

ABSTRACT

YILMAZ, ECE. Women's Experiences in Associate in Engineering Degree Programs in North Carolina Community Colleges: A Case Study Exploration. (Under the direction of Dr. Alyssa N. Rockenbach).

This study explored how women with multiple intersecting identities decided to enroll in an Associate in Engineering degree program in North Carolina community colleges, and how they described their experiences in the program and their transfer aspirations. It employed a case study design and was guided by intersectional feminist theory. Intersectional feminist theory served as a theoretical and methodological tool to examine women's multiple realities within interlocking power structures that privilege, oppress, and/or marginalize them in male-dominated Associate in Engineering programs. Data were obtained from semi-structured interviews with women enrolled in the Associate in Engineering degree programs in three selected research sites, field observations, document analysis (i.e., analysis of program websites), and interviews with program directors and faculty. The study findings illuminated crucial gender-based and intersectional experiences encountered by women enrolled in the Associate in Engineering program, uncovering four major themes. First, participants faced the challenging task of confronting and persevering through gender-, race-, and class-based stereotypes in their decision to enroll in the program. Second, women in this study described gendered and intersectional experiences within both curricular and extracurricular spaces of the Associate in Engineering program. The male dominance in the curricular and extracurricular spaces not only impacted women's academic pursuits, but also affected their mental and emotional well-being and sense of safety. The third theme highlighted a lack of support networks for women in the engineering classroom, attributed to both a faculty diversity gap and a peer support gap. Finally, the fourth theme emphasized the critical need for tailored institutional student support systems, shedding

light on the importance of addressing intersectional challenges faced by women as they navigate their educational journey. The study's findings contribute to the existing body of knowledge on women's experiences in community college engineering programs by revealing women's multiple realities, challenges, and needs shaped within the interlocking systems of privilege and oppression in the Associate in Engineering degree programs. This understanding helps articulate the complexity of women's experiences in these programs. I use this understanding to develop a coherent set of actionable steps for higher education practitioners and policy-makers to create more inclusive and equitable college environments, practices, and policies for women in Associate in Engineering programs.

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Women's Experiences in Associate in Engineering Degree Programs in North Carolina
Community Colleges: A Case Study Exploration

by
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DEDICATION

To my superhero, Aysel Yilmaz.

BIOGRAPHY

Ece Yılmaz was born in Turkey, and she is a proud product of Turkish public education. She came to North Carolina in 2021 as an international doctoral student. Before starting her doctoral studies, she worked in Turkish higher education for eight years in both academic and administrative positions. She received her Bachelor's degree from the Department of Foreign Language Education at Boğaziçi University, Turkey. She holds Master of Science degrees in Educational Administration and Gender and Women's Studies from Middle East Technical University, Turkey. During the second year of her doctoral journey, she worked for the College of Education's Global Programs Office at North Carolina State University. She has been working as a research associate at the Belk Center for Community College Leadership and Research for the last two years, where her interest in community colleges started. In her free time, she enjoys spending time under the sun, taking long walks in nature, and spending time with her friends.

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CHAPTER 1: INTRODUCTION

The Federal Government's strategic plan for Science, Technology, Engineering, and Mathematics (STEM) education acknowledges that "not all Americans have equal access to STEM education or are equally represented in STEM fields," and the significantly underrepresented groups in STEM are "women, persons with disabilities, and three other racial and ethnic groups, Black and African Americans, Hispanics or Latinos, American Indians or Alaska Natives" (Committee on STEM Education of the National Science and Technology Council, 2018, pp. 2-3). Women make up almost half of the college-educated workforce (48%) in the United States, yet they constitute just over one-quarter (27%) of the STEM workforce (Burke et al., 2022; Martinez & Christnacht, 2021; Pham & Triantis, 2015). They remain more underrepresented in engineering jobs, constituting only 22% of engineering degree holders and 15% of the engineering workforce (Fry et al., 2021; Martinez & Christnacht, 2021).

Historically dominated by men, the fields of engineering and engineering education has presented unique barriers and challenges for women (Bix, 2014; Penprase, 2020; Sloan, 1975). These barriers include gender bias and stereotypes, hostile academic environments, lack of support systems, unequal opportunities, and institutional structures that perpetuate gender-based challenges for women (Bix, 2014; Pawley, 2019; Seron et al., 2018; Smith & Gayles, 2018). While these challenges exist, women's underrepresentation in science and engineering continues to be a threat to the country's capacity for innovation and international competitiveness because science and engineering disciplines and the U.S. economy need women's contributions to reach their full potential (Chan, 2021; Pham & Triantis, 2015).

Therefore, the Federal Government's strategic plan for STEM education asks for urgent nationwide collaboration to address the barriers to equal access to STEM education and the

workforce (Committee on STEM Education of the National Science and Technology Council, 2018). The Federal Government's aspirational goals of promoting access, increasing diversity, equity, and inclusion in STEM education—and preparing the STEM workforce for the future—align well with the community college mission and vision in the United States. Although the contributions of community colleges are not publicly well-recognized, these higher education institutions serve as critical entry points to engineering education and offer valuable opportunities to diversify the engineering workforce (National Academy of Engineering and National Research Council, 2005; Knaphus-Soran et al., 2020). Consequently, women's experiences in community college engineering programs remain a critical opportunity for exploration to address women's underrepresentation in engineering. The following section discusses the distinctive potential of community colleges in diversifying the engineering workforce.

Community Colleges Have Distinctive Potential to Diversify the Engineering Workforce

Several factors uniquely position community colleges to significantly contribute to diversifying the engineering workforce. The first one is about the STEM programs offered by community colleges. There are two categories of STEM programs in community colleges. While the first set of programs, technician programs, can lead to an associate's degree in applied science and transfer, their main goal is to help students gain the necessary skills and knowledge to enter the workforce directly. The second set of science and engineering programs are transfer programs that prepare students for studies requiring a bachelor's degree or higher. These programs offer two-year preparation and an associate's degree, which can lead to a transfer to a four-year institution's program for the pursuit of a baccalaureate degree (National Academies of Sciences, Engineering, and Medicine, 2016).

Community colleges' unique capacity to diversify the engineering workforce is also related to their diverse student body. Their open-door admissions policy makes them more accessible and affordable local alternatives to four-year institutions. In the 2020-2021 academic year, 33% of all undergraduate students enrolled in community colleges (National Center for Educational Statistics, 2022), which means many undergraduates took the lower-cost community college path to higher education (Burke et al., 2022). Community college students are more likely to be older and work while enrolled—and most are women (National Academies of Sciences, Engineering, and Medicine, 2016; St. Rose & Hill, 2013). Thirty-three percent of all undergraduate students in the United States enrolled in community colleges in the 2020-2021 academic year, and 60% of this student population was women (National Center for Educational Statistics, 2022). Community colleges and the transfer mechanism remain a critical source of female talent for science and engineering fields (Rincon et al., 2022; Wickersham & Wang, 2016).

In addition, community colleges provide access to higher education for low-income, first-generation, and racially minoritized students and offer STEM degree programs and pathways for high- and middle-skill jobs (Hagedorn & Purnamasari, 2012; National Academies of Sciences, Engineering, and Medicine, 2016; St. Rose & Hill, 2013). They offer “exposure to STEM-related options to many individuals who would not have had extensive exposure in any other way” (Hagedorn & Purnamasari, 2012, p.156). This exposure broadens educational opportunities and offers opportunities for diversifying the engineering workforce.

In addition to their mission to expand access to higher education by students of all identities and backgrounds, community colleges also serve as significant pivots for workforce development, especially for addressing local workforce needs (Khan & Unruh, 2022; Turner,

2021). Community colleges help students enter the workforce with associate degrees or through non-degree certification programs, or students can also transfer to four-year institutions (Burke et al., 2022). Associate's degrees offered by community colleges are another significant entry point to the STEM workforce in addition to four-year degrees (Okrent & Burke, 2021).

Community colleges also have many positive characteristics that can support students' STEM learning. For example, peer support and positive interactions with faculty are among the most significant aspects of STEM education in community colleges (Allen et al., 2022; Blaney, 2022; Packard et al., 2011; Starobin & Laanan, 2008; Yap, 2022). In community colleges, teaching and learning are prioritized (Zhang & Ozuna, 2015); the classes are smaller with a more diverse population (Allen et al., 2022); faculty is more available and approachable to help students (Elliott & Lakin, 2021) compared to four-year science and engineering programs.

Overall, community colleges are a popular starting point for women and students with diverse backgrounds to pursue higher education. With a focus on serving local communities, community colleges provide access to education and workforce training that might not be available otherwise. These institutions also play a vital role in workforce development through a variety of programs including engineering transfer programs, enabling students to transfer to four-year engineering programs. Community colleges, with their unique student population and mission to address workforce needs, have the potential to diversify the engineering workforce.

The Statement of the Problem: Challenges Exist for Women in the Community College Engineering Programs

Community colleges play an essential role in women's access to four-year degrees in American higher education (Handel, 2013; Rincon et al., 2022), and the vertical transfer mechanism, which allows students to start in community colleges and transfer to a four-year

degree program, remains a significant function of community colleges (Taylor & Jain, 2017).

Through this transfer mechanism, community colleges can help address the gender inequities in engineering by encouraging more women to take the transfer path (Rincon et al., 2022).

However, existing research documents challenges women face in community college engineering programs (Knaphus-Soran et al., 2020; Marco-Bujosa et al., 2021; Rincon, 2017; Sullivan et al., 2012).

Women are less likely to pursue STEM degrees in community colleges than men (Evans et al., 2020; Wang, 2013). Research also documents differences across STEM disciplines in women's enrollment. While women are more likely to enroll in biological, agricultural, and environmental life sciences, they are less likely to enroll in engineering and engineering technologies programs in community colleges (Wang & Wickersham, 2019). In the 2020-2021 academic year, 5,101 Associate's degrees in engineering were conferred to men, while only 1,215 Associate's degrees in engineering were conferred to women in the United States (National Center for Educational Statistics, 2022a).

Existing research demonstrates several challenges for women engineering students in community colleges. Studies document gender differences in interactions with community college faculty, with men having more access to professors in and out of the class (Knaphus-Soran et al., 2020). Women face gender-based and racial marginalization and isolation within the masculine cultures of engineering programs in community colleges (Allen et al., 2022; Jain, 2009; Knaphus-Soran et al., 2020; Lester et al., 2016; Marco-Bujosa et al., 2021; Melendez, 2017; Rodriguez et al., 2019). Women in community college engineering programs report being marginalized by peers and professors (Jain, 2009; Melendez, 2017). They lack support systems and are more likely to be excluded from conversations about engineering careers (Knaphus-

Soran et al., 2020; Rincon, 2017). They are also more likely to switch out of engineering programs (Rincon, 2017). Looking at these findings and considering the demands of highly competitive four-year engineering programs, how community colleges can better prepare women for four-year engineering programs requires further investigation.

In addition, women in community colleges are less likely to have aspirations to transfer to and major in STEM than men (Myers et al., 2015), and transfer students in four-year engineering programs are less likely to be women (Sullivan et al., 2012). Women community college students do not enroll in and complete four-year engineering programs at the same rates as women enrolling in four-year engineering programs right after high school (Sullivan et al., 2012). While one reason may be women's lower enrollment patterns than men's, this explanation remains inadequate to present a complete picture. Even when women community college students transfer to four-engineering programs, their likelihood of dropping out or leaving the institution is higher than women non-transfer students (Sullivan et al., 2012).

Overall, existing research on women's challenges in science and engineering programs in community colleges highlights their low enrollment rates, as well as the challenges they face and their lower transfer aspirations compared to men. These challenges include unwelcoming STEM cultures, negative interactions with peers and professors, and a lack of supportive environments due to gender and racial stereotypes. While the existing body of knowledge underscores significant questions and concerns about women's experiences in community college science and engineering programs, it also has limitations in representing women's experiences. The following section discusses why an intersectional lens is essential to understanding women's experiences in community college engineering programs.

An Intersectional Lens is Crucial for Studying Women's Experiences in Community

Colleges

Students in community colleges bring their multiple identities and diverse backgrounds to the classrooms, including other work and family commitments (Khan & Unruh, 2022; Rodriguez et al., 2017; Wickersham & Wang, 2016). They are first-generation college students, commuters, and caretakers; they have full-time jobs outside the school and come from racially minoritized backgrounds (Khan & Unruh, 2022). The complexity of women's roles and identities within the higher education context that privileges White, class-privileged, and male identities shapes how they navigate their community college education, practices, and policies (see Yap, 2022).

Existing research demonstrates the unique challenges of women of color, first-generation women of color, parenting women, and women who work while enrolled in community colleges (Leggett-Robinson et al., 2018; Madden, 2018; Sallee & Cox, 2019; Yap, 2022; Holland Zahner & Harper, 2022). Although community colleges serve to equalize access to higher education, they are criticized for failing to bring in systemic changes necessary to address the needs of this diverse student population (Khan & Unruh, 2022). An intersectional approach enables a more comprehensive and nuanced understanding of the complexity of women's college experiences (Rodriguez et al., 2017). Intersectionality serves as a tool to conceptualize the simultaneous operation of multiple mechanisms of power, privilege, and oppression (e.g., racism, sexism, classism, heterosexism, ableism) in producing women's experiences (Crenshaw, 1989, 1991).

Student experiences in community college STEM programs are simultaneously gendered and racialized (Choi, 2022; Herrera et al., 2022; Jain, 2009; Melendez, 2017; Reyes, 2011, Rodriguez et al., 2017). The dominance of White men in the historical and cultural construction of these programs creates a hegemonic existence, serving and privileging White men's ways of

being and knowing (Yap, 2022). Women of color are discouraged from pursuing engineering, and they lack support systems (Jain, 2009; Melendez, 2017). At the intersection of racism and sexism, women of color report feeling marginalized and isolated (Herrera et al., 2022). Other identities and life experiences (e.g., being an undocumented student, a parent, having fewer economic resources, being a parent or a single parent, being disabled) also intersect with women's experiences in racist and sexist structures (Choi, 2022; Wickersham & Wang, 2016). All these intersectional experiences add unique needs and challenges to women's journeys. Women's journeys in the community college STEM programs and their transfer aspirations are situated within these interlocking systems of power, privilege, and oppression.

These intersectional experiences in community college STEM disciplines require an investigation attentive to students' multiple and intersecting identities. Otherwise, homogenizing women's experiences in the community college engineering programs can only offer a partial understanding of their experiences by leading to an understanding that all women have similar experiences, which is not the case. Analyzing women's experiences using an intersectional perspective leads to a more thorough and refined understanding of their experiences within the Associate in Engineering degree programs. An intersectional lens also demonstrates how the interlocking systems of privilege and oppression inform women's unique experiences.

In the existing literature about women enrolled in in STEM programs in community colleges, few studies have benefited from feminist theoretical frameworks like intersectionality (see Choi, 2021; Rainey et al., 2018), feminist standpoint theory (see Yap, 2022), or feminist theories like gendered organizations (see Madden, 2018). Even when some studies employ intersectionality, the analysis focuses only on intersections of race and gender, with limited capacity to include women's other self-identified identities that shape their STEM experiences in

community colleges (see Choi, 2021; Rainey et al., 2018). The current literature provides valuable insights into women community college students' needs and challenges based on their multiple roles and identities as working students, parenting students, and students from different racial and socioeconomic backgrounds. However, some questions like “what women’s experiences in community college engineering programs look like if they are working, parenting, and coming from racially and socioeconomically disadvantaged backgrounds at the same time” remain unanswered by these studies.

Intersectionality as a feminist framework makes several contributions to the study. First, it helps articulate women’s multiple identities and realities in community colleges within the hierarchal and interlocking power relations. Second, the intersectionality framework allows analysis at the macro and micro levels. Social positions and power hierarchies are situated at the macro level, and these intersecting social positions inform each individual’s experience at the micro level (Collins et al., 1995). Intersectionality allows analysis at the individual, social, and institutional levels, and it helps reveal how power hierarchies and intersecting social positions operate within the broader social, institutional, and structural contexts and influence an individual’s experiences. Intersectionality emerges as a critical, political, and transformative intervention in this study as it aims to unmask existing power relations and challenge the status quo that marginalizes women in engineering (Bilge, 2013; Overstreet et al., 2020).

Furthermore, this study’s approach to employing intersectionality allows for a nuanced analysis of the various factors that inform women’s multiple realities. The concept of intersectionality has traditionally been understood as a theory focusing on multiply marginalized identities (Sibbett, 2020). This perspective highlights how individuals navigate intersecting forms of oppression stemming from various social dimensions such as race, gender, class,

sexuality, ability, and nationality (Crenshaw, 1989, 1991; Shields, 2008). However, our lived experiences often present a greater level of complexity, as individuals frequently find themselves occupying positions in both privileged and marginalized social spheres simultaneously (Goodman, 2015; Huijg, 2012). Thus, in this study, the notion of women's multiple identities refer to both privileged and marginalized aspects. This understanding is essential for recognizing women's diverse realities, shaped by the intersections of their privileged and marginalized social positions. For instance, a woman enrolled in a community college engineering program may face gender-based discrimination while also benefiting from socioeconomic privileges. By adopting this approach, this study sheds light on women's multiple realities, illustrating the differences between those with familial financial support and those working in multiple jobs to afford their education. Capturing both sets of experiences in addition to what happens when women without the financial backing of their families have access to robust institutional financial support systems is significant in revealing the role of institutional financial support systems as equalizers. Therefore, the study's approach to defining intersectionality provides a more nuanced understanding of women's experiences and how institutional support systems can serve as equalizers, revealing their significance. Further insights into the conceptualization of intersectionality in this study can be found in Chapter 2.

It is Imperative to Avoid a Monolith Conceptualization of STEM

While there is plenty of research on women's engineering education in four-year institutions (see Banda, 2020; Blosser, 2020; Camacho & Lord, 2011; Cheryan et al., 2015; Dortch & Patel, 2017; McLean et al., 1997; Ong et al., 2020; Pawley, 2019; Rincón & George-Jackson, 2016; Secules, 2019; Seymour, 1995; Thomas et al., 2021), research on community college engineering programs and women's experiences in them remain more limited (see Baker

et al., 2015), partly due to the monolithic way of defining STEM disciplines in the studies of two-year institutions. However, existing research highlights the contextual differences between two-year and four-year engineering programs (Allen et al., 2022; Elliot & Lakin, 2021; Zhang & Ozuna, 2015) and raises questions about the preparedness of community college transfer students to meet the demands of four-year engineering programs (Knaphus-Soran et al., 2020; Laanan et al., 2010). This situation necessitates a specific focus on community college engineering programs to gain a better understanding of how these programs are doing to prepare women for engineering careers.

Most studies in the current literature have studied community college engineering programs in an aggregated manner among other disciplines under science, technology, engineering, and mathematics (STEM) (Acevedo et al., 2021; Herrera et al., 2022; Jorstad et al., 2017; Myers et al., 2015; Reyes, 2011; Wickersham & Wang, 2016). This situation remains as a major limitation in understanding women's experiences in community college engineering programs because not all STEM programs are male-dominated, and some are more gender-balanced (Cheryan et al., 2017; Wang & Wickersham, 2019). For example, women are less likely to enroll in engineering programs in community colleges compared to other STEM disciplines such as biological and environmental life sciences (Wang & Wickersham, 2019). As all STEM disciplines have unique cultures, policies, and practices (Ferrini-Mundy & Gucler, 2009; Reinholz et al., 2019), disaggregating STEM disciplines is essential to understanding women's unique characteristics and experiences within each disciplines' distinctive context (Sax et al., 2016; Sax & Newhouse, 2018). Engineering programs stand out with women's underrepresentation and masculine cultures (Marco-Bujosa et al., 2021), necessitating a deeper understanding of women's experiences within these programs.

Therefore, this study avoids a monolith conceptualization of STEM disciplines and focuses specifically on a community college engineering transfer program—the Associate in Engineering degree program. The Associate in Engineering degree program in the North Carolina Community College System (NCCCS) aims to offer uninterrupted engineering education for students transferring to one of the four-year UNC engineering programs from a community college (Meardon & Vestal, 2019; Engineering Pathways, n.d.). The pathway courses and course materials are structured to ensure that students transferring to these institutions from a community college have the same academic background as the engineering population at four-year institutions. The strong partnership seeks to support women, first-generation students, and racially minoritized populations by providing them with a solid background in engineering (Meardon & Vestal, 2019). However, in the summer of 2023, there were 1,019 men (81%) and 239 women (19%) enrolled in the Associate in Engineering degree programs in North Carolina community colleges (North Carolina Community College System Dashboards, 2024). Among the students who attained an Associate’s degree in Engineering in North Carolina community colleges and transferred to a four-year institution in the fall of 2023, 84.7% were men, and 15.3% were women (The University of North Carolina System Interactive Data Dashboards, 2024). Given the gap between the program goals to support women and women’s actual enrollment and transfer rates in the program, it is critical to study women’s experiences in the Associate in Engineering degree programs in North Carolina community colleges.

Purpose Statement

The purpose of this study is to provide an in-depth understanding of how women with different intersecting identities decide to enroll in the Associate in Engineering programs in North Carolina, how they describe their experiences in the program, and what their transfer

aspirations are. By focusing on the community college context, this study endeavors to offer a comprehensive understanding of women's experiences in Associate in Engineering degree programs, including their decision-making process to pursue this community college engineering transfer pathway and their experiences in the community college. Such understanding will shed light on the complexity of women's multiple realities in community college engineering programs while offering higher education practitioners a better understanding of how to address women's unique needs in these programs.

Research Questions

In this study, I aim to answer the following research questions:

1. How do women with different intersecting identities decide to pursue an Associate in Engineering degree program?
2. How do women with different intersecting identities describe their experiences in male-dominated Associate in Engineering degree programs in North Carolina community colleges?
3. What are the transfer aspirations of women in Associate in Engineering degree programs in North Carolina community colleges?

Significance

Contributions to Existing Knowledge about Women's Experiences in Community College Engineering Programs

The quotation below struck me hard while reading Yap's (2022) study, in which she used the feminist standpoint framework to explore how women of color STEM students' scientific thinking may be under the influence of social networks.

In the process of obtaining data from the participants in my study, many of the women expressed gratitude for being able to participate in the study. When I asked them why, some of the responses that I received included insights such as (1) nobody ever asks them (women of color STEM majors in the community college) regarding their thoughts, opinions, and experiences as they navigate the STEM pathway, and (2) sharing aspects of their journey gave them the time and space to reflect on their pathway, reminding them why they are pursuing this educational and career path. (Yap, 2022, p.103)

This hot-off-the-press study, with the data collected in 2017-2018, demonstrates that the historical neglect and epistemic erasure of women in science continues. The selection of the intersectional feminist theory as the theoretical framework and analytical tool is essential to articulate the experiences of women of color because neither race nor gender is enough to explain what is experienced at the intersection of gender and race (Collins et al., 1995; Crenshaw, 1989; Crenshaw, 1991). This study is significant because it aims to increase the visibility of women's multiple and intersecting identities, unique experiences, challenges, and achievements, which have historically been silenced in STEM and in higher education (Penprase, 2020).

This study builds on existing research on women's experiences in community college STEM programs by focusing specifically on engineering programs and adopting an intersectional feminist approach. Focusing on a specific STEM program, namely Associate in Engineering degree programs, allows for a more detailed understanding of the challenges and barriers that women face within the unique context of these programs. By examining women's experiences and needs at the intersection of multiple and intersecting power structures, such as race, class, gender, and sexuality, this study aims to generate deeper knowledge about women's

diverse realities. Understanding the role of broader and societal power structures in shaping women's experiences is crucial to addressing the underrepresentation and challenges that women face in community college engineering programs.

Implications for Policy and Practice

This study addresses a practically-relevant knowledge gap regarding women's experiences and multiple realities in engineering programs in community colleges at the intersection of various forms of privilege and oppression. Disrupting this epistemic erasure and exclusion and inviting women's voices to the study advances knowledge on women's experiences in Associate in Engineering degree programs and informs higher education practitioners and policy-makers about how to support this student population better. Gaining a more in-depth understanding of the unique needs of student subpopulations with the same gender identity can help community college faculty and staff meet these women where they are. Conducting this study, I aim to develop a coherent set of actionable steps for higher education practitioners and policy-makers to create more equitable college environments, practices, and policies for women in Associate in Engineering programs.

Societal Benefits: The Need to Diversify Engineering Workforce

Women's underrepresentation in the engineering workforce emerges as a social and economic problem. When women and their needs are not at the table that shapes the scientific agenda, this situation leaves us with a world of innovation catered to and designed for men (Chan, 2021). The crash tests of car companies with only-male dummies and medical research primarily conducted by men and on men are great examples of gendered scientific practices historically risk women's safety and lives (Haridasani Gupta, 2021; Leslie AO, 2020). Similar to these examples, the engineering designs we use daily are not free from gender biases. Our

phones fit a man's hand better (Petter, 2018), and voice recognition applications recognize a man's voice much better than a woman's voice (Bajorek, 2019). While engineers across a wide range of sectors and industries (e.g., automotive, healthcare, education, technology, construction, energy) work to improve our lives by identifying problems in our societies and addressing them with engineering designs, the adoption of masculine norms as universal human norms leaves us with a world designed for men.

Women must be among those who shape the scientific agenda to help develop more inclusive engineering designs. Due to their unique social locations and gendered life experiences, women are more likely to notice gender bias in masculine engineering designs, and they are more likely to add women's unique needs to the scientific agenda (see Hartsock, 1997). For example, women are more likely to notice that the safety belts in their cars do not fit their bodies properly. This knowledge is less accessible to men due to their social locations as they do not experience the same problems. By integrating their unique lived experiences into the scientific agenda, women in engineering teams can help produce more inclusive designs.

Similarly, women's underrepresentation in engineering perpetuates the gender pay gap. Although STEM occupations generally offer higher wages than non-STEM fields (Pham & Triantis, 2015), women in STEM still earn less than men due to wage disparities within STEM occupations. While women are more likely to study in certain STEM fields such as biology and chemistry, they are still underrepresented in higher-paying STEM occupations, such as engineering (Buffington et al., 2016; Cheryan et al., 2017). Therefore, it is crucial to address women's underrepresentation in engineering to achieve gender pay equity (Michelmore & Sassler, 2016).

Lastly, women's underrepresentation in STEM fields can have significant negative effects on the U.S. economy and its potential for innovation and competitiveness on a global scale (Chan, 2021; Pham & Triantis, 2015). This is because STEM fields are crucial for driving innovation and technological advancements that drive economic growth. By excluding women's unique contributions, the country is missing out on the full range of diverse perspectives, skills, and talents that women can bring to STEM industries (Chan, 2021; Pham & Triantis, 2015). Gender diversity has the potential to improve problem solving, increase creativity, and innovation (Díaz-García et al., 2013; Nielsen et al., 2017; Yang et al., 2022). Therefore, fostering more inclusive STEM teams can not only boost productivity but also enhance global competitiveness and contribute to economic growth.

Methods

This study is an instrumental case study. The case is women in Associate in Engineering degree programs at three community colleges in North Carolina. Feminism can serve as a theoretical tool and a methodological practice in case studies (Merriam, 2009; Wallace, 2010). Intersectionality, as a feminist framework in this case study, helps examine and articulate the interlocking forms of power structures that oppress and marginalize women in male-dominated Associate in Engineering programs. It becomes an analytical tool to reveal women's multiple realities. In addition, feminism as a methodological practice helps address power relations between the researcher and the participants in each study phase. Employing a case study design with a feminist framework, I situate the participants in this study as experts and subjects of their experiences, and their voices are also represented in the study design process. The methodology section will provide more information about the study design, participants, and selection of research sites.

The data collection methods are semi-structured individual and focus group interviews with women enrolled in the Associate in Engineering degree program, field observation, document analysis, and interviews with program directors and faculty. As I aim to understand the case “women’s experiences in the Associate in Engineering degree program, the main data source is the individual interviews with women in the program. All other sources of data help contextualize and better understand the data that comes from women enrolled in the program. The field observations include campus tours and academic and extracurricular spaces (e.g., engineering classrooms, STEM labs, STEM-focused events) to better understand the physical setting, people, activities and events, interactions, and cultural aspects of the physical space and human interactions (values, rules, unspoken norms, rituals, artifacts). More information about how the data will be collected and analyzed will be provided in the methodology section.

Limitations and Delimitations

This study has the following limitations. One limitation has to do with participant selection criteria. The criteria to participate in this study involved being enrolled in the program. As all participants in this study are currently enrolled in Associate in Engineering programs, the findings may not reflect and represent the experiences of women who have had to drop out of their programs or could not make it to college.

The second limitation concerns the recruitment of participants. I did not have access to enrolled student lists and email addresses in each institution. As a result, recruitment efforts were primarily confined to classroom visits and faculty members’ online announcements. Therefore, there is a potential bias in the sample towards those who were more accessible through these channels at the time of the data collection. The challenges associated with women’s underrepresentation in the program and the small enrollment size in two of my research sites

further contributed to an uneven distribution of participants across research sites. Achieving a more balanced representation from each research site would have been beneficial for exploring differences among institutions and understanding how institutional characteristics shape women's experiences in the program.

Faculty member recruitment for the faculty interviews is another limitation. My initial goal was to conduct an interview with three program program directors and with one faculty member from each research site. Although I successfully conducted interviews with all three program directors, I faced challenges in recruiting a faculty member from Triangle Community College as I did not receive a response to my emails. Thus, the findings do not fully reflect faculty perspectives about women's experiences in the Associate in Engineering degree programs.

The study design introduces some additional limitations. Longitudinal research designs, involving multiple interviews conducted at various time points throughout the associate degree program, could have offered a more comprehensive and nuanced understanding of women's engineering education experiences in North Carolina community colleges. Such an approach could have revealed the evolving nature of women's challenges, milestones, and academic growth over time. In contrast, the present study does not adopt a longitudinal approach, potentially missing out on the dynamic aspects of participants' journeys. This limitation implies that the findings may not fully capture the evolving nature of women's experiences in engineering education, providing a snapshot rather than a continuous narrative.

In terms of delimitations, my primary concern in this study is to understand women's experiences in Associate in Engineering programs in three community colleges in North Carolina. Therefore, I chose this group of women as the case of the study. My main focus is

neither the study of institutions selected for this study nor the study of conceptualization and development of theoretical models to explain the phenomenon. Instead, I focus on women to understand how women with multiple roles and identities decide to enroll in Associate in Engineering programs, how they describe their education, and what their transfer aspirations are.

Clarification of Terms

“Associate in Engineering Degree Programs” refers to the community college curriculum programs that prepare students to transfer to an engineering program at a four-year institution.

