do homework. It's so much work, but I don't mind doing it, and just very fascinating. And then I have a couple of friends who are working in the field as water engineers. So I got very interested in that. So, as of right now, I'm doing that. I just accepted an internship in water engineering.

Izzy explained her first semester pursuing her STEM degree before she was admitted to the College of Engineering. This major, similar to others at the university, requires students to be admitted to the major to complete this program of study. Izzy's first engineering course was an introductory course. She felt a lot of pressure and intimidation in her first semester but also excitement for what was to come. One aspect that intimated her was due to demographics:

> I was probably one of maybe four girls in my entire physics one class, and physics one was relatively large. It's probably a good 40, 50 people, maybe larger, maybe 60. So maybe there were a few more. But, like, I think that on my side of the room, because it was just if you were on one side you couldn't really see the other side. So I think on my side. I mean, I only really noticed a few more girls, but I wasn't at a table with a girl. It was like me, and like 8 or 9 guys. So I would say, honestly, for physics that was intimidating. And I also, a lot of those guys came out of high school already having taken like physics before, and like learning it. Well, I didn't come, my high school. I didn't learn it that well, so I was not like on everybody else's level to begin with. So that was intimidating. But on top of that, like, guys, kind of taking control of everything like, I would say, that would be the most intimidating.

Izzy also noticed demographics in the engineering course, including how few female students were compared to males. Izzy's experience got better the more she started getting involved on campus and in the engineering department:

> Once I started getting involved in my organizations in the College of Engineering, it was even better, and having, like, I think, my first group I joined was the Society of Women in Engineering. So, I think that honestly helped me a lot. I wasn't super involved, but I still went to a couple of meetings, and that was like really nice. So I would say generally like initially, the guys kind of took over a lot of stuff. But as I started getting more into my coursework, there are many more women. Much more collaborative. It wasn't as it was initially, initially, it wasn't that great, but it started getting better. And then again, like integrating myself into those organizations. I don't even notice it anymore.

A challenge Izzy experienced as a female in STEM was networking with employers. She has had great opportunities and made connections but experienced some adversity to get where she is:

> Networking, like with employers I've gotten, I do well. Like I've gotten lucky and I've reached the right people for what I want to do. But a lot of the time I mean, you could even see it like when you maybe go to a career fair. Maybe it's not intentionally people, maybe it's just natural for engineering. I don't know. But yeah, I mean like career fairs like going to career fairs and then maybe having a conversation. And then I know I'm obviously very qualified. But then, maybe, like stepping away to the like the next employer, and then maybe hear a guy come up and it's like a different conversation. But like not because they're like more

> qualified. It's just maybe they get along better talking about sports, or like just guy on guy talk or something like that. So I would say, you know, seeing the difference in networking at career fairs,

Izzy is a member of the American Society of Civil Engineers and on the executive board. Getting elected was one of the highlights of her collegiate experience in STEM. Peers, both male and female, encouraged her to run for this leadership position, and it had a positive impact on her. Not only did this encouragement push her to run, but it also solidified that they were not only her classmates but also her friends.

Her academic advisor first told Izzy about the American Society of Civil Engineers. Initially, she was not very interested in the club but got more involved. If it was not for her advisor, she may not have known about it:

> I showed up to a couple meetings, wasn't that interested initially. But eventually, like, I was more integrated into this. Yeah, like, somebody needed to tell me like I wouldn't have known, because nobody at that point we weren't recruiting, like they. Nobody came to the civil engineering class, the Intro to Civil class, and recruited. They weren't like, “Hey, guys, this is an organization come out.” So I wouldn't have even known unless I had like gone on like a directory. And like, I don't, freshman, or you know, we're just trying to learn stuff around the university like, we're not necessarily super involved in the College of Engineering yet. So I'm very grateful to my advisor for that.

Initially, Izzy was just excited to join the club to build a community within her program of study. This organization helped her realize this major was the right fit for her:

> Initially, I was just excited to be a part of something outside of the academic classroom. I was like, Wow, this is going to be like community. That that's probably the biggest thing I was like, okay, like, I'll find a civil engineering community here that will actually motivate me to stay in civil engineering, because I, for the longest time I was between civil and mechanical. I was very close to switching but it was this organization that did it for me. So it and it was the people, I would say, like above any above all, like above you know, getting involved with conference my freshman year. going to like a general body meeting and hearing from an employer like I would say, above all, it was like everybody there being like welcoming and being like, yeah, please get involved.

When asked how her involvement in ASCE has helped her persist with her STEM major, Izzy explained her experience going to conferences and leading a steel bridge design project:

> I was leading steel bridge design as a sophomore. So yeah, I was kind of pushed into it, unfortunately, but it was, it was a great experience, one of the hardest things I've ever done in my life, like, mentally and physically.

Izzy explained how many obstacles occurred at conference, which led to her team having to work together to fix issues. They needed to persevere, which led to their bridge standing:

> So that whole situation leading steel bridge and going having those issues and having to come out the other end. And like we, our bridge stood. You know, that was a big success. So I would say that helps with like perseverance and like persistence, is like, I think I think about that and I'm like that was like one of like

> the couple of the hardest weeks of my life. Yes, like academically. And like, I don't know. I love the organization so much and my team, so we just all needed to do well for each other. And for how much work we put in. like, I, I remember sitting in that lab and being like, okay, it's like a few more days, like, just push through like stuff like that. So that was definitely, especially in engineering. Like, now, I can do anything like there's nothing I can't do at this point, stress-wise.

This experience showed Izzy that she is not interested in bridge engineering. However, it did open her eyes to the fact that she is in the right major, which taught her how to "overcome an issue like that and come out the other end."

Izzy feels this organization is a great way to build confidence for other females. "It is not just guys out there who can use their hands and build something like I was one of the only girls out there like working with our construction team, in fact, leading our construction team." Izzy feels that her organization does a great job of showing female representation and how important it is to show other females that they can succeed in this major.

> If other women saw that like saw me in the lab like drilling something like something as simple as that. Then may, maybe just give them some confidence and be like, "Hey, like this is male-dominated, but you can earn respect and don't be afraid to like, get involved and try it out because I love it."

Not only has Izzy's involvement helped her persist, but it has also shaped her feelings of belonging by helping her meet students and build relationships.

> Conference was kind of like that breaking point of like, my first conference, my freshman year, I would say, was the breaking point for this was when I met a lot

> of other students who are around my age… And then we got a lot closer after conference, because conference is just a very, this great bonding experience for all of us.

Izzy now has a support system due to her involvement. This experience made her realize how much she enjoys being a member, leading her to attend more events and meetings and join the executive board. One of the events Izzy was able to build connections through her organization involved a time when the club went on a site tour:

> For example, [Football Stadium]. We saw that entire renovation, and I got to talk to people and have further conversations with people because we were, you know, walking around in our PPE, in our personal protective equipment. And you know, talking about [Football Stadium], the renovations like things like that, like where we're able to like have time to discuss stuff. So I would say site tours are a big one because it's a very collaborative like vibe.

Izzy feels that involvement has been the best part of her collegiate journey:

> I would say this is the most important thing in my entire college career. Yes, being involved in this. Yeah, the most important, like. not classes, not yeah, not academics. And I mean, yeah, it. It was because, again, community, which is important to have when you're in college, especially doing something difficult like this. And the professional opportunities and doing those simultaneous, having those simultaneously, like those relationships building relationships, while you're also able to like, prepare for your future. Yeah, and getting, again, getting hands-on experience with stuff. I mean it is, it has been the biggest contribution to my

> like knowledge and intelligence. Like the bridge project, I was thrown into that, but I'm so grateful because now I know I don't want to do it.

This involvement provided her with opportunities and experiences that have shaped her academic experience. If Izzy did not join this organization, she probably would have changed her major:

> I would have either switched to mechanical, or I probably I don't think I would have switched out of engineering just because of, I know myself, and I know that there are not many other things I would be interested in for a career. So I don't think I would have switched out of engineering, but I don't think I would be in civil.

Izzy strongly believes that female STEM students should get involved in a major-focused student organization. There are so many advantages to joining:

> I mean, we're giving you everything you need, right? Like we're like handing everything to you right now. All these connections, all these friendships, all these employers are coming to talk to us. You know. So I would say, that is like we have all these opportunities like, I don't know why you wouldn't wanna be involved in like work towards your future.

Izzy feels very passionate about her involvement and how important it is for females in STEM to get involved. “Involvement is everything.”

Jessica

Jessica is in her senior year at the university, majoring in astrophysics. She is on the executive board of the Physics Club. Jessica received many college acceptances to

universities across the nation. She ultimately chose to pursue her education at the university for various reasons:

> I landed a research opportunity, starting my first year, and got into the honors program at [the university] and [received a university scholarship]. We just felt the [university scholarship] was worth more than spending the money out of state. So if I'm getting astrophysics research here and also being part of CURO [Center for Undergraduate Research Opportunities], and having [the university scholarship] and being in the honors program where I can make connections, I thought I might as well go to [the university] for astrophysics.

Jessica decided to pursue this STEM major and her career aspirations through various inspirations:

> Starting off about up until I was 14 years old, I wanted to be a veterinarian, but my ambition changed after I entered high school because then my dad took me to lot of lectures, and we watched the stars through observatories, and we went to the planetarium at [another in-state university], which is a private women's college… I thought it was really cool, and there were a lot of women in astrophysics there, which inspired me.

Along with enjoying physics in high school, Jessica's dad also inspired her through his interest in astrophysics.

Jessica had difficulty adapting in her first semester due to demographics, not knowing many people in her major, and adjusting to college life.

> I would say it was definitely difficult to adapt as there were; there is definitely a small like woman to male ratio in at the field of astrophysics and most of

> everyone else. When I lived in the dorms, everyone I talked to most of the freshmen were pre-med or they were another major that was outside of mine. Like the closest to astrophysics would be computer science with because includes coding as well. But I couldn't really like interact with people in my own major. So it was difficult for me to like understand the material and cope, especially if you don't have the connections with the peers, since it's a very small department, and we do have a very like female male ratio when it comes to students.

In addition, Jessica found physics courses to be more challenging in college compared to the ones she took in high school. One aspect of her first semester that she found helpful was the small department, which made it easier for her to connect with instructors.

As a female in STEM, Jessica has found that through her experience, it can be tough, “There's a really small female-to-male ratio in the department, especially for astrophysics. since, like astrophysics is a sub of physics. So there, there's even a smaller ratio than the physics degree-seeking students.” However, there are opportunities to go to conferences such as the “Undergraduate Women of Physics” where “we can share like-minded interests with other like-minded women.” She has also found it challenging to interact with peers:

> But like it's really hard to like mingle with like a group of men just doing stuff in the board and the undergrad room, and I might of felt left out. And since I might feel left out because they're talking within themselves. So it's really hard for me to like I guess talk to my peers when they have their own like friend group, and like they might be solving problems on their own. And I'm here in the undergrad room

> I can't like mingle easily with them, you know. It takes time to actually talk to them and ask them questions.

Jessica shared a specific time when she experienced a challenge being a female in STEM and working in a research lab, being the only female with her major in a group of males:

> I just felt like my feelings were not being heard or included on the team. It was so difficult to share my feelings outside, like wanting to prove myself, but not being given the chance to perform a task or be part of the team, like there were some restrictions placed on me.

During a presentation, the team lead was not allowing her to present her research:

> The current team lead did not allow me to present; he said, “You are always trying to sell yourself out there, wanting to present, like… if we did not like you, we wouldn’t keep you on the team, did you not pay attention, why are you here, you insult everyone, you disrespect everyone, she hears inner voices guys. Do you hear inner voices?” My team leads always criticizing me, four boys always ganging up on me, always using the words “we and our.” And two of my team leads falsely accused me for disrespecting them and insulting them whenever I wanted to take up on a task or want to present. The current team lead never let me work on a task, and he would always make me feel left out or excluded and they would make fun of me sometimes and never even respond or acknowledge my texts on Slack. He said, “I will give you something low to do.” The word “low” was already enough to know for how these boys viewed me on the team, always belittling my importance and making me feel excluded.

Being a female in a male-dominated area made Jessica feel left out and as if she "did not have a place to share my feelings." She just wanted to be able to participate and show what she could do. This ultimately led to her poster being accepted to a conference where she went herself and presented.

When asked to share a positive experience, Jessica talked about being president of the physics club and how she has been able to grow and develop personally and professionally:

> I thought that was a really good way for me to like connect with other peers, and I like host social events and like mingle with everyone from with like different backgrounds and different genders. And being the president, I was able to have some sort of like authority and build my confidence over like a larger group of astrophysics and physics students. So I didn't really felt like I didn't feel left out. I didn't feel discriminated. I felt like I was. I felt like I had a position a place in the in the major being a female.

Jessica first decided to join the physics club to form connections and meet new people. She met the president and found out about all the opportunities provided through it:

> I was talking to him, and he said, like, we'll have like guest speakers come in lectures, physics, workshops, and it was a great way for me to mingle and like meet new friends, and I thought the President did a great job of like involving everyone into like a larger community of physics, where we can just talk about the same interests, or even there were other people from outside our major.

As an executive board member of this organization, Jessica works hard to find ways to help members make connections and "make sure every student knows that they belong."

When Jessica joined her organization, she felt “like I had a sense of belonging.”

> Yeah, like, like being like an only Asian female, and not knowing anyone and before, like freshman year, and coming in and struggling to make like new connections, and struggling to meet peers and like I didn't know how to make study groups with them. I didn't know how to study with them. I don't know how to like, actually talk to them, or like ask them questions like, what if they think I'm dumb like, I don't want them to get annoyed by my like questions, you know… But then, when I went to the Physics Club I was very social, and I can meet new connections, meet new friends, and then I got an officer position, which built my confidence even more so. Like part of my position was to talk to everyone and make sure they have a sense of belonging, and help others gain that confidence in physics as well. Like tutor them for physics and like make sure they they're not confused about a concept like and like how I was when I needed help.

Jessica went from being very shy and having a difficult time when she first started college to being confident in who she was due to joining the physics club, making connections, and getting an officer position.

Not only has Jessica been able to make connections with other members of the club, she has been able to connect with professors and build close-knit relationships through this organization:

> The close-knit relationship, half of it does come from me being part of the Physics Club, because that's where I interact and email the professors for them to come in and give talks and talk about their research.

Through her administrative responsibilities in the club, she can now easily communicate with professors, which has assisted her in her major persistence. One specific event was when the physics club had a Nobel Prize winner as the speaker, which required her to interact closely with the professor to host this significant event.

> So, through that, like connection with the professor, we were able to do that like leadership really mattered for me to like. Understand what my belonging as an astrophysics female is, and if I made the right decision to come to [the university] and pursue astrophysics, and I think I do, because I was able to learn new experiences and understand, like the growth that happened from being like a shy person didn't know didn't know. Where I didn't know anyone and to like wanting to put up with being an astrophysics major because I have these close-knit connections with the professors.

The Physics Club has reaffirmed that she wants to pursue this major and eventually apply to graduate school:

> So the persistence would definitely come from like how Physics Club helped me gain that sense of leadership and sense of authority to lead a big community of both physics and astrophysics. Students know that okay, this is something I'm capable of. I'm not changing my major. I want to do astrophysics, and I want to apply to graduate school after this.

Jessica has found a sense of belonging through her student organization. She felt the feeling of belonging when recruiting other students to join the physics club:

> When I'm like hosting the engagement fair, like when I'm talking to the students, it feels like I have like a lot of authority over the Physics Club like one man, one

> woman army. That's how it feels like cause I'm here like talking to them, answering questions. Educating them. So it feels like I do have a sense of belonging, because I'm trying to take this physics club like to a larger community of people.

She realized through her promotion of the club how much her involvement has shaped her feelings of belonging.

Jessica described being a member of the Physics Club as "part of my identity." It has positively impacted her progression toward her degree:

> Being part of the Physics Club for the past four years is like a large component of being an astrophysics major for me. That's like part of my identity, right? Because I've been there since my freshman year, and this is. And now I've I'm an officer and new people, new officers are coming… And so it's just been a progression, where I started off shy to being more social, to leading a group and having new officers come in and like collaborating and working with different types of people with different types of backgrounds different majors and conducting like meetings and hosting lectures, and a big lecture hall that's like a main component to making the connections towards a larger community of physics students.

Jessica overcame the adversities she experienced when she first started her collegiate journey and the challenges she experienced being the only female on a research team. She found an organization that helped her build connections, confidence, and skills that assisted her in her progression.

> It shaped my experiences and like learning new skills, building up my confidence. And now, I do think I do belong in this field, and I don't want to keep doubting

> myself, thinking I want to change my major or not, because they're always fluctuations, like with my family, like the professors. Do I really want to be doing this? It's very challenging, like I've thought about it many times, but like and like, but gaining leadership, qualities like definitely helped me like gain that confidence to put up with it.

Jessica believes academic clubs make people feel welcomed and recommends that females pursuing STEM degrees join them for many reasons:

> Because we want a sense of belonging. We want individuality like we don't want to feel like we don't want to feel left out. We don't want to be excluded, definitely like these male-dominated fields, like physics, need to be changed like we need more women to come in. We need more diversity. We like need more people to join. So by having, like academic clubs, like having women in physics club, you feel welcomed… You get to meet a group of people where you belong and where, like, you have an individuality where you can get involved and where you can actually give out something like in a part of an academic club like this, you're able to do stuff that you want like, if you want to solve problems, you get to solve problems.

She feels that joining major-focused organizations gives students networking opportunities such as "lectures, talks, guest speakers, connections like applying to work under research projects" that can benefit them. Involvement outside of the classroom allows students to "gain a lot of insight about your career, and that there are people who share similar interests to you."

As a female in STEM, Jessica wants females to succeed. She wanted to add that she feels there should be a separate club just for females in the physics department.

> I feel like we need, like a separate Woman in Physics Club as well. Along with just like a larger physics club like how we have like conferences for undergraduate women in physics like that inspires more women to pursue the field, right? Cause like this is possible. We wanna like, we want to show the younger people confidence that women can excel in this field without being condescended or like, without feeling bad about themselves.