“Community college” refers to higher education institutions accredited to award the Associate in Arts or Associate in Science as the highest degree. Their curricular functions are as follows:

“academic transfer preparation, vocational-technical education, continuing education, remedial education, and community service” (Cohen & Brawer, 1996, p.21).

“Four-year institutions” refer to colleges and universities that provide baccalaureate degrees and graduate degrees.

“STEM education” refers to “teaching and learning in the fields of science, technology, engineering, and mathematics” (Gonzalez & Kuenzi, 2012, p.1).

“Transfer” refers to transfer from a two-year community college to a four-year institution for a baccalaureate degree.

“Women” refer to participants’ self-identified gender identities.

CHAPTER 2: REVIEW OF LITERATURE

The diverse student population in community colleges can offer opportunities to diversify the engineering workforce through the transfer mechanism (Knaphus-Soran et al., 2020). Although women in community colleges are more likely than men to transfer to four-year institutions and earn a bachelor's degree (Shapiro et al., 2017), fewer women (2%) than men (11%) transfer to engineering and computer science majors from community colleges (Rincon, 2023). In addition to women's underrepresentation in community college engineering enrollments, this situation indicates dysfunction in the transfer mechanism and acts as a barrier to a more diverse engineering workforce. If community colleges aim to equalize access to higher education, it is essential to problematize women's underrepresentation in community college engineering programs and transfer. This study aims to understand how women decide to pursue the engineering transfer pathway in community colleges, their experiences, and their transfer aspirations. It focuses on women's community college experiences to gain an in-depth understanding of the opportunities and challenges community colleges offer in educating women engineers of the future.

This chapter discusses the existing literature as a foundation for understanding women's experiences in community college engineering programs. The first section starts with a discussion of the intersectional feminist theory because the theoretical framework is the "blueprint" that gives the study "a structure and vision" (Grant & Osanloo, 2016, p.13). In addition, it provides a critical lens to analyze the studies that addressed women's underrepresentation in STEM, specifically in engineering education. In the first section, I also highlight the missing intersectionality discussion in research on women in STEM and discuss why focusing on intersectionality is critical in the community college context. Secondly, I

present a feminist critique of engineering education in the United States. In the following section, I discuss how community colleges offer opportunities as more supportive engineering education environments for women. In the same section, I also discuss the challenges women in community college engineering programs face. This contextual understanding helps situate women's experiences within their social and structural contexts, which is essential for a study grounded in intersectional feminist theory (Bilge, 2013). Thirdly, as the main focus of this study is an engineering transfer pathway, I discuss the existing research on women's transfer aspirations in community college STEM and engineering programs. The final section also highlights the importance of institutional support systems for students to reach the desired transfer outcome.

Intersectional Feminist Theory

Students in community colleges bring their multiple identities and diverse backgrounds to the classrooms, including other work and family commitments (Khan & Unruh, 2022; Rodriguez et al., 2017; Wickersham & Wang, 2016). The complexity of women's roles and identities is related to how they navigate their community college experience, practices, and policies. An intersectional lens sheds light on the complexity of women's experiences and how their experiences in community colleges are shaped at the intersection of multiple systems of privilege and oppression (Rodriguez et al., 2017).

The intersectional feminist movement emerged in response to the failure of White feminism to address Black women's oppression. Merely combating gender discrimination, as White feminism does, strengthens other forms of domination by rendering them invisible (Phipps, 2020; Schuller, 2021). Accordingly, prioritizing solely gender in examining women's oppression would only serve White women's interests as White women are not oppressed by

race (Phipps, 2020). Black feminist scholars (e.g., Kimberlé Crenshaw, Patricia Hill Collins, bell hooks) challenged White feminism and developed intersectional feminist theory to acknowledge the interconnectedness of race-, gender-, and class-based oppressions. Intersectional feminists acknowledge that sexism is a powerful mechanism of structural inequity and work to unfold its complex interactions with other forms of oppression such as racism and classism (Schuller, 2021).

A Black feminist legal scholar, Kimberlé Crenshaw (1989), used the term intersectionality to illuminate the simultaneous operation of gender and racial hierarchies in Black women's oppression in her critique of anti-discriminatory laws in the United States. Crenshaw centered her discussion on the experiences of Black women and explained how these experiences could be similar to and different from the Black men's and White women's experiences due to the simultaneous operation of racism and sexism in their lives. She used Lerner's (1973) rape case of Black women by White men as an example to explain her argument. Accordingly, Black women's vulnerability was twofold due to sexist and racist power structures. While womanhood was a source of vulnerability in the case of rape and racist domination, their Blackness prevented them from receiving any legal protection that a White woman might have received (Crenshaw, 1989; Lerner, 1973). Crenshaw used this example to demonstrate how White feminism's conceptualization of rape "as male control over female sexuality" is a limited account for Black women. The laws protecting women in rape cases were based on the preservation of White female chastity, leaving Black women vulnerable due to the intersection of sexism and racism. While sexism did not assume chastity for Black women, racism assumed their sexual promiscuity. As a result, Black women were not safeguarded by law in the cases of rape and sexual violence. Both White feminist politics that center on White women's experiences

and antiracist politics that center on Black men's experiences failed to see Black women's experiences which were different from White women's and Black men's experiences. This example highlights the significance of considering racism and sexism as intersecting systems of oppression shaping Black women's lives while underscoring the incompleteness of narratives that consider only White women's experiences while telling women's stories (Crenshaw, 1989).

Employing intersectional feminist theory as the theoretical framework helps recognize the limitations of and risks involved in exploiting gender as the only analytical category to make universal claims about women's experiences in community college engineering programs (see McCall, 2005). Intersectional feminist theory helps reveal that gender is related to other social categories and power structures (e.g., race and class) that shape our gendered lives. Grounding this study in intersectional feminist theory, I recognize that the discussion of intersectionality is not limited to gender, race, and class. Aiming for a more nuanced and comprehensive understanding of women's experiences necessitates attending to other social identities and categories like age, ableness, sexual orientation, and nationality (see Shields, 2008). In the following sections, I introduce and discuss the central concepts of intersectionality and how they enrich this study.

Revealing Interlocking Systems of Privilege and Oppression

Intersectionality helps conceptualize how our multiple identities and social locations (e.g., race, class, sexuality, ability, and nation) are related to each other within the interlocking power structures (Crenshaw, 1989; McCall, 2005). To understand what *interlocking* means, it is essential to know the difference between intersectional and additive approaches to conceptualizing the operation of power structures (Bowleg, 2008; Spelman, 1988). In an additive approach, racism is an additional oppressive power to sexism that oppresses all Black women.

An additive approach means that racial identity can be taken from an individual's identity, focusing on the shared identity: "We are all women" (Spelman, 1988, p.125). The primary risk in adopting such an approach is the loss of information about what happens at the intersections of being, for example, Black and a woman. Going back to Crenshaw's (1989) examples from the failures of antidiscriminatory laws, ignoring the simultaneous operation of racism and sexism under the narrative of "we are all women" prevents Black women from receiving the protective measures they need (Crenshaw, 1989). On the other hand, an intersectional approach makes it clear that systems of privilege and oppression (e.g., sexism, racism, classism, heterosexism, ableism) operate simultaneously, informing our experiences, needs, and opportunities within the existing power structures based on our social locations (Cole, 2009).

Recognizing the interlocking systems of oppression, I avoid any universal claims about women's experiences by using gender as a single analytical category. Employing intersectional feminist theory as the theoretical framework necessitates inviting women with different, multiple, and intersecting identities and social locations to the study. Their representation in this study offers opportunities to understand the heterogeneity of women's experiences, an understanding indispensable to addressing their needs and challenges properly within the interlocking systems of privilege and oppression. In the following section, I present a more in-depth discussion of how intersectionality helps reveal women's multiple realities.

Revealing Women's Multiple Realities and Disrupting Epistemic Erasure

Intersectional feminist theory is a theoretical and analytical tool to reveal and understand women's multiple realities. Crenshaw (1989) criticizes feminist and antiracist politics for failing to address the heterogeneity of womanhood and Blackness. Accordingly, while antiracist politics are informed by the experiences of Black middle-class men, feminist politics are informed by the

experiences of White middle-class women. However, women's realities are multiple and shaped at the intersection of simultaneously operating power structures like sexism, racism, classism, and heterosexism. Race and gender, when they are alone, cannot represent a complete picture of experiencing the world as a Black woman (Crenshaw, 1989). Intersectional feminist theory adds epistemological value to this study by helping reveal multiple realities of women's experiences at the intersection of their positions within various power hierarchies (Carastathis, 2014).

Focusing only on one of these systems of oppression (i.e., race or gender in the case of Black women) leads to the epistemic erasure of Black women's experiences by preventing us from understanding what happens at the intersection of racial and gender-based oppression (Collins et al., 1995; Crenshaw, 1989; Crenshaw, 1991). Disrupting a homogenous conceptualization of womanhood, intersectional feminist theory helps us describe the multiple and intersecting identities of these women. Knowing who is included and represented in a study can help us see whose voices are missing in the existing literature (i.e., the current understanding of women's lives and experiences) (Cole, 2009). In this study, understanding women's multiple realities also offers opportunities for community colleges to develop more equitable and inclusive interventions to improve women's experiences by addressing their multiple and unique needs.

Revealing Multiple Contextual Layers at Play

As feminist research is concerned with revealing women's experiences and understanding their oppression, it is critical to understand how this oppression is produced and perpetuated within the broader social and institutional contexts (Kelly et al., 1994). An intersectional analysis examines race, class, and gender as socially constructed categories and situates them in broader historical, social, and institutional contexts (Weber & Parra-Medina, 2003). Without

intersectionality, it is difficult to capture the complexity of power relations at the individual, social, and institutional levels by solely focusing on a single social category. Intersectionality is a powerful tool to understand how oppressive systems like sexism, racism, and classism operate at macro and micro levels and how they are related (Collins et al., 1995). At the macro level, oppressive systems create social positions (e.g., gender, race, and class) and power hierarchies within the social structures. These intersecting social positions and power relationships at the micro level shape an individual's experiences (Collins et al., 1995). Intersectional feminist theory enriches this study by enabling analysis at multiple levels while revealing their interconnectedness.

Intersectional feminist theory also rewards our efforts to challenge and disrupt existing power structures and the status quo, making it a critical, political, and transformative intervention (Bilge, 2013; Overstreet et al., 2020). This political and transformational power is reduced when an intersectional analysis fails to situate intersecting social identities within their broader social, historical, and institutional contexts (Bilge, 2013). Therefore, this study aims to understand women's experiences in historically male-dominated engineering education by situating these experiences within their social and structural contexts. This goal is possible through attention to power, privilege, and marginalization at the intersection of women's social locations (e.g., race, class, sexuality, ability, and nation) within socially constructed power hierarchies.

Conceptualizing Intersectional Identities

Intersectionality has received criticism due to the vagueness of the definition of intersectional identities (Nash, 2008). Are all identities an individual has intersectional? Can we only talk about intersectionality for individuals with multiple marginalized identities? These unanswered questions make "it unclear whether intersectionality is a theory of marginalized

subjectivity or a generalized theory of identity” (Nash, 2008, p.10). While Gopaldas (2013) suggests that the broad definition of intersectionality makes it possible to examine all individuals’ unique social advantages and disadvantages, Nash (2008) questions the ability of intersectional approaches to explain the co-construction of an individual’s privileged and marginalized identities (Nash, 2008). Schuller (2021) contributes to these discussions by shifting the focus of intersectionality from identities to power structures. According to Schuller, while identities are an essential component of intersectionality, the primary focus of intersectionality should be the systems of power, privilege, and oppression. While I take Nash’s critical questions and Gopaldas’ approach into consideration while determining my approach to defining intersectionality in this study, I benefit from Schuller’s focus on power relations in shaping my discussions.

In this study, women’s multiple identities refer to both privileged and marginalized identities. I agree with Gopaldas’ (2013) approach to defining intersectionality and recognize that an individual’s social advantages and disadvantages can be simultaneously examined. While Black feminist scholars developed and shaped intersectionality to conceptualize and explain Black women’s oppression, limiting the use of intersectionality merely to race and gender—or merely to marginalized identities—is not necessary and accurate. Similarly, it is not true to claim that the theory cannot be applied to social categories other than race and gender (Carbado, 2013). Both Carbado (2013) and Gopaldas (2013) discuss how scholars have effectively used intersectionality to examine various aspects of difference, such as class, sexual orientation, nationality, citizenship, immigration status, disability, and religion, not just race and gender, and studied various systems of power, privilege, and marginalization.

My goal in this study is to understand the simultaneous and intersectional operation of power structures beyond a plain discussion of individuals' identities (see Cooper, 2015; Schuller, 2021). Cooper (2015) states that the primary concern of intersectionality is not about individuals' identities but about how power structures and relations within institutions restrict or increase the opportunities available to individuals at the intersection of particular identity categories. For this reason, I value inviting women with privileged and marginalized identities to the study. This invitation can enrich the discussions because privilege and oppression coexist, and they are "the two sides of the same coin" (Goodman, 2015, p. 1). Acknowledging that oppressive systems consist of both privileges and oppression can help better understand how power relations work. Goodman (2015) recognizes that individuals simultaneously have marginalized and privileged identities. According to Goodman, discussing privilege and oppression is critical to challenging and disrupting systems that unfairly privilege or oppress individuals.

Considering Cooper's (2015) and Schuller's (2021) focus on an intersectional analysis of power structures, I also find recruiting women with multiple marginalized identities important. Inviting women with multiple marginalized identities to the study is significant and necessary because the experiences of marginalized people can reveal the actual functioning of power in all its various forms (Schuller, 2021). The White masculine culture of engineering education creates a chilly climate for women, especially those with multiple marginalized identities (Blosser, 2020; Ong et al., 2020). While gender identity is one source of marginalization for women in community college STEM programs, women of color, student mothers, women from lower socioeconomic backgrounds, or women with a disability experience multiple forms of marginalization (see Choi, 2021; Jain, 2009; Melendez, 2017; Wickersham & Wang, 2016). Revealing women's multiple identities and realities within the interlocking systems of privilege

and oppression will also help answer what women with multiple marginalized identities experience at the intersection of multiple forms of oppression. This understanding is necessary to create more inclusive and equitable engineering programs in community colleges.

Based on these discussions, my approach to employing intersectionality is to ask the participants about their central identities and open a space for them to build conversations upon these social locations. I prefer to avoid entering the study with pre-determined intersectional identities because their central identities may differ from what I want to focus on. Entering the study with pre-determined categories may limit what intersectionality can offer as a theoretical framework in this study. For example, I may focus only on the intersections of being a first-generation woman of color in community college engineering programs. However, if a participant's central identities—as described by the participant—are shaped around being a single-parent woman of color, I may miss critical information about the single-parent identity in this case.

In this study, multiple and intersectional identities refer to all aspects of women's identities. While identities are used for recruitment purposes, my approach emphasizes the significance of multiple and intersecting power structures shaping women's experiences. I aim to understand how various systems of power, privilege, and oppression intersect to shape women's experiences in the Associate in Engineering degree programs in North Carolina community colleges, thereby either restricting or expanding their opportunities to access resources that would benefit them.

Naming the Missing Intersectionality Dimension in Research with Women in STEM

Although an intersectional approach to understanding the complexity of women's experiences in STEM offers the benefits mentioned in the previous section, this theoretical

framework has been underutilized in women in STEM research. Diving deeper into the history of research on women and STEM, the impact of the feminist movement is evident starting in the 1960s. Within the male-dominated history of STEM in higher education, the 1960s stood out with a feminist interest in the historically and culturally male-dominated areas, an interest brought by the second wave of the feminist movement. However, articles on women in science were sparse in the journals published between 1970 and 1995, and most publications focused on specific women and their professional expertise (Zanish-Belcher, 1998). Studies mainly focused on marriage, maternity, and their effects on women's occupational choices and careers (see Miller, 1957; Rossi, 1965; Rule, 1965). The recommendations for how to close the gender gap in STEM remained at the individual level, suggesting that women were responsible for overcoming institutional barriers (see Miller, 1957; White, 1970). Women's underrepresentation in STEM was a problem that women needed to solve by finding ways to fit into the existing institutional structures without critiquing the social and institutional power structures and hierarchies that marginalized them. The conceptualization of gender identity in these publications also reflected the perception of womanhood as a single homogenous social category representing White middle-class women (Munro, 2013).

In the 1990s, there was an increased need for American scientists and engineers, leading to an academic interest in understanding systemic barriers to women's participation in STEM (Brush, 1991; Rosser, 1993). Scholars acknowledged that women's science and engineering pathways were diverse, and institutional barriers to science careers differed for men and women (Ambrose et al., 1998; Barber, 1995; Sonnert, 1999). Transforming the culture of science instead of assimilating women into the existing discriminatory culture of science started to be seen as the key to narrowing the gender gap in science and engineering (Barber, 1995; Harding, 1995;

Rasmussen & Hapnes, 1991; Rosser, 1993; Sonnert, 1999). Some scholars explored why the “leaky pipeline” was leaking women scientists as they advanced in their education and transitioned into the workforce (Alper, 1993; Pell, 1996). However, the limitations of this metaphor were also evident because ethnically and racially minoritized women often did not have access to the pipeline from the outset (Wickware, 1997). This awareness paralleled the third-wave feminist movement’s debates on the homogeneity of womanhood in the mid-90s, with the recognition of intersectionality and how the intersections of racism, sexism, and classism positioned women of color in unique ways (Fernandes, 2010).

Despite this recognition, studies continued to explore women’s social position in STEM from the lens of a homogenous woman identity into the 2000s (Blickenstaff, 2005; Soe & Yakura, 2008). Gayles and Smith (2019) systematically reviewed journal articles on women in STEM between 2007 and 2017. They found that only a few studies framed their analysis via theories concerning women’s multiple identities and oppressive intersectional power structures. Social cognitive career theory was one of the most commonly used frameworks, focusing on women’s characteristics (e.g., gender, race, ethnicity), environmental influences (e.g., supports and challenges), and outcomes (i.e., career outcomes). Thus, studies were limited in addressing the role of intersectional oppressions and hierarchical distributions of power (Gayles & Smith, 2019). In the studies published after 2018, social cognitive career theory has remained one of the most commonly used theoretical frameworks to study women’s underrepresentation in STEM fields (see Cohen & Kelly, 2020; Erkkila, 2019; Evans et al., 2020; Marco-Bujosa et al., 2021; Wang & Wickersham, 2019).

Ignoring intersectional realities and oversimplifying the complexity of women’s identities results in a loss of critical information about women’s experiences in STEM (Gayles & Smith,

2019; Rodriguez et al., 2017). Within these male-dominated sociohistorical and institutional contexts that silence and marginalize women, this study addresses the need for understanding women's experiences in community college engineering programs by situating these experiences within the broader interlocking systems of power, privilege, and marginalization.

Understanding Women in STEM in Community Colleges: Multiple Identities and Life Experiences

Factors shaping student experiences in community college are complex due to their diverse identities and backgrounds (Khan & Unruh, 2022; Wickersham & Wang, 2016). They are more likely to come from racially minoritized backgrounds, be first-generation students and caretakers, and work while enrolled (Khan & Unruh, 2022). While women are less likely to pursue STEM than their male peers, their individual, complex, and intertwining identities are related to their STEM pathways in community colleges (Evans et al., 2020; Wang & Wickersham, 2019; Zhang, 2019). Women's younger age and full-time enrollment significantly predict their intentions to transfer into STEM (Jorstad et al., 2017).

External obligations like family and work commitments and having fewer socioeconomic resources than their peers at four-year institutions affect community college students (Anderson & Nieves, 2020; Baber, 2018; Baugus, 2020; Leggett-Robinson et al., 2018; Velez et al., 2018; Wickersham & Wang, 2016). Sallee and Cox's (2019) study reveals student mothers' challenges in accessing all-day and affordable childcare on community college campuses. They have to navigate their roles as mothers and students on their own. The lack of campus facilities like lactation rooms or study spaces that allow student parents to use the space with their children gives students the message that being a student and a mother are two incompatible roles. Although Sallee and Cox's (2019) study do not specifically focus on women in STEM, the

majority of participants are women in community colleges, and the findings inform the current study about the need for attending to women's identities as mothers and parents in the community college setting. Employing an intersectional lens to investigate women's experiences will help increase the visibility of the experiences that come with these identities.

The perceived incompatibility of these roles (i.e. being a mother and a student) gives women stress, shame, and isolation that result from the pressure to balance their identities as mothers and students (Lovell & Scott, 2020; Madden, 2018). Madden's interviews reveal more challenges than support systems for low-income pregnant and parenting women in community colleges. These findings reflect the male-dominated history of higher education. The systemic and structural contexts that fail to support student mothers leave them with feelings of shame and guilt as student mothers trying to navigate their education independently.

Another critical student background characteristic for this study is precollegiate academic experiences in STEM as they inform a student's interest in STEM careers (Erkkila, 2019; Evans et al., 2020; Jorstad et al., 2017; Lichtenberger & George-Jackson, 2013; Tyson, 2011). Students who take science and performance courses in high school are more likely to demonstrate an increased interest in STEM (Lichtenberger & George-Jackson, 2013), and women who have taken previous math courses are more likely to transfer into STEM (Jorstad et al., 2017). It is also worth noting that students from lower socioeconomic backgrounds do not have access to opportunities to prepare for STEM pathways in high school (Bottia et al., 2022). Not all these studies focus on women's experiences, but they all inform my study about the importance of precollegiate STEM exposure in developing an interest in STEM careers and how socioeconomic background can intersect with these previous STEM experiences. The current study will extend

these findings by demonstrating how women with multiple intersecting identities develop an interest in pursuing an engineering transfer pathway.

Focusing on high school science and math coursework, Tyson et al. (2007) analyze the longitudinal quantitative Florida Longitudinal Education and Employment Dataset by students' racial, class, and gender identities. Accordingly, although women complete high-level science and math courses, they are less likely to complete the highest-level science and mathematics courses. Even when women take high-level science and math courses, they are less likely to complete their STEM degrees than men. As for racial identities, Black and Hispanic students are more likely to take lower-level high school science and mathematics courses, but when they take high-level courses, their likelihood of pursuing STEM degrees is similar to White students. These findings underscore the gender and racial inequities in the academic preparation of Black and Hispanic students for college STEM degrees. However, we also need studies taking an intersectional approach. This study builds upon Tyson et al.'s findings by bringing an intersectional approach to understanding women's pre-college academic preparation to study in a community college engineering program.

Wang (2013) contributes to these discussions by comparing students' STEM interests in two- and four-year institutions by attending their high school science and math courses. High school science and math courses are more likely to influence four-year beginners' STEM interests than community college students. Although exposure to high school math and science courses positively predicts community college students' STEM interests, the effect is much smaller. However, quantitative studies like this still need to be expanded in explaining why and how community college STEM populations differ from their peers in four-year institutions. The current study builds upon these quantitative findings by employing a qualitative approach to gain

a more comprehensive and nuanced understanding of women's pre-collegiate experiences that have prepared them for engineering education in community colleges.

In addition to the pre-collegiate STEM exposure, family is a source of support and frustration for women's interest in STEM careers and intellectual development (Choi, 2021; Erkkila, 2019; Yap, 2022). When one woman, a community college student, in Erkkila's (2019) study shared her interest in Wind Energy, her mother provided her with the resources she would need to navigate her interest in this field. However, family involvement is also challenging when the decision-making process involves the whole family without room for independent thought (Erkkila, 2019). The family is also a source of pressure with the involvement of gender stereotypes (Choi, 2021; Erkkila, 2019).

Accommodating the needs of this diverse student population requires developing multiple pathways for success based on their unique experiences and needs (Green, 2006). As women come to community colleges with these multiple identities and life experiences, they have diverse needs to succeed academically, and one-size-fits-all programs fail to address these needs. This recognition is crucial in moving away from a deficit model of understanding community college student experiences. The deficit model suggests that students from minoritized and lower socioeconomic backgrounds cannot be successful in college and justifies policies and programs that serve the traditional student (Green, 2006). At this point, intersectionality becomes a helpful tool to understand their diverse backgrounds, identities, experiences, and unique needs informed by the intersecting systems of oppression and marginalization. Intersectionality helps to deconstruct the adjectives used to describe them: Who is underprivileged? Who is disadvantaged? Who is underprepared? As we explore these questions, we will realize that the answers are not single identities but consist of multiple and intersecting identities. Answering

these questions also helps us explore our biases and assumptions and allow us to challenge the status quo and existing power relationships that deem these students underrepresented, underprivileged, and disadvantaged at the intersection of multiple socially constructed power relations (see Clark, 2012).

A Feminist Critique of Engineering Education in the United States

The manifestation of sexist and racist structural inequities in engineering education has a long history, with persistent underrepresentation of women and people of color (Secules, 2019; Simmons & Lord, 2019). This section focuses on four-year engineering programs to discuss their gendered history, masculine and competitive cultures, and how these cultures create a chilly climate for women with multiple marginalized identities in engineering.

A Gendered History of Engineering Education

In her book, *STEM Education for the 21st Century*, Penprase (2020) discusses the male-dominated history of STEM in U.S. higher education. The number of higher education institutions in the U.S. increased rapidly by the early nineteenth century, but the enrollments were limited to almost only White men. Even after the Morrill Act of 1862 emphasized the significance of access to higher education and the diversity of the student body, higher education was still mainly serving White men (Penprase, 2020). The first women who entered engineering programs in land-grant higher education institutions and small private universities in the late 1800s were marginalized as “others” and “invaders” in the male-only engineering world (Bix, 2014, p.1). In the early 1900s, women were allowed to audit some engineering courses but were not allowed to enroll in them (Sloan, 1975).

The United States underwent far-reaching scientific and technological advances after World War II, and a quarter of college degrees were in STEM by the 1960s (Penprase, 2020).

However, structural barriers that were sexist, racist, and classist continued to limit who would have access to STEM education. The social and academic engineering environments were not welcoming for women due to their gendered and masculine traditions. The leading institutions that delivered engineering education did not enroll women during World War II and beyond. The academic honor societies did not recognize women's successes and excellence in engineering, denying their full membership in these societies (Bix, 2014).

From World War II to the 1960s, the leading higher education institutions experienced social, legal, and political pressures to transition to co-education in engineering. World War II transformed gendered aspects of the labor force, and women participated in even heavy industrial jobs as men fulfilled the needs of the international emergency and U.S. military. At the same time, the second wave of the feminist movement and the social and cultural changes in American life facilitated removing barriers to women's education and participation in the labor force. However, integration did not coincide with co-education, and engineering education remained unwelcoming for many women due to women's marginalization, isolation, and harassment (Bix, 2014).

In the early 1970s, the percentage of female engineering degree holders was around 1% (National Center for Education Statistics, 2019). In the meantime, engineering schools and society intentionally discouraged women from pursuing engineering due to the perception of engineering as a male profession (Sloan, 1975). However, the civil rights movement, women's rights movement, and federal legislation demanding equal opportunities in education and employment took place simultaneously in the second half of the 1960s (LeBold & LeBold, 1994). Women's demands for equity in education and employment in the 1960s and 1970s would also lead to a growth in women's engineering enrollments toward the end of this period.

In addition, the engineering schools that suffered from low enrollments were willing to admit women (Sloan, 1975). The female representation among engineering degree holders reached 11% in the early 1990s, 18% in the early 2000s, and 21% in the 2017-2018 academic year (National Center for Education Statistics, 2019). These percentages also paralleled the percentage of women working in engineering occupations, which increased from 3% in 1970 to 15% in 2019 (Martinez & Christnacht, 2021).

Recent studies indicate that women's marginalization in engineering education and the workforce continues. Smith and Gayles (2018) interviewed ten women engineering seniors to investigate their gendered experiences within academic and workplace settings. While implicit bias was challenging for women in their educational settings, workplace settings were more unsupportive, hostile, and discriminatory, replete with bias, sexism, and sexual harassment. Although there were campus resources for these women, women avoided using them due to concerns that others would perceive a lack of sufficient skills to pursue engineering. These findings demonstrate that engineering education and occupations are still perceived as male occupations and that women may not benefit from the diversity-focused and gender-exclusive resources available.

Although women have been historically and collectively marginalized in engineering education, the narratives that promote the significance of individual merits to study engineering individualize and mask this institutional and systemic problem. In Seron et al.'s (2018) study, women presented evidence of inequality and demonstrated signs of marginality (feelings of inferiority, self-doubt, and lack of self-confidence). Their dissatisfaction was due to a perceived personal inability to meet the high standards of engineering. The ideology of meritocracy makes engineering students believe that they obtained their place in engineering due to their efforts.

Any efforts to address diversity and equity in engineering are perceived to threaten engineering quality, resulting in little support to promote diversity programs (Seron et al., 2018). Ignoring women's collective marginalization serves to maintain and reproduce White supremacy and patriarchy in engineering education (Seron et al., 2018; Pawley, 2019).

Similarly, grounding the arguments in the critical theory, Pawley (2019) suggests that higher education in the United States reflects the social structures grounded in White supremacy and patriarchy. Accordingly, higher education produces and maintains the social, cultural, economic, and institutional elite privileges for White and class-privileged men. According to Pawley, this is because of the "historical architecture of the institution," which "requires dismantling to produce engineering as a more demographically just profession" (Pawley, 2019, p. 27).

Pawley's (2019) critique of higher education institutions underscores the intersectional nature of women's experiences with sexism, racism, and classism. Black women tend to report a more hostile engineering education climate than their White counterparts, suggesting racialized and gendered oppressions work together in shaping Black women's experiences (Rincón & George-Jackson, 2016). Similarly, Stitt and Happel-Parkins (2019) interviewed nine undergraduate Black women engineering students at a predominantly White institution. All participants mentioned situations where they "felt ignored, under-estimated, dismissed, or excluded" at the intersection of racialized and gendered experiences (p. 70). The marginalization came from all directions, including their professors, advisors, peers, and Black communities, due to internalized racism.

Policies and practices in engineering education serve to govern the majority and fail to attend to the needs of students who have been socially and structurally marginalized (Pawley,

2019). In this context, economics of scale, which requires investments made for many instead of for few, and meritocracy, which maintains and reproduces existing privileges, are used to justify these policies and practices (Pawley, 2019). However, any policy or practice ignoring race and gender reproduces the institutions' White, class-privileged, and masculine ideals. For example, the financial aid system privileges some students because students who do not need to use the financial aid system may have more time and energy to dedicate to their studies than those who need to use the financial aid system and spend time and effort to develop the literacy of how it works. When this system privileges White, class-privileged men, race and economic power connect, creating a raced ruling class. Developing literacy about how this system works becomes an individual responsibility that students with multiple marginalized identities need to shoulder (Pawley, 2019). In an environment marred by multiple forms of oppression and marginalization—including, but not limited to, racism, sexism, and classism—it is crucial to explore how to improve equity for women of different races and social classes.