Thematic Analysis

Each participant shared their experiences as a female pursuing a STEM degree and being involved in a major-focused student organization. These stories relay why they decided to pursue their chosen majors, how they got involved, and how their involvement has shaped their academic experiences. Many participants expressed having challenges in acclimating and integrating into the university as STEM students and found joining their organizations to impact their overall experience thus far positively. There were common themes across the stories shared by the participants. Throughout the interviews, the following themes emerged: (1) "Feeling you are wanted and welcome": Finding a Sense of Belonging; (2) "I would have probably switched": Major Persistence; (3) "Maybe just give them some confidence": Female Representation;

"Feeling You are Wanted and Welcome": Finding a Sense of Belonging

Participants described sense of belonging with various words, but all surrounding the idea of comfort. Many talked about being accepted, respected, confident, and comfortable. Abigail described it as "Having that like sense of ease over yourself when

you're in like a group of people." All participants gravitated toward feelings of comfort, peace, and welcome. Bailey stated, "A sense of belonging is like the feeling you get when you are wanted and welcome somewhere."

The participants shared how their involvement in their chosen organizations helped them feel a sense of belonging by making connections with other members and building community. Jessica decided to join her major-focused student organization as she wanted to meet people and make connections, which she was able to do. As she mentions, "Mingling and making the connections is what really like made me think that I have a sense of belonging." Abigail talked about how much it meant to be involved:

> I mean, I just think being involved in like something with your major is so important and just to like, have those connections, and, like that community around a major was like vital for my college experience.

Debra felt like she belonged by attending a conference with her major-focused student organization, where she participated in a competition and made connections with other females. Erica also had a similar experience, attending an event with other organization members and spending the entire day together. Fran explained how she felt happy about her connections and belonging due to people looking out for her, "They care about like your experience as well like they've obviously been through it before." Just like many others, Hannah explained how her major-focused student organization connected her to people with similar interests:

> That was the first time within the major that (1) I started actually talking to people connecting with people on like a large scale, and (2) where I actually felt like I belong. I'm like, I'm with people that have the same niche interest as me.

Along with feeling a sense of belonging through connections to peers, they found sense of belonging through the support they received from their peers. Izzy explained, “That belonging that close group of people that I know I can always rely on.” She made connections and received support from her peers as they were going through the same thing she was going through, having a community by her side. Hannah recommends major-focused student organizations as “They’re people that are there for you, they’re there to support you, and you know, help you get to where you want to be.” Abigail described the support: "It was definitely felt like a weight off my shoulders, just having like people I can go to.” Izzy states, “I don’t know what I’d do if I didn’t have that support system,” which she has made through her sense of belonging in her major-focused student organization. Many participants spoke about how having the connections led to support with classes, and Erica explains:

> It definitely helped me meet more people in my major. And you know, you find people you can do schoolwork with, you can study for tests with. It was just a good way to find other people in my specific major.

Jessica talked about how her involvement opened up opportunities to be a part of study groups and interact with peers, leading to them feeling welcome and having the support of others. As Fran mentions, “It’s nice like, to meet someone that’s like, been there and done that, that way like you have like a reassurance and like there’s always someone you can go to and speak with within the club.”

“I Would Have Probably Switched”: Major Persistence

Many participants felt that their involvement in a major-focused student organization reinforced their major choice, as Bailey mentions, “So definitely like

belonging to the organization, has, like reinforced my sense of self, that, like this is the major that I belong to, kind of like my pride in my major." Participants have found that joining their major-focused student organization has helped them persist with their major through hands-on experiences, networking, career development, and motivation through connections. Abigail explained her thoughts on females joining major-focused organizations as it helped her feel more confident in her own persistence:

> Opportunities and like pathways to different career paths, and like showing them like giving them like networking opportunities and helping, put them their names out there, and like introducing them to real world situations in real world, like what MIS majors do after graduation, because I know like without this without this club I would have had no idea like what I was gonna do.

Erica shared an experience of building a concrete canoe, and how this experience helped her persist with her STEM major:

> I was on the concrete canoe team, so we would meet every Sunday, and we would build the canoe, and it was just a good way to connect with these people more, and actually do something hands-on related to your major and then going to the conference was another thing, where I got to spend more time with them, and we got pretty close then.

This hands-on experience helped her build connections with other students in her major. Many participants talked about finding internships through their organization involvement that assisted their persistence. Giana described her internship helping her determine what she does and does not like in relation to her major and career path:

> It showed me what I didn't want to do in that major, but it did make me feel like I chose the right one, if that makes sense. Like I know what I want to do but I know this internship is not it, and I know this one, isn't it. But I know that this is the field I want to be in, because I can see some aspects that I love, and I can see some aspects that I don't.

Hannah felt “The opportunities that’s given or provided with this program really has set me up for or helped me set up for success, especially in what I want to do.” Hannah had the opportunity to present at her organization's annual conference. Izzy feels that if it were not for her organization, she would have switched majors, “These relationships and these opportunities to have this hands-on experience, I mean, I realized I was like in love with studying civil.”

Many of the organizations provide the participants with networking opportunities. Jessica, Izzy, and Bailey mention their organizations hosting guest speakers to speak at their events. Jessica mentioned, “Joining academic clubs like this gives you those like insights into lectures, talks, guest speakers, connections like applying to work under research projects.”

Erica talked about her organization having different employers come and speak, which helped her through the major, getting first-hand information about what she can do with her major, “Every week we have a different employer come speak to us about different things you can do in the field.” Debra also felt similar in that “It’s good to build connections and kind of see what companies are looking for, what they, why they kind of joined that company.” Abigail had a meaningful networking opportunity through her organization, where she was invited to dinner by one of the companies that came to

speak. Similar to other participant's organizations, Abigail's club also brings in companies to speak, and for her, it motivated her: "Hearing them talk about like what you can do in the future that's always like pushed me to keep at it." Giana said, "Getting that networking to professionals, getting to improve your resume and stand out to companies. Which in turn will help your career grow."

Abigail feels, "It's super duper important just to have like people to talk to about your classes and about like future internships because if you're going through it, like all by yourself, it's impossible." As with many others, for Erica, having "people just believing in me helped a lot." Many participants find motivation through their connections and sense of belonging to help them persist. Debra relies on her executive board members:

> Their encouragement, they're just like, yeah, like, we gotta study, we gotta do this. Really, yeah, just being around them. They're very positive people. So that really that just makes me persist in my degree.

Giana's connections impacted her persistence as they "encourage me to keep on pushing myself to higher heights." Bailey states," Being with other students that are also wildlife majors in the club definitely like reinforced some of my confidence in like going into some of my classes where I felt more prepared, or that I was like able to pass my classes." And for Debra, "Being around other people who are positive helps. If there's a time where I'm doubting my engineering pathway." Hannah has also found a support system that are her "cheerleaders" to stay motivated:

> We keep each other going, even though we're all going on the struggle bus, and we're all struggling altogether. We keep each other going forward. We help each

other by telling each other about different opportunities, giving each other feedback, helping each other with homework.

“Maybe Just Give Them Some Confidence”: Female Representation

Representation and exposure to influential females in the field were common among the participants. Many participants talk about how they can see more female representation in their STEM fields through their major-focused student organizations and how important it is in a male-dominated field. Bailey, Jessica, and Hannah talk about their organizations promoting more females. Bailey states:

> I think just like by promoting more female activities. So, when I started out as a freshman in this club, it was primarily men in the club, and then this year I'm an officer in the club, and it's actually, we have an all-female officer team.

Hannah’s major-focused student organization also has an all-female executive board and works hard to recruit more female students to meetings and events.

Bailey also has been able to find a female mentor who is the president of the [state] Chapter of the Wildlife Society, and through this, it has shown her she too can be successful:

> It's definitely nice to see like females being represented in, like, I guess, positions of power, because it shows that like, we don't.. we're like we can do it like I can do anything that I set my mind to.

Izzy was able to interact with females in leadership positions through her internship:

> My internship, I got through organizations. I was in construction. I was one of the only women there, and I worked under some very like boss women, and like

> something like that, motivated me to like, you know. Keep pursuing what I want to pursue like. Don't be afraid to put on a hard hat type of thing, you know.

Debra talked about her major-focused student organization having a female president and how representation can encourage other females to try, "It probably encouraged other woman, you know, like you don't have to be a man to pursue engineering. I mean it probably give them like a sense of belonging to see other women in like higher positions. me and be inspired and be like oh, well, if they can do it, then, you know I can do it, too." Bailey talked about a national conference for her major-focused student organization celebrating women's accomplishments, which inspired her:

> And so they actually like, were celebrating women's achievements and women in the field, and that kind of promoted young women like me to be welcome, and that, like we also can achieve great things.

Participants appreciate seeing females in leadership positions in a male-dominated field, "It's definitely nice to see like females being represented in, like, I guess, positions of power, because it shows that like, we don't.. we're like we can do it like I can do anything that I set my mind to."

Summary

In this chapter, I provided the narratives of each participant in this study. This narrative inquiry focused on female participants pursuing STEM majors and involved in major-focused student organizations. When reviewing the narratives, common themes were found: (1) "Feeling you are wanted and welcome": Finding a Sense of Belonging; (2) "I would have probably switched": Major Persistence; (3) "Maybe just give them some confidence": Female Representation. Together, these themes share the stories of the

participants. In Chapter 5, I will discuss the findings, conclusions, implications, and recommendations for further research studies.

CHAPTER 5

CONCLUSION

This chapter will focus on the findings discovered and explain future implications for female STEM students involved in major-focused student organizations, as well as the universities who hope to enroll them and the STEM field who hopes to employ them. I will begin by utilizing previous literature to discuss my findings and then explain the study's implications and recommendations for higher education institutions to support future students.

This study aimed to explore the academic experiences of female STEM students involved in major-focused student organizations. I was able to learn through the stories of each participant how they decided to study at the university chosen as the site for this study, why they chose their major, how they decided to get involved, and how their involvement has shaped their sense of belonging, major persistence, and retention. Although recruitment took longer than anticipated, a quality group of students ultimately agreed to participate, and by listening to the participants' lived experiences, I could make meaning of how their lives have been shaped through involvement in their major-focused student organizations.

Summary of the Findings

This study was guided by three research questions (RQ) to explore how major-focused student organizations shaped the academic experiences of female STEM students regarding sense of belonging, major persistence, and retention. Higher student

involvement in their college experience leads to more knowledge and personal growth for students (Astin, 1999). Compared to students who participate less or not at all in campus-related activities, students who are more active in college life also report feeling close to one another on campus (Strayhorn, 2019). Students who choose to get involved can find community and feel belonging.

Effective retention and people's participation in the college's intellectual and social activities are intertwined (Tinto, 1988). Repeated interactions lead to connections that assist in the retention of students in higher education. My goal for this study was to explore if the involvement of females in STEM major-focused organizations shaped their feelings of belonging and persistence to their chosen STEM major. Along the way, I gained an understanding of the participants' lived experiences through their stories, learning of positive experiences and challenges they have experienced being females in STEM. Although women enrolled in STEM majors in higher education are making significant progress toward gender equality among STEM professionals and workers, more work needs to be done before they can be regarded as stable and elevated within the STEM workforce (Blackburn, 2017). The STEM field is still male-dominated despite efforts to increase gender diversity. Even with some positive movement, ways to increase the number of females in STEM will continue to be explored to learn what increases female interest and persistence in the field, and what new initiatives can be implemented at colleges and universities. The hope of this study was to explore how involvement in STEM major-focused student organizations has shaped female STEM students' experiences in hopes that these narratives could provide insight as to how universities can

assist future females pursuing STEM majors with their sense of belonging in college and persistence in their STEM bachelor's degree.

RQ1. What are the experiences of female STEM students involved in major-focused student organizations?

According to the study's findings, female STEM students involved in major-focused student organizations still faced challenges in their STEM major but have had positive experiences overall. Involvement in major-focused student organizations helped the participants build connections with others in their major and see female representation within their STEM field. Bowman et al. (2022) found that female students do better in STEM fields when there is more female representation, and those findings were consistent with this study.

All of the participants shared how their involvement in their major-focused student organization reaffirmed their interest and passion for their chosen STEM major, positively influencing their persistence to continue with their STEM programs of study. Many participants talked about having a difficult transition to college, but once they joined their major-focused student organizations, they felt more at ease, found friends and support, and found confidence in their STEM major choice. Hannah mentioned towards the end of her interview how much her involvement has shaped her STEM academic experience:

> It helped me fall in love more with what I was studying, fall in love with the community, and actually see firsthand why we are here, why we do what we do, and it's really helped me a lot with progressing in the major and sticking with it, and motivating me, despite all the obstacles and stuff that may come up.

This positive experience is consistent with Astin's Theory of Student Involvement (1984), which states that involvement in college results in personal growth and development.

One way of receiving support from a higher education institution is through involvement in a student organization (Tinto, 1993). Almost all of the participants described finding support from the university through their involvement in their major-focused student organization, which provided them with opportunities to support their career development. Participants shared how their organizations brought companies and speakers to meetings on campus and gave members opportunities to attend, present, or compete at conferences with university support. Their involvement allowed them more hands-on learning experiences in conjunction with their major at the university that they may not have gotten otherwise. These experiences helped the participants learn first-hand about the career paths they could pursue in their STEM fields. Many spoke about how these opportunities through the university facilitated by their major-focused student organization helped reaffirm for them why they chose their STEM majors in the first place.

Even though their involvement in their major-focused student organizations provided them with many positive experiences and opportunities, every participant still expressed a challenge while being enrolled in their STEM major. They shared experiences of prejudice due to their gender or having to prove themselves compared to the males in their STEM classes, internships, or organizations. Despite holding elected leadership roles on the executive boards of their organizations, participants still had experiences where they felt they had to prove that females like them belong in STEM and

their worth to the field. They shared how they used their leadership positions to create more diverse major-focused student organizations and positive experiences for future females in their STEM majors.

RQ2. How do female STEM students perceive the impact their involvement in major-focused organizations has had on their sense of belonging?

Based on the findings in the study, female STEM students perceive their involvement in major-focused student organizations as having had a positive and impactful influence on their sense of belonging at the university. Every participant mentioned the connections they made with other members and how those connections have had positive effects on their academic experience. Having these connections reaffirmed for them that they have a place where they are accepted and wanted within the university.

Having a sense of belonging is crucial, and it becomes even more crucial in situations where people are more likely to feel alone, alienated, or unseen (Strayhorn, 2019). Many participants either initially did not know others in their STEM majors or felt loneliness at the beginning of their collegiate journey. Once they decided to get involved in their major-focused student organizations, they described finding a community of people. Some participants talked about explicitly looking for any organization to join to meet people. They found in a major-focused student organization a community of people who share similar interests and passion for their programs of study.

Involvement in major-focused student organizations made finding a sense of belonging more easily achievable for the participants. The major-focused student organizations provided the participants many opportunities to meet people, whether it

was through a regular club meeting, an event, a conference, or other activities. Many participants talked about how specific events in their chosen major-focused student organizations made them feel they belonged. Women's experiences in STEM majors are significantly influenced by whether or not they feel like they belong with their peers (Johnson, 2012). Their involvement in major-focused student organizations gave them support from peers who have become cheerleaders for one another. Sense of belonging grew as communities were formed and brought positivity to each participant. They explain how crucial it is to form connections and how involvement in a major-focused student organization made it possible for them. These connections fostered feelings of belonging, which helped participants stay motivated and continue with their chosen majors.

RQ3. How, if at all, do female STEM students perceive any impact their involvement in major-focused organizations has had on their academic retention and persistence in the STEM major?

Female STEM students in this study perceived that their involvement in major-focused student organizations positively impacted their academic retention and persistence in their chosen STEM majors. Major-focused student organizations impacted the students' persistence through connections to peers and career development, hands-on learning experiences, motivation, and representation. Tinto (1993) says that for student persistence and retention to be successful, student involvement is essential, and that is consistent with the findings of this study.

Through involvement in major-focused student organizations, participants formed connections with their peers enrolled in the same STEM majors. These connections

helped participants persist in their STEM major, as the connections provided them with peer support systems.

Informing females about STEM occupations is a crucial component in promoting female enrollment and perseverance in higher education STEM degrees (Edzie & Alahmad, 2013), and the major-focused student organizations helped the female STEM students in this study network with STEM employers when the organizations hosted events where speakers and companies came to meet with students. The participants shared how these opportunities helped reaffirm their passion for their STEM fields. Seeing what pathways they had available to them after graduation in the STEM workforce through these interactions with employers also helped them continue with their STEM majors.

Along with networking, major-focused student organizations provided these participants with hands-on learning experiences in their STEM fields. Through their involvement in their major-focused student organizations, they were able to find internship opportunities that gave them a first-hand look at what they would experience in the workforce if they continued with their STEM degree and joined the workforce. These experiences helped many participants see that they have a passion for the work done within their STEM major and also helped them narrow down what they wanted to pursue career-wise after graduation. The findings also showed how many participants had the opportunity to attend conferences through their major-focused STEM organizations. Those conferences helped confirm that they had chosen the major that was the best fit for them and had a positive influence on their academic retention and persistence in the STEM major. The presence of women in STEM fields increases the possibility that

women stay in the field (Koch et al., 2022), and many participants shared how seeing females further along in their major or their STEM careers within their major-focused student organizations or at conferences made them want to continue being enrolled in their STEM field. They fostered connections with these more senior members and professionals, who gave them advice that motivated them to continue. They also were able to see females in leadership positions within the major-focused student organizations and conferences, which also showed how, in a male-dominated field women can lead. Others were able to see representation through female professors or other networking opportunities, whether it was a company dinner or faculty advising session. Seeing the females in their aspirational STEM career positions reinforced the confidence among the participants that they could succeed in their STEM majors.

Interpretation of the Findings and General Discussion

The findings show that major-focused student organizations provide female students enrolled in STEM majors with opportunities to surround themselves with peers who share their interests. Thus building a community of friends and a place where they are wanted, increasing their sense of belonging. The more involved students are in their major-focused organizations, the more rewarding their collegiate experience is. Every participant mentioned how involvement in their major-focused student organization has positively impacted them in some way.

The findings also show how the participants found support systems in their challenging STEM majors and found confidence in themselves through the connections they made in their major-focused student organizations. Involvement in major-focused student organizations allows students a space to meet others who share their interests and

passions for their programs of study. Through their involvement, they found a community of peers they can go to when they need reassurance that they have made the right major choice. The findings show how important it was to the participants to have relationships with other members of major-focused student organizations, as they could easily relate to each other and support one another within the major and field. The community they built through their involvement also allowed them to have people to go to when they had questions or needed someone to believe in them. This form of involvement offers support that aids in student major persistence and retention.