A Masculine and Competitive Culture

Engineering remains historically and stereotypically a White male middle-class occupation, and masculinity is deeply embedded in its disciplinary history through vocabulary, social exclusion, marginalization, and male domination (Bastalich et al., 2007; Cheryan et al., 2015; McLean et al., 1997; Secules, 2019; Seymour, 1995). A masculine culture creates a social and academic environment that privileges men to develop a greater sense of belonging and the ability to be successful (Cheryan et al., 2017). Just like the ideology of meritocracy (see Pawley, 2019), the competitive discourse legitimizes gender-based, racial, and socioeconomic exclusion and marginalization by producing and maintaining a social hierarchy between deserving winners and unworthy losers (Secules, 2019). Not attending to the identities of these winners and losers

and not naming the systems of oppression and marginalization that create these categories hide existing power relations that shape individuals' experiences (Secules, 2019).

Higher education, social life, and engineering workspaces collectively perpetuate the perception of engineering as a masculine space. In social life, this perception is reproduced and maintained through engineering stereotypes through associations between engineers with men (Cheryan et al., 2015). In higher education, women have been historically and systematically excluded from the production of knowledge (Thomas, 1990), and the media presentations of women engineers reflect this exclusion. The media, for example, fails to portray women in engineering as knowledge authority. Instead, male colleagues continuously challenge and question their knowledge (Steinke, 2005). Engineering workspaces maintain this social hierarchy through conversations concentrating on male interests, male networks, offensive language toward women, heteronormatively sexualized environments, and forcing women to conform to masculine norms (Faulkner, 2009).

Within this male-dominated culture, it is not surprising that women are less likely to major in engineering (Cheryan et al., 2015; Sax, 2008; Sax et al., 2016). Highlighting how the masculinity and competitiveness of engineering cultures can harm women, Banda (2020) employed a case study design to explore 11 Latina female engineering students' experiences. Participants described the competition using the phrase "dog eat dog" (p. 831), and they underscored the negative impact of this competitive environment on their education. Grading practices reproduced the competitive culture and created an environment that set students up for failure. Female Latina students reported feeling marginalized at the intersection of sexist, racist, and classist oppressive structures embedded in engineering cultures.

A “Chilly Climate” for Women

Hall and Sandler (1982) described the classroom climate for women in traditionally masculine fields as a “chilly climate.” They underscored the roles of subtle (e.g., interrupting women while they speak) and overt forms of discrimination (e.g., sexist humor) in creating a chilly climate for women in the class. The chilly climate is evident in women’s intersectional marginalization, oppression, and isolation in the four-year engineering programs (Blosser, 2020; Camacho & Lord, 2011; Dortch & Patel, 2017; Ong et al., 2020; Rincón & George-Jackson, 2016; Thomas et al., 2021). Women of color portray their marginalization through descriptive utterances like being the “other” (Blosser, 2020, p. 60) and being a “unicorn” (Rodriguez & Blaney, 2021, p. 448) in the engineering field. By comparing herself to unicorns that are “mythological, rare, and enigmatic creatures,” a Latina engineering student highlighted how the perception of engineering as a male space made her feel as a future engineer (Rodriguez & Blaney, 2021, p. 448).

Participating in engineering as a woman of color is not the norm (Blosser, 2020; Ong et al., 2020). Blosser (2020) explored the marginalization of Black women in engineering by interviewing 12 Black women studying engineering at one flagship university in the Southern United States. Participants mentioned discomfort and anxiety about being the only Black woman in the space. Ong et al.’s (2020) study examined 65 empirical studies published between 1999 and 2015 to understand the factors contributing to the participation and advancement of women of color in engineering education and revealed similar findings. The social pain came from four sources, being the only Black woman, not being seen or being hyper-seen, gendered and racial stereotypes, discrimination, and harassment. The White masculine culture of engineering

education creates a chilly climate for women, especially for those with multiple marginalized identities.

These studies provide further evidence for sexist and racist structural inequities in undergraduate engineering education and underscore the importance of challenging male competitive characteristics of engineering education to create more equitable and inclusive engineering education for women with diverse identities. “How are community college engineering programs situated within this engineering education culture?” is an essential question that needs to be addressed to understand the contextual factors contributing to women’s experiences in the engineering transfer pathway in community colleges. The following section presents a discussion of opportunities and challenges for women in community college engineering programs.

Women in Community College Engineering Programs

Community colleges have a unique potential to diversify engineering education by supporting the transfer of racially and ethnically minoritized students, women, first-generation students, older adults, and students from lower socioeconomic backgrounds to four-year engineering programs (Starobin & Laanan, 2008; Zhang & Ozuna, 2015). However, although transfer programs aim for a “seamless transition” to a four-year institution and engineering education (Engineering Pathways, n.d.), research shows that this transition is not as seamless as intended due to the social, academic, and contextual differences between community college and four-year engineering programs (see Allen et al., 2022; Elliot & Lakin, 2021; Zhang & Ozuna, 2015). Therefore, understanding the differences between community college and four-year engineering education contexts is necessary before focusing on women’s experiences in community college engineering programs. This section draws from STEM and engineering

transfer literature discussing the social and academic differences between community college and four-year engineering programs.

Opportunities for Women

This section summarizes critical research which informs this study about the differences between the engineering education contexts in community colleges and four-year institutions. Research demonstrates that community college engineering classrooms can positively impact underrepresented students in engineering. The characteristics that led to this conclusion are smaller classes, teaching focus, and a warmer climate with positive engagements between faculty and students compared to four-year engineering classrooms (Berhane et al., 2023; Stack Hankey et al., 2019; Townsend & Wilson, 2006; Zhang & Ozuna, 2015).

Zhang and Ozuna (2015) examined engineering students' community college experiences before transferring to a four-year university. Although this study does not focus only on women's experiences, it offers valuable insight into understanding the differences between engineering education in community colleges and four-year universities because the participants experienced both environments as transfer students. Their findings indicate that community colleges provide a safe space for students to explore their interests in engineering. Some participants enrolled in community colleges because they did not know the application process for four-year institutions and were not sure about their abilities to learn as college students. Among the participants, many were first-generation students and had difficulty knowing which engineering discipline they were interested in. Students reported that "community college instructors were more accessible, personable, and dedicated to teaching" (p. 360). Community college professors cared about good teaching to ensure student learning. They were influential in recognizing the students' abilities, talents, and interests. These students resided off campus, had

multiple responsibilities, and were on campus only when they had a class. Therefore, community college faculty was the only regular contact point, and their recognition was significant because students' campus experience was limited to the classroom experience (Zhang & Ozuna, 2015). One limitation of this study was the underrepresentation of women (four female students out of 21 participants). The study remained limited in portraying women's multiple realities that inform their needs and challenges.

Building upon Zhang and Ozuna's (2015) study, Elliot and Lakin (2021) studied the post-transfer contributors of transfer shock in STEM. Women constituted 52% of their sample, and their definition of STEM disciplines also involved engineering students. For this reason, their findings are significant in discussing the differences between community college and four-year university engineering programs. Their findings highlight the differential academic norms between community colleges and four-year STEM programs, which are about exams, where to get help, and expected ways of learning. In community college exams, students are responsible for the coverage during class time; however, in four-year institutions, they are responsible for all the relevant content, whether the professor has spent time on it in class or not. One engineering student reported a case in which they studied only the slides shared by the professor. The professor did not mention that they needed to read the book, and they did not cover the book in class. All the exam questions would come from direct classroom materials in community college, but this was different in the four-year engineering program. Students considered the community college context more teaching-centric, with higher faculty availability and approachability. In four-year institutions, students mentioned waiting in long lines in front of the faculty offices to ask only one question. Understanding the course content and completing the assignments meant spending a great deal of out-of-class time and effort working independently. However, the

community college context required less effort in independent learning because support was often available (Elliot & Lakin, 2021).

Women who transfer from a community college to a four-year STEM program benefit from peer support and their interactions with professors in community colleges (Allen et al., 2022; Blaney, 2022; Packard et al., 2011; Starobin & Laanan, 2008; Yap, 2022). Starobin and Laanan's (2008) qualitative examination explored students' learning experiences in outstanding transfer programs (i.e., programs that allow transfer from a two-year institution to a four-year institution). Positive personal interactions with faculty and counselors consistently emerged as a significant theme contributing to women's STEM success in these interviews. Participants remembered key moments with faculty members and counselors, telling them they could study engineering and become engineers. Similarly, Allen et al. (2022) employed longitudinal interview data from seven Black women who were community college students intending to transfer to a four-year STEM program. With their smaller class sizes, teaching focus, and greater student diversity, community colleges offered a greater capacity to create supportive environments for Black women. In contrast, at four-year institutions, transfer students reported the negative impacts of systemic racism and sexism, a decreased capacity for supportive relationships, and poor-quality lecture-based teaching on their STEM success. Larger classes and campus sizes were also associated with feelings of disconnection (Allen et al., 2022).

While the existing research demonstrates that community college STEM programs offer opportunities for women, most of this research has taken a monolithic approach to defining STEM disciplines. However, we need more in-depth discipline-specific studies because different programs in different STEM disciplines have unique cultures, policies, and practices (Reinholz et

al., 2019). In the following section, I discuss the challenges for women in engineering programs in community colleges.

Challenges for Women

Although the community college engineering classroom offers support and opportunities for women, the masculine engineering culture remains. For example, Marco-Bujosa et al.'s study (2021) focused on two community college engineering programs to explore the gendered experiences of male and female students. Their findings revealed women's challenges with social intimidation and their male peers' inappropriate behaviors. The engineering culture was more like a boy's club, in which women did not feel part of the conversation and felt uncomfortable. Women's persistence was alienation from their femininity to fit in a male-dominated environment. Due to the dominant masculine culture, feminine characteristics were not welcomed. Women were proud of undoing their gender, and women in community college engineering programs were not perceived as "girly girls" by their male peers (p. 511). Even when academic support was available, women first needed to overcome social and institutional barriers, which brought them feelings of isolation and marginalization (Marco-Bujosa et al., 2021). One limitation of this study was not taking an intersectional approach in the data analysis, which may mean a loss of information about women's multiple realities in the program. How women with multiple marginalized identities experience feelings of isolation and marginalization remains unanswered.

Classroom interactions with faculty and engineering course designs are another challenge for women in community colleges (Allen et al., 2022; Jain, 2009; Knaphus-Soran et al., 2020; Lester et al., 2016; Melendez, 2017). Women in these studies described situations in which they felt ashamed by an instructor's comment in front of the class. One Latina student in Melendez's

(2017) study described a situation in which the instructor made her feel uncomfortable for asking a question about a point she could not understand. Her peers in the class were White, and her lack of Latino peer support systems to ask questions made her feel isolated after hearing the instructor's response to her question. Similarly, one woman in Knaphus-Soran et al.'s (2020) study described feeling stupid in front of the class due to her instructor's response to her question. A woman in Lester et al.'s (2016) study reported an adverse classroom climate created by a female instructor. This female instructor believed that engineering education should be harsh for women because engineering is not a welcoming environment for them.

Women engineering students in community colleges question their support systems (Knaphus-Soran et al., 2020), although they would benefit from role models, encouragement, and networking opportunities (Jorstad et al., 2017). While women, as students, remain underrepresented in community college engineering programs, women are also underrepresented in faculty positions (Allen et al., 2022; Herrera et al., 2022). Women's underrepresentation among faculty may have consequences for women community college students' challenges in accessing mentoring to build engineering careers. Existing research demonstrates instances in which women are openly discouraged from pursuing engineering careers. One woman of color in Jain's (2009) study reported an instance in which she was discouraged from pursuing engineering because a business career might be easier for her. Similarly, Meghan, a woman who intended to major in chemical engineering, reported discouraging academic experiences in Allen et al.'s (2022) study. These findings also align with other studies which indicated women's exclusion from conversations about engineering careers in community colleges (Knaphus-Soran et al., 2020; Rincon, 2017), and these findings may also explain why women in engineering

programs in community colleges are more likely to switch out of engineering programs than men (Rincon, 2017).

Understanding the multiple realities of women (i.e., experiences, needs, and challenges informed by sexist, racist, heteronormative, and classist power structures) is significant to serve these students better. While community colleges offer some opportunities for women, they receive criticism for failing to adequately prepare students for four-year programs (Knaphus-Soran et al., 2020; Laanan et al., 2010). This section presented the contextual differences in engineering education in community colleges and four-year institutions while presenting the opportunities and challenges for women in these spaces. This contextual information is vital for this study for two reasons. First, this study aims to understand how women with multiple and intersecting identities experience their engineering education in community colleges. Second, this study aims to understand how community colleges can encourage women to consider the transfer option. Understanding these contextual differences and women's concerns about them is a must in supporting women's seamless and smooth transition to a four-year engineering education program. In addition, although community college contexts offer a more supportive environment for women, it is evident that women need more support in these masculine spaces as more women switch out of engineering programs more often than their male peers. What *more support* means for women with multiple marginalized identities and how simultaneously operating multiple forms of oppression shape their challenges and needs still needs further investigation. This study addresses this need by taking an intersectional approach to studying women's experiences in community college engineering programs.

Transfer Aspirations

The transfer mechanism is particularly significant for women in community college STEM programs for two reasons. First, the engineering transfer pathway, with more women from socioeconomically and racially diverse backgrounds, offers opportunities to close the equity gaps in the engineering workforce (Knight et al., 2014). However, women remain underrepresented in community college pre-engineering programs and the transfer student samples in four-year engineering programs (Knight et al., 2014), which makes it essential to study women's transfer aspirations in Associate in Engineering programs. Second, although starting in a community college is negatively related to STEM bachelor's degree attainment for men, this is not the case for women. Attending a community college before the four-year STEM program does not negatively influence women's STEM degree attainment (Hu & Ortagus, 2019). These two reasons make further exploration of women's transfer aspirations in community college engineering programs significant. This section draws from STEM and engineering transfer literature to understand the factors contributing to women's transfer aspirations in engineering programs.

Demographic Characteristics and Life Experiences Associated with Transfer

Women are reported to be less likely than men to have STEM transfer aspirations, in a study by Myers et al. (2015) who developed a measurement model for community college students' intentions to transfer to and major in STEM. Research documents the role of multiple life experiences, demographic identities, and roles in women's experiences and transfer intentions in STEM (Acevedo et al., 2021; Herrera et al., 2022; Reyes, 2011; Wang & Wickersham, 2019; Wickersham & Wang, 2016). For example, in Wang and Wickersham's (2019) study, there were age-related and racial disparities in women's transfer aspirations.

In addition to race, older age, part-time enrollment status, and being married are significant predictors of lower transfer aspirations and rates for women in STEM disciplines (Jorstad et al., 2017; Wang & Wickersham, 2019). This finding calls for an intersectional approach to understanding women's transfer aspirations because they reveal their unique needs at the intersections of these demographics and life experiences. Jorstad et al. (2017) highlight that women who are also adult learners come to community colleges with different needs than younger women. For example, having a full-time job or parenting status may bring different needs and challenges than a younger community college student's needs (see also Wickersham & Wang, 2016).

Financial factors also impact women's transfer aspirations. One woman in Packard et al.'s (2011) study, which explored women's experiences in the STEM transfer pathway, mentioned that she could not prioritize the bachelor's degree attainment due to family finances and her parenting roles. Similarly, another woman did not know how to finance a four-year program as she needed to work. However, it is also critical to note that the transfer pathway can become a path to hope for these women with financial challenges. For example, one woman in Wickersham and Wang's (2016) study, which investigated women's transfer intentions in STEM, shared how transfer and a bachelor's degree could be a path to hope and change in her life.

While these findings underscore the importance of women's multiple and intersecting identities in understanding their transfer aspirations in STEM, these studies do not focus only on women in community college engineering programs. The current study aims to extend this body of knowledge on women in STEM by developing a more nuanced and in-depth understanding of

how women's transfer aspirations are shaped within the interlocking power structures of community college engineering programs.

Institutional Factors Associated with Transfer

A critical facilitator in women's engineering transfer process is having access to institutional resources (Packard et al., 2011; Starobin & Laanan, 2008; Wickersham & Wang, 2016). For example, in Packard et al.'s (2011) study, one woman who planned to study engineering found the math resource center in her institution useful. Starobin and Laanan (2008) found the critical role of faculty and program coordinators in women's persistence in engineering programs and their transfer intentions.

However, when the masculine cultures of engineering programs are considered, interactions with faculty can also be a source of stress for women in community college engineering programs. While women engage more with faculty in class and during office hours, men have access to faculty during office hours and outside the class (Knaphus-Soran et al., 2020). More limited access to faculty could be why Denner et al.'s (2014) found peer encouragement as a stronger predictor of STEM transfer aspiration for women than men. However, this finding still needs further investigation within the context of Associate in Engineering programs because Paola, a woman of color in engineering, in Jain's (2009) study reported racist and sexist discriminatory behaviors from peers and professors. She reported being demoralized by peers and her professors. These findings necessitate focusing on community college classrooms and women's interactions with faculty and advisors to understand women's transfer aspirations in Associate in Engineering programs.

Effective transfer advising support mechanisms are also important to support women in the STEM transfer pathway (Packard et al., 2011). Women who seek advice from academic

advisors or counselors are more likely to transfer into STEM (Jorstad et al., 2017). On the other hand, the lack of proper advising mechanisms served as a barrier to transfer (Packard et al., 2012). Supporting women engineering students in the transfer process necessitates understanding their unique experiences with the transfer advising mechanisms. In addition, research demonstrates the importance of the involvement of four-year institutions in the transfer process (Fink & Jenkins, 2017; Jackson, 2013; Rodriguez et al., 2021). In Rodriguez et al.'s (2021) study, one first-generation female participant highlighted the importance of advisors from four-year institutions in relieving students' concerns about having the necessary skills and transfer credits to be successful in a four-year engineering program.

All in all, existing research demonstrates the significance of institutional resources, faculty, advisors, and involvement of four-year institutions in shaping women's transfer aspirations in engineering. The existing research also underlines how women's social locations within the interlocking systems of privilege and oppression can inform their community college experiences and transfer aspirations in STEM (see Berhane et al., 2023; Jain, 2009; Melendez, 2017; Wickersham & Wang, 2016). Women with different intersecting identities will have different needs when making transfer decisions based on their needs and available social and institutional support systems. A better and more comprehensive understanding of these experiences and needs is essential to meet women in community college engineering programs where they are.

Lacking Sense of Belonging for Women Transfer Students in Engineering

How STEM environments and achievements are communicated to students impacts how students perceive themselves and their ability to thrive in STEM (Jackson & Laanan, 2011; Packard et al., 2011; Ramsey et al., 2013; Wang & Wickersham, 2019). The intersection of

adverse experiences and unwelcoming STEM culture negatively impacts women's sense of identity, belonging, and efficacy, all significant to STEM retention and persistence (Leggett-Robinson et al., 2018; Rainey et al., 2018; Rodriguez et al., 2019). Although this study does not focus on women's transfer experiences, the studies on transfer student stigma inform the current study because their findings provide insight into how engineering cultures and community college stigma may contribute to the complexity of women's transfer aspirations.

High-stakes assessment practices, weed-out courses, and grading practices that make students doubt their abilities negate students' sense of belonging in STEM majors. While these challenges are valid for all students, being a transfer student also brings additional challenges (Holland Zahner & Harper, 2022). Engineering transfer students have more significant challenges with integration, especially at more selective institutions, because student success programs for non-transfer students are also more common in these institutions than student success programs for transfer students (Ogilvie & Knight, 2021). One first-generation Latina engineering transfer student in Holland Zahner and Harper's (2022) study shared how her financial challenges are visible in her grades. Not having a straightforward path to engineering, she questioned whether she belonged and was smart enough to study engineering. She added that she would have already completed her degree with better resources. Another woman, a transfer student, shared the negative impact of the competitive environment on her and how she questioned her belonging to the computer science space. Similarly, women in Jackson and Laanan's (2011) study reported feeling that their abilities were overlooked due to stigma and negative perceptions of transfer students in four-year science and engineering programs. Therefore, in addition to gender stereotypes, transfer student stigmatization remains a challenge for women considering the transfer option (Laanan et al., 2010).

To summarize, community colleges and their advising mechanisms play a key role in impacting students' transfer outcomes. While student characteristics are also important, they are not the mere determiners of this outcome. This situation is especially important for students who lack family and social support systems in navigating the transfer process (Jabbar et al., 2019; Jackson, 2013).

Conclusion

The underrepresentation of women in Associate in Engineering programs in North Carolina community colleges and their underrepresentation as transfer students in four-year engineering programs necessitates an exploration of their experiences to enhance how community colleges serve and support their learning and aspirations. In engineering education's masculine and competitive history, community colleges offer unique capacities and opportunities as entry points for women's engineering education. Women benefit from peer support and interactions with professors in community college engineering programs. Community colleges, with their smaller class sizes, focus on teaching and learning, and greater student diversity offer a more supportive engineering education environment for women compared to the chilly climates of four-year engineering programs especially for women with multiple marginalized identities.

Despite these opportunities, women also experience challenges in community college engineering programs. They doubt their academic preparation to study in a four-year engineering program, they are more likely to be excluded from conversations about engineering careers than men, and their likelihood of dropping out of engineering programs is higher than men. Although faculty interactions emerges as a strength of community college engineering programs, research also reveals that women have more limited access to community college faculty compared to their male counterparts.

While the transfer mechanism remains a critical function of community colleges, women remain less likely than men to transfer to a four-year engineering program. Women's age, racial identity, marital status, and enrollment status are among the factors significantly related to their transfer aspirations. Similarly, financial factors shape women's motivations for transfer. While women's life experiences inform their transfer aspirations, these life experiences are the only determinant of the transfer outcome. Community colleges can significantly shape women's transfer aspirations with their faculty, advisors, and counselors. Such an institutional and structured support system is significant for women with marginalized identities and students lacking family and peer support.

While the existing research effectively portrays the opportunities and challenges for women's engineering education in community colleges, more studies are needed to explore what these opportunities and challenges mean for women with intersecting and multiple marginalized identities and how they impact their transfer aspirations. This exploration is significant for community colleges because women come to community colleges with multiple and intersecting identities, diverse life experiences, and roles which all shape their community college experiences within the interlocking systems of power, privilege, and oppression.

CHAPTER 3: METHODOLOGY

This study aims to investigate how women with multiple and intersecting identities decide to pursue an Associate in Engineering program in North Carolina, how they describe their engineering education in community colleges, and what they aspire to do regarding transfer after community college. I aim to answer the following research questions:

1. How do women with different intersecting identities decide to pursue an Associate in Engineering degree program?
2. How do women with different intersecting identities describe their experiences in male-dominated Associate in Engineering degree programs in North Carolina community colleges?
3. What are the transfer aspirations of women in Associate in Engineering programs in North Carolina community colleges?

Case Study Design

Although case study designs are commonly used in educational research, the case study as a methodological term does not have a single definition. Various methodologists have developed different definitions of a case study, focusing on distinctive aspects of these designs (Bassey, 1999; Merriam, 2009). For example, Merriam (2009) defines *a case study* as “an in-depth description and analysis of a bounded system” (p. 40). Yin (2009) defines *a case study* as “an empirical inquiry that investigates a contemporary phenomenon in depth and within its real-life context, especially when the boundaries between phenomenon and context are not clearly evident” (p. 18). For Stake (1995), *a case study* is “the study of particularity and complexity of a single case, coming to understand its activity within important circumstances” (Stake, 1995, p. ix). Yin’s (2009) definition is more inquiry-focused and positivist (Bassey, 2009; Merriam,

2009). Merriam (2009) and Stake (1995) take more case-focused approaches to defining case studies. While Yin's definition emphasizes the importance of a structured and systematic inquiry process, Stake's definition highlights the ultimate goal of understanding the case in its entirety. Merriam, Stake, and Yin all underscore the significance of context which is integral to understanding the case.

Case study designs can offer an in-depth and nuanced understanding of a case within its unique context (Simons, 1996). Despite this great capacity, case studies receive criticism for their incapacity to provide generalizable knowledge based on a single case (Yin, 2009). Simons (1996) criticizes this polarized view of research and suggests that unique and universal understandings of complex phenomena in education are possible through case studies if we can holistically explore what case studies have to offer. Similarly, Bassey (2009) rejects reducing different methodologists' definitions into a single definition as this would be "a dangerous game" (p. 35). The risk is the potential loss of different ways of seeing the data (Bassey, 2009; Simons, 1996). However, "we would be wise to maximize the possibilities of different ways of seeing how we represent research evidence" (Simons, 1996). Therefore, I adopt Bassey's (2009) and Simon's (1996) approaches to defining case studies in this study. I adopt an eclectic approach to maximize the possibilities of different ways of seeing and representing the research evidence. To this end, I selectively and purposefully refer to multiple case study methodologists as I design my study.

"What is a case?" remains a critical question for understanding case studies. Merriam (2009) depicts a case as "a bounded system" (p. 40). Being bounded and definable provides a solid framework for the analysis. Thus, a case should be bounded and definable by specific parameters (Creswell & Poth, 2018; Merriam, 2009; Privitera & Ahlgrim-Delzell, 2019). The

case I am studying in this study is a group: Women studying in the male-dominated Associate in Engineering programs in North Carolina. While Merriam's definition of a case helps determine the case using specific parameters, Stake's (1995) definition of a case as "a specific, complex, functioning thing" helps me recognize significant characteristics of my case (p.2).

I also benefit from Yin's (2009) conceptualization of *a case* as "the primary unit of analysis" in a study (p.29). Yin (2018) states that the case selection should be grounded in theory. As my study is grounded in intersectional feminist theory, I focus on women enrolled in the Associate in Engineering programs in North Carolina community colleges. In this way, I study a single case, which is critical to my feminist framework (see Yin, 2018). However, the intersectionality aspect in my theoretical framework requires me to "involve units of analysis at more than one level" (Yin, 2018, p. 51). Therefore, I deconstructed the data based on women's identities at the individual level and reconstructed it to reveal women's collective experiences. If I had not gone through this process, a global approach would have resulted in losing information about women with marginalized identities. For example, I may have missed Black women's, Latina women's, or first-generation college student women's unique experiences in a global approach to data analysis. Deconstructing these identities at the individual level and reconstructing them at the collective level helped demonstrate women's collective experiences without losing unique information about their marginalized identities. Yin's (2018) formulation of an *embedded single case study design* based on the unit and subunits of analysis allowed me to study women's experiences at the individual (a subunit of analysis) and collective (the primary unit of analysis) levels. Based on the participants' multiple identities, creating other subunits of analysis like "women of color" and "immigrant women" was also possible to understand their

unique experiences at the intersection of multiple systems of privilege and oppression. This is one of the significant contributions of the case study design to my study.

The current study uses an instrumental case study design to study the research questions. In my instrumental case study design, the case—women in Associate in Engineering programs—is “instrumental to” learning about their experiences in male-dominated Associate in Engineering degree programs (Stake, 1995, p. 3). I am neither following an intrinsic interest in a particular Associate in Engineering program in North Carolina nor following an intrinsic interest in a particular woman. The case in this study is instrumental to developing an in-depth understanding of women’s experiences in Associate in Engineering degree programs in North Carolina community colleges. Employing a case study design, I aim to understand “the particularity and complexity” of this single case (Stake, 1995, p. ix).

The case study design allows an analysis of the case from a critical theory perspective, and feminist case study designs allow the researchers to study and challenge power relations that oppress and marginalize women from various perspectives (Merriam, 2009; Wallace, 2010). The intersectional feminist theory enables an investigation of women’s marginalization in male-dominated engineering programs based on their intersecting identities of race, ethnicity, sexuality, first-generation, and enrollment status, among other identities. The intersectional feminist theory informs critical methodological choices from sample selection to data analysis.

Merriam (2009) defines the unique features of case studies “as being particularistic, descriptive, and heuristic” (p.43). Being particularistic, this case study focuses on a specific group of community college students. The case is intended to yield an understanding of the phenomenon, the underrepresentation of women in engineering. Being descriptive, this case study provides a “thick” and in-depth understanding of the problem; being heuristic, it aims to

lead to new meanings or expand the knowledge of already-existing meanings regarding the case. The uniqueness of case studies is not related to the methods utilized but to the questions asked and how they relate to the findings (Merriam, 2009). A case study design allows me to focus on a particular case, gain an in-depth understanding of the case, and contribute to the knowledge of the case by revealing its new meanings from a feminist perspective.

In summary, a case study design aligns well with the purpose of this study, its theoretical framework, and its data collection and analysis plans. Employing intersectional feminist theory as the theoretical framework, I focus on “women in Associate in Engineering programs in North Carolina community colleges” to understand their experiences regarding how they decide to pursue these programs, how they describe their experiences in the program, and what their transfer aspirations are. In this way, the case I focus on is instrumental to understanding the research questions. Similarly, the embedded single case study design works perfectly with the theoretical framework and shapes how I analyze the data. As I develop an in-depth understanding of the case, deconstructing and reconstructing data at the individual and collective levels also helps contribute to the existing body of knowledge by revealing new meanings of the case from a feminist lens.

Researcher Positionality

I identify as an international, first-generation college student, a Turkish woman currently studying in the United States. My undergraduate degree was in teaching. Traditional gender roles and stereotypes heavily influenced my career choice because there was an agreement between my family and high school teachers that teaching is an excellent job for a woman because of the free time it provides for domestic responsibilities and childcare. At 18, I agreed that this was a good decision for me. However, the critical education I received at my alma mater, Boğaziçi

University, made me question how much of this decision I had control over and wanted or if it was a collective decision informed by socially constructed gender roles. My life story took a different route thanks to the critical education I received at Boğaziçi University. Boğaziçi University did something different through its curriculum and challenged my existing beliefs, values, and worldview. The courses I took there, such as *Sociolinguistics* and *Gender and Language*, taught me how gender roles were socially constructed, how complex the issue of gendered behavior was, and they helped me question my own assumptions and career choices. This was the transformative power of higher education in my life. The higher education I received at Boğaziçi University transformed me by influencing how I see the world and social relations, changed my life story and gave me opportunities I could have never imagined as a first-generation college student in my family. Therefore, I firmly believe in the power of education in transforming individuals, lives, and communities. I conducted this research with this awareness, hoping that the findings and implications of this study can contribute to a better and more equitable college environment for women studying and hoping to study engineering in community colleges.

As for researcher reflexivity, I shared some aspects of my identity with the participants. I am a woman who conducted this research with other women. I am a first-generation college student, an identity that was also shared by some participants. My career choice was influenced by gender stereotypes, and participants had also been receiving messages about gender stereotypes and their career choices. These identities and experiences served as a point for commonalities between the participants and me. During the interviews, I was able to share these aspects of my identity and academic journey, and my personal story helped me enhance rapport

between me and the participants, potentially leading to more open and authentic responses during interviews or data collection.