The findings show that connections were also made between faculty, staff, and employers. Many of these connections allowed participants to develop personally and professionally. Involvement in these organizations gives students perspectives as to what career opportunities lie ahead and helps connect them to ways to reach those career goals while in college. For many students, it may be difficult to find opportunities, or they may not even get the same opportunities or interactions if they are not involved. This form of involvement opens up many pathways and advantages that can benefit them on their collegiate journeys and later in the workforce.

Female representation through involvement in major-focused student organizations was also found in the study to help females persist in STEM. For some, it helped them reaffirm their interest in their majors and why they want to pursue this path. Having other females whom these students can look up to has shown that it is possible for women to persevere and thrive in a male-dominated field. This representation helps female students see what possibilities are awaiting them and help them realize that if those females can persist and become leaders, then so can they. Overall, the study shows

how impactful student involvement is to college students. It shows that for females pursuing male-dominated majors how much involvement in major-focused student organizations can help and guide students.

Implications for Practice

This narrative inquiry provides findings of implications for student affairs professionals or higher education professionals who work with undergraduate student organizations, whether that be a specific department staff member or a club advisor. The findings from this study show how beneficial major-focused student organizations are to females in male-dominated majors. With how impactful these organizations are to students, universities should do more to increase engagement in these forms of organizations and make them a focus for student affairs divisions. Faculty can also support them through their own participation and encourage outside stakeholders, such as STEM employers, to engage with the organizations. The data supports the continued backing for major-focused organizations and female support. The findings show that major-focused student organizations provide females with a sense of belonging and aid their persistence in STEM majors. Male allies and female club members should encourage other females in their classes to get involved by promoting the organization and sharing how their involvement has impacted them. This study signifies the importance of major-focused student organizations. The implications found in this study lead to future recommendations for practice and future research to continue the support of female students in STEM.

Recommendations for Future Practice

The findings of this research study have implications for females pursuing STEM majors and being involved in major-focused student organizations. The implications of this narrative inquiry resulted in several suggestions for future practice for any higher education professional working with females in male-dominated majors and working with major-focused student organizations. The findings also suggest recommendations for male allies, STEM employers, female STEM students, and student organizations in general.

Many recommendations can be implemented to increase the number of females or students in general to join and actively participate in major-focused student organizations, Universities should require their student affairs departments to focus on enhancing and increasing major-focused student organizations in every department on campus. With how beneficial major-focused student organizations are to females in STEM, increasing the support and recruitment for these organizations can benefit the academic experiences of more students on campus.

Faculty can also be influential to major-focused student organizations. They can assist in recruitment efforts for these organizations by advertising them in their lectures each semester and allowing club leaders to come to speak on them. Faculty should also provide more support to these organizations. They can volunteer with these organizations in different capacities, such as speaking at events or connecting these organizations with outside stakeholders such as STEM employers. Faculty can support students by encouraging hands-on learning experiences that they can lead or connect the organization with additional outside opportunities.

Along with faculty providing hands-on learning experiences, STEM employers should interact more with student organizations, especially major-focused ones. These students will soon be joining their companies, and it is important to help them develop while in college. They can do this by attending more student organization events and offering site tours, internship positions, and other opportunities. The more they interact, the more passionate the students are about joining the workforce and the more prepared they will be. This can also help bridge gaps between the community and the college.

Male allies should also be supporting and encouraging female friends to join their organizations, sharing the benefits of being involved in them. They should help females feel welcome in their colleges and recommend that they join major-focused organizations. Being encouraged to join a student organization in a male-dominated field by a male alley can give females the confidence they may need to take that step and join. Male allies should also support females in running for leadership positions within these organizations. They can uplift their female peers and support those whom they feel will do well in a leadership role. This can help with more female representation in leadership roles, leading to more females joining these organizations.

Females in STEM should also take steps to improve female STEM student's involvement in major-focused organizations. Just like male allies, females in STEM should also help recruit other females. They should reach out to other females in classes and in the college and encourage them to join. To increase female representation in leadership roles, they need to run for leadership positions or support their female peers in running for them. Whether a female is in a leadership role or not, they can still interact with outside stakeholders such as STEM employers. If they find an internship outside of

their involvement, they can request that the employer participate in employer events with the student organization, thus sharing the organization with students and helping to support other students in finding internships with this organization.

The participants' lived experiences show that these student organizations are working hard to increase diversity. They discuss promoting and tailoring events to females in the college. To continue the growth of females in STEM, higher education professionals need to continue what these organizations have already started. They need to continue increasing female growth in STEM by including more representation. Student organizations can continue finding ways to tailor events toward female members when recruiting participants, support female members in leadership positions, and provide females with a safe and comforting place to share their passions for their majors in their organizations.

Major-focused student organizations are more than just social organizations in higher education. They provide opportunities for support, growth, and retention. Participants of this study shared how involvement in their major-focused organizations helped them find a sense of belonging and made them want to continue with their major. Not all STEM majors have student organizations related to them. Depending on the enrollment for each major, departments can create major-focused organizations for majors or overlapping majors so that students can be involved in academic-based organizations.

Another recommendation for practice is having guidelines or quotas for major-focused student organizations. Based on the findings, not all organizations had as many events or networking opportunities as others. It would be beneficial for major-focused

student organizations to request that this form of organization require a certain number of speakers, events, meetings, etc., each semester so that the organization members are provided with these beneficial opportunities and aid in major persistence. This benefits the regular members and provides skills and knowledge to the organization's executive board members in creating these events and activities.

Recommendations for Future Research

This study was a narrative inquiry focusing on the experiences of female STEM students involved in major-focused student organizations. One limitation of this study was recruiting participants. Even though multiple recruitment methods were utilized, such as flyers, emails, and speaking at student organization meetings, it was still challenging to find female STEM students interested in participating. Conducting a quantitative study similar to this may aid in getting a large pool of participants, as a quantitative survey may get more responses.

The study can also be replicated using a qualitative methodology for other gender types, such as male-identifying students or gender nonconforming students. It would be beneficial to hear about their lived experiences as STEM students and identify how their involvement in major-focused organizations shape their academic experiences. Replicating this study can assist higher education professionals can learn a lot about these students and how to support them better. This study can also be replicated for other majors, such as females pursuing business degrees or social sciences degrees, which are also considered male-dominated majors. It would be interesting to learn if females in business or social science majors share similar feelings to females in STEM and if their involvement in major-focused student organizations shapes their experiences in relation

to the sense of belonging, major persistence, retention, or other forms of academic experiences.

Another recommendation would be to conduct a longitudinal study focusing on STEM major choice. Based on the findings of this study, some participants' passion for STEM came about from familial influences, and others always had a passion for math and science. It would be intriguing to further study the factors that led to these students' interest in STEM. For example, were they influenced at home, school, or outside interactions? The study could focus on females from childhood to early adulthood and what factors affected their decisions.

The study's participants consisted of student leaders of major-focused student organizations. Further research can explore the experiences of students who are general members rather than leaders of a major-focused student organization. This can allow for more information on how general members' experiences may compare or differ from the experiences of students who serve in leadership roles. It can also explore the rate and experience of involvement for general members as well as how they compare to students in leadership roles.

Lastly, in this study, one of the participants' lived experiences mentioned being a first-generation student. Future research can be done to explore how subgroups such as first-generation students or backgrounds impact their experiences. It can be focused on transitions and being a female in STEM.

Conclusion

In this chapter, I discussed the findings of this study and answered the research questions. Based on the study's findings, I explored the implications and established

recommendations for practice and future research. The participants of this study willingly shared their experiences of being female in a male-dominated field. They shared how their participation in major-focused student organizations has shaped their academic experiences.

This study found how beneficial major-focused student organizations are to females in STEM and shows how they can help all higher education students. The findings also discovered implications and future recommendations for higher education professionals to utilize in supporting students' extracurricular involvement. The implications signify the importance of major-focused organizations. Not all majors on campus have major-focused organizations, which is a disservice to them. How positively impacted the participants are by their experiences shows the need for all majors to have this form of involvement. Along with the need for involvement, not all participants had the same opportunities. To ensure all students have these forms of opportunities, it would be valuable to have set guidelines for all major-focused student organizations. If these organizations are all required to have a specific number of events, it may assist more students in networking and major persistence.

This study showed that while the field of STEM is still male-dominated, major-focused student organizations are extremely impactful to females who choose to be involved. The data has shown that their involvement has positively influenced their sense of belonging. These women chose to get involved, which led them to find a community and build connections in their STEM majors. Involvement in major-focused organizations opened opportunities for growth and experiences they may not have had if they were not involved. To some, involvement was crucial for their persistence in their

STEM majors and STEM pathways. Being a female in a male-dominated field has its challenges, but these women chose to make the most of their collegiate experiences and, through their involvement, have found more than they could have ever imagined.

References

Astin, A. W. (1984). Student involvement: A developmental theory for higher education. *Journal of College Student Personnel*, *25*(4), 297-308.

Astin, A. W. (1996). *Involvement in learning* revisited: Lessons we have learned. *Journal of College Student Development, 37*(2), 123–134.

Astin, A. W. (1999). Student involvement: A developmental theory for higher education. *Journal of College Student Development, 40*(5), 518-529

Baker, C. N. (2008). Under-represented college students and extracurricular involvement: The effects of various student organizations on academic performance. *Soc Psychol Educ*, *11*, 273-298. https://doi.org/10.1007/s11218-007-9050-y

Banda, R. M., & Flowers, A. M. (2017). Birds of a Feather Do Not Always Flock Together: A Critical Analysis of Latina Engineers and Their Involvement in Student Organizations. *Journal of Hispanic Higher Education*, *16*(4), 359–374. https://doi.org/10.1177/1538192716662966

Barkatsas, T., Carr, N., & Cooper, G. (2018). *Stem education: An emerging field of inquiry.* BRILL.

Biddix, J. P. (2018). Research methods and applications for student affairs. Jossey-Bass.

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

Blaney, J. M. (2022). Cultivating Community College Pathways to STEM Leadership: Examining the Relationships Between Gender, Upward Transfer, and Students' Computing Leadership Identity. Community College Review, 50(3), 269-291. https://doi.org/10.1177/00915521221087283

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

Bruning, M. J., Bystydzuenski, J., & Eisenhart, M. (2015). Intersectionality as a framework for understanding young women's commitment to engineering. *Journal of Women and Minorities in Science and Engineering*, *21*(1), 1-26. DOI: 10.1615/JWomenMinorScienEng.2014007345

Carlone, H. B., & Johnson, A. (2007). Understanding the science experiences of successful women of color: Science identity as an analytic lens. *Journal of Research in Science Teaching*, *44*(8), 1187-1218. https://doi.org/10.1002/tea.20237

Cletzer, D. A., Mott, R., Simonsen, J., Tummons, J., & Peckman, J. (2023). "Roll Up Your Sleeves and Get to Work": Understanding undergraduate leadership experiences in student organizations. *Journal of Agricultural Education*, *64*(1), 116–135. https://doi.org/10.5032/jae.v64i1.33

Creswell, J.W., & Poth, C. N. (2024). *Qualitative inquiry & research design: Choosing among five approaches* (5th ed.). SAGE Publication.

Cohoon, J. M. (2002). Recruiting and retaining women in undergraduate computing majors. *SIGCSE Bulletin 34*(2), 48-52. DOI: 10.1145/543812.543829

Donnelly, M. (2023). STEM fields and stem education. *Salem Press Encyclopedia.*

Edzie R. L. and Alahmad, M. (2013). Exploring the factors that motivate female students to enroll and persist in a collegiate STEM degree program. *2013 7th IEEE GCC Conference and Exhibition (GCC)*, Doha, Qatar. 419-424. DOI: 10.1109/IEEEGCC.2013.6705815

Espinosa, L. (2011). Pipelines and pathways: Women of color in undergraduate STEM majors and the college experiences that contribute to persistence. Harvard Educational Review. (81), 209–241. http://dx.doi.org/10.17763/haer.81.2.92315ww157656k3u

Freeman, T. M., Anderman, L. H., & Jensen, J. M. (2007). Sense of belonging in college freshmen at the classroom and campus levels. *Journal of Experimental Education, 75*, 203–220. DOI: 10.3200/JEXE.75.3.203-220

Gamse, B. C., Martinez, A., & Bozzi, L. (2017). Calling STEM experts: How can experts contribute to students' increased STEM engagement? *International Journal of Science Education, Part B, 7*(1), 31–59. https://doi.org/10.1080/21548455.2016.1173262

Goan, S. K., & Cunningham, A. F. (2006). *Degree completions in areas of national need, 1996–97 and 2001–02*. Washington, DC: National Center for Education Statistics. Retrieved from https://nces.ed.gov/pubs2006/2006154.pdf

González-Pérez, S., Martínez-Martínez, M., Rey-Paredes, V., & Cifre, E. (2022). I am done with this! Women dropping out of engineering majors. *Frontiers in Psychology, 13*. https://doi.org/10.3389/fpsyg.2022.918439

Guetterman, T. C. (2015). Descriptions of sampling practices within five approaches to qualitative research in education and the health sciences. *Forum Qualitative Sozialforschung / Forum: Qualitative Social Research, 16*(2). https://doi.org/10.17169/fqs-16.2.2290

Hartman, H., & Hartman, M. (2003). Empowering female students: SWE vs. disciplinary organization participation. In *33rd Annual Frontiers in Education: Engineering as a Human Endeavor: Partnering Community, Academia, Government, and Industry, FIE 2003 - Conference Proceedings* (pp. F1D2-F1D7). (Proceedings - Frontiers in Education Conference, FIE; Vol. 2). Institute of Electrical and Electronics Engineers Inc. https://doi.org/10.1109/FIE.2003.1264673

Holzweiss, P., Rahn, R., & Wickline, J. (2007). Are all student organizations created equal? The differences and implications of student participation in academic versus non-academic organizations. *College Student Affairs Journal, 27*(1), 136-150. https://www.proquest.com/scholarly-journals/are-all-student-organizations-created-equal/docview/224811315/se-2

Jayabalan, M., Caballero, M. E., Cordero, A. D., White, B. M., Asalone, K. C., Moore, M. M., Irabor, E. G., Watkins, S. E., Walters-Conte, K. B., Taraboletti, A., Hartings, M. R., Chow, B. Y., Saeed, B. A., Bracht, K. A., & Bracht, J. R. (2021). Unrealized potential from smaller institutions: Four strategies for advancing

STEM diversity. *Cell*, *184*(24), 5845-5850. https://doi.org/10.1016/j.cell.2021.10.030

Johnson, D. R. (2012). Campus racial climate perceptions and overall sense of belonging among racially diverse women in STEM majors. *Journal of College Student Development*, *53*(2), 336-346. https://doi.org/10.1353/csd.2012.0028

Jones, J. A., & Giles, E. H. (2022). Higher education outreach via student organizations: Students leading the way. *Journal of Higher Education Outreach & Engagement, 26*(3), 99-115.

Jones, S. R., Torres, V., & Arminio, J. (2014). *Negotiating the complexities of qualitative research in higher education: Fundamental elements and issues* (2nd ed.). Routledge.

Jones, S. R., Torres, V., & Arminio, J. (2022). *Negotiating the complexities of qualitative research in higher education: Essential elements and issues* (3rd ed.). Routledge. https://doi.org/10.4324/9781003090694

Kang, R., Mahabaduge, H. & Flores, P.R. (2023). Sense of belonging and transition to college: A qualitative case study of freshman and sophomores in physics and chemistry. *Journal of College Student Retention: Research, Theory, & Practice.* https://doi.org/10.1177/15210251231184364

Kanny, M. A., Sax, L. J., & Riggers-Piehl, T. A. (2014). Investigating forty years of STEM research: How explanations for the gender gap have evolved over time. *Journal of Women and Minorities in Science and Engineering, 20*, 127–148. DOI: 10.1615/JWomenMinorScienEng.2014007246

Kim, J. (2015). *Understanding narrative inquiry: The crafting and analysis of stories as research*. SAGE Publications, Incorporated.

Kim, J. K. (2016). *Understanding narrative inquiry*. Sage.

Kinitz, D. J. (2022). The Emotional and Psychological Labor of Insider Qualitative Research Among Systemically Marginalized Groups: Revisiting the Uses of Reflexivity. *Qualitative Health Research, 32*(11), 1635-1647. doi:10.1177/10497323221112620

Knekta, E., & McCartney, M. (2021). What can departments do to increase students' retention? a case study of students' sense of belonging and involvement in a biology department. *Journal of College Student Retention: Research, Theory & Practice*, *22*(4), 721–742. https://doi.org/10.1177/1521025118788351

Koch, A. J., Sackett, P. R., Kuncel, N. R., Dalke, J. A., & Beatty, A. S. (2022). Why women STEM majors are less likely than men to persist in completing a STEM degree: More than the individual. *Personal and Individual Differences, 190*. 111532. https://doi.org/10.1016/j.paid.2022.111532

Kuh, G.D. (2009). What Student Affairs Professionals Need to Know About Student Engagement. *Journal of College Student Development 50*(6), 683-706. doi:10.1353/csd.0.0099

Kulp, A. M., Pascale, A. B., & Grandstaff, M. (2021). Types of extracurricular campus activities and first-year students' academic success. *Journal of College Student Retention: Research, Theory & Practice, 23*(3), 747-767. https://doi.org/10.1177/1521025119876249

Lefever, R. (2012). Exploring student understandings of belonging on campus. *Journal of Applied Research in Higher Education. 4*(2). 126-141. DOI: 10.1108/17581181211273075

Lufi, D., Parish-Plass, J., & Cohen, A. (2003). Persistence in higher education and its relationship to other personality variables. *College Student Journal, 37*(1), 50.

Marshall, C., Rossman, G. B., & Blanco, G. (2021). *Designing qualitative research*. SAGE Publication.

Merriam, S. B., & Tisdell, E. J. (2016). *Qualitative research: a guide to design and implementation* (Fourth edition.). Jossey-Brand, a Wiley Brand.

Mertens, D. M. (2021). Research and evaluation in education and psychology (5th edition, pp. 7-34 & 41-42). SAGE Publications.