I was a complete outsider when participants shared their experiences shaped by their other intersecting identities (e.g., mother, full-time worker, part-time student, returning student). An awareness of our commonalities, differences, and the privileges I bring into the study as the researcher required special attention because they are also embedded in the power relations between the researcher and the participants. In the data collection phase, my strategies to address these power dynamics involved informed consent, voluntary participation, transparent communication (i.e., being transparent about the purpose of the study, field observations, and interviews), sharing the preliminary findings with them, and co-constructing knowledge with the participants through a focus group interview where we talked about the preliminary findings. As the study transitioned into the data analysis, interpretation, and reporting stages, thick descriptions and direct quotes from participants became the primary vehicles for conveying the richness and complexity of their experiences. By adopting these strategies, I aimed to preserve the authenticity of participants' voices, letting their narratives guide the interpretation process.

I also kept a research journal to reflect on my own transformation as a researcher in this study. For example, this study has been instrumental in revealing the gaps in my knowledge and confronting my preexisting biases concerning community colleges. Prior to this study, my exposure to community colleges had been limited, with my first visit to a community college occurring within the context of this study. This was also because I am an international graduate student in the United States. Guided by the insights gained from articles during my doctoral courses, I had initially perceived community colleges as institutions perpetuating systemic inequities. However, upon entering engineering classrooms as part of this study, I witnessed a

sharp contrast. Both faculty members and students demonstrated a true commitment to the program goals, challenging my initial conceptualization of community colleges. Conducting interviews with women enrolled in the program further dismantled my biased conceptualization of community colleges, especially as I listened to their transfer aspirations. I was also aware that my initial conceptualization of community colleges was under the influence of what I knew about two-year higher education institutions in Turkiye. Therefore, whenever possible and relevant, I also had conversations with participants—especially if they moved to the United States from another country and they mentioned community college stigma—and my Turkish friends to have a clearer view of two-year higher education institutions in different countries and education systems. In conclusion, conducting this study has been a transformative journey that not only deepened my understanding of the experiences of the participants but also prompted self-reflection and growth as a researcher.

Guiding Philosophical Assumptions

The philosophical assumptions I bring into this study are significant because they guide the research process (Creswell & Poth, 2018; Mertens, 2007). I engage in qualitative research with a belief system grounded in social constructivist and transformative paradigms. In social constructivism, the researcher wants to understand the subjective meanings of the participants' experiences which are constructed and situated socially and historically (Creswell & Poth, 2018). Similarly, the transformative paradigm is grounded in the ontological assumption of socially constructed multiple realities. Still, it differs from the social constructivist paradigm in its emphasis on explicitly addressing power relationships and social justice in each stage of the research process (Hurtado, 2015; Mertens, 2007). This emphasis requires involving community members in identifying the research focus/problem and research design, building a relationship

with them, and involving them with the findings to contribute to sustainable change in the community. The researcher initiates a research process in which they work with the participants and communities to co-construct knowledge in alignment with “an ethic of inclusion and a plan for action or empowerment that will advance social justice” in the community (Hurtado, 2015, p. 286).

While designing the study, I aimed to engage with the stakeholders and faculty members from my research sites. I had conversations with enrollment advisors working with transfer students in four-year engineering programs. I had conversations with engineering instructors at research sites. These conversations helped me identify community needs and understand the characteristics of the communities I was going to work with. Community stakeholders helped me clarify this study’s purpose and potential impact on women in community college engineering programs. All these conversations were great learning opportunities because I was an outsider to the community college and engineering education contexts in the United States.

To begin, conversations with community stakeholders helped me develop my research questions. For example, one common topic in all these conversations was women’s lower transfer rates to four-year engineering programs. Clearly, women’s lower transfer was a consequence of their lower enrollment rates in community college engineering programs. These conversations and women’s lower enrollment rates in these programs helped me develop my first research question. I wanted to understand why community college engineering programs are not popular among women because enrollment in a community college can be a valuable first step toward a four-year engineering degree for women. One of the engineering instructors underscored the critical role of socioeconomic status in women’s decision to enroll in a community college. This observation indicated the significant role of community colleges in

providing access to higher education and engineering programs, especially for women from lower socioeconomic backgrounds. This discussion also indicated the intersectional impact of gender and social class shaping women's decisions to enroll in community college engineering programs. Thinking that studying how women with different intersecting identities decide to enroll in an Associate in Engineering program can help understand their unique needs within the interlocking systems of privilege and oppression, I shaped my first research question.

Conversations with community stakeholders also shaped the third research question. My initial goal was to understand how community colleges can better support women for degree completion outcomes in engineering. However, I learned that degree completion is not always desirable in these programs. An engineering program advisor from a four-year university explained that degree completion extends the years students spend earning an undergraduate degree. A more desirable outcome is to transfer to a four-year program at the end of the first year in community college, which means students have a better chance to complete the undergraduate degree in four years. In the same conversation, I had a clearer understanding of the primary purpose of the Associate in Engineering programs, which is to prepare students for transfer to a four-year engineering program. These conversations helped me have better research questions to better serve the community's needs, focusing on the more meaningful transfer outcome.

Learning about the research sites, I witnessed how the literature, conversations with the stakeholders, and my site visits supported each other. When I first arrived at my research site on a Friday morning, few students were on campus. I could make sense of this situation thanks to Zhang and Ozuna's (2015) article, which suggested that community college students' primary point of campus experiences is their classrooms because they are students with multiple responsibilities. They come to the campus primarily to attend their classes. Similarly, one of the

stakeholders said that I should consider having virtual interviews while collecting data because students spend limited time on campus due to their additional responsibilities. Although my initial intention was to conduct in-person and on-campus interviews, I decided to offer the participants both options and let them decide what was best for them. My takeaways from these interactions also meant considering ways to respect the participants' time and ensure that this study is not just another burden on them. In this respect, voluntary participation, informed consent, and compensation of their time become genuinely significant in the study design.

In addition, conversations with community stakeholders and site visits in the design process gave me a more in-depth insight into the characteristics of women in community colleges. When I visited one of the research sites, I carefully looked at the announcement boards in the library to understand the needs and characteristics of community college students. One observation was about the "English speaking club" flyers on the boards. Previously, I did not know that community college students are more likely to be first-generation immigrants who completed primary or high school in another country. In a conversation with a community stakeholder, she said I would also find an international diversity component in working with community college students. As my theoretical framework is grounded in intersectionality, this international diversity aspect made me aware that I would need a question about women's immigrant status in the participant screening survey. This question will help me integrate this aspect of the participants' identities in my interview questions and explore what this identity means in their lived experience.

Conversations with community stakeholders also informed which research sites I will include in this study. I learned about differences in the resources available to community colleges in these conversations. The study would miss critical information if I only focused on

one community college with the most resources. Although I aimed to remain in a particular area for accessibility purposes, I benefited from input from community stakeholders in identifying three research sites. Based on input from community stakeholders, I used institution size (based on student enrollments) and degree of urbanization as criteria to select the research sites.

Transformative paradigm also underscores the importance of co-constructing knowledge with the participants and engaging them with the findings (Hurtado, 2015). When the data analysis of individual interviews with women enrolled in the program was completed, I shared the findings with the participants and conducted a focus group interview to receive their feedback and input in interpreting the findings. These processes will be explained in the following sections in this chapter. Including women's voices in interpreting findings helped co-construct knowledge and turn the research process into a mutual learning experience. For example, their input guided me as I developed the themes, which will also be explained in more detail in the data analysis section. This mutual learning was essential to address the power relationships between me as the researcher and the participants. I situate the participants and communities in the study as the knowers, subjects, and experts of their own lives and experiences. This research and me, as the researcher, are situated as a means to make their voices, needs, and agency heard. I also used the focus group interview technique in the member-checking process to develop a set of actionable steps with the community members to drive institutional change. In this interview, I dedicated some time to discussing what kinds of policies, practices, and interventions would make community college engineering programs more equitable and inclusive environments for women.

The Associate in Engineering degree program directors and faculty members proved to be invaluable assets during the data collection phase. Upon obtaining the preliminary findings

from interviews with women enrolled in the program, I further engaged in semi-structured interviews with all three program directors and faculty members at the research sites. These interviews allowed me to share the preliminary findings with them and provided a platform for gaining insights into their perspectives on the findings.

All in all, this study aims to address the power relationships in the research process and the broader social and institutional structures by focusing on multiple systems of oppression (sexism, racism, classism, etc.). Having a social justice agenda to impact change in community college engineering programs, this study aims to contribute to transforming these educational environments into more inclusive and equitable spaces for women.

Research Sites

A detailed and thick description of research sites helps contextualize the participants' experiences and provides the reader with rich contextual information to make informed transferability judgments (Lincoln & Guba, 1985; Merriam, 2009). North Carolina has a unique position in technology and education with its Research Triangle Park, world-class universities, community colleges, and strong business community (Falkenbury, 2022). The Research Triangle Park is North America's largest and thriving research park, which means that a wide variety of businesses recruit in the area, and there is an increasing demand for talent (Cuthrell, 2022). While STEM job postings increase, women—especially Black and Latina women—remain underrepresented and experience wage gaps in these high-demand fields (NC Department of Administration, 2019; Wake Invests in Women Research Subcommittee, 2021). Considering the mission of community colleges to meet the local workforce needs, I selected three research sites in the Triangle area. I used enrollment size and degree of urbanization as criteria to select the research sites. Using these criteria, I aim to provide a more comprehensive portrayal of women's

experiences in Associate in Engineering programs within different community college contexts. I chose one institution in an urban setting, one in a suburban setting, and one in a rural setting. All three community colleges offer Associate in Engineering programs, preparing students for transfer to a four-year institution for a degree in engineering. Women's underrepresentation in these three programs makes them significant sites to conduct this research.

Park Community College

Park Community College is a public institution in an urban setting with more than 18,000 students and multiple campuses. Park Community College advertises its Associate in Engineering program with its general education and engineering prerequisite courses accepted by all four-year engineering programs in public universities in North Carolina. In Fall 2022, 20 women (15%) and 110 men (85%) enrolled in the Associate in Engineering program at Park Community College. Among the women were five Black, 10 Hispanic, one White, and four in the "other" race category (North Carolina Community College System Data Dashboards, 2023).

Triangle Community College

Triangle Community College, located in a suburban setting, is one of the largest community colleges in North Carolina. It serves more than 70,000 students on multiple campuses. The institutional website promotes the Associate in Engineering program as a transfer pathway, saying that it provides students with the necessary preparation to transfer to a four-year engineering program. Advising tools and the program's focus on solid training in mathematics and science are also highlighted. In Fall 2022, 149 women (16%) and 770 men (84%) enrolled in the Associate in Engineering program at Triangle Community College. Of the 149 women students, 19 were Black, 29 were Hispanic, 51 were White, and 50 were in the "other" racial category (North Carolina Community College System Data Dashboards, 2023).

Land Community College

Land Community College is a public institution located in a small rural town in the Triangle and serves more than 10,000 students every year with its multiple campuses. The Associate in Engineering program at Land Community College offers general education and prerequisite courses that are transferable to all four-year engineering programs in public institutions in North Carolina. The goal is to offer the Associate in Engineering program graduates a seamless transition without having them take additional and duplicative courses. In Fall 2022, 71 students enrolled in the Associate in Engineering program at Land Community College. The 71 students included 20 women (29%) and 50 men (71%). Of the 20 women, one was Black, three were Hispanic, and 16 were White (North Carolina Community College System Data Dashboards, 2023).

Participant Selection

The sample in this study was determined using a purposive sampling strategy, in which the researcher selects “a sample from which the most can be learnt” about the issue under investigation (Merriam, 2009, p.77). I utilized criterion sampling and maximum variation sampling strategies to recruit the participants. As a purposive sampling strategy, criterion sampling involves recruiting participants based on a predetermined criteria with the goal of collecting rich and relevant data for the research questions (Privitera & Ahlgrim-Delzell, 2019). The criteria to recruit the participants were as follows: 1) they self-identified as women; 2) they were students enrolled in Associate in Engineering programs in one of the three community colleges selected; 3) they were at least in the second semester of their studies. Women enrolled in their first semesters were excluded from the study because their first semester might not allow them enough time to experience the community college environment and share their experiences.

Dual enrollment students who were high school students enrolled in community college courses were also excluded from the study because they might choose to attend a four-year institution after they graduate from high school. By excluding dual enrollment students, I aimed to maintain a group of participants whose experiences were more indicative of those pursuing the entirety of their higher education at a community college. This criterion enhanced the study's ability to capture meaningful insights into the unique challenges and opportunities faced by women enrolled in Associate in Engineering programs at community colleges.

The maximum variation sampling strategy helped me recruit participants with a wider range of intersecting identities. The goal of maximum variation sampling is to increase the study's potential to capture a wider range of experiences by increasing the variability in the participant pool (Privitera & Ahlgrim-Delzell, 2019). Interested participants (i.e., women who meet the criteria to participate in the study) were asked to complete the pre-screening demographic survey. The recruitment email and the printed flyers had a link and a QR code, taking students to this demographic survey (Appendix C). This demographic survey had questions about students' institution, their semester in the program, gender, race/ethnicity, sexual orientation, enrollment status, immigrant status, age, domestic or international student status, family status (e.g., single, married, with a partner, etc.), parenting and caregiving responsibilities, work responsibilities outside the school, first-generation student status, and the financial resources they utilize to study in their programs. This pre-interview demographic survey helped me recruit women with different intersecting identities to ensure maximum variation regarding students' multiple and intersecting identities.

In my initial study design, I also aimed to use the snowball sampling strategy. Snowball sampling means recruiting participants who meet the criteria to participate in the study through

referral from other participants (Privitera & Ahlgrim-Delzell, 2019). If I was missing a particular group of participants, I was going to ask the participants if they knew anyone in that particular group by using snowball sampling. For example, if I reached a certain number of interviews and if I had not interviewed a Latina student yet, I planned to ask the participants in the study if they knew a Latina student who would be interested in participating in the study and if they could put me in touch with that student. However, this sampling strategy did not work due to the absence of peer relations in the engineering classrooms, which also emerged as a theme in the data analysis. Therefore, only criterion and maximum variation sampling strategies were used in this study.

My recruitment strategies at each research site were shaped by the access (i.e., access to classrooms and student lists) granted to me by my campus contacts. In my Institutional Review Board (IRB) application for each research site, I was asked to designate a campus contact to facilitate access to the research sites and participants. My campus contact at Land Community College was a faculty member who also supported me in the study design by having some conversations with me about women enrolled in the program. When I emailed the Triangle Community College's Institutional Effectiveness and Research Office to learn more about their IRB process, the staff member who responded my email informed me that I would need a campus contact and kindly offered to be my campus contact. Then, she put me in touch with the program director who gave me access to the classrooms and participants. To designate a campus contact at Park Community College, I benefited from the networks of the Belk Center for Community College Leadership and Research, where I worked. Our executive director put me in touch with an NC State alumnus who worked at Park Community College. This person helped

me get in touch with the program director at Park Community College, and the program director kindly accepted to be my campus contact.

In this section, I explain my recruitment strategies in each research site in the order that I visited them. At Park Community College, the program director was my faculty point of contact, and he introduced me to the other engineering professor in the program. They both let me visit their classrooms to recruit participants, and one of them shared the recruitment flier on the Moodle pages of the courses she was teaching in the Associate in Engineering program. However, the program was not able to share a list of women enrolled in the program with me. I visited all engineering classes offered by the two engineering instructors of the program, but I could recruit only two women because the majority of women in the engineering classes I observed were either dual-enrollment students or they were enrolled in the Associate in Science degree program, and they did not meet my inclusion criteria.

At Land Community College, my faculty contact shared my recruitment flier on the Moodle pages of her courses, allowed me to visit in her classrooms, and provided the program's email list of eight eligible women (enrolled in the Associate in Engineering degree program, identifying as a woman, and at least in the second semester of the program). I invited all women on the list via email, successfully recruiting one participant. As I had a very limited potential participant pool, I visited all the classrooms I was given access to. Two additional participants were recruited during classroom visits. Despite sending a second reminder email, I did not receive responses from these women. I refrained from sending a third reminder as some had already expressed disinterest during classroom encounters. This approach aimed to respect their preferences and avoid unnecessary invitations.

At Triangle Community College, my campus contact facilitated an introduction to the Associate in Engineering program director. Upon explaining my inclusion criteria, he provided information about the classes where women in their second semester were enrolled. Given the size of Triangle Community College, being the largest institution among my research sites, a multitude of sections and courses were available for observation. I made an effort to visit nearly all of them to increase the chances to recruit participants from a wider range of demographics. During these class visits, I engaged with women, briefly informed them about the study, and invited those meeting the inclusion criteria to complete the pre-screening demographic survey. The overarching goal of my recruitment strategy at this research site was to ensure the attainment of maximum variation within my sample. For instance, I prioritized recruiting only women of color at some point during the recruitment process, or if a participant had a sexual orientation not previously represented in the sample, I made it a priority to recruit them. Out of those who were officially recruited to participate, two women of color could not show up for their interviews, and they did not reschedule the interview. One woman of color was under 18 years old, and I could not interview her due to IRB restrictions, making it possible for me to conduct 12 interviews in my third research site, reaching a total of 17 participants.

Participants: Whose Stories are Represented in the Findings?

Among the participants, two women were enrolled part-time, while 15 were enrolled full-time in the program. Twelve of them were first-time college enrollees, and five were returning students. Participants' ages ranged from 18 to 41. Three women in the study identified as bisexual, 13 identified as heterosexual women, and one woman preferred not to respond to the sexual orientation demographic question.

As to the racial/ethnic composition of the sample, one participant identified as Asian, one as African American, one as biracial (Indian and Black), one as Black; two identified as Middle Eastern; four women identified as Hispanic; and seven women identified as White/Caucasian. Two participants were international students, both with ongoing Green Card applications at the time of the interview. Four women in the study were first-generation immigrants, and three were second-generation immigrants.

Among the participants, five were married, one had two daughters, and four had caregiving responsibilities. Only two did not have work responsibilities, while 15 had various work commitments, ranging from part-time jobs to full-time employment or holding multiple jobs. Seven participants were first-generation college students, with neither parent having attended college, and three had one parent with a college degree. Three participants disclosed having a disability that impacts their learning. A list of participants can be found in Table 1.

The participants of the focus group interview were one Black woman (Rere), one Hispanic woman (Lilly), one Middle Eastern woman (Ada), and two White women (Elaine and Birdy). Rere identified as bisexual, she was full-time and first-time enrolled, and she was a first-generation immigrant. Lilly was a part-time and first-time enrolled student; she was a second-generation immigrant and first-generation college student. Ada identified as an international student, she was a full-time enrolled returning student, and she was also a first-generation college student. Elaine was a full-time enrolled returning student. She also disclosed having a disability during her interview. Birdy identified as bisexual, and she was a part-time enrolled returning student.

Table 1. Participants' demographic characteristics in this study.

Pseudonym	Full-time/Part-time Enrolled	Enrollment	Age	Sexual Orientation	Race / Ethnicity	International Status	Immigration Status	Family Status	Caregiving Responsibilities	Work Responsibilities	First-generation Status
Ada	Full time	First-time enrolled	26	Heterosexual	Middle Eastern	International	Yes	Married	No	Yes	Yes
Alice	Full time	First-time enrolled	20	Heterosexual	Hispanic	Domestic	No	Single	No	Yes	Yes
Birdy	Part time	First-time enrolled	21	Bisexual	White	Domestic	No	Single	No	Yes	No
Edith	Full time	First-time enrolled	19	Heterosexual	Biracial	Domestic	No	Single	No	Yes	No
Elaine	Full time	Returning student	29	Heterosexual	White	Domestic	No	Single	No	Yes	No
Hedy	Full time	First-time enrolled	20	Heterosexual	Middle Eastern	Domestic	Yes	Single	No	No	No
Jasmine	Full time	First-time enrolled	22	Heterosexual	Asian	International	Yes	Married	No	Yes	No
Kate	Full time	Returning student	26	Preferred not to respond	White	Domestic	No	Single	Yes	Yes	Yes
Lilly	Part time	First-time enrolled	41	Heterosexual	Hispanic	Domestic	Yes	Married	Yes	Yes	Yes
Margaret	Full time	First-time enrolled	19	Heterosexual	White	Domestic	No	Single	No	Yes	No
Martha	Full time	First-time enrolled	20	Heterosexual	Hispanic	Domestic	Yes	Single	No	Yes	Yes
Mary	Full time	Returning student	21	Heterosexual	African American	Domestic	No	Single	No	Yes	Yes
Nikki	Full time	First-time enrolled	18	Heterosexual	Hispanic	Domestic	Yes	Single	No	No	No
Nora	Full time	First-time enrolled	19	Bisexual	Caucasian	Domestic	No	Single	Yes	Yes	No
Olive	Full time	Returning student	29	Heterosexual	White	Domestic	No	Married	Yes	Yes	Yes
Rere	Full time	First-time enrolled	19	Bisexual	Black	Domestic	Yes	Single	Yes	Yes	No
Sarah	Full time	First-time enrolled	20	Heterosexual	White	Domestic	No	With partner	No	Yes	No

The participants in this study exhibited a diverse range of characteristics and backgrounds, contributing to the richness and complexity of their experiences in the engineering program. Notably, some participants shared having to drop out of high school, while others embarked on a non-traditional path by initially pursuing majors such as nursing and arts before switching their community college major to engineering. Some participants were returning students, having already earned associate degrees in different fields. They returned to school to enhance their career prospects. Some viewed community college as an opportunity to prove themselves academically, in other words, they sought to prove their academic abilities after perceived struggles in high school. Financial constraints emerged as a common thread among participants, preventing them from attending four-year engineering programs. The participants further included individuals with immigrant backgrounds, either being children of immigrants or immigrants themselves, highlighting the diverse cultural landscape within the program. Overall, the participants shared a common goal of pursuing the engineering program for a better future, financial stability, and financial independence.

Data Collection

As case studies present an in-depth understanding of the case they investigate, the researchers need multiple sources and forms of qualitative data to achieve this in-depth understanding (Creswell & Poth, 2018; Merriam, 2009; Stake, 1995; Yin, 2018). This study employs five forms of data collection.

Semi-structured Interviews with Women Enrolled in the Program

As my goal in this to understand women's experiences in the Associate in Engineering degree program, the primary data collection method was interviewing. Yin (2018) considers interviews one of the most critical data sources in case studies. Interviewing is necessary when a

behavior, feeling, or people's interpretation of the world cannot be directly observed and replicated (Merriam, 2009). I conducted 17 semi-structured interviews with women enrolled in the program. Semi-structured interviews are "a mix of more and less structured questions" (Merriam, 2009, p. 90). They allow the researcher and the interviewee to elaborate on the questions more deeply when an opportunity arises through follow-up questions. The specific types of interview questions in this study were background/demographic, experience, behavior, and feeling questions. With the informed consent of the participants, the interviews were recorded and transcribed. I conducted virtual and on-campus interviews to accommodate students' needs. The date and time of the interviews was decided by the participants, depending on their availability. These interviews lasted around 45-65 minutes. The interview protocol is provided in Appendix D. Upon the completion of the interview, the participants' time was compensated with \$25 Amazon digital gift card.

I organized the interview questions by research questions. My first research question was "How do women with different intersecting identities decide to pursue an Associate in Engineering degree program?" The interview questions aimed to understand women's central and intersecting identities and whether these central identities informed their journey to the program. The intersectionality framework informed the formulation of interview questions. Bowleg (2008) underscores the importance of asking good questions in intersectionality research because additive questions receive additive answers. As I aimed to articulate "experiences that are intersecting, interdependent, and mutually constitutive" (Bowleg, 2008, p. 314), the questions should also be formulated accordingly. Based on this guidance from Bowleg, I aimed to avoid additive questions to understand women's identities and focused on developing questions that would give me insight into women's intersectional experiences. Sample questions included "You

told me in the survey that you identify as (a list of identities students mentioned in the survey). What identities are most central to who you are and how you see the world?” and “How, if at all, have your identities shaped your journey to this program?” In this part, I also aimed to understand their pre-collegiate social and academic environments and how these environments informed their decision to pursue a degree in engineering at a community college. A sample question was “What was your exposure to science, engineering, technology, and math before college?”

The second group of interview questions concerned the second research question: “How do women with different intersecting identities describe their experiences in male-dominated Associate in Engineering degree programs in North Carolina community colleges?” To capture how women’s experiences in Associate in Engineering programs were shaped within the interlocking systems of privilege and oppression, I employed interview questions like “Can you tell me a story of how being a (list the participants’ central identities) has helped or hindered your success in the program?” and “How do you experience your interactions with classmates, faculty and staff of different identities than you?” These questions helped reveal how interlocking systems of privilege and oppression were related to women’s experiences in Associate in Engineering programs.

The third group of interview questions aimed to understand the third research question: “What are the transfer aspirations of women in Associate in Engineering programs in North Carolina community colleges?” I asked the following questions to understand whether they had intentions to transfer and whether they intended to stay in engineering: “What intentions or plans, if any, do you have regarding transfer to a four-year institution?” and “What intentions or plans, if any, do you have regarding transfer to a four-year engineering program?” Based on their

answers to these questions, I elaborated on their answers by asking questions like “What contributed to this decision?” and “How could your college and program support you better to prepare you for an engineering career?” Before I ended the interviews, I asked the participants if there were anything they would like to add and talk about. This question gave me an opportunity to hear participants’ critical experiences I might not have captured with the existing interview questions.

Documentation

One of the data collection methods that case study researchers use is documentation (Bassey, 2009; Stake, 1995; Yin, 2018). The documentation data come from the Associate in Engineering program websites in three research sites. Yin (2018) argues that websites can provide “invaluable preparatory and orienting information” before the researchers land in the field (p. 115). Learning more about the programs and institutions helped during field observations and interviews. In addition, I skimmed the institutional websites to find STEM resources (STEM and engineering labs, clubs, and events). I also checked for specific institutional programming and efforts to close the gender gap in STEM. I specifically searched for information about the program’s recruitment strategies, the resources they have for their students, and gender-based and racial representation in any visuals that they share. The analysis of the institutional websites contributed to the understanding of the findings.

By analyzing the institutional and program websites, I aimed to learn more about the institutional contexts that shape women’s experiences in community college engineering programs. I aimed to investigate how women with different intersecting identities are included in or excluded in engineering education programming in community colleges. Studies miss this essential contextual component when they only focus on individuals’ experiences. Adopting an

intersectional feminist approach to analyzing the documents helped identify how existing policies and practices marginalize women of intersectional identities in STEM (Gayles & Smith, 2019). The transformative power of the intersectional feminist theory stems from the integration of a critique of existing power structures and relations into the analysis (Bilge, 2013; Gayles & Smith, 2019). A document analysis protocol is provided in Appendix B.

Field Observations

Case studies offer opportunities for direct observations when the case study takes place “in the real-world setting of the case” (Yin, 2018, p. 121). *Qualitative observations* are defined as “deep, rich descriptions of what is being observed in naturalistic settings” (Privitera & Ahlgrim-Delzell, 2019, p. 399). Field observations helped better understand women’s experiences in Associate in Engineering programs (see Stake, 1995). I achieved this understanding by exploring the campus and its surrounding area and visiting academic and extracurricular spaces. These spaces included engineering classrooms, engineering clubs, and events. I gained access to all observation sites with the permission of program directors and instructors. I engaged in observations as “participant as observer” (Privitera & Ahlgrim-Delzell, 2019, p. 391). The participants knew that I am a researcher and an outsider to the community. At the beginning of the class or club meetings, the faculty members introduced me to their students and allocated some time for me to share more about myself and my research. Then, depending on the classroom setting (i.e., lecture-based or team project), I either sat and listened to the lecture with the students, or actively circulated among teams, engaging with students. I also took notes during or right after the observations. My observation protocol (Appendix A) focused on the physical setting, people, activities and events, interactions, and cultural aspects of the physical space and human interactions (values, rules, unspoken norms, rituals, artifacts, etc.). I utilized an

intersectional lens to examine the characteristics of the setting (e.g., identifying who is present and absent, portraying the roles of the participants, assessing whether there are voices dominating the space, and analyzing the gendered and intersectional aspects of interactions).

Focus Group Interview

The addition of a participant-to-participant interaction path in focus groups enriches the conversations by helping individuals mold and articulate opinions that might not have been voiced in a one-on-one interview (Vaughn et al., 1996). The focus group interview in this study served two purposes. One purpose was to serve as a member-checking process. Member checking involves taking the data, its analysis and interpretation, as well as conclusions drawn from it, back to participants for them to judge the accuracy of the representation of their experiences in the study (Creswell & Poth, 2018; Lincoln & Guba, 1985). This interview allowed the participants to assess how well the findings, their interpretation, and practical implications reflected their experiences and needs. The second purpose was to enrich data by offering a better understanding of the preliminary findings. Therefore, while the member-checking process ensured trustworthiness, doing this in a focus group format enriched the data.

After the data analysis phase, I created a member-checking summary of the preliminary findings. I sent an email to the participants with this member checking summary attached, and asked if they would be interested in participating in a focus group interview to learn more about the findings, how I interpreted the findings and the practical implications of the study. They also knew that they would be asked to assess how well the findings and implications represented their experiences and needs. The incentive to participate in the focus group interview was \$15, and the focus group interview was going to be held virtually.

Only two participants responded to my initial email, and after I sent a reminder, I was able to schedule a time for a focus group interview with six participants. One of them could not make it to the interview, and I conducted the focus group interview with five women. The participants of the focus group interview were Ada (a Middle Eastern woman), Birdy and Elaine (two White women), Lilly (a Hispanic woman), and Rere (a Black woman). Ada identified as an international student, she was a full-time enrolled returning student, and she was also a first-generation college student. Birdy identified as bisexual, and she was a part-time enrolled returning student. Elaine was a full-time enrolled returning student. She also disclosed having a disability during her interview. Lilly was a part-time and first-time enrolled student; she was a second-generation immigrant and first-generation college student. Rere identified as bisexual, she was full-time and first-time enrolled, and she was a first-generation immigrant. The interview lasted for 70 minutes.

The first section of the focus group interview focused on the preliminary findings. There were three themes highlighted in the member-checking summary, and after a brief presentation of each theme, I asked the participants two questions: “How well do you think the findings reflect your experiences? Why?” and “What are some significant stories missing from this summary?” In the second part of the interview, we focused on the study’s practical implications. Before the interview, I crafted the implications for practice section based on their responses to the question “How could the program support you better?” The interview questions about these policy and practice implications involved “How effective do you think these implications for practice would be in addressing your needs and challenges as you continue your studies?” and “In what other ways can the program support you better?” My final question in this interview

was “What are some other aspects of your experiences you want to lift up that are not reflected in the findings I have shared with you?” Appendix E presents the focus group interview protocol.