Meyers, K., & Pieronek, C. F., & McWilliams, L. H. (2012, June), *Engineering Student Involvement* Paper presented at 2012 ASEE Annual Conference & Exposition, San Antonio, Texas. DOI: 10.18260/1-2—21313

National Center for Science and Engineering Statistics (NCSES). 2023. *Diversity and STEM: Women, Minorities, and Persons with Disabilities 2023*. Special Report NSF 23-315. Alexandria, VA: National Science Foundation. Available at https://ncses.nsf.gov/pubs/nsf23315/report/science-and-engineering-degrees-earned#overall-s-e-degrees-earned-by-women

National Center for Science and Engineering Statistics (NCSES) 2023. *Integrated Postsecondary Education Data System (IPEDS), Completions component, Fall 2012 through Fall 2021 (final data) and Fall 2022 (provisional data).* https://nces.ed.gov/programs/digest/d23/tables/dt23_318.45.asp

Nolen, Z. L., Daniel, K. L., & Bucklin, C. J. (2021). Perceived benefits from participating in content-based student organization. *Journal of Student Affairs Research and Practice, 58*(4) 417-429. DOI: 10.1080/19496591.2020.1796689

Ong, M., Smith, J. M., & Ko, L. T. (2018). Counterspaces for Women of Color in STEM Higher Education: Marginal and Central Spaces for Persistence and Success. *Journal of Research in Science Teaching, 55*(2), 206–245. https://doi.org/10.1002/tea.21417

Patton, M. Q. (2002). Qualitative research and evaluation methods (3rd ed.). Thousand Oaks, CA: Sage.

Pittman, L. D., & Richmond, A. (2008). University belonging, friendship quality, and psychological adjustment during the transition to college. *Journal of Experimental Education, 76,* 343–362. DOI: 10.3200/JEXE.76.4.343-362

Rainey, K., Dancy, M., Mickelson, R., Stearns, E., & Moller, S. (2018). Race and gender differences in how sense of belonging influences decisions to major in STEM. *International Journal of STEM Education, 5*(10). https://doi.org/10.1186/s40594-018-0115-6

Riegle-Crumb, C. & Peng, M. (2021). Examining high school students' gendered beliefs about math: Predictors and implications for choice of STEM college majors. *Sociology of Education, 94*(3), 227-248. DOI: 10.1177/00380407211014777

Rodriguez, S. L., & Blaney, J. M. (2021). 'We're the unicorns in STEM': Understanding how academic and social experiences influence sense of belonging for Latina undergraduate students. *Journal of Diversity in Higher Education, 14*(3), 441–455. https://doi.org/10.1037/dhe0000176

Rothwell, J. (2013, June). The hidden STEM economy. Washington, DC: Brookings. Retrieved from https://www.brookings.edu/research/the-hidden-stem-economy/

Saldaña, J. (2013). *The coding manual for qualitative researchers* (Second edition.). SAGE Publications.

Savage, M. W., Strom, R. E., Ebesu Hubbard, A. S., & Aune, K. S. (2019). Commitment in college student persistence. *Journal of College Student Retention: Research, Theory & Practice*, *21*(2), 242–264. https://doi.org/10.1177/1521025117699621

Sax, L.J., Blaney, J.M., Lehman, K.J., Rodriguez, S.L., George, K.L., & Zavala, C. (2018). Sense of Belonging in Computing: The Role of Introductory Courses for Women and Underrepresented Minority Students. *Social Sciences*, 7(8):122. https://doi.org/10.3390/socsci7080122

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

Siekmann, G. (2016). *What is STEM? The need for unpacking its definitions and applications.*

Simmons, D.R., Van Mullekom, J. & Ohland, M.W. (2018). The Popularity and Intensity of Engineering Undergraduate Out-of-Class Activities. *Journal of Engineering Education*, *107*(4), 611-635. https://doi.org/10.1002/jee.20235

Smith, C. A. S., Wao, H., Kersaint, G., Campbell-Montalvo, R., Gray-Ray, P., Puccia, E., Lee, R., Skvoretz, J., & MacDonald, G. (2021). Social capital from professional engineering organizations and the persistence of women and underrepresented

minority undergraduates. Frontiers in Sociology, 6,1–13. https://doi.org/10.3389/fsoc.2021.671856

Soria, K. M., Boettcher, B., & Hallahan, K. (2022). The effects of participation in recreational activities on students' resilience and sense of belonging. *Recreational Sports Journal*, *46*(2), 184–192. https://doi.org/10.1177/15588661221125201

Strayhorn, T. (2019). College students' sense of belonging: A key to educational success for all students: (2nd Ed.). Routledge.

Stout, J. G. & Blaney, J. M. (2017). "But it doesn't come naturally": How effort expenditure shapes the benefit of growth mindset on women's sense of intellectual belonging in computing. *Computer Science Education, 27*(3-4), 215-228. DOI: 10.1080/08993408.2018.1437115

Subedi, K. (2021). Determining the sample in qualitative research. *Scholar's Journal, 4,* 1-13. DOI: 10.3126/scholars.v4i1.42457

Thurairajah, K. (2019). Uncloaking the researcher: Boundaries in qualitative research. *Qualitative Sociology Review, 15*(1), 132–147. https://doi.org/10.18778/1733-8077.15.1.06

Tinto, V. (1988). Stages of Student Departure: Reflections on the Longitudinal Character of Student Leaving. *The Journal of Higher Education*, *59*(4), 438–455. https://doi.org/10.2307/1981920

Tinto, V. (1993). Leaving college: rethinking the causes and cures of student attrition (2nd ed.). University of Chicago Press.

Tonso, K. L. (2006). Student engineers and engineering identity: Campus engineer identities a figured world. *Cultural Studies of Science Education, 1*(2), 273-307. https://doi.org/10.1007/s11422-005-9009-2

U.S. Census Bureau (2020). Total U.S. Resident Population by Age, Sex, and Series: April 1, 2020. Retrieved October 27, 2023, from https://www.census.gov/data/tables/2020/demo/popest/2020-demographic-analysis-tables.html

Vargas-Solar, G. (2022). Intersectional study of the gender gap in STEM through the identification of missing datasets about women: A Multisided Problem. *Applied Sciences, 12*(12), 5813. https://doi.org/10.3390/app12125813

Webber, K.L., Krylow, R.B., & Zhang, Q. (2013). Does involvement really matter? Indicators of college student success and satisfaction. *Journal of College Student Development 54*(6), 591-611. doi:10.1353/csd.2013.0090.

Ying, K. M., Martin, A. C., Rodriguez, F. J., & Boyer, K. E. (2021). CS1 Students' perspectives on the computer science gender gap: Achieving equity requires awareness. *2021 Conference of Research in Equitable and Sustained Participation in Engineering, Computing, and Technology (RESPECT)*, 1-9. https://doi.org/10.1109.RESPECT51740.2021.9620659

Appendix A

Participant Recruitment Materials

Recruitment Email to Club/Organization Faculty Advisor or President

Dear Club/Organization Faculty Advisor or President,

My name is Jaime Caperton, and I am a graduate student at the University of Georgia, enrolled in the Student Affairs Leadership Program. I am conducting a research study to explore academic retention, major persistence, and sense of belonging for female STEM students participating in a club or organization related to their major. I would like to hear about the stories and experiences of females in the STEM field and how their participation in these specific clubs and organizations has shaped their sense of belonging, retention, and persistence to continue with their chosen majors. I hope this study will help higher education professionals who work with female STEM students help support and improve experiences for future female students in STEM.

I need your assistance in sharing this with any female students involved in this student organization who meet the following criteria:

- Must be currently enrolled in a STEM major or a recently enrolled STEM major (who graduated within the last three years),
- Identify as female,
- Be a full-time undergraduate student currently or have been a full-time undergraduate student during their STEM major enrollment and
- Must be a current or former member of an organization and/or club within their major department, and the organization must be centered on the student's major

Participation in the study is voluntary. Participants ' strict confidentiality will be maintained throughout the entirety of the study.

I am looking for students who are interested in sharing their stories and experiences in a 45-60 minute one-on-one interview in person or via Zoom. All participants will remain anonymous and will receive a $10 Amazon gift card for their participation. Please share this information (see attached recruitment flyer) with the members of this student organization and allow them to complete a prescreening survey to confirm they are eligible and provide demographic information.

If you have any questions about the study, please email me at jaime.caperton@uga.edu. I am hoping to have all participants by xxxx. Your help with this is very much appreciated. Thank you in advance for your help.

Best,
Jaime Caperton
University of Georgia
Doctoral Candidate, Doctor of Education

Recruitment Email to Student

Dear Student,

My name is Jaime Caperton, and I am a graduate student at the University of Georgia enrolled in the Student Affairs Leadership Program. I am conducting a research study to explore academic retention, major persistence, and sense of belonging for female STEM students participating in a club or organization related to their major. I would like to hear about the stories and experiences of females in the STEM field and how their participation in these specific clubs and organizations has shaped their sense of belonging, retention, and persistence to continue with their chosen majors. I hope this study will help higher education professionals who work with female STEM students help support and improve experiences for future students.

Female students pursuing a STEM major and actively involved in a club or organization specifically for their chosen major are invited to take part in this research study. To be eligible, you must meet the following criteria:

- Must be currently enrolled in a STEM major or a recently enrolled STEM major (who graduated within the last three years),
- Identify as female,
- Be a full-time undergraduate student currently or have been a full-time undergraduate student during their STEM major enrollment and
- Must be a current or former member of an organization and/or club within their major department, and the organization must be centered on the student's major

Participation in the study is voluntary. Participants ' strict confidentiality will be maintained throughout the entirety of the study.