Semi-structured Interviews with Program Directors and Faculty

The interview protocol for the semi-structured interviews with faculty and program directors was based on preliminary findings of the study. These interviews aimed to provide contextual information to gain a better understanding of women’s experiences in the Associate in Engineering degree program. When I crafted the preliminary findings, I sent an email to program directors and one faculty member (faculty members whose classrooms I visited or faculty members who were my campus contact) from each research site to ask if they would be interested in participating in an interview to talk about the initial findings of the study. Three program directors and two faculty members participated in these interviews. Regarding the racial composition of program directors, one program director was a White man and two were men of color. Two faculty members were women of color.

Conducting interviews with program directors, I aimed to learn more about the program’s recruitment strategies, if there were any efforts to support women’s academic journeys in the program, how students with disabilities received accommodations, and transfer support systems for students. The program director interviews comprised two sections. The first section involved questions only for program directors and focused more on administrative questions, with sample questions from the protocol such as “What strategies or efforts, if any, has the program taken to encourage and increase women’s enrollment in the program?” and “How, if at all, does the program solicit feedback from women students to better understand their experiences and continuously enhance their academic journey?” The second part of the interview was more about engineering classrooms, and I asked these questions to both program directors and faculty

members. This part of the interview protocol included questions like “How are group projects typically organized in your classes?” and “How, if at all, do you approach fostering a classroom environment that is supportive and inclusive for students from diverse backgrounds, especially with respect to gender and intersectionality?” While the program director interviews lasted 60-70 minutes, the faculty interviews lasted 40-45 minutes. Appendix F presents the program director and faculty interview protocol.

Data Analysis

The documents, observation data (field notes), and interviews were analyzed using a qualitative data analysis tool, Atlas.ti. In this section, I discuss how I analyzed each data source separately. As the purpose of the study was to understand women’s experiences in the Associate in Engineering degree programs, I approach the semi-structured interviews I conducted with women enrolled in the program as the primary data source. All other data sources in this study (i.e., documents, field observations, focus group interview, and interviews with program directors and faculty) serve to gain a better understanding of the findings from this primary data source. As the understanding of the case relies on context (Stake, 1995; Yin, 2009), it is critical to see how the contextual data from field observations and documents and the interview data support and explain each other. When the field notes, document analysis, and interview data come together, this approach enables “a critique of structural oppressions that intersect in ways that shape individual experiences and group outcomes” (Gayles & Smith, 2019, p.35).

I utilized thematic analysis to analyze the data collected in this study. Thematic analysis is “a process of making sense of the data and abstracting broader ideas than the explicit words on the paper,” and it can be applied to various data forms such as documents, interviews, visuals, and observations (Fugard & Potts, 2019, p. 3). Fugard and Pott (2019) describe thematic analysis

as a creative process because it is a practice beyond counting frequent words or phrases in the data. It is about developing deeper connections “where two fragments of text using different words can be seen to be related at the level of meaning or a common phenomenon” (Fugard & Potts, 2019, p. 3).

Thematic analysis is an iterative process necessitating familiarity with the data (Braun & Clarke, 2006; Fugard & Potts, 2019). Data collection and transcription phases are the first steps in building this familiarity (Braun & Clarke, 2006; Fugard & Potts, 2019). In this study, initial familiarization with the data involved collecting documentation data, creating field observation notes, and transcribing interview data. I used the online transcription tool otter.ai to retrieve the first drafts of the interview transcripts. I checked the accuracy of these transcripts by listening to the interviews again. After this data-cleaning phase, I continued to work on these transcripts by adding analytical memos and observer comments. Adding these memos and comments ensured a deeper engagement with the data before the data analysis. While writing memos is not a highly structured process with fixed steps, it helped me examine the meanings the data offer as I prepared for the actual data analysis (Birks et al., 2008). I analyzed each data source separately when the field notes, documents, and interviews are ready for analysis with analytical memos and reflective notes. I discuss how I analyzed each data source below.

Semi-Structured Individual Interviews with Women Enrolled in the Program

Direct Interpretation and Categorical Aggregation of Individual Interviews. I benefited from Stake’s (1995) direct interpretation and categorical aggregation in analyzing this primary data source. Case studies benefit from a direct interpretation of individual instances and categorical aggregation of observations until “something can be said about them as a class” (Stake, 1995, p. 74). In this context, direct interpretation of individual instances refers to the

analysis of each individual interview separately. Categorical aggregation combines data from all conducted interviews to identify common themes and patterns. Analyzing individual instances and employing categorical aggregation allowed me to understand both individuals' experiences and group outcomes.

The Procedure for Thematic Analysis. I benefited from thematic analysis to move from direct interpretation to categorical aggregation. The analysis of the interview data started with an analysis of individual interviews (i.e., direct interpretation) (Stake, 1995). After getting familiar with the data, the second step in the thematic analysis is developing initial codes (Braun & Clarke, 2006). I started by coding individual interviews using descriptive (i.e., attaching descriptive labels to small chunks of data), in-vivo (i.e., using short phrases from documents and participants' words), and process (i.e., brief reports of changes in processes with the dynamics of time) codes (Miles et al., 2014). I employed both inductive (i.e., open coding driven by what data offers) and deductive coding strategies (i.e., theory- and literature-driven coding) (see Fugard & Potts, 2019).

In the next phase, I searched for themes and patterns in data by employing thematic analysis and categorical aggregation (Braun & Clarke, 2006; Fugard & Potts, 2019; Stake, 1995). This phase occurred in two stages. In the first stage, I used the theoretical framework to explore what the data said about women's experiences with similar intersecting identities, and in this way, I created subunits of analysis based on my data and women's intersecting identities represented in the data. I was able to explore the common experiences of "immigrant women," "women of color," "first-generation college student women," "women with a disability," and "women who identified as international students." Creating these subunits of analysis allowed me to reveal the unique experiences that came with these social locations.

In the next stage, I explored women's collective experiences and how the interlocking systems of power, privilege, and oppression shaped these experiences. Understanding women's experiences required me to search for patterns in the data at the collective level (Stake, 1995). In this phase, I continued to look for and review potential themes for women's collective experiences. It is worth noting that a theme in this stage might present participants' multiple and contradictory realities (Fugard & Potts, 2019). As I employ intersectional feminist theory as a theoretical and analytical tool, women's multiple and intersecting identities could emerge with different experiences and realities, and they were discussed under the same relevant theme. An illustrative example involves women sharing similar intersecting identities, such as being first-generation college students or being an immigrant woman. Notably, their experiences diverged based on factors like parental college funding and access to robust institutional financial support systems. Those with financial support enjoyed the privilege of prioritizing their studies, effectively managing work commitments even while employed outside of school. Conversely, those lacking such support faced constraints, being unable to prioritize academic pursuits due to the imperative need to earn income. The application of intersectionality as a theoretical framework facilitated an in-depth examination of these intersections, highlighting the nuanced emergence of multiple realities and experiences among women who shared the same identities.

Field Observations

In the analysis of my field observation data, I adhered to a systematic process mirroring that of my interviews. Initially, I formulated preliminary codes for individual field observation notes from a single institution. Employing a descriptive coding strategy (Miles et al., 2014), I assigned labels that aptly capture the essence of the data. This coding phase incorporated both deductive and inductive strategies. Predefined codes, including "physical setting," "gender and

racial composition of the setting,” “activities,” “culture,” and “interactions” guided this phase. Notably, an unforeseen but significant theme, “faculty members’ focus on building students’ engineering identity,” emerged during this coding process. Subsequently, I explored patterns that transcended individual institutions, drawing connections and contextualizing the interview data within the broader framework of women’s individual and collective experiences.

Document Analysis

While analyzing data from the program and institutional websites, I reiterated the data analysis process I utilized for my field observations. Initially, I established descriptive codes for the analysis, drawing on the preliminary findings from my interview data to formulate these initial descriptive labels. The a priori codes encompassed crucial aspects such as “gender and racial composition of visuals,” “program recruitment strategies,” “gender and racial composition of faculty,” “information about engineering as a career (e.g., engineering salary),” “student characteristics,” “resources for students with disabilities,” “mental health resources,” and “reporting sexual harassment.” In the subsequent coding phase, I delved into identifying patterns across research sites, establishing connections to be able to contextualize the interview data.

Focus Group Interview

After transcribing and cleaning the focus group interview data using otter.ai, I proceeded to generate analytical memos and reflective notes, reflecting on how this focus group interview contributed to an enriched and expanded comprehension of the study’s findings. Initially, I applied descriptive a priori codes that were crafted in consideration of the preliminary themes and study findings. While utilizing these codes derived from the main study, I concurrently sought new codes and categories. This iterative approach ensured that the analysis of the focus group interview was informed by the themes emerged from individual interviews, and

reciprocally, the focus group interview data influenced the coding of individual interviews. For instance, whereas faculty diversity and peer relations were initially discussed as separate facets under curricular and extracurricular experiences, one participant's narrative about how a lack of faculty and peer support led to her course withdrawal prompted a reevaluation, prompting me to consolidate these subcategories under a unified theme.

Semi-Structured Interviews with Program Directors and Faculty

The interviews with program directors and faculty were conducted with the specific aim of gaining a better understanding of the findings and providing richer contextual information. After the data familiarization phase, which included creating interview transcriptions and cleaning, I began crafting analytical memos and reflective notes about how these interviews contribute to a more nuanced understanding of the program context, leading to a deeper understanding of women's experiences in Associate in Engineering programs. Given that the interview protocol was developed based on the preliminary findings, I utilized a set of a priori codes derived from these preliminary findings. These codes were seamlessly integrated into the overall findings of the study. This strategic approach allowed for a cohesive merging of insights from program director and faculty interviews with the broader study findings, refining and enriching the contextual understanding of women's experiences in the Associate in Engineering programs.

Bringing all Data Sources Together

The final steps in the thematic analysis are reviewing, defining, and naming themes (Braun & Clarke, 2006). At this point, I developed a thematic map (see Braun & Clarke, 2006) based on initial themes and subthemes in a table format, and checked if the thematic scopes overlap (Braun & Clarke, 2006). Creating the initial drafts of the findings chapter also allowed

me to see if my themes overlap with data from different data sources. Braun and Clarke (2006) suggest that reviewing and refining should end when “you should have a fairly good idea of what your different themes are, how they fit together, and the overall story they tell about the data” (p. 92). Therefore, this final phase was an iterative process and involved developing multiple drafts of the findings section. In the final phase of data analysis, I also developed case assertions by searching for significant patterns and strong correspondences in the data, which contribute to a deeper understanding of the phenomenon under investigation (Stake, 1995).

In the context of this community-engaged research with a transformative paradigm, a crucial aspect of the thematic analysis involved structuring themes in a way that facilitates accessibility for faculty, program directors, and practitioners seeking information about distinct facets of the program. To enhance usability, I specifically organized themes to cater to the diverse interests of stakeholders. For instance, I ensured that a faculty member reading this study could readily find information pertaining to classroom experiences and teamwork. Similarly, for an engineering club faculty advisor perusing this study, the information about extracurricular spaces was deliberately structured for easy location. This strategic organization aims to streamline access to relevant insights based on the varied roles and interests of those engaging with the research.

Ethical Considerations

An ethical study considers participants’ privacy and informed consent, aims to minimize harm to the participants, and aims to promote justice through inclusivity and fair treatment (Creswell & Poth, 2018). To safeguard the confidentiality of participants, I replaced participant names with pseudonyms. I utilized pseudonyms for institutions as well. However, some complexity arose in instances where two to three research participants, particularly when

women's underrepresentation in the program was considered, could be easily identified. To mitigate this risk to the best extent possible, I refrained from explicitly linking participant names with institution names unless such information was pivotal to highlighting important distinctions across institutions. For instance, Table 1 intentionally excluded specific mentions of research sites. Moreover, given the potential identifiability of institutional program directors and faculty members, I exercised caution in the narrative of the findings, avoiding explicit reference to the research site unless it proved essential for elucidating significant variations among institutions. This careful approach is adopted to uphold participant confidentiality and address the unique considerations associated with participants' confidentiality.

For this study, I obtained approval from the Institutional Review Board (IRB) at NC State University and submitted individual IRB applications for each research site. Any modifications to the interview protocols, such as those for focus groups, program director, and faculty interviews, were promptly submitted as amendments to the existing applications. No research activities took place until receiving formal IRB approval from each respective research site.

After going through the required IRB processes, I asked the participants for their informed consent to participate in the study. At the beginning of each interview, I reminded the participants that their participation in the study should be voluntary, and they could withdraw from the study at any time. I aimed to ensure that the interview was a safe place for the participants to share their experiences. I also engaged the participants in the data analysis through member-checking. This decision aimed to promote collaboration and co-construction of knowledge, which addressed the power imbalance between the researcher and the participants.

Trustworthiness

Trustworthiness of a study is about two critical questions. “How can an inquirer persuade his/her audiences (including the self) that the findings of an inquiry are worth paying attention to, worth taking account of? What arguments can be mounted, what criteria invoked, what questions asked, that would be persuasive on the issue?” (Lincoln & Guba, 1985, p. 290). I addressed these questions in this study in several ways.

Credibility of Findings

First, I benefited from a member-checking process to achieve credibility. The credibility of findings in qualitative research refers to the degree to which the reader considers the findings credible and truthful (i.e., believable), reflecting what has been observed (Lincoln & Guba, 1985; Nassaji, 2020). Building credibility requires the researcher to develop an accurate representation of the phenomenon under investigation by taking the data, its analysis, interpretation, and conclusions back to participants for them to judge the accuracy of the study’s representation of their experiences (Creswell & Poth, 2018). In this study, I took the analyzed data and my interpretations back to the participants. I sought their input about how well my analysis and interpretation of the data represented their experiences. I also utilized data triangulation (i.e., employing multiple data sources to see if different data confirm each other) to address the findings’ credibility and reveal the links between the existing literature, documents, field observations, and individual, focus group, program director, and faculty interview data.

I also addressed the credibility of the findings by employing prolonged engagement and persistent observation strategies, as suggested by Lincoln and Guba (1985). I started my engagement with community colleges and community stakeholders in the study design, and I continued to engage with them to learn more about their contexts in a prolonged and persistent

manner. While prolonged engagement ensures sufficient involvement with the research sites and participants regarding the scope of the study, persistent observation ensures a deeper understanding of elements most relevant to the study (Lincoln & Guba, 1985).

Transferability of Findings

Another way to achieve trustworthiness was ensuring that the readers could make transferability judgments. The transferability of findings refers to the degree to which the research findings can be transferred or generalized to other contexts (Korstjens & Moser, 2018; Lincoln & Guba, 1985; Nassaji, 2020). A deep engagement with multiple sources of data through continuous reflection and analytical notes led to a rich and thick description of research sites, participants, and findings. Using this information, the readers can make transferability judgments.

Dependability of Findings

The dependability of findings in qualitative research is equivalent to reliability in quantitative terms and refers to the appropriateness and acceptability of the inquiry process (Lincoln & Guba, 1985). Ensuring dependability requires a detailed description of the research process and how the methodological decisions have been made. I aimed to achieve this by providing a thick and rich description of the research processes. In addition, Lincoln and Guba (1985) draws from Halpern's (1983) audit trail and suggest a dependability audit, the first phase of an audit trail, to ensure the dependability of findings. In the dependability audit, an auditor assesses the appropriateness and acceptability of the inquiry process. As I collected and analyzed the data, I had regular meetings with my research advisor and shared the details of this study's inquiry process. These included the details of the data collection process, summaries I developed

based on the preliminary findings of the study, the new data collection tools as the study progressed, and the procedures regarding how I developed these data collection tools.

Confirmability of Findings

The confirmability of findings is about the objectivity criteria in quantitative research terms and refers to if other researchers can confirm the findings by following the same methodological steps. While dependability of findings is about the inquiry process, confirmability is about “whether findings are grounded in the data.” (Lincoln & Guba, 1985, p. 323). Kyngäs et al. (2020) suggest that confirmability is related to ensuring authenticity of findings, which can be used as a strategy to highlight the connectedness of data and findings in a study. Accordingly, any reports of the findings should possess various citations that effectively illustrate the interconnectedness between data and findings. Kyngäs et al.’s (2020) methodological suggestion is to systematically incorporate citations from participants throughout the text (e.g., at least one citation for each emerging category in the presentation of findings). Therefore, whenever I made a claim based on the data, I ensured adding examples of relevant citations. In this way, the readers can make confirmability judgments by reading the instances of original data and my interpretation of these quotations.

Chapter Summary

This dissertation study aims to explore how women with multiple and intersecting identities decide to pursue an Associate in Engineering program in North Carolina community colleges, how they describe their experiences, and what transfer aspirations they have. Employing an instrumental case study design, I selected women in Associate in Engineering programs in North Carolina community colleges as the case. I aimed to develop an in-depth understanding of women’s experiences in these male-dominated programs by focusing on this

group. The theoretical framework, intersectional feminist theory, informed critical methodological decisions from selecting participants to formulating interview questions. In a study grounded in a feminist theory and transformative paradigm, each phase aimed to integrate and reflect the voices of the communities the researcher was working with.

In this study, I conducted field observations, analyzed document data from institutional websites, and conducted semi-structured interviews with women enrolled in the Associate in Engineering degree program, program directors, and faculty members. After the data analysis phase was completed, the focus group interview served as a member-checking process in which the participants could assess how well the findings, their interpretation, and practical implications reflected their experiences and needs. This chapter provided more detailed information about how I conducted the study. This chapter also discussed how I addressed ethical considerations and ensured the study's trustworthiness. The next chapter will discuss the findings.

CHAPTER 4: FINDINGS

This study aimed to explore how women decided to enroll in the Associate in Engineering degree programs in North Carolina community colleges, what their experiences in the program are, and their transfer aspirations. To this end, I aimed to answer the following research questions:

1. How do women with different intersecting identities decide to pursue an Associate in Engineering degree program?
2. How do women with different intersecting identities describe their experiences in male-dominated Associate in Engineering degree programs in North Carolina community colleges?
3. What are the transfer aspirations of women in Associate in Engineering degree programs in North Carolina community colleges?

This chapter starts by offering contextual information about what was happening during the study at the research sites. Following this, I present demographic details about the participants to provide clarity on the identities of those who shared their perspectives and experiences. Subsequently, the discussion delves into the themes unveiled through the data analysis. The chapter concludes with a summary of the key findings.

Setting the Context: Research Sites at the Time of the Study

The Associate in Engineering degree programs at my three research sites are designed with a comprehensive degree plan that includes required general education and prerequisite courses. These courses are carefully selected to be acceptable to all public Bachelor of Science Engineering programs in North Carolina, providing a seamless pathway for students to continue their education at the bachelor's level. Graduates of this program are well-positioned to meet the

entrance requirements for any of the North Carolina public Bachelor of Science Engineering programs. A distinctive feature of the program is that students following the degree progression plan can apply to these programs without the need for additional and potentially duplicative courses. Nevertheless, it is stressed that gaining admission to these engineering programs is fiercely competitive, and achieving success is not assured. In the subsequent sections, I discuss my observations from site visits and the analysis of program websites to set the context for the findings. Before I share my observations, I also would like to acknowledge that program directors, and my faculty and staff contacts at the research sites had a genuine interest in learning more about women's experiences in the program.

Park Community College

Over a period of six days spanning three weeks in August and September 2023, I dedicated a total of 10 hours to actively observing the engineering classrooms and an engineering club, to which I was granted access by my faculty point of contact at this research site. Through these experiences, I was able to gain valuable insights into the educational practices employed. In a course that I observed, the students engaged with essential engineering drafting tools, learning about the differences between an engineering scale and an architectural scale. The engineering club sessions were particularly instructive, as participants learned to use Jupiter (Phyton) as a calculator, reinforcing their computational skills. In another course, the focus extended to the unit conversions, with students solving assigned problems.

In these learning environments, class sizes typically ranged from 13 to 17 students, and notably, there was a modest representation of two to four women in each class. It is noteworthy, however, that the pool of eligible participants for the study was limited, given that some were enrolled in the Associate in Science Program or were dual-enrollment students, meaning that

they were high school students simultaneously enrolled in the community college and ineligible to participate in this study. I observed courses delivered by two faculty members—one a man of color and one a woman of color—both teaching engineering courses. Initially, there was no information about the faculty on the program website. However, I later learned from the program director that there were only two engineering faculty members in the program, and I visited all courses delivered by these two faculty members.

The classroom atmosphere was generally characterized by silence, creating an individualistic setting with few peer-to-peer interactions. When students sought assistance, they typically directed their questions to the instructors, and women were active in asking questions. Nevertheless, there was an instance where I specifically monitored women's voices in a class, and for a duration of two hours, none were audible. However, this pattern was not consistent; during collaborative problem-solving exercises, instructors encouraged students to come to the board and write their solutions on board. Women students also actively engaged in this process, standing up and sharing their solutions with classmates. Furthermore, I noted occasions when White men were present, and the articulation of questions or responses to the instructor's questions was primarily led by the voices of White men. This observation highlighted a noteworthy racial and gendered dynamic within the classroom environment.

In the instructors' communication with students, the expectation of students pursuing an engineering career was consistently evident. The instructors routinely linked course content to engineering careers, providing students with valuable insights into what awaits them in their future professional paths. In a specific instance, one of the instructors, a man of color, related the course content to his internship experience, highlighting how his programming proficiency distinguished him among his peers. I found these interactions to be valuable and motivational for

students, as they offered glimpses into the instructors' professional experiences while connecting the students' educational journey to the broader landscape of engineering opportunities. As an observer, it became apparent to me that the true expectation for these students was to transfer to an engineering program and pursue engineering careers, as all conversations in the class assumed this goal. Another particularly noteworthy moment was when the Dean of the Engineering department, a man of color, visited the class I was observing. He introduced himself to the class, engaging students by asking questions about their motivations to pursue engineering. All three women in the class enthusiastically shared their aspirations, with one aspiring to be an electrical engineer, another expressing interest in computer science, and the third aiming for mechanical engineering. The dean encouraged ongoing dialogue by inviting all students to visit him for further conversations about engineering.

In addition to emphasizing the technical aspects of engineering, there were instances where the pursuit of engineering was intricately linked with the promise of a better life by instructors. During a class, the instructor underscored the significance of active class engagement and introduced a motivational element by posing a question to the students: "Do you want a better life?" This question was accompanied by a subtle but impactful message, suggesting that choosing a path in engineering could lead to an improved quality of life. This sentiment was further reinforced on the program's website, where salary prospects for engineers were highlighted. By providing students with a clear understanding of the potential financial rewards associated with engineering, the program also aimed to underscore the social mobility function it could offer, presenting engineering not just as a field of study but as a pathway to personal and financial advancement.

The visual representation of gender in both the engineering program website and classrooms conveyed a notable gender disparity. On the front page of the program website, while there were several student photos, it was evident that only one woman was featured prominently. In contrast, three other photos prominently showcased men as engineering students, accompanied by a quote from a man detailing his transfer to one of the UNC engineering programs. This visual composition emphasized gender imbalance, potentially influencing the perception of the engineering program by women. This gender imbalance extended to the observed classroom settings, where promotional material for a student-led engineering club depicted an exclusive representation of men.

Subtle instances of gendered dynamics were also observed in classroom communications. For instance, there was a potential gendered aspect in a well-intentioned encouragement from the instructor, a man of color, urging students to participate in an engineering competition. The professor's mention of time constraints, coupled with the suggestion that students might be "wasting" their time on other pursuits, could unintentionally imply a judgment. This implication gains significance when considering the myriad roles and responsibilities that women in the study juggle, such as work, caregiving, and studying. It is imperative to underscore the importance of fostering inclusive spaces for women, rather than potentially blaming them for allocating time to other commitments, recognizing and validating the diverse challenges they navigate.

Triangle Community College

During late September and early October 2023, I dedicated two to three full days each week for two consecutive weeks to observing engineering classes at Triangle Community College. In early December 2023, I spent an additional five hours at this research site observing

an engineering competition, which was the final project of a course that I observed. Among the 10 class hours I observed, only one hour of class was lecture-based, while the remaining nine hours of class featured a project-based approach. The lecture-based class was a drafting class, in which students followed the instructor's guidance while utilizing design software. The project-based classes were different sections of the same introduction to engineering class, and students were actively working on making egg catchers. This project required a synthesis of engineering principles, problem-solving skills, and practical application, with the overarching goal of designing devices to protect eggs from breaking when dropped from a specific height. The entire class sessions that I observed were dedicated to hands-on work without any lecturing.

The gender composition of the classes and the engineering competition I observed was characterized by a noticeable gender imbalance, with the number of men ranging from eight to seventeen, while women constituted a smaller group, ranging from zero to six in each class. Notably, among the faculty members, only one was a White woman, and all other three faculty members were identified as White men, highlighting a gender disparity. The faculty information on the program website aligned with this observation, indicating a predominantly White male composition.

The lecture-based class had an environment characterized by individualism. There was minimal student-to-student interaction, and while some students directed questions to the instructor, it was noteworthy that men exhibited a higher level of activity in their interactions with the instructor. Drawing parallels to my observations at Park Community College, it became apparent that women tended to remain more reserved in lecture-based settings compared to men.

The dynamics within project-based lessons varied considerably among groups. Due to women being underrepresented in the classroom, there were a significant number of all-men

groups. While women's groups were gender-mixed, there was a tendency for women to gravitate toward each other. For instance, if a class had three women, it was highly likely that at least two of them would end up in the same group. Some groups were exceptionally reserved, completing tasks with minimal verbal interaction. Within these groups, some women appeared quite at ease, others adopted a more assertive approach, while a few remained relatively silent. It was only through subsequent interviews that I came to understand that both assertiveness and silence stemmed from gender-based dynamics, with women either feeling silenced or becoming more assertive in response to not being heard by other team members who were men.

Similar to the two other research sites, the program's primary objective was to train future engineers. For instance, in one of the classes, the board displayed a comprehensive summary of the semester's progress, detailing completed topics and outlining upcoming weeks. The organized presentation conveyed a sense of meticulous planning and clarity. As the class started, the instructor systematically went through the information on the board, providing students with a clear overview of both their past achievements and upcoming plans. The instructor connected the planning process to real-world applications in the field of engineering.

In addition, the design of groups in certain courses aimed to prepare students for collaboration in their diverse future engineering teams. In one of the classes, after the groups were formed, the instructor, a White man, approached and asked if I had any questions for him. I asked about the criteria for forming the groups, and he informed me that he utilized a DISC assessment to assign students into groups. He explained that the DISC assessment evaluates an individual's position within the four primary personality categories: dominance, influence, steadiness, and conscientiousness. During the assignment of students to groups, he ensured that all personality traits were represented in each team. He believed that this approach was

instrumental in constructing well-functioning engineering teams in the workplace. However, gender was not at the center of this consideration. When I asked him if he had observed any gender differences in traits, he responded that this was not the case. He shared that he had encountered numerous instances of women demonstrating dominant leadership traits.

Furthermore, in the classes I observed at Triangle Community College, instructors consistently remained available beyond the scheduled class time, acknowledging the distinctive needs of students at a commuting community college. Given the limited time students spend on campus, they often needed extra time to collaborate with their teams and complete assignments. The instructors underscored the diverse responsibilities students juggle, including time constraints to meet outside the class due to work and family commitments. Additionally, they allowed students to use the classroom after the class to continue working on their projects.

Land Community College

I spent two days conducting interviews and observations at Land Community College in September 2023. During this time, I dedicated a total of six hours to actively observing three engineering classrooms. Access to these classrooms was granted by my faculty point of campus contact, who was teaching the courses I observed. In one of the courses, the main activity was building electric circuits. I observed two different sections of this class. Additionally, I observed a Statics class in which students were learning the concept of moment, specifically determining moments of a force in both 3D and 2D settings. The instructor engaged the students in theoretical discussion and practical problem-solving related to this concept.

In these classrooms, there was a gender imbalance, with the gender composition of the students ranging from eight to seventeen men and three to six women in each class. The majority of these women were dual enrollment students, who were high school students simultaneously

enrolled in the community college. The professor, a woman of color, exhibited an in-depth understanding of women enrolled in her class, including details about their academic programs, progress in the program, transfer aspirations, and their current status in the transfer process. Her strong connections with the students were apparent. Perhaps due to these connections with women students in her class and her identity as a woman instructor, the classroom interactions did not conform to a gendered pattern of classroom participation I observed in other lecture-based classrooms in the other two research sites. At Land Community College, I observed instances of both men and women actively participating in the class, responding to the professor's questions, and posing their own inquiries.

During the class where students were constructing electric circuits, a significant portion of the class time was dedicated to a hands-on activity. I noticed the instructor strategically organized students into pairs. She explained her rationale, stating that she preferred pairs because in groups of three, one student might not have sufficient opportunities for hands-on engagement. Curious about any potential gender-related considerations, I had a subsequent lunch conversation with the professor during my next visit. She expressed a keen awareness that in larger groups, it tended to be women who might miss out on the opportunity for hands-on engagement, highlighting her thoughtful approach to fostering an inclusive learning environment. During my observations, it was also evident that pairing students helped ensure that each student had a direct role in the task, promoting active learning.

Just like the other two research sites, the program's objective was to train engineers, a goal evident in professor-student interactions in the classroom. For instance, I documented an occasion where the professor paused to offer words of encouragement to the students, emphasizing that they should not be discouraged by anyone suggesting that they were not suited

to become engineers. To illustrate this point, she shared a compelling anecdote about a friend who initially faced setbacks, failing the same class three times, yet ultimately succeeded in becoming a control engineer. I found this personal story to be a powerful and motivating example, designed to instill confidence and resilience in her students.

Land Community College's Associate in Engineering program website emphasized a focus on the high school pipeline, evident through the abundance of information detailing programs and activities specifically designed for high school students. Similar to Park Community College, the engineering program at this institution is led by two faculty members, a White man and a woman of color. There are also two Math and one Physics instructors in the program. The visuals representing students on the program website are also gender-balanced. On the website, it is also possible to see the program's commitment to providing flexibility for individuals with various responsibilities outside of their academic pursuits.

In summary, there were similarities and contrasts in terms of characteristics that defined the Associate in Engineering programs in my three research sites. One common characteristic was the underrepresentation of women. Across all research sites, the gender imbalance remained, with men comprising the majority of the class. Another notable similarity pertained to the program goal of training future engineers. Faculty members at all research sites frequently referenced how engineers work and what an engineering job entails, offering students words of encouragement. In lecture-based learning environments, women tended to be more reserved compared to men. However, at Land Community College, the presence of a woman of color as an engineering professor, along with her genuine interest in her students and their progress in the program appeared to make a difference in encouraging women's participation in the lecture-based classes. In terms of faculty diversity, the gender imbalance in faculty positions was most

apparent at Triangle Community College, where only one White woman served as an engineering faculty member and all four faculty members, including the program director, were men. The following sections discuss the key themes revealed by the data analysis.

Presentation of Findings

The data analysis revealed four themes. The first theme is about women’s audacious entry into engineering education. The second theme is about women’s gendered and intersectional experiences in the curricular and extracurricular spaces of the Associate in Engineering degree program. The third theme is about the pressing need for diverse faculty and peer support systems for women enrolled in the Associate in Engineering program. The fourth theme is about the quest for tailored institutional support systems while navigating challenges. Table 2 presents a summary of key themes and sub-themes, and each theme is discussed in more detail in the sections that follow.

Table 2. Summary of key themes and sub-themes.

<i>Themes</i>	<i>Sub-themes</i>	
An Audacious Entry into Engineering Education	<ul style="list-style-type: none"> • A Strategic Decision for a Brighter Future: “It is smarter to start in a community college.” • A Courageous Decision: “They warn you that it is a very male dominated field.” • A Lack of Institutionalized Support: “I did not really have anyone to turn to.” 	<ul style="list-style-type: none"> • Taking a Cost-Effective Path to a Better Future: “Community college is cheaper.” • Evaluating their Diverse Needs: “Attending community college was more convenient for me.” • Overcoming Community College Stigma: “To them, coming to community college, it seemed like a little less.”

Table 2 (continued).

Gendered and Intersectional Experiences in the Curricular and Extracurricular Spaces	<ul style="list-style-type: none"> • Being Underrepresented in the Class: “It is common to expect a five-to-one ratio.” • Marginalization and Bias in Team Projects: “I was being spoken over by a bunch of men.” • Gendered and Intersectional Patterns in Extracurricular Participation: “I felt out of place.” 	<ul style="list-style-type: none"> • Emotional Toll of Underrepresentation: “I am tired of looking at people who do not look like me.” • A Deeply Personal Reaction to Systemic Underrepresentation: “It is my self-esteem.” • A Cautious Approach to Class Participation: “I just did not want to ask for help.” • Unveiling the Nature of Marginalization in Teams: “I feel like it is not as overt as people would think.” • Navigating the Challenge of Ensuring their Voice is Heard: “What I do is try to be more assertive.” • Faculty Approaches to Addressing Bias: “I don’t know if that works.”
A Pressing Need for Diverse Faculty and Peer Support Systems	<ul style="list-style-type: none"> • Faculty Diversity: “It would be helpful if we had a Black woman as an engineering instructor.” • Peer Support Gap: “It’s kind of hard to find things in common with my classmates.” 	
The Quest for Tailored Institutional Student Support while Navigating Intersectional Challenges	<ul style="list-style-type: none"> • Academic Support beyond the Class: “I can ask those stupid questions.” • Transfer Support Systems and Challenges: “They do not really talk about competitiveness.” • Financial Support Systems: “It’s just me working two jobs.” • DEI and Other Support Systems: “I do not recall any kind of specific process for that.” 	<ul style="list-style-type: none"> • Challenges and Concerns: “More information about what needs to be done in the transfer process would be helpful.” • Intersecting Identities, Transfer Aspirations, and Support Needs: “I really want to go to a HBCU.” • Accessibility Services: “Do you mind speaking a little louder?” • Mental Health Support Systems: “I have a lot of anxiety.” • Reporting Sexual Misconduct: “They are drunk, they call me, they ask if I am available.”

An Audacious Entry into Engineering Education

The first theme revealed by data analysis focused on women's audacious entry into engineering education through community college. The decision to enroll in the Associate in Engineering degree program was characterized by strategic and courageous decision-making processes in the absence of institutionalized support systems for women. Enrolling in the program, women in this study considered factors such as affordability, the challenge of overcoming community college stigma, and their diverse life experiences. Secondly, it was a courageous decision as women in this study confronted and persevered through gender-based, racial, and class-based stereotypes, consistently causing them to question if they could succeed in the engineering field. While women in this study demonstrated resilience, agency, and determination throughout these challenges, there were no available institutionalized support systems to address their fears and concerns. These key findings are discussed in more detail below.

A Strategic Decision for a Brighter Future: "It is smarter to start in a community college."

Women's enrollment in the Associate in Engineering degree program was driven by their pursuit of a better life (e.g., financial stability and independence) and financial considerations associated with pursuing a postsecondary degree. For the women in this study, selecting a community college engineering transfer program represented a strategic decision, that entailed considerations of affordability, evaluating their own diverse needs, and the stigmas associated with community college attendance. Each component of this complex decision-making process is discussed in detail.

Taking a Cost-Effective Path to a Better Future: “Community college is cheaper.”

All participants described the cost-effectiveness of community college as the primary reason for their decision to enroll in the Associate in Engineering degree program over a four-year engineering program. For example, Hedy, a Middle Eastern woman, said that community college was “financially the best option” for her. For Rere, a Black woman, finances also played a significant role in her decision to enroll in the Associate in Engineering degree program. Her senior year in high school coincided with the midst of the COVID pandemic. With everything shifting online and many aspects of life shutting down, she found herself grappling with a lack of guidance and resources during a critical time in her academic journey. Rere, continued,

Four years are very expensive, and I just did not want to jump into the process. When I was in my senior year of high school, we were pretty knee deep in the COVID pandemic. So, I did not have a lot of resources to search for colleges and how to navigate that type of stuff because everything was online and shut down. So, I just thought it would be smarter to just go to community college for two years. And then just do my research as I am there.

Just like Rere, for Jasmine, an Asian woman who is also an international student, opting for a community college was a financially better option when her status as an international student was considered. When I asked her what factors led her to enroll in a community college, Jasmine shared,

To be honest, community college is cheaper, and it is smarter to start in a community college because if you start at a university, it is harder to change your major too. In community college, you can change your major any time, and you can try out courses without high cost.

Starting at a university would have been challenging for Jasmine, especially when her out-of-state student status was considered for tuition and enrollment purposes. Community college provided the flexibility to change majors at any time and explore courses without a huge financial burden for Jasmine. This is why, beginning at a community college made more sense to her. Similarly, Ada, another international student, stated “Because I am an international student, it was not easy for me to start at a four-year university. I actually chose to start coming to community college because it was cheaper.” For both Jasmine and Ada, financial considerations were at the center of their decision-making process as international students.

For some participants, attending a community college engineering program was a more practical option, offering an opportunity to stay with their families, thereby eliminating the need for additional expenses related to relocation and increased living costs, such as rent. Just like other participants, the main reason for enrolling in a community college engineering program for Margaret who is a White woman was the cost. She said that her parents never had college funds for her or her brother. Therefore, her parents spent their entire lives encouraging them to enroll in a community college. She opted to enroll in community college to remain close to her family, lowering her college attendance costs. Similarly, Sarah shared:

Attending a community college helps with financing because it is a lot cheaper than going to college. That they do not pay for dorms or housing really did help. I was able to stay near my family because most of my family is in this area. Also, I was able to keep a part time job I have (Sarah, a White woman).

Navigating a complex web of identities and aspirations was also at heart of this strategic decision-making process, particularly for immigrant women. For them, community college became a cost-effective gateway to a better life, breaking barriers related to the costs of attending

higher education. In this case, attending the Associate in Engineering degree program and transferring to an engineering program in a four-year university meant breaking free from the limitations of the past and building a brighter future. Their narratives depicted the program as a bridge between their reality and dreams. Nikki whose family was immigrants from a country located in Central America shared, “I am a second-generation immigrant here, and it was always instilled in me to go to college, get a good job, so you do not have be working like the way we are working.” She was referring to the way her parents were working, and she continued, “you need a degree if you want a decent job in the United States, so I was like, college, no question. I always knew I was going to go to college. I knew I had to go.” Knowing that she would eventually go to college, she did her research about costs of attending higher education and made the decision to enroll in a community college engineering program.

Checking how much the costs were, I think it is about \$9,000 for a semester in a four-year engineering program, and then comparing it to the community college, where it is at the most is going to be like \$2,000. Considering my mom is a single mom, I did not want to take out loans. So, I was definitely coming here (Nikki, a Hispanic woman).

Just like Nikki’s parents, Martha’s parents had always encouraged her to go to college. Martha, a Hispanic woman knew that she would go to college, but the four-year out-of-state tuition costs dissuaded her from pursuing a traditional university route. Martha also expressed a desire for financial independence, a goal that aligned with her decision to study engineering.

Well, I know, I have always been like a studious person. Both my parents did not have the opportunity to go to college. Literally ever since I was little, they would always tell me how important it is to get a good education. I was pretty good at school, so it was not hard to like, I never disagreed with them on that. I always knew I wanted to go to college.

I was not going to go to a four-year university because four-year out-of-state tuition would be a lot. Also, I just want to be financially independent. I think that probably also influenced me to do engineering (Martha, a Hispanic woman).

Similar to other first-generation immigrant parents Nikki and Martha mentioned, Lilly was an immigrant parent, and her enrollment in the program was also driven by offering a better career for herself and a better future for her daughters.

Seeing it as an immigrant, giving a new generation a higher perspective and goals, is not just finishing high school and just finding a job, but finding a better career. So that way I can get my daughters to go farther and then look out for what they want to do after high school (Lilly, a Hispanic woman).

Having these goals in mind, Lilly wanted to go further and advance in her career to get a better position. Although she considered attending a four-year university, the cost was too expensive. She decided to do the first two years in the community college as it would be “easier, better, and more economical” for her.

In summary, the recurring theme across women’s narratives in this study is the significant role of financial considerations in their decision-making process. For many, community college emerged as the financially best choice, offering an accessible and flexible platform to pursue higher education. The diverse stories presented in this section illustrate the significance of the Associate in Engineering degree programs in breaking down financial barriers and fostering opportunities for women from various backgrounds to achieve their academic and career goals.

Evaluating their own Diverse Needs: “Attending community college was more convenient for me.”

It is worth noting that the women in this study individually evaluated and defined why attending a community college engineering program was a better option for them based on how specific aspects of their lives aligned with the features offered by community colleges. For example, as a returning student, Elaine had previous college experience and had been working for some time. However, she reached a point where she realized that there was a ceiling to her growth in her career. Therefore, she wanted to further her education in a STEM field after hearing from people with computer science degrees about their love for the field. She wanted to start in a community college, a decision shaped by her status as a returning student at the age of 29. She felt uncomfortable jumping directly into a four-year engineering program and saw community college as a beneficial transition from being out of school for several years to re-entering a classroom as a student, saying “I think it was a good transition from not being in school for several years to going here instead of a university.” Therefore, her decision to enroll in the Associate in Engineering program rested on her unique need for a smooth transition into the college.

Just like the returning student status, the international student status was also a critical factor shaping Ada’s and Jasmine’s entry into the Associate in Engineering program. Ada—an international student— said, “attending community college was more convenient for me.” When I asked her what convenience meant for her, she defined it particularly in terms of the language requirements of four-year engineering programs. She mentioned having to take exams like TOEFL if she wanted to attend a four-year university. Such enrollment requirements of four-year universities influenced her decision to enroll in a community college.

Another strategic aspect of enrolling in a community college engineering program was related to women's pre-college STEM exposure and experiences. Some women in this study recognized a gap in their high school STEM exposure and strategically chose community college to address this gap. By opting for a community college STEM program, they saw their time in the community college as an opportunity to enhance their skills, close the gap in their knowledge, and demonstrate their ability to succeed in a STEM academic setting. For example, Kate, a first-generation college student, decided to enroll in a community college engineering program as it was a way for her to get into the four-year university. She could not apply to a four-year engineering program because she thought they would not admit her as she once dropped out of high school. She wanted to prove that she could do well in school by attending the Associate in Engineering program. Rere, a Black woman, shared a similar experience,

I did not perform very well in high school just because of family issues, mental health issues and stuff like that. I did not want to just apply to any college, but I wanted to show academically what I can do at a community college (Rere, a Black woman).

In conclusion, the women in this study exhibited a thoughtful and personalized approach to evaluating their educational needs and choosing to enroll in a community college engineering program. Their decisions were shaped by a nuanced understanding of their unique circumstances, such as returning student status, international student status, and the need to bridge gaps in pre-college STEM exposure. The diverse range of motivations underscores the importance of community colleges in accommodating individual needs and fostering pathways to success in engineering education.

Overcoming the Community College Stigma: “To them, coming to community college, it seemed like a little less.”

Another significant aspect of this strategic decision-making process was facing and overcoming the community college stigma. Although the Associate in Engineering degree program was seen as a pathway to a better life, the decision to enroll in the program was sometimes hindered by the prevailing societal stigma associated with community colleges (i.e., negative perceptions and biases associated with attending or graduating from a community college). Some women found themselves facing a dilemma given two competing considerations: affordability and the community college stigma. While the economic advantage of community colleges motivated them to pursue their academic goals at these institutions, the community college stigma meant losing crucial social support systems. Referring to lack of peer support systems, Margaret shared,

In my senior year of high school when the college application season was coming on, I was friends with a lot of high achievers, people that were applying to Ivy League schools and stuff like that. None of them understood or agreed with my decision to go to community college, and it kind of made me feel bad about myself. I kind of wish I had more support from my friends (Margaret, a White woman).

Similarly, Nikki who is a Hispanic woman shared:

Well definitely at first it was the stigma around community college because all my friends are going to, I have a lot of friends, going to [mentions the name of a four-year university in North Carolina], or a lot of my friends actually went to [another four-year university in North Carolina], so being the only one going to community college was definitely hard. My mom, my parents, my grandparents were like “you have to go to

college.” So, to them, coming to community college, it seemed like little less, especially since my mom has done a two-year technical college in [a country in Central America]. As she has done it, this is not good in her mind. She thought I needed to be better. She was also really pushing me and my older sister because she also went to the same community college, really pushing us straight into a four-year university. My older sister and I thought we could transfer because community college was cheaper. There is this stigma in my family. That definitely made it harder to just go here. I am glad I did (Nikki, a Hispanic woman).

Margaret’s strategic decision to enroll in community college, despite her peers’ decisions to attend four-year institutions, was influenced by her parents’ encouragement and the financial considerations stemming from the fact that her parents did not have a college fund for her. On the other hand, Nikki found inspiration in her sister’s positive example, which played an important role in helping her overcome the stigma associated with attending community college. These unique paths reflected the diverse factors that contributed to individual decisions, showcasing the intricate interplay of familial support, financial considerations, and personal role models in shaping women’s educational choices in this study.

These findings shed light on the complex and multifaceted nature of intersectionality in the lives of women enrolled in the Associate in Engineering program. Women in the Associate in Engineering program were not only motivated by their interest in engineering, but also by a need to accommodate their diverse needs while securing their financial independence and well-being. To this end, their identities and life experiences informed their strategic decisions, motivations, and pathways into engineering education with the hopes to secure a better life.

A Courageous Decision: “They warn you that it’s a very male dominated field.”

The analysis of the interview data highlights a significant aspect of the decision-making process to enter the male-dominated engineering field within the community college context: it often necessitates confronting and persevering through gender-based, racial, and class-based stereotypes. The women in the study shared their experiences of receiving direct and indirect messages about who should or should not become engineers. They shared instances of heightened pressure and scrutiny when considering engineering as a career choice. Consequently, enrolling in the Associate in Engineering program required not only overcoming personal doubts but also breaking free from societal expectations rooted in bias and discrimination related to gender, race, and class. Attending the Associate in Engineering program thus reflected a courageous commitment to the goal of becoming an engineer. For example, Jasmine’s journey into the program was heavily under the influence of traditional gender roles. She shared,

I am from a Muslim country, you know. A lot of people tell me “All right, get married, have kids.” My mother was especially like “you should not do math, science, physics.” She does not think girls are good at math, science (Jasmine, an Asian woman who is an international student).

When I asked her about her pre-college STEM exposure and experiences, Jasmine said:

I went to school in [an Asian country]. They always have all these science programs such as science camps and computer camps. I always wanted to go, but I was discouraged. Most of them who attend are boys. If you are a girl, they tell you “You are a girl, you should study nursing. You should study this and that.”

Some women of color noted how misleading racial and gender-based stereotypes came together and shaped other people's expectations about women's education. They shared examples of situations in which they were discouraged by racial and gender-based stereotypical expectations of others. Alice, a Hispanic woman, shared that people did not expect her to study and did not expect her to study engineering at all.

Yes, being Hispanic, there are a lot of stereotypes. There is a lot of misleading information. That we are not smart, that we will not make it to college, or that we are lazy. When people look at me, and they know that I go to school, they do not know at first actually, the first thing they asked me if I was working. Am I working? Yes, I am working. They ask me so many questions about what my work is, but they never asked me about school. Once I said "I am going to school as well," and they were really surprised. I am not sure if it is because I do not look like I go to school or it is because I am Hispanic. I tell them I am going to school. They ask what career, I tell them engineering, and they are really shocked. They are like, "that is hard." Okay, I know. Yeah, it is hard. But I am doing it. I am trying. I do not want to assume that it is because I am Hispanic. But I think because I am Hispanic, they think that way: that I should not be studying something so hard or should not be studying at all (Alice, a Hispanic woman).

Alice's narrative reflected the challenges and stereotypes faced by Hispanic women in engineering. She highlighted the prevalence of misconceptions, such as doubts about intelligence, the assumption that Hispanic individuals would not pursue higher education, and stereotypes related to work ethic. However, her determination to pursue engineering reflected resilience and a commitment to challenging these societal expectations.

Furthermore, women also faced class-based stereotypes and bias as they considered studying engineering. In her interview, Kate, a White woman, self-identified her social class by saying that “I come from a lower-class background.” She criticized the misconception that only a specific type of person (i.e., class-privileged men) could enter engineering by underscoring that it was not true. She continued:

We can all learn how to do engineering. Men are the ones you traditionally think of as climbing to the top of anything. It is still the same in this country today. I mean, people would think it is getting better than it is in some ways, but it is still so ingrained in us, what our parents taught us, our grandparents taught them and so on, so forth. I chose engineering knowing that neither of those things are typical, not for a woman and not for someone who is, you know, uneducated being a GED recipient. That is not something we typically do. But that is something I have never cared for what someone could tell me.

Kate also believed that the absence of people from lower socioeconomic backgrounds in engineering contributed to a lack of self-confidence for her. She continued “you do not know that you can go and do this. Because if you do not know how to start, if you have no foundation, you think it is out of your reach.” In the face of societal expectations and deeply ingrained stereotypes, Kate’s narrative was a testament to her resilience, agency, courage, and determination. She challenged the traditional view that engineering is reserved for men from middle- and upper-class backgrounds. Despite societal expectations and the ingrained beliefs passed down through generations, she boldly chose the engineering field and challenged the norms associated with being a woman from a lower socioeconomic background and someone with a GED (i.e., an equivalent of high school diploma for those who dropped out of high

school). Her story reflected the challenges of classism and sexism while demonstrating her refusal to be constrained by those limitations.

Some participants expressed concerns about entering a male-dominated field, particularly in terms of being surrounded by people outside their demographic or gender groups. For example, Margaret—a White woman—said, “I was scared about being surrounded by people who are not in my demographic gender group,” and she was worrying about what that would be like as she considered enrolling in the Associate in Engineering program. Alice, a Hispanic first-generation college student woman, also shared,

They warn you about it. I mean, they warn you about it that it is a very male-dominated field but you do not take it as that. Then coming down here and seeing all the males, it is intimidating. I mean, I think as it impacted me it has intimidated me, but it has made me feel like I need to keep pushing more I need to make it.

Furthermore, during the focus group interview, participants extensively discussed this portion of the first theme—the fear and anxiety associated with entering a predominantly masculine-dominated field. They shared that this fear and anxiety caused them to constantly question if they could succeed in the field, both prior to and following their entry into this environment. Constantly receiving direct or indirect messages about who should be in engineering underscored the complex dynamics at play, leading participants to question their sense of belonging.

In this study, women’s commitment to pushing through the obstacles highlighted the complexity of their experiences. The intersection of sexism, racism, and classism added layers to the challenges they faced in deciding to pursue a career in a traditionally male-dominated field. In acknowledging and honoring their resilience, courage, and agency, it is crucial to emphasize

that they should not bear the burden of overcoming these challenges alone. Recruitment strategies targeted at women can significantly alleviate the weight they carry in the decision-making process, but this study also identified a recruitment gap in institutional efforts to recruit more women. This finding is discussed below.

A Lack of Institutionalized Support: “I did not really have anyone to turn to.”

The decision-making process to study engineering in a community college is characterized by lack of institutionalized strategies to recruit more women in the program. Both in the individual and focus-group interviews, almost all participants described the process “as a self-service project,” in which they searched for community colleges and programs on their own, using online resources. To better understand this finding, one of the questions that I asked program directors was about their recruitment strategies. These interviews revealed that institutional recruitment efforts primarily focused on high school students. Since this study excluded dual enrollment students, all participants found themselves in a gap space where no targeted recruitment endeavors were made to include them in the engineering program. Program directors shared that as the main recruitment was through high schools, the majority of the students in the program were coming from that pipeline. This was also something very visible during my classroom observations and in the participant recruitment process. As I recruited the participants of the study during classroom observations, I had great difficulty finding women students who were not dual-enrollment students in the Associate in Engineering program. The big portion of the student population I met during site visits were dual-enrollment students.

At Land Community College, there were specific efforts to recruit women and nonbinary students, but they were also targeted at high school students. The program director shared:

We have a high school robotics team that is open to all high schoolers in this county. Anybody can join it. We organize summer camps to bring younger children into the campus. That is led by our robotics team members and a couple of them that we have done in the past have been female only ones, so only girls can join this camp. Another thing we have done with that robotics team is girl-only events, or the last one was for women and non-binary students only.

Furthermore, the programs at the research sites lacked a dedicated individual or position responsible for marketing and outreach. Instead, recruitment efforts were managed by the program directors, who concurrently held faculty roles within the program. One program director shared:

I am not a marketing person. I am a teacher. I just happened to be over the program as well. I am not on social media for them. I am not necessarily a recruitment person, and there is no one in charge because we do not have a recruiter of engineering. That is not a position at our college. So almost all of our students, whether male or female, kind of find it on their own, or we find them through the high schools.

While there were human resources-related challenges to recruit more women into the program, one of the program directors at the research sites also considered that the current challenge for them was not a shortage of women in engineering but a shortage of students overall. He was open to welcoming anyone, irrespective of their gender or background. He shared that “gender doesn’t matter, and I want to have more students because it is fundamental for the development of the country.” This comment is also a clear explanation for women’s representation in the program.

In the absence of recruitment strategies targeting women (excluding dual-enrollment students) in the Associate in Engineering programs, making the decision to enroll in the program and the overall enrollment journey was a self-service project, according to participants. For some participants, this self-service process was smoother thanks to family members who are already in STEM fields, who already attended a community college and transferred to a four-year university, or who could provide different forms of support (e.g., guiding the participants through the process; offering emotional, financial, academic support). For example, Edith, a biracial woman, grew up in a STEM-centered household, with her father being an engineer and her brother attending the same community college before transferring to a four-year university. She said, “because we had done this before with my brother, we did not really need that much support.” Similarly, after sharing that the decision to enroll in the program was her own discovery and research, Elaine, a White woman who was a returning student, highlighted the importance of support from her family, with her brother just graduating from a STEM major. “Through just word of mouth,” Elaine was able to understand how this engineering transfer program worked, and she found the process straightforward.

However, for some women in the study (especially if they are women of color, first-generation college students, first-generation immigrants), accessing information sources about Associate in Engineering programs took longer, and the overall enrollment and decision-making processes were more complex, including starting in a different major and then switching into engineering in some cases.

I guess, during the financial aid and all that, or just looking for resources online, which there are a lot, helped. Because I have never done that before. I have one older sibling; he has never done that before. I really did not really have anyone to turn to. So, I just looked

at it online. And that helped a lot. And now like, I said, I was helping my sister with it like a while ago. That was good (Martha, a Hispanic woman who is a first-generation immigrant).

Jasmine, an Asian woman and international student, started her journey in the nursing program in her community college, and she shared the challenges of accessing information from another country.

I searched for all the information online on my own, and it took me like 6 months, because it's so hard to get information from another country. I would like to have a school advisor that is more international. It would be easier for me to obtain more information. Actually, a lot of people want to do the same. They do not have the same information, or they do not know how to access information, and some people do not even know that there are community colleges that are easier for international students to enroll in. If you are not from the US, no one will know how to come, or how to apply for a visa. No, there is no one to tell you, it is so hard. Here you take six hours, it took me six months.

While it took her a long time to enroll in the nursing program, she decided to change her major thanks to support from her husband. When she shared with her husband that she did not enjoy studying nursing, her partner encouraged her to study computer science, knowing that she liked science and math. Thanks to this encouragement, she changed her community college program to Associate in Engineering from nursing. Similarly, Alice, a Hispanic woman, started her community college journey in the Associate in Arts degree program, then switched to Associate in Science to pursue her interest in math. It was through her own research that she thought the Associate in Engineering degree program would better align with her future career goals and interests, and she switched to the Associate in Engineering program.

In summary, this study indicated that the recruitment focus on high school students left a gap for students who were not coming through the high school pipeline. Despite challenges, the decision-making journey varied for participants. Those with STEM backgrounds or familial support found the process smoother, while others faced more complexity, especially women of color, first-generation college students, and immigrants. Accessing information sources and navigating enrollment procedures posed challenges, with varying degrees of support available. The finding underscores the need for women-targeted recruitment strategies, recognizing the diverse pathways and support systems essential for facilitating women's enrollment in community college engineering programs.

Gendered and Intersectional Experiences in Curricular and Extracurricular Spaces

One key observation during the classroom visits was the noticeable underrepresentation of women in engineering classes. On several occasions, women enrolled in that class section were absent on the day of my observation, and I found myself observing an engineering class with nine men, one of them being the instructor. A similar situation occurred when I expressed my interest in observing an engineering club at one of my research sites. The instructor welcomed me but mentioned, "I have been running this club for ten years, and I have never seen a woman attending this club." Despite this warning, I expressed my intention to attend, as I believed it was essential to make women's invisibility visible and explore the reasons for their underrepresentation and absence in curricular and extracurricular engineering spaces. The following day, when I arrived at the engineering club, I did not see any women present in the space, only three men. This section discusses women's gendered and intersectional experiences in the curricular and extracurricular spaces of the Associate in Engineering degree program.

Being Underrepresented in the Class: “It is common to expect a five-to-one ratio.”

Discussing the gender distribution of a typical engineering classroom, program directors and faculty, in their interviews, agreed that women’s underrepresentation remained consistent over time, with only subtle differences. One faculty member shared that it was common to expect “a five-to-one ratio.” This meant that in a class of 15, one could typically find about three women compared to the majority being men. They acknowledged that while there might be slight variations across institutions and classrooms, this ratio was quite persistent in the Associate in Engineering classroom—an observation I also made during my classroom visits.

The interview data that come from women enrolled in the program, faculty, and program directors clearly indicated that male domination in the community college engineering classroom extended beyond just the numerical majority. It significantly affected women’s experiences in the classroom and beyond. The following sections describe how the male domination in the engineering classroom evolved into a draining pursuit for representation among women in the program, women’s deeply personal responses to this systemic issue, and the consequences of male domination in terms of women’s classroom engagement.

Emotional Toll of Underrepresentation: “I am tired of looking at people who do not look like me.”

The majority of participants used the following adjectives to describe the male domination in their classes: “isolating,” “intimidating,” “daunting,” and “frustrating.” Using intersectionality as the analytical framework was critical in uncovering how gender intersects with other aspects of identity, such as race, age (especially for returning students), and sexual orientation, which helped demonstrate that women’s experiences were not uniform even when they used very similar adjectives to describe their experiences. Women’s experiences

significantly varied depending on where they stood at the intersection of multiple forms of privilege and oppression. For example, it was evident for women of color that their experiences in the classroom were isolating because they did not share much in common with their predominantly male and racially different classmates. Hedy, a first-generation immigrant Middle Eastern woman, said:

I take classes like a hybrid of online and in-person classes, but, in both I feel a little isolated. I feel like I do not have as much in common with some people in my class, I guess because it is really male-dominated. In a lot of my classes, there are very few girls, and then, there are a lot of guys.

Similarly, Mary, an African American woman who is also a first-generation college student, shared:

Whenever I went to class and I showed up on my engineering or my calculus class, I realized there were less and less people of color and then there were even less women, not even just women in general. I notice I am tired of looking at people who do not look like me. I am tired of looking around and seeing people who are not my ethnicity or you know, are not a woman.

For White women, the male domination in the community college engineering classroom also instilled feelings of intimidation, but their experiences were further nuanced by additional marginalized identities like being a returning student or a first-generation college student. For example, Elaine, who was a White returning student at the age of 29, shared her feelings of intimidation, highlighting that her return to school was daunting for reasons beyond just gender dynamics. She openly expressed that her age played a significant role in shaping her experiences in the classroom. She found the experience particularly challenging because she was

transitioning from a different life stage, not directly from high school. She also mentioned taking a physics class, where she was one of only two women as an example to emphasize a sense of difference. She said, “it is definitely daunting because, for example, my physics class was just me and one other girl. That was definitely different, but it was also more like because of my age.” Her story illustrated how other identities as well as gender (i.e., her age and returning student identity) could play a substantial role in shaping her feelings of isolation and intimidation in the program.

While the male dominance in the program posed a challenge for women in the program, it is also crucial to note that it also served as a powerful source of motivation for many of them. The male dominance in the program motivated them to keep pushing to make a significant impact in a field where women are traditionally underrepresented.

You know it is a heavily male dominated program that the classes like fully, mostly male. Still women can make a difference. Now, that is what’s the motivation. Yeah, it’s like, we can show this is not only for men, that women can go into these fields men are doing, and then we can bring really good results (Lilly, Hispanic woman, age 41).

Similarly, Alice, a Hispanic woman, said:

My first experiences into the engineering field, I spoke to just women. And so then coming to the classroom and seeing all the males is intimidating. I mean, it has impacted me, it has intimidated me, but it has made me feel like I need to keep pushing more.

Lilly’s and Alice’s words highlighted the dual nature of women’s experiences in engineering. On one hand, it is important to recognize their resilience and determination in overcoming challenges. On the other hand, it is crucial to acknowledge the emotional costs associated with

navigating an environment where they might face intimidation, discrimination, and a lack of support as they “kept pushing more.”