Participants will be asked to partake in a one-on-one interview with the researcher in person or via Zoom. The interviews will last 45-60 minutes. All participants will remain anonymous and will receive a $10 Amazon gift card for their participation. If you are interested in participating, please complete the prescreening survey.

If you are a female STEM student or know of any who would like to participate in this study, please email me at jaime.caperton@uga.edu for additional information. Thank you for your help.

Best,
Jaime Caperton
University of Georgia
Doctoral Candidate, Doctor of Education

Eligible Participants Email

Dear %Name%

Thank you for completing my initial screening/demographic survey. Based on your survey response, you are a great participant for this study.

As a reminder, the purpose of this study is to explore how involvement in major-focused student organizations shape female STEM students' sense of belonging, academic retention, and major persistence in STEM majors. Interviews will be conducted via Zoom or in person and will last 45-60 minutes.

Here is a link to schedule a Zoom or in-person meeting time:
https://doodle.com/meeting/participate/id/erXkW8Kb

Please let me know if alternative times and dates are needed. Once a date and time have been chosen, I will email you an Outlook calendar invite that will include a Zoom meeting link or in-person location.

Please let me know if you have any questions.

Best,
Jaime Caperton
University of Georgia

Calendar Invite

Hi %Student%,

Thank you for agreeing to take part in this research study. Here is the calendar invite for our meeting on xxx, xxx, at xxx, including (Zoom link or Location). I have again attached the consent form for you to review before our meeting.

Please let me know if you have any questions.

Best,
Jaime Caperton
University of Georgia

Participant Thank You Email

Dear %Name%,

Thank you again for agreeing to participate in this study, which I am completing for my doctoral program. Your time, as well as the stories and experiences you have shared with me, are very valuable and sincerely appreciated.

Here is a $10 Amazon gift card, which you can redeem by using this link___. If you have any difficulties accessing the gift card or have questions, please don't hesitate to email me at jaime.caperton@uga.edu.

Best,
Jaime Caperton
University of Georgia

Recruitment Flyer

PARTICIPANTS NEEDED FOR RESEARCH STUDY

The purpose of this study is to explore the experiences of female students pursuing STEM degrees and actively participating in student organizations focused on their majors and how their involvement has shaped their sense of belonging, academic persistence, and retention in STEM majors.

PARTICIPANT ELIGIBILITY

- Complete an initial demographic survey (Time 10-15 mins.)
- Complete an individual interview, via Zoom or in-person (Time 45-60 mins.)
- Review transcription of the interview (Time 20-30 mins.)

PARTICIPANT INVOLVEMENT

- Must be currently enrolled in a STEM major or a recently enrolled STEM major (who graduated within the last three years),
- Identify as female,
- Be a full-time undergraduate student currently or have been a full-time undergraduate student during their STEM major enrollment and
- Must be a current or former member of an organization and/or club within their major department, and the organization must be centered on the student's major

Participants will receive a $10 Amazon gift card for their participation at the conclusion of the study.

ACCESS THE ONLINE SURVEY HERE:

For more information about the study, please contact Jaime Caperton at jaime.caperton@uga.edu

Appendix B

Initial Screening/Demographic Survey

Thank you for your interest in participating in this dissertation study. The purpose of this survey is to collect demographic information and determine the eligibility of potential participants. If eligible, interviews will be conducted via Zoom or in person and will last 45-60 minutes. If you have any questions about the study, please feel free to contact me at jaime.caperton@uga.edu

1) Please provide your First Name and Last Name:
2) Please list your primary email address:
3) Please provide your age:
4) Please provide your Ethnicity:
5) Please indicate your Gender Identity:
6) Please indicate what year you are in college:
7) What is your enrollment status?
    - Full-time (At least 12 credit hours for an undergraduate student)
    - Part-time (at least 6 credit hours for an undergraduate student)
    - Graduate with a bachelor's degree
8) Please indicate your declared major:
9) Please indicate which student organization you are an active participant in:

Appendix C

University of Georgia Consent Letter

Dear Participant,

My name is Jaime Caperton, and I am a student in the Department of Counseling and Human Services at the University of Georgia under the supervision of Lindy K. Parker. I am inviting you to take part in a research study.

Purpose of the Study
The purpose of this study is to explore the experiences of female students pursuing STEM degrees and actively participating in student organizations focused on their majors and how their involvement has shaped their sense of belonging, academic persistence, and retention in STEM majors.

You have been invited to participate in this study because you meet the study eligibility criteria. Specifically, I am looking for undergraduate female students with a declared STEM major who are actively involved in a student organization focused on their STEM majors.

What is asked of each Participant
If you agree to take part in this study, your participation will involve:

1) A demographic/initial screening survey (10-15 minutes)
2) Reading a consent form with participation information
3) Participating in one virtual Zoom or in-person interview (45-60 minutes)
4) Reviewing the transcription for accuracy (20-30 minutes)

Risks and Discomforts
Participation in this research study has minimal potential risk associated with it. Potential risks or discomforts for participation could include emotional discomforts when discussing your experience as a female undergraduate STEM student. This could include reliving past experiences that you may share as a female pursuing a STEM major that may not have been the best experiences.

Key Information

- Participation is voluntary. You can refuse to take part or stop at any time without penalty. If you decide to withdraw from the study, the information that can be identified as yours will be kept as part of the study and may continue to be analyzed unless you make a written request to remove, return, or destroy the information.

- You have been notified that all information will be confidential throughout the study, and your identification will not be used in the results of this study. Only the data collected in the initial screening/demographic survey will contain the participant's identifiable information.
- You will remain anonymous in any report related to this study. Pseudonyms will be used for all participants throughout the study.
- Audio/video Zoom recordings through my UGA Zoom account will be used to collect and transcribe responses from each participant. The audio/video Zoom recordings will be destroyed upon completion of the research study.
- You will be provided with a transcription of the interview to review and provide feedback on the analysis to ensure responses were transcribed accurately.
- Your decision to participate will have no impact on your participation in academic programs.

Incentives for Participation

Participants will receive a $10 Amazon gift card for their participation at the conclusion of the study. The gift card will be emailed within 10 business days of you receiving the transcript and returning your feedback. If there is no communication within this time, I will assume that no changes need to be made to the transcript. I will proceed with completing the study, and you will receive the $10 Amazon gift card via email.

If you are interested in participating or have questions about this research, please feel free to contact me at jaime.caperton@uga.edu. If you have any complaints or questions about your rights as a research volunteer, contact the IRB at 706-542-3199 or by email at IRB@uga.edu.

Please keep this letter for your records.

Sincerely,

Jaime Caperton
University of Georgia

Appendix D

Interview Protocol and Questions

The participant will receive an email reminder twenty-four hours before the interview, including the Zoom or location details, time, and date.

Hello. Thank you for taking the time to meet with me today.

Have you had the opportunity to read the IRB consent form? Do you have any questions or concerns about the IRB protocol or interview process?

Everything we discuss today will be confidential. You will be able to choose a pseudonym that will be used to record the findings. If you are not interested in selecting one, I will choose one for you. Participation is voluntary. If there are any questions you do not wish to answer, please let me know.

The interview will last 45-60 minutes. I will video and audio record it through Zoom, which will also provide a transcription of our conversation. I will review the transcription to ensure it is verbatim. A copy of the transcribed interview and narrative will be shared with you to give you the opportunity to review and ensure accuracy.

I will ask you a few questions to hear about their sense of belonging, major persistence, and retention through your involvement in their major-focused student organizations.

Do you have any questions before we get started?

Interview Questions

1. Why did you decide to enroll at the university, and what was most important to you in your decision-making?
2. What was the reason you decided to pursue this STEM major?
    a. What are your career aspirations?
3. Describe your experience when you started your STEM degree.
4. How would you describe your experience as a female pursuing a STEM degree?
    a. Can you tell me about some challenges you encountered as a female in STEM?
5. How did you decide to join this specific student organization?
    a. How did joining this student organization make you feel?
6. How has being involved in this student organization affected your decision to continue with your major?
7. What does it mean to you to feel like you belong? How would you describe the term “sense of belonging”?
8. How has being involved in this student organization shaped your feelings of belonging?
    a. Tell me what type of connections you made through your involvement in this organization.
9. In what ways has your involvement in this student organization impacted your decision to continue at the university and in STEM?
    a. Please explain how your feelings of belonging and any connections you have made from participating in this organization have impacted your persistence with your major.

10. Why or why not would you recommend joining a major-focused student organization to other female students pursuing STEM degrees?
11. Is there anything else you would like to share about your experience being a female student in STEM and being involved in a major-focused student organization?

Probing Questions

These probing questions will be used to encourage participants to share more information, expand on previous answers, and provide examples.

- Can you tell me about a specific time when this happened?
- How did that affect your choice to continue with your major?
- What effect did that have on your sense of belonging or relationships at the university or within your major?
- Can you provide me with an instance where what you just mentioned was evident?
- Can you describe what that was like?

Interview Conclusion

Once the interview concludes, I will stop the Zoom audio/video recording and check in with the participants to see how they are. I will then explain the member checking process again and how they will receive the gift card afterward.