In conclusion, the narratives shared by participants illustrated the emotional and psychological consequences of gender disparities for women in the engineering classroom. The application of an intersectionality framework also revealed that women’s experiences were far from uniform, with variations informed by the interplay of privileges and oppression depending on their social locations determined by their race, age, and other identities. While recognizing the remarkable resilience of women in persistently “pushing more” in this male-dominated environment is essential, but equally imperative is acknowledging the importance of building safe and supportive learning environments for them.

A Deeply Personal Reaction to Systemic Underrepresentation: “It is my self-esteem.”

After conducting interviews at multiple research sites, I became aware that women participating in this study were expressing similar forms of self-blame as a response to their systemic underrepresentation in the community college engineering classroom. While isolation and intimidation were influencing their classroom behaviors similarly, these women described the effects of this male-dominated environment in deeply personal terms, often using expressions like “it is me and my anxiety (Nora, a White woman),” “it is my mental block (Edith, a biracial woman),” and “it is my self-esteem (Sarah, a White woman).” The vocabulary they used was different, but they all meant the same thing. It became evident that the pervasive sense of isolation, coupled with the inability to share their experiences with others who had similar struggles and the lack of representation of those with whom they could relate, led these women to believe that such feelings were unique to them. This fostered an environment where self-blame became a natural response.

However, in reality, the feelings mentioned in the previous paragraph were a shared experience among the participants. For example, Sarah, a White woman, described her biggest challenge in the classroom as her self-esteem, conspiring against her capabilities and creating mental barriers. Her self-doubt was a result of comparing herself to others whom she perceived as more intelligent. She expressed self-doubt and questioned her capabilities, wondering if she could succeed in a demanding environment like engineering. When I asked her if she received any stereotypical messages about women's capabilities in science and engineering, she noted her awareness of the pervasive stereotypes undermining women's abilities in engineering, while adding that she had not directly received any messages aimed at her or at anyone she knew.

Just thinking by myself, can I actually do this? My self-doubt. I always heard about those messages like saying, women cannot do this. I have always heard those messages but I have never heard either directly toward me or toward anyone that I know. It is just more on I think it is because I have heard it, even though it was ever directly at me or anyone that I know. This is the idea that I guess (Sarah, a White woman).

Sarah's self-doubt could be an indication of how powerful the pervasive societal messages could be in shaping women's perceptions of their capabilities even when the messages were not directly aimed at them as individuals.

Bringing societal stereotypes to light, one faculty member, in the faculty interviews, highlighted the role of pre-college societal expectations in shaping women's initial experiences in engineering, particularly concerning hands-on work. The faculty member who was a woman of color discussed the prevailing expectation that women would not be involved in physically demanding or hands-on tasks. This societal perception presented a significant challenge for women in the class, as men tended to have more exposure to and confidence in performing

hands-on work. The initial disadvantage for women stemmed from societal expectations rather than any inherent inability. She also noted that “these skills could be learned quickly,” emphasizing that it was more of an initial hurdle than a lasting barrier. So, while there might be an initial disadvantage in terms of hands-on work, the faculty member clearly stated that “this is a challenge that could be easily addressed.” However, in the student experience and perception, there was a constant interplay between internalized gender stereotypes, male-domination in the engineering classroom, and their insecurities. For example, Ada, a first-generation college student and first-generation immigrant in the United States, shared,

For example, when I first took physics class or engineering class, what I saw was that almost all of the students, mostly male students, wanted to be computer scientists. They wanted to go into computer science. I thought they were going to see me as a girl who does not know what to do with computers. I know most men love computer games. Yeah, they are more experienced with games. I am not like that. So, I thought the future is going to look like this. Am I going to be behind? This is something I am working on.

This internalized perception of inadequacy in Ada suggested a level of self-blame for her potential struggles in the field. By internalizing gender stereotypes related to gender and computers, Ada was attributing her challenges to personal shortcomings, rather than recognizing the societal and systemic barriers (e.g., gender stereotypes and women’s systemic underrepresentation in engineering) that undermined her self-confidence.

Similarly, Nora, who is a bisexual White woman, revealed a complex interplay between her psychological insecurities and the male-dominated engineering classroom. She began by acknowledging that “the male-dominated environment has had only a slight impact on her.” Instead, she highlighted her significant struggle with social anxiety, attributing it more to her

own insecurities than to the male domination within her field. Her worry primarily revolved around her perceived inadequacy and her fear of not being prepared enough to meet the challenges of being an engineer. She continued,

The field being male dominated, I knew I was going to be working with people who are good at calculations. I am not a calculations person. I know, it is more typical for males to do calculations. I have noticed that it has been a common occurrence that in my classes, males have been easily converting centimeters to meters. It is not difficult, and it is just my brain has a hard time wrapping itself around that. I knew that was going to be a difficult challenge for me. So, it is not only about the field being male dominated, it is more about me underestimating my abilities and skills, but also, I am comparing them to what I believe male skills are and what I have seen as male skill sets to be in my engineering classes. I do not know if I can put that on it being highly male dominated (Nora, a bisexual White woman).

Nora's and Ada's expressions in this section shared a lot in common. They demonstrated how women internalized gender stereotypes about what skills were traditionally associated with men in the engineering field. Ada underestimated her skills in using computers and anticipated being seen as less capable due to not conforming to stereotypical masculine interests. Nora underestimated her skills in calculating by comparing them to what she believed as masculine skills. As she continued in her interview, Nora confronted her own internal biases and acknowledged her perception that men are superior, despite not truly believing this herself. This internal conflict caused her anxiety, a contradiction in her mindset that she was actively working to overcome. She described how, through conversations and self-reflection, she could shift her perspective toward viewing men in the class as equals, thereby reducing her self-induced

anxiety. The interview data effectively demonstrate that the impact of male dominance in the classroom goes beyond the immediate academic context, which is the classroom, affecting women's mental and emotional well-being, career aspirations, and even sense of safety.

Therefore, the quote below from Margaret is significant in showcasing an alternative scenario of how she would feel if there were an equal gender distribution in the class.

I do not really think it (the male domination in the class) has an impact on my experiences in the program, but it has an impact on my mental construction of the program. The fact that there are so many men in the class just stresses me out. I would feel safer if it was like a 50-50 gender distribution. I do not feel particularly as safe as I could in the classroom. I also feel scared for my future, like my future career. I feel scared that these problems that I am having now will continue like men might start talking down to me. I am just kind of worried about that (Margaret, a White woman).

Margaret's emphasis on the fact that she would feel safer in a more gender-balanced classroom was a good indicator of the systemic aspect of women's internalized fears and anxieties regarding the male-dominated classroom. Similarly, Mary, an African American woman who is a first-generation college student, not only shed light on personal struggles but also addressed broader societal patterns, calling for a shift away from internalized blame and an acknowledgment of the intentional undermining of women's contributions in the engineering classroom. Mary's interview highlighted a broader issue—how women's self-blame and other similar emotions can be exploited by men in the class to gain an advantage. This observation underscored the power dynamics at play, where emotional responses from women are sometimes weaponized to manipulate situations in the engineering classroom. Referring to her classroom interactions with men in the engineering class, Mary shared:

It basically gave me the feeling that men wanted me to get upset. And to feel something other than just helpfulness, in a positive way, men want me to feel a little bit of anger because they are not listening to me. So then when he finally listened to me, it was like they were doing something for me, like doing me a favor, when that is not the case. And it happens more often than I would like to admit.

By drawing attention to the intentional exploitation of women's emotions by men in the class, Mary unveils a power dynamic at play. Her observation sheds light on how emotional responses from women may be manipulated to gain advantages, reflecting broader gendered interactions within the engineering classroom. In light of these findings, this study shows how important it is to identify the systemic and societal aspects of gender dynamics within the engineering classroom. Moreover, the findings underscore the importance of fostering a more inclusive and equitable environment, free from the internalized fears, anxieties, and intentional undermining that currently characterize the male-dominated engineering classroom.

A Cautious Approach to Class Participation: "I just did not want to ask for help."

In the immediate academic environment, which was the classroom, the male-dominance also informed women's participation in the class. They hesitated asking questions or for help with the fear that they would misrepresent themselves, their cultures (in the case of immigrant women), or look dumb. For example, Edith, who was a biracial woman, feared creating a negative image, which seemed to create a barrier, preventing her openly expressing confusion or seeking help. She shared, "I do not want to make a bad impression when I am confused about something." Similarly, talking about the pressure to make a positive impression in the class, Elaine, a White returning student shared, "Because we are the only one (referring to being a woman) here, we have this expectation that we better not fail this class." Talking about her

experiences and challenges in her first year in the program, Martha who is a Hispanic woman and a first-generation college student said:

I just did not want to ask for help, which obviously made other classes more difficult. But I think that has gotten better. But that was probably the biggest thing that I can pinpoint. I have learned to, kind of like learning by myself, I have become more of an independent learner than I would not be if I was not so anxious. I guess probably that stems from the identity of being a Hispanic woman.

Also, when I asked faculty members and program directors whether they have observed any gendered patterns in students' class participation, some faculty members said, "women in the class tended to be more reserved." Women tended to keep to themselves, hesitating to ask questions or engage with their peers. However, faculty members and program directors also highlighted that these women tended to excel academically, outperforming men in terms of grades. Indeed, this observation of faculty members perfectly aligned with what women shared during the interviews with them. They did not want to make negative impressions, they were more hesitant to ask questions, they became independent learners, and they excelled academically.

Because women did not feel comfortable asking questions during the class time, they tended to ask their questions to faculty members outside of the class. For example, Margaret, a White woman, acknowledged that her reluctance to actively participate during lectures might limit her interaction with teachers, but she still felt comfortable reaching out to them outside the class when questions arose. Margaret said that, for her, "participating in lecture-based classes is challenging," making it difficult for her to speak up. She also articulated a desire for instructors to recognize her understanding of the material, perhaps by noticing her performance on quizzes.

Margaret suggested that instructors calling on her based on their recognition of her knowledge might be a more comfortable way for her to contribute without the pressure of volunteering herself. However, she emphasized the preference not to be randomly called on, as this posed its own challenges for her; she felt the burden to prove herself in this male-dominated environment and did not like to risk making mistakes. Similarly, Alice, a Hispanic woman, shared:

So I really feel like what is hindering my success, I do not think being a woman has anything to do with it. The social situation of the classroom has more to do with it. I do not know if it is because I am a woman, but I do feel kind of like it is hard for me to raise my hand and answer a question in class. Maybe if I did that more, then I would have a better time.

In the focus group interview, participants shared that this finding resonated with them.

The participants further discussed it:

Rere (a Black woman): When it comes to outside of the classroom in a school setting, you may also be afraid to ask for help because you are just conditioned to not ask for help, otherwise, your competence is possibly being questioned.

Elaine (a White woman): I would agree with that. For sure, I feel like, because, I am less likely to ask questions in class setting, right, that extends into asking questions out of the class. We have, like, you know, a tutor. Right?

Birdy (a White woman): I also kind of feel like asking questions is already kind of hard, like disregarding the fact that you know asking questions as a woman just asking questions point blank can be kind of hard for some people, because it can be perceived as a weakness, right? So you are opening yourself up to get criticized for not knowing something. But if you add on, you know, being a woman or being a woman of color, it is

like it puts a whole different layer on that already perceived weakness, and that just kind of makes it more anxiety-inducing to do so.

In this conversation among Rere, Elaine, and Birdy, the common theme which was the reluctance to ask questions in the class was confirmed. The phrase Rere used “conditioned not to ask questions” also explained how Martha as a Hispanic woman became an independent learner, linking it to the fear that seeking help might imply incompetence. This fear of having their competence questioned is a shared sentiment among the participants. Elaine expanded on the connection between the classroom setting and seeking help outside of it. The hesitancy to ask questions in class seemed to carry over into seeking help elsewhere, reinforcing the impact of classroom dynamics on students’ behavior beyond the classroom. Birdy emphasized the broader societal challenge of asking questions. She specifically addressed the additional layer of difficulty that women, particularly women of color, might experience. The act of asking questions was seen as potentially opening oneself up to criticism, and this vulnerability was heightened for women and women of color due to societal stereotypes.

In summary, these conversations illustrated the complex interplay of societal expectations, classroom dynamics, and intersectionality, highlighting the barriers that women—and especially women of color—face when seeking help or asking questions. The fear of being perceived as weak or incompetent remained a significant concern for women in the Associate in Engineering program, contributing to an overall culture of silence and hesitancy.

Marginalization and Bias in Team Projects: “I was being spoken over by a bunch of men.”

Another subtheme the data analysis revealed was about women’s marginalization and bias against them in team projects in the community college engineering classroom. This study revealed that women grappled with the intricate dynamics of marginalization, and the subtle

nature of this bias could make them challenging to identify and address effectively. Women in this study utilized different strategies to navigate these challenges, and faculty approaches to these challenges in the class played a crucial role in offering insights into a better understanding of women's experiences.

Unveiling the Nature of Marginalization in Teams: “I feel like it is not as overt as people would think.”

In the individual interviews with women enrolled in the Associate in Engineering program, gender-based and intersectional dynamics in team projects were prominent in the experiences of women of color, some of whom were also first-generation college students and first-generation immigrants. Their experiences with their classmates demonstrated instances of bias and discrimination at the intersection of racism and sexism. Their experiences in group projects included being silenced, enduring gendered expectations in a teamwork (e.g., doing the secretarial work of the team project like note-taking), being ignored, and being invisible to other team members (e.g., not being assigned any roles, feeling left out).

For example, this was the second day of class, we were having this team project, and I was trying to help everybody out with it, and I was being spoken over by a bunch of men and it was a sight. Okay, I do not really take it as malice like, “oh, they are intentionally doing that,” but it is like, “they grew up in an environment where they are used to having their voice heard first over anyone else’s.” So, I get that, but at the same time, it still does have an effect on me and the other girls in that classroom. And that is not the only time I have experienced something like that (Rere, a Black woman).

Similarly, Edith, a Black and Indian biracial woman, recalled an incident from an engineering class. On the first day of class, one of the men in the class gave her a whiteboard marker during a

collective brainstorming exercise and asked her to assist by writing on the board. This request left her startled because she was unexpectedly assigned menial work while others actively participated in the discussion, reinforcing racial and sexist stereotypes. Similarly, Ada, another first-generation immigrant woman who is also a first-generation college student, shared,

What challenges, this might be in my head, but sometimes I think for example, if I work as a group with my classmate, if I was the only female in that team, I sometimes tend to think they do not want to give me the important responsibilities. They want to give me easy parts of the assignments. “Oh, you can take a picture and upload it” something like that. Yeah, I do not know. Maybe it is because of this. I might take them personally.

Yeah, maybe I am sensitive. Maybe? I do not know.

A first-generation immigrant and Middle Eastern woman, Hedy said:

I’m never too sure if that has to do with my gender or just the color of my skin. I just noticed that sometimes. People can say things like ‘Oh, you are a critical thinker. Oh, you like problem solving.’ That is so surprising for them or they take initiative for team projects, and I kind of do not get a say. I feel a little more in my shell and soft spoken when I am in these kinds of teams. I just do not feel as confident as I usually am.

Hedy and Ada were not alone having the feelings of doing unimportant things or feeling left-out team projects. As we continued to talk, Ada shared other examples from her other courses in the engineering program. In her physics labs, she shared noticing gender bias as a recurring issue. In their three-person team along with two other men, she often felt excluded and left out. Men in the team took the initiative and began working without involving her. She felt left-out and confused as she did not understand what the team was doing. She added that she was a successful student with a GPA of 4.00, but it was frustrating for her to be excluded from the teamwork

despite being a successful student. In another class, she was paired with another man in an engineering class, and they were doing some calculations.

Our instructor wanted to refresh our memories on fundamental concepts such as rounding numbers. He discussed the rules, showed some examples, and gave some problems for us to solve. For these problems, he wanted us to partner up with a classmate seated nearby. We could work on the problems together or solve them individually then compare our answers with our partners. It was indeed a very basic concept. I mean, I am sure everyone in the classroom would know how to round numbers. Anyway, I was sitting next to a male student, and as soon as we began, he asked, “Did you understand the concept?” I told him that I did. I don’t know why but I kept thinking why he asked me that question. I was confident that every student in the classroom would be familiar with rounding, considering that prerequisite courses like pre-calculus were required. Rounding is something taught in middle school, after all. I wondered whether he asked me if I understood because English was my second language, and he thought I might struggle to understand what the instructor was teaching. Would he have asked the same question if he were seated next to another male student? Or was he simply trying to make a conversation? The last option makes sense the most. After we solved the problems, he did not compare his answers with mine to check for matching solutions. He waited for the instructor to show the correct answers.

Ada’s experiences were an example of how racism, sexism, and linguistic bias merge to create multiple layers of discrimination. The experiences of women of color underscored the importance of addressing not only overt biases but also the nuanced, intersectional nature of discrimination within engineering teams in the classroom. The individual interviews conducted

with women enrolled in the program demonstrated that White women also had concerns regarding the male domination which caused anxiety and fear that men in their classes might perceive them as less intelligent or dismiss their ideas because they are a woman. Despite these initial concerns, they also shared that they had not encountered anyone who treated them negatively because of their gender, and they described the situation as a source of relief for them. For example, Birdy, a White bisexual woman, said:

It is (referring to the male domination) a little bit intimidating. To be honest, I do kind of get a little anxious sometimes that they are going to think I am not as intelligent, or they are going to scoff at my ideas instead of welcoming them or experimenting with my ideas because I am a woman. But, honestly, so far, I have not really met anybody like that, which has been a huge relief, you know, but I would say it is just a little bit intimidating to be in like that kind of environment (Birdy, a White bisexual woman).

However, when I brought up this discussion during the focus group interview, White woman expressed having similar experiences. When I shared the preliminary findings and asked them if there were any significant stories missing from these findings, Elaine, a White returning student, started talking:

I have experienced that within my physics class, doing calculations. I was asked to check again and asked to recalculate. I have three other men as lab mates in the same group. I have had them do things like that which they have not done to their other classmates. But there are a lot of times where they ask me to redo it, and I know it is correct. Yeah, I have experienced a little bit of this for sure.

As a response to Elaine, Rere a Black woman who identified as bisexual, said:

I would not say necessarily that we do not experience discrimination for being women, but I feel like it is more subtle and things like not being trusted with calculations or being spoken over like I remember. I think it was the first group lab we had in our engineering course. and it took me like a solid 10 min for everyone to hear my idea, and even then, it was like glazed over. People were making their own twist on it instead of going to me and asking how it was supposed to go. The end result did not even really work, because they did not fully understand the idea of it. I would not say necessarily that you do not experience it, but I feel like it is not as overt as people would think. It would be that they perpetrate it without being aware of it.

While Ada and Elaine concurred with Rere's observations, Elaine further shared that it took her half of the semester to recognize an issue with her lab mates' behaviors towards her. Rere's insight, suggesting that discrimination could be perpetrated unconsciously and individuals might not immediately recognize or acknowledge such biases, was valuable because it was the subtlety and unconscious operation of these biases that made them challenging to address.

The interviews with women enrolled in the program reflected a gendered and intersectional pattern where women faced challenges and their competence was questioned or undermined. Instances such as not being trusted with calculations or being spoken over in group discussions were highlighted. The struggles of women of color to have their ideas heard in a group setting illustrated their challenge of having their contributions overlooked or undervalued.

Navigating the Challenge of Ensuring their Voice is Heard: "What I do is trying to be more assertive."

Such multifaceted and intersectional bias and marginalization might make locating the true source of the problem challenging for women. The result was an inequitable tendency for

women to blame themselves and feel pressured to fix a systemic problem by asserting themselves on the engineering teams. Therefore, as a response to these negative experiences, some women felt that they should be more outspoken while some reported feeling less confident and more silent, both strategies are discussed below.

Women in this study used assertiveness as a strategy to advocate for themselves and to navigate the challenge of not being heard in a team, but this strategy was not easy. For instance, Ada, a Middle Eastern woman, questioned if she was too passive in a team, ending in self-blaming. To cope with this challenging situation, Ada decided to take a more assertive approach. She noted, “So what I do is try to be more assertive to avoid the situation. Yeah, maybe I am too passive. That is why they do this.” Unlike Ada who attributed to the problem her being passive, Mary, a first-generation college student African American woman, adopted the same strategy as Ada but noted how exhausting it feels to carry the burden to be vocal and assertive to be heard in a team:

It is really tiring. I always have to not only repeat myself, but I also have to keep, I have to advocate. I am the only one advocating for myself when everyone else just already has a place at this table. Regardless of race, I feel like men are kind of in one ear out the other when women say things. She said it, who cares? Let the men talk. That really feels like they are still in the 1980s. Women are supposed to cook clean, take care of the kids, and they just stay at the house all day. I have a voice, and I am going to use it, and you should be smart enough to listen. That is what I feel like. They are being stupid. That is what I feel on a day-to-day basis, especially in a group setting. I have to keep pressing, but I should not have to. That really sucks.

As I recruited participants during the observations, I vividly recall Mary's assertive approach to the team project and her interactions with other team members. To maintain a non-intrusive presence and avoid causing any discomfort to the team due to my observation, I positioned myself at a reasonable distance while still observing who was talking, the extent of their participation, and how team members engaged with each other. Without the subsequent interview with her, I might have assumed that she was excelling both academically and psychologically in the teamwork. After the interview, it was clear to me that her assertiveness in the team stemmed from not being heard. As we talked, Mary continued to share her frustration about team dynamics in the classes. She expressed a desire to step back and observe if anyone would even ask for her opinion without her active involvement. The burden of having to repeat herself many times to be heard and pushing her thoughts and ideas forward was on her.

Some women in this study also struggled with being confrontational in a team setting, where they had to collaborate with others. For example, Hedy, a Middle Eastern woman, expressed a desire to be more assertive or better at addressing issues, but her fear of upsetting her classmates or creating a negative dynamic prevented her from speaking up. She felt silenced and acknowledged a pattern of not expressing their thoughts or concerns when they arise. Instead, she internalized the situation, hoping that things would improve naturally or that others might gain a different perspective over time.

Honestly, I wish I were a lot better at being confrontational, but I never am, especially since I am going to work together with these people in the class. I do not want to upset them or get on the wrong side. I do not say anything. I feel like I am very silenced. Once that happens, it is just like I take it and just hope it improves or that they might get a different perspective later on. I do not know.

Overall, Hedy's narrative highlighted a challenge in navigating interpersonal dynamics and the difficulty of finding a balance between assertiveness and maintaining positive relationships within a group context.

Understanding these strategies is crucial because they shed light on the challenges that women, particularly those from diverse backgrounds, face in team settings in the community college engineering classroom. The use of assertiveness as a strategy for self-advocacy is highlighted in the interviews, but the participants' narratives also underscore the difficulties associated with adopting such an approach. Hedy's struggle with being confrontational adds another layer to the narrative, showing that different individuals employ varied strategies to navigate teamwork. Recognizing and addressing these strategies and challenges is crucial for fostering a more supportive and collaborative atmosphere in engineering education.

Faculty Approaches to Addressing Bias: "I don't know if that works."

To gain deeper insights into these experiences, I asked the program directors and faculty whether gender was ever taken into consideration when forming teams in the class. This was aimed at obtaining a more comprehensive understanding of the gendered nature of teamwork. Faculty members generally expressed a tendency to grant students the autonomy to choose their own teams, avoiding the imposition of predefined groups. Additionally, some faculty members observed a natural tendency for women to form groups among themselves, a phenomenon consistent with my own observations at the research sites.

Before I shared the findings regarding marginalization and bias against women in team projects with the program directors and faculty, some were already aware of those issues, while others did not show any awareness. For example, one program director said:

Students usually participate well in the team projects. And the differences are not because of gender, they are about what the person is. Sometimes there are students that are not so proactive, and that is reflected in the group work. So, this is what they are. Some are more proactive. But it is not because of gender differences.

The program director asserted that gender differences were not a factor in the observed disparities in team projects. Instead, he attributed variations in participation to individual differences.

There were also faculty members who were more aware of gender bias in team projects. When they realized different forms of bias and marginalization against women in teams, they took various actions, ranging from reconsidering how teams were formed to actively intervening to reverse gendered roles. For example, there was one team formation strategy that I observed during my site visits. The faculty member at Land Community College placed students in pairs, and she explicitly conveyed to students that if the group exceeded a pair, not everyone would have equal opportunities for hands-on engagement. In Triangle Community College, students were organized into larger groups, and one student participant, Mary, expressed dissatisfaction with this group size, noting that “not everyone could engage in the task equally.” Confirming Mary’s thoughts about the importance of group size, when the same topic emerged in the interview with this faculty member, she once again acknowledged significance of group size for student engagement and academic performance:

Yes, it is important. Because the bigger the group, the more likely you are always going to have members who will not contribute as much. This not only affects their engagement but also impacts their academic performance.

Faculty members also used more subtle approaches to addressing gendered and intersectional dynamics in teamwork in their classes. For example, one faculty member at Park Community College said that if they believed that a woman student had a strong personality and could handle it, they might pair her with a man whom they thought needed some humbling – someone who needed to understand that women were just as capable.

So I do not think I have seen anything too blatant. But sometimes what I will do is if I think the girl can handle it, I mean, she has a strong personality, I will put them with a guy that I think this guy needs some humbling, you know, like he needs to be shown that women are just as capable. So, there is like, maybe one or two women in the class that I think have that strong personality that can do it.

However, they were also aware that it was a significant burden to place on a young woman student to prove herself to a man. The faculty member said, “it is again like a heavy burden to put on this young student, this woman, to have to prove to a guy that she is just as capable. So, I do not know how I feel about that tactic.” She continued,

I mean, I think one thing I have really appreciated is that I feel like the younger generation. The women are a lot more confident than I was, or like women from my generation growing up, and I think they're a lot more willing to advocate for themselves, and they speak up. But I think that's one of the ways that I tried to nip it in the bud a little bit, or just try to humble some of the men. I don't know if that works.

As can be seen in her final remarks on the topic, although the member used this pairing strategy as one way to attempt to address the issue early or humble some of the men in the class, they were uncertain about its effectiveness.

A different approach to addressing women's marginalization in team projects used by faculty was reversing gender roles in a team project. One program director shared some team project observations where women took more menial tasks like notetaking and men were engaging in more technical aspects of the task. Whenever the program director saw something like that in his class, he made sure to address it by reversing roles:

So, I am going to point that out if I see it in my class. I am going to be saying like, "OK, Susie, no, you are the one that is cutting the wood. Johnny, set up that Word document." I am not going to say why I am saying this. In my head, I am saying, "Okay, we did make sure that that gets broken down." So that is kind of how I address it. There is no big scheme or anything like that. It is more done on a micro level of like, "Hey, when I see that, I am going to correct it." But I do not know of anything that is done at the macro level.

In summary, the exploration of gender dynamics in team projects within academic settings has illuminated a multifaceted landscape. In this landscape, gendered expectations informed the roles assigned to women and team dynamics in both subtle and overt ways. Women took different approaches to navigating this landscape, in most cases, thinking that being more assertive could help them. The awareness of gendered dynamics in team projects varied among program directors and faculty, leading to a range of strategies being employed. However, the effectiveness of some strategies remained uncertain.

Gendered and Intersectional Patterns in Extracurricular Participation: "I felt out of place."

I walked into the engineering club on Tuesday. I saw four men, one woman. I am like, oh, more people are going to come. I started counting them as they came and left. There

were 10 men engineers and two women, myself included. So two in total, and I was shocked. I told my mom earlier too. I was like, “you know how many women there were?” She was like “two.” I was like, “Yes, correct.” Two just two — me being the only Hispanic one out of every one that came in. It was weird. I felt uncomfortable the whole time. My legs were shaking, my anxiety all the time. I did not want to speak. But then towards the end, you know, we had to participate in the project. So my teacher asked me, “what are you going to do?” Because I was the only one who had not answered the whole class, and I was like, “I am gonna do wiring.” I have started telling them I have this kit I can bring in, but it seems like they looked at me as if I was not supposed to be there. I felt so weird. I felt quite emotional right now even thinking about it because I felt out of place. That is not something you want to be, but I did. I felt quite dumb because I did not really speak, not because I could not or not because I did not have any ideas but because I felt so weird. So weird, like, so uncomfortable. But no one had said anything to me. It is just the vibe. It is just the looks, I do not know, just wanted to leave. Quite honestly, I saw a lot of people leaving; so necessarily, I have to leave early. No, but I did leave at 2:30 instead of 3:00 because I was like, I just need to get out of here before everyone starts standing up and leaving. So their discussion was over there. The plan was already done. And I was like, “Okay, I will just bring it next week.” (Alice, a Hispanic woman and first-generation college student)

My observations and interview data revealed that participating in extracurricular activities involved gender-based and intersectional dynamics. Participants in this study reported feeling intimidated by male dominance in these spaces. In the introduction section of this theme centering underrepresentation, I presented my observations from research sites, emphasizing a

particular instance involving an engineering club I attended, which comprised only men. Alice's narrative was incredibly strong in illustrating the emotional toll of entering an extracurricular space without anyone with whom she could relate. I opted not to narrate this account in my own words; rather, I aimed for Alice's story to unfold at the outset of this section, presenting itself with all its striking reality.

In Alice's narrative, the numerical discrepancy between women and men in the engineering club, with Alice being one of only two women and the only Hispanic woman, set the stage for her feelings of discomfort and unease. The emotional toll was evident in her body's physical responses — shaking legs and persistent anxiety. The sense of being perceived as an outsider contributed to the overall discomfort. Despite her capability and willingness to contribute, the prevailing atmosphere and non-verbal cues from others made her question her place in the club. The feeling of being out of place and the emotional weight associated with it was obvious, emphasizing the psychological toll of being marginalized in such a setting. While engineering was traditionally perceived as a space for White middle- and upper-class men, Alice was in the space as a Hispanic first-generation college woman, which added a complex intersectionality to her experience. Referring to the other woman in the space, Alice shared,

I think the other woman, she, I kind of admired her actually, she was dominating. She spoke the most. She was more like asking questions, writing things down. I saw her and I think being intimidated by men is one thing but being intimidated by another woman is also another thing, especially since there were only two of us. I could not speak but she spoke. She knew most of the guys there saying "hey" to them, and so she was already comfortable. I was like, oh, okay.

Following Alice's narrative, I asked about the racial identity of the other woman present in the space, and Alice confirmed that she was indeed a White woman. In the context of the study's findings, several possibilities emerge regarding her behavior: she might be attempting to assert herself and compensate for the underrepresentation of women in the field, aligning with the experiences of other women in the study who believed that increased assertiveness could mitigate gender discrimination and marginalization. Alternatively, this dynamic could stem from a nuanced intersection of racial privilege and gender marginalization, with racial privilege leading to domination in the conversations. In any case, in this unique setting, where only two women were present, Alice's feelings of intimidation by the other woman underscored the intricacies of navigating not just gender dynamics but also dynamics within the same gender due to different degrees of (racial) marginalization and privilege.

What Alice experienced in the engineering club resonated with the expectations of other women who formed preconceptions about engineering clubs based on their classroom experiences. Consequently, many women refrained from expressing interest in joining these clubs, anticipating an environment similar to their classes. For instance, when considering joining the engineering club, Hedy, a Middle Eastern woman, expressed reservations stemming from feelings of intimidation. The prospect of entering an environment where others might perceive her as less knowledgeable triggered a sense of unease. The prevalent expectation was that the club would be predominantly male-dominated, reinforcing stereotypical perceptions. This concern about encountering such stereotypes and the perception of the club being predominantly populated by men significantly influenced her decision not to attend. Similarly, Margaret, a White woman, shared:

I tried to join one or two clubs last year. I think it was a math club and a programming club. But I did not follow those through as I did not really have much interest in them.

They were very male-dominated. So, they did not seem like something I wanted to spend my extra time doing.

In Mary's case, who is an African American woman, there was a communication gap between her and the engineering club she wanted to attend. This semester, she decided to try joining two engineering clubs. In one of them, she was genuinely excited about it, but to her surprise, when she attended the first meeting, she found herself to be the only one in the club, and I had no idea what was happening. A friend of hers mentioned the second club to her. It was a STEM Club for students of color. Her friend decided to check it out. However, upon entering the venue, he quickly realized that the majority of attendees were White. Feeling out of place, he recounted that he casually looked around, confirmed he was in the right place, and promptly left. He expressed a sense of disappointment, realizing that the event did not align with the inclusive atmosphere he expected, prompting him to choose not to participate. Mary's narrative was also significant in demonstrating the challenges that students of color face in finding spaces where they truly feel welcome and included.

Another noteworthy factor influencing women's participation in extracurricular spaces was the multitude of roles and responsibilities they shouldered as caretakers, employees, and students. This array of obligations posed a significant challenge for them to find time to engage in these extracurricular activities. One White woman who was a first-generation college student, Kate, emphasized the challenges of balancing caretaking, work, and study responsibilities. She pointed out that women, in particular, found it more challenging to allocate time for these activities due to their additional caregiving responsibilities. Kate said,

Women have more responsibilities. Does that make sense? Whether you are single, or whether you are in a family, you are taking care of responsibilities of your household.

That makes it harder for us to make time for things like engineering clubs.

In the focus group interview, participants also highlighted the challenges that stemmed from trying to balance all their responsibilities and roles. They also brought the conversation back to women's underrepresentation in these spaces. Rere, a Black woman who identified as bisexual, shared:

With what it said about the feelings of loneliness, not wanting to be like the only person there, if we already experienced that loneliness in our classes, we would not really want to go out of our way to experience that when it is not mandatory, which is why I feel like if we have a club that is more catered towards on women in STEM or underrepresented people in STEM, that would be more likely to fit into the schedule versus something that mimics the traditional engineering classroom.

Women in this study, despite feeling uncomfortable in the male-dominated extracurricular settings, were aware of the potential negative outcomes associated with missing out on these opportunities. When asked about the challenges they anticipated in the process of transferring to a four-year engineering program, Ada and Hedy, both identified as Middle Eastern women, emphasized the importance of enhancing their involvement in extracurricular activities to bolster their competitiveness in the application process. Hedy said, "I feel like maybe I could do a little better with my extracurriculars." Ada said, "I mean, I look at other students. They engage in extra-curricular activities. I do not have any of this. This might be a challenge in the transfer process. That is why I need to improve myself with other extracurricular activities like engineering projects."

These findings highlighted the challenges of women, especially women of color, in finding truly inclusive extracurricular spaces in engineering. Additionally, the discussions presented in this section underscored the multifaceted roles and responsibilities that women juggled, serving as a barrier to their participation in extracurricular activities. Highlighting the impact of loneliness and the reluctance to voluntarily subject oneself to isolation women already experienced in regular classes, participants emphasized the need for clubs tailored to women in STEM or underrepresented individuals, providing a more fitting and inclusive alternative to traditional engineering settings.

A Pressing Need for Diverse Peer and Faculty Support Systems

The majority of women in the study lacked peer support systems in the engineering classroom. Lacking peer support networks, women often turned to their professors when they needed help. Regarding faculty diversity, Park Community College and Land Community College had two engineering faculty in the Associate in Engineering program. While they both had men as program directors, the faculty members in both institutions were women of color. Triangle Community College had a higher number of engineering faculty members due to its larger enrollment size, and its engineering faculty consisted of three White men, one man of color, and one White woman. The program director was a man of color. While the gender diversity gap among faculty was the most evident at Triangle Community College, the importance of gender and racial diversity among faculty in terms of providing women students with role models and mentors came up in all interviews across all institutions.

In this section, two subthemes—the importance of faculty gender and racial diversity and peer support gap—are discussed together because the focus group interview revealed the interconnected nature of peer and faculty support in informing women's experiences in the

program. When I asked the focus group participants if there were any significant stories missing from the member-checking summary that I shared with them, Rere, a Black woman who identified as bisexual, unveiled this interconnected nature faculty and peer support by saying:

I would just add that when there is a lack of a peer support system, there is also a chance that there could be a lack of a professional faculty support system, too, which is something I experienced over the summer. I wanted to take the engineering course over the summer, and I lacked both. I just ended up dropping the class because of it. I am retaking it in the fall with a different professor, because I just did not feel like my voice was being heard, which, I feel like is a good point to add to.

By sharing her personal experience, Rere added a tangible and relatable example to the current theme. Her decision to drop the class and retake it with a different professor underscored a severe consequence that absence of peer and faculty support networks could have on a student's educational journey. Her example emphasized the importance of fostering peer connections and ensuring a robust faculty support system for women in the Associate in Engineering degree program. Her guidance prompted me to categorize the faculty diversity and peer support gap under a unified theme.

Faculty Diversity: “It would be helpful if we had a Black woman as an engineering instructor.”

The significance of gender and racial diversity was evident in interviews with women enrolled in the Associate in Engineering degree program. It is noteworthy to underscore that some women of color and some White women held contrasting views on faculty diversity within the same program at Triangle Community College. This observation underscores the role of intersectionality, where race intersects with gender to shape how women perceive the same

phenomenon. For example, Nora and Margaret, both White women, perceived the diversity among faculty positively at Triangle Community College, noting that there is a good gender and racial distribution among faculty.

There are different people all over the place all the time. Everyone is doing something different. I will always see teachers in the STEM lab or in the library, and everyone is different genders and different races. Anyone I have talked to has just, we just talk, it has not been a problem. I love everyone there, it has been a great time, with the entire end the students too (Nora, a bisexual White woman).

Similarly, Margaret shared her positive evaluation of gender and racial diversity among science and engineering faculty teaching engineering students:

I have had a good gender and racial distribution. I have had a good number of Black professors and for physics and math, I have only had female professors. So, I feel like in terms of faculty, it is pretty diverse (Margaret, a White woman).

While it is clear that both Nora and Margaret were referring to science and engineering faculty together as they talked about gender and racial diversity among faculty, their positive evaluation was not shared by women of color in the program. For example, Hedy, a Middle Eastern woman enrolled in Triangle Community College, shared:

I have had mostly men as professors. I do not have any women professors this semester. I think I had one woman professor out of four classes last semester, so it is not as frequent that I have a woman professor.

Participants also observed differences in teaching styles based on the gender of their instructors. While Jasmine, an Asian woman, highlighted a trend where women tend to be more detailed and proactive in ensuring student understanding, Hedy, a Middle Eastern woman,

emphasized the woman instructors' use of technology to offer more resources to support student learning. These perspectives suggested that teaching styles might be influenced by gender, impacting the dynamics of the student-instructor relationship and the methods used to facilitate learning.

I can feel that women as faculty members are more detailed. She makes sure you understand. She is like, "Are you sure you understand it? You can always ask me." Then men are more likely to visit everything at once, and then they expect you to understand. Not all, but what I encounter is mostly that (Jasmine, an Asian woman).

The help-seeking behaviors of women were also found to be related to the gender of the faculty. For example, Edith, a biracial woman, said "it can be a little intimidating to ask for help when you have men as professors because I can feel a little embarrassed." Talking about her male engineering professor, Mary, an African American woman, said "it took me a while to go up to him and ask for help." Similarly, Elaine, a White returning student, shared how she perceived the presence of women faculty as a source of support in the class:

I think it is really awesome that my physics teacher is a woman. That just makes me feel more comfortable in the class because then it is not just me. I do enjoy that. I think that is definitely helpful.

What Elaine shared was also confirmed by Nikki, who is a Hispanic woman. In the quote below, she reflected upon what it would look like if she had a Hispanic woman as an engineering professor:

If I imagine it, with a Hispanic woman, I probably feel more comfortable because it is more relatable. Having men as professors now is not necessarily hindering anything, but definitely, if there was a Hispanic woman, yeah, it would be more comfortable.

Nikki's sentiment was also shared by Martha, who was also a Hispanic woman. Martha had a Hispanic woman as an engineering professor in her program, she shared feeling more comfortable in the courses which a Hispanic woman faculty member was teaching although she underscored that she appreciated other professors as well:

I mean [her professor's name] been great because she is [a woman of color]. Having her as my teacher just makes me more comfortable, just in the whole environment, in general. That is not to say my other teachers are not good enough. It is just... I do not know the difference. But you know, all my other instructors are pretty great too.

Martha's professor, who was a Hispanic woman, was the faculty contact of my research at Land Community College. As I also mentioned while describing the research sites at the beginning of this chapter, she was very knowledgeable about her students, where they were in the program, and she knew all details about their transfer aspirations and where they were in the transfer process. The depth of information she gathered and retained about her students reflected a genuine and meaningful connection with them, fostering a more comfortable learning environment in her class. Highlighting the importance of developing such meaningful relationships with faculty quite important, because this characteristic set Land Community College and her classes apart from other research sites, where a recurring theme was the absence of gender and racial diversity among the faculty teaching engineering students.

In instances where women of color in this study lacked a meaningful connection with their professors or encountered faculty diversity gaps in terms of gender and race, they also lacked role models and mentors. They shared that having faculty who share the same identities would be empowering because they could easily relate to their experiences and see how they overcame the challenges they had been experiencing. For example, Mary, an African American

woman, was one of the participants who expressed a desire for greater diversity among faculty, specifically noting a wish to see more African American teachers. She acknowledged that the majority of their teachers, particularly in the engineering department, have been White. When I asked how it would be helpful for women of color to have other women of color as engineering professors, Mary shared,

I do feel like if it was an African American man or woman among faculty, I would feel a little bit more comfortable because they would kind of know what I am going through.

They have already surpassed me. They have already done this. They would know kind of what I am feeling, but a White man really would never be like, “I do not feel like being heard.” You would never hear that sentence from a White man. If there was a woman of color and I shared that “I feel like I have to repeat myself too many times,” she would be like “I completely understand what you are talking about. This is how you can help this situation or this is how you can deal with it.” I just felt like she would be a little bit more personal (Mary, a first-generation college student and African American woman).

The desire for a more diverse teaching staff stemmed from a recognition that shared experiences and perspectives can contribute to a different and perhaps deeper level of connection and understanding in discussions about lived experiences. In alignment with Mary’s words, Rere who was a bisexual Black woman, shared that it would be really helpful if they had a Black woman as an engineering instructor, or even just a woman as an engineering instructor. She was not sure if there were any women in the program as engineering instructors. She continued, “I would think that would be really cool. I would like to know her experience as well. That would definitely be very interesting to hear.” When I asked her, in what specific ways having a Black woman as an engineering professor would help her, she shared:

I think it will also help building a support network. I feel like if she were to talk about her instances of like, “okay, I went through this as an engineer, I went through that,” it would feel more relatable, maybe more realistic towards me. Because I know whether it is intentional or not, when I am in those spaces, they see me as a woman, and a lot of people when they see you as a woman in those spaces, they see that as incompetence. Or they see that as just kind of scraping by, not doing the same work as everybody else, or just not being able to be better. Being able to relate to, being able to have advice on how to cope with stuff like that, and that would be amazing, absolutely amazing.

Not having woman as engineering professors was hindering women in this study from developing close or mentor-like relationships with faculty. For Hedy, the professors seemed to provide the expected level of support, answering questions when asked, but “they did not go above and beyond in establishing a deeper or more meaningful connection.” Furthermore, Nikki, a Hispanic woman, was very happy with her classroom interactions with faculty, but she also acknowledged having a relatively limited engagement with faculty that does not extend beyond the formal classroom setting, and she acknowledged that she had not built strong bonds with professors:

I have not necessarily built bonds. I do not really go to office hours or anything else. But in terms of like, just in the classroom, it is pretty good. I have never felt any hostility or anything like that. If you ask your questions, they are very open to help.

Although the majority of women in this study shared positive experiences with faculty at three research sites, they also expressed a desire to have instructors who shared similar backgrounds with them. Shared experiences and perspectives were seen as valuable contributors to deeper connections between students and instructors, enhancing connection and

understanding. Participants thought that having a more diverse faculty could contribute to the building of support networks for them. Faculty members' diverse experiences, insights, and coping strategies become valuable resources for students navigating similar challenges in engineering spaces. These findings revealed that faculty diversity can play a crucial role in creating an inclusive and enriching academic environment.

Peer Support Gap: “It’s kind of hard to find things in common with my classmates.”

Another important aspect of the experiences of women in the community college engineering program was the noticeable absence of peer support networks. In an academic and social environment where women were underrepresented, building and having a peer support network was not an easy task for women, as Margaret, a White woman, shared: “I found it kind of hard to find things in common with my classmates like making friends with them.” While the underrepresentation of women was a significant factor contributing to the absence of peer support networks in the class, the diverse and multifaceted life experiences of women added layers of complexity to the challenge of establishing these support networks. Ada, who was a non-traditional age college student, and she said she “sometimes struggled interacting with classmates,” attributing this struggle to the age factor. Kate, for example, faced challenges in making friends at school due to caregiving and work responsibilities outside of academia, leading to a sense of isolation. Similarly, Mary, an African American woman, worked two jobs concurrently and encountered difficulties in forming connections, particularly because the community college operated on a commuting basis. She noted,

Getting to know people is really hard here because everyone just comes to school and leaves right after class. At my other school when I went to the four-year university before I started here, since I was on campus, I could see them more. It was easier for me to make

friends. We went back to the dorms, and we could study at the library, and it was a lot closer knit because you could be close (Mary, an African American woman).

During the interviews, a common theme emerged regarding the participants' shared desire for enhanced communication and connections among classmates, particularly among women. They highlighted numerous benefits associated with the possibility of having more robust peer support networks. Margaret, a White woman, expressed, "I also feel like class could be a little less boring, a little more enjoyable if I could talk easily with my classmates, but I cannot really do that." Nora observed that men in the program seemed to experience the program in a way that Margaret desired. According to Nora, a White woman, men in the class tended to adopt a laid-back approach, enjoying a relaxed and fun atmosphere. She noted, "they are here for fun. They just want to hang out and have a good time, and it is fun for them."

Women in this study also underscored the importance of a camaraderie among women, supporting and encouraging each other. For example, Jasmine, who was an Asian woman and international student, wanted to understand and share the experiences of other women in the context of an engineering program.

I actually also want to know what other women experience so we can encourage and support each other because only women can feel what women feel. Only women know what women feel and need. No man can feel what this is. When you say "Oh, I encountered this in the class," women will immediately know what you are talking about.

But if you tell it to a man, they will not (Jasmine, an Asian woman).

Similar to Jasmine, Rere, a Black woman who identified as bisexual, expressed, "I do have moments of time where I wish, like, you know, there is another woman in the classroom to talk about our experiences in the program or to just relate on stuff with." Her desire stemmed from

the wish to engage in discussions about challenges or to establish a relatable connection with someone who shared similar experiences.

While these narratives came from Triangle Community College and Park Community College, two women from Triangle Community College shared that the male dominance in the program did not affect their peer support networks. Nikki and Lilly, both Hispanic women, were also working in the same team when I visited their classrooms. When I asked Nikki, how the male dominance in the program impacts her experiences in the program, and her response was “not at all.” She said “everyone has been able to just be open share their ideas, and everyone listens to each other. So far, I have had a good experience.” Similarly, referring to her classmates, Lilly said, “we are getting along. Everybody is not focused on that ethnicity, but what we can do together.” When I asked Lilly in the focus group interview if her age can be an advantage for her in the program, she said, “maybe. Younger people coming out of high school and without parental support might suffer more anxiety than those who had relevant experience in how to handle some of these things.” The fact that Nikki and Lilly were part of the same team may have contributed to their aligned views, highlighting the importance of considering individual team dynamics when interpreting such narratives.

While women enrolled in the Triangle Community College and Park Community College presented similar patterns in terms of the absence of peer support networks, the experiences of women in the Land Community College was different. Martha, Sarah, and Olive, who are women enrolled in Land Community College, shared being able to get academic support from their classmates who were men. For example, Martha, a Hispanic woman, shared,

Do you remember the guy who was asking questions while you were in the class? I was asking him for help because my book is different and the problems in my book do not

match the assignments. We just work some things together. By now, gender does not really matter in peer support.

Earlier in her interview, Martha highlighted differences between her first year in the program and her fourth semester, expressing an increased sense of comfort in the latter. Therefore, her use of the term “by now” carries significant weight as a reflection of these observed changes. Similarly, the interview with a faculty member at Land Community College provided additional context to underscore the importance of the phrase “by now” in Martha’s description:

I think it takes them a while for them to acknowledge that “oh, this student, whether Hispanic or whatever women, she knows what she is doing and getting good grades.” I guess it takes a couple of years for the rest of the students to realize who is who, who is getting better grades, and then that is when the gender dynamics in the class change. By then everybody knows gender does not really matter, right?

The mention of “gender dynamics” in this faculty member’s quote suggested that initially, there might be preconceived notions or stereotypes about the academic capabilities of certain genders, particularly disadvantaging women in the engineering classroom. The faculty member suggested that over the course of a few years, students started to realize who among them was consistently performing well and achieving good grades. This realization, according to the faculty member, led to a shift in the gender dynamics within the class. Olive, a returning student who identified as White, also noted that when women actively participated in class discussions, such as answering questions, men in the class were unafraid to approach them and seek clarification on concepts they were struggling with. Olive’s observation also aligned with

the faculty member's observation that once students knew that women excelled in the class, previous gender dynamics no longer presented a barrier to peer connections.

In conclusion, the experiences of women in community college engineering classrooms shed light on the prominent absence of peer support networks, with a common thread of a desire for improved communication and connections among classmates. Despite the acknowledged need for such networks, building them proved challenging for women. The narratives also revealed that the challenges in establishing peer connections were not solely rooted in gender dynamics but were compounded by diverse life experiences due to age, caregiving responsibilities, and work commitments. Women's experiences at Land Community College differed, and women could find academic support and collaboration among their male classmates. This variance highlighted the potential for positive change over time and emphasized the significance of highlighting women's success stories in the class to disrupt the stereotypical perceptions of women in the engineering classroom. Overall, the narratives illustrated the complex interplay between gender dynamics, life experiences, and the evolving nature of peer support networks.

The Quest for Tailored Institutional Student Support while Navigating Intersectional Challenges

Under this theme, I discuss the need for tailored institutional student support systems to address women's diverse needs. First, I present a discussion of women's experiences with various academic support systems beyond the class. Second, I examine women's encounters with the institutional transfer support systems. Third, I discuss the importance of institutional financial support systems in addressing women's needs and challenges. Lastly, I focus on diversity, equity, and inclusion (DEI) and other support systems.

Academic Support Beyond the Class: “I can ask those stupid questions.”

Participants revealed the paramount significance of professors and their office hours, advisors, success coaches, and tutoring services as sources of academic support. Participants frequently cited the responsiveness of faculty members to their questions and needs for accommodation. For example, referring to faculty members, Jasmine—an Asian woman—said, “they are really responsive. They are very good at what they do. I mean, they are really attentive. They ask you what you need, and then they provide.”

Furthermore, academic tutoring services proved particularly helpful, aiding participants in grasping challenging concepts. Elaine, a 29-year-old returning student with a disability, expressed her gratitude for tutoring resources and appreciated the extended hours during which students could seek assistance for questions related to various subjects such as physics or math. The tutoring services proved to be a substantial aid in her learning journey. Similarly, Nora, a bisexual White woman, deemed the tutoring services in her institution as her “best friend,” suggesting her strong reliance on the learning assistance and tutoring services provided by the institution. Confirming what other participants said, Edith, a biracial woman, said “they have tutors in the learning center that can help with things like the homework, especially in science subjects where I might be struggling. They are a great support.”

Advisors emerged as significant sources of academic support, guiding the students’ academic journeys and assisting them in reaching future academic goals. Hedy, a Middle Eastern woman, underscored the efficiency of advising services by saying “I like the advising department here. They have a really good online layout of all the classes you need to take just to finish all your prerequisites, so you do not have to keep scheduling appointments with them.” When I asked Alice, a Hispanic woman, about how she had been overcoming the academic challenges

she had been experiencing, she underscored the important role of her advisor. Her advisor was able to provide tailored guidance specifically for her and address her concerns effectively. Alice acknowledged her advisor's willingness to go beyond her role by aiding in class enrollment:

When I took the semester off, I came back to register for this fall semester. I had just disappeared. She had not seen me since last fall semester, and the first thing she told me when she saw me was "Hey, how are you?" I was like, "I took a semester off." She said, "Yeah, I got you." She already knew, since she was the one who helped me withdraw last semester told me that a W is better than F, knowing my work and where I want to transfer to. She is helping me know which prerequisites I need to have a better chance to transfer and making sure that I can or will likely get accepted to the program I want for engineering (Alice, a Hispanic woman).

These external avenues for academic support offered a valuable relief from the challenges posed by the male-dominated classroom environment. The insights I gained from both individual interviews with faculty and students underscored a notable trend: women in Associate in Engineering degree programs exhibited a higher degree of reservation within the classroom, often refraining from asking questions. This need arose from the masculine-dominant atmosphere within the classroom, where women felt compelled to prove themselves, leading to a hesitancy to ask questions and a fear of appearing less knowledgeable. These dynamics revealed a distinctive need for out-of-class academic support during focus group interview. The relationships established with faculty or advisors played a crucial role, and the out-of-class support systems emerged as essential, providing a secure space for women to seek clarification, ask questions without apprehension, and receive the academic support they required. I provide a

snapshot of a conversation from the focus group interview to demonstrate the importance of these external avenues for women:

Birdy: Sometimes, if it is a one-on-one session, I can usually push past that anxiety, and just be like, okay, I just need to ask this question. Just get it out there, and I will get my answer. But it can be hard, especially if the relationship with the teacher is not really favorable, or I do not know them too well, or I am not very comfortable with them, you know, like, it can just be kind of anxiety-inducing in general.

Elaine: Or asking for help from a tutor. I definitely feel like once I break that anxiety-inducing feeling, I can ask those stupid questions. In my opinion, right? It is a lot easier to really ask the questions because they get to know you a little bit. And so they know exactly where you are at and how you are learning. So, they are able to kinda meet you there. And that helps a lot, at least, my personal experience.

While this snapshot highlighted the importance of one-on-one engagement with faculty, tutors, and advisors, it also highlights the anxiety that stems from asking for help. Similar to Birdy and Elaine, Kate, a first-generation college student and returning student who identified as White, opened up about her struggle to seek academic support when needed in a specific example where she needed support from her advisor. She attributed this hesitation to a sense of insecurity discussed earlier in the conversation about the stereotypes of people from lower-income backgrounds in engineering. She said, “I do not use resources because of that anxiety and that insecurity of, you know, I do not want to seem dumb.” Kate perceived all the institutional academic support systems to be useful, but she shared, “that is really just about getting a student motivated to use them when they need them. I think that is the challenging part, because these things do exist.”

In addition to the anxiety of asking for help, women in this study encountered some other barriers in accessing academic support systems. There were issues related to the quality and availability of the support offered. Some women expressed dissatisfaction with the tutoring support, citing concerns about tutoring quality, and limitations in tutoring hours. Another notable case involved a participant who was unaware of who her counselor or advisor was, making it challenging for her to seek assistance:

I feel like just more support from the counseling from the college counselors would be helpful, because once my original college counselor quit, now, I do not even know who my college counselor is right now. No one has reached out to me. So I have no idea who I can talk to if I want help with an application or something. I think just having one person reach out to me, asking me if I need help with anything would be nice, like having a counselor or an advisor reach out would be helpful (Margaret, a White woman).

Mary, an African American woman, recounted instances where she faced challenges accessing tutoring services, also there was a gap in her awareness about the existence of the STEM Center. Mary expressed her wish for increased accessibility, noting that assumptions of equal access were flawed since many students might not be aware of available resources due to various constraints like time conflicts, work commitments, or transportation issues:

They say everyone has the same access, but they really do not because you may have a time conflict or if people have to work like me, or if they have to catch the bus or you know... They (referring to tutoring services) only really have one block. I wish I had like two or three.

In conclusion, the experiences of women in the Associate in Engineering degree program underscore the vital role played by professors, office hours, advisors, and counselors as crucial

sources of academic support outside the classroom. As the male-domination in the program impacted women's classroom experiences, the academic support networks outside the classroom were significant for women in this study. However, the study also revealed challenges accessing and using available academic support services. This highlights the ongoing need for increased awareness and accessibility to support services, ensuring that women in the Associate in Engineering degree program can confidently navigate their academic journeys with the necessary guidance and resources.

Transfer Support Systems and Challenges: “They do not really talk about competitiveness.”

All women in this study aspired to transfer to a four-year engineering program. Their institution's partnerships with four-year engineering programs were a source of confidence and support for them, and even when they were not actively seeking support for the transfer journey at the time of the interview, the majority highlighted the assurance of available transfer resources whenever the need arose. Advisors emerged as pivotal figures, consistently playing a key role in supporting and guiding the women towards their transfer goals. Their institutions' commitment to fostering these partnerships and the proactive role of advisors contributed significantly to the women's confidence for the transition to four-year engineering programs. For example, Hedy who aspired to obtain a bachelor's degree in computer science to become a software engineer said:

My advisors reach out every few weeks just to see how I am doing, like if I am doing well and my classes and what I would like to do for next semester. They do all the planning really early, so that we are not confused at the last moment on what to take (Hedy, Middle Eastern immigrant woman).

While all women in this study aimed to transfer to a four-year engineering program, they expected various challenges throughout the process. The upcoming section first examines these challenges and concerns. Subsequently, it explores how the intersection of women's multiple identities plays a central role in shaping both their transfer aspirations and support requirements.

Challenges and Concerns: “More information about what needs to be done in the transfer process would be helpful.”

In this study, women participants outlined a multitude of significant challenges and concerns they either expected or encountered during the transfer process. These challenges encompassed various dimensions, including the absence of clear guidance on transfer procedures, discrepancies between the curriculum of their community college courses and the requirements of four-year engineering programs, insufficient support in navigating the competitive nature of transfer admissions, the struggle to allocate time to understand the transfer process while juggling multiple roles and responsibilities, and financial anxieties. Through their experiences, these women shed light on the intricate and multifaceted nature of the transfer journey. This section discusses these challenges in more detail.

Participants shared concerns about the transfer process, emphasizing the need for more comprehensive guidance. For example, Elaine, aspiring to transfer to a four-year computer science program, envisioned the transfer process as an unbuilt bridge, highlighting the lack of clarity on the necessary steps. Referring to the transfer process, she said: “there is a bridge that is going to come up, but right now the bridge has not been built.” She acknowledged the need for a more detailed roadmap, by saying that “more information about what needs to be done for in the transfer process would be helpful.” Rere, a bisexual Black woman aspiring to transfer to a four-year computer science program, emphasized the need for informative seminars or workshops.

She suggested that “these sessions should break down what each college offers,” providing a comprehensive overview of the engineering programs, projected outcomes upon transfer, and other crucial details to foster informed decision-making. She envisioned a scenario where students could confidently articulate the reasons behind their four-year university choices for transfer, moving beyond vague statements like “it is good” or “it is not too far.” Rere’s suggestion highlighted the importance of providing students with the tools and information necessary to make well-informed decisions about their academic journeys. Similar to Rere, Edith, a biracial woman aspiring to transfer to a four-year computer science program, also highlighted the need for and importance of making informed decisions by sharing,

A lot of the classes that you end up taking in the community college are general education, and they do not really give you an idea of what the engineering job will look like. There is not a lot of classes that offer you some kind of insight into what working as an engineer would look like, which I think it would really benefit from early on if you have an idea of what you are getting yourself into further down the road.

Some participants also shared some concerns about the partnership between their institution and four-year engineering programs, highlighting the need for improvement in their course alignment. To illustrate, Olive, a returning student White woman aspiring to transfer to a civil engineering program, provided a concrete example, noting the discrepancy between the required programming languages at her community college for an engineering Associate’s degree and the four-year institution’s preference for a different programming language. As Olive was a returning student, she recalled a tough experience in the past when none of her credits transferred after earning a degree. She was frustrated to discover a similar issue even though they

took extra care this time to ensure every credit transferred. This situation was causing her a lot of stress and disappointment as she navigated unexpected challenges in their academic journey.

The challenges the participants perceived were also about the competitive aspect of the transfer process, but these concerns were also intricately connected to their experiences as individuals situated at the intersection of multiple systems of power, privilege, and oppression. For example, Kate, a White, returning, first-generation student aspiring to obtain a bachelor's degree in aerospace engineering, shared her aspirations and concerns about her plans to attend NC State College of Engineering, acknowledging the intense competition for admission. She started by expressing "the competitiveness of the program" and acknowledging "the uncertainty of being accepted." She remained hopeful but cautious, not wanting to set unrealistic expectations. Despite her optimism, she opened up about the fear of potential obstacles stemming from her past academic challenges, including dropping out of high school, failing a class, and temporarily dropping out of college. She contrasted her academic journey with those who have excelled, humorously describing her own as "a little bit colorful," highlighting the uniqueness of her path in comparison to others. Similar concerns regarding the competitiveness of the transfer process were also shared by Nora, Edith, Jasmine, and Margaret. A bisexual White woman aspiring to transfer to either an industrial or environmental engineering program, Nora, voiced her concerns, even though she recognized that the concern may not be grounded in reality. She expressed concerns about "not meeting the required GPA scores to gain entry into the four-year engineering program." However, Nora reassured herself, noting that, at her current stage, she did not foresee any issues with the transfer process. Edith, who was a biracial woman aspiring to transfer to a four-year computer science program, and Margaret, a White woman aspiring to transfer to a computer science program, identified "competitiveness" and "high GPA

requirements” as their primary concern. An essential aspect to emphasize in their narratives about the competitive nature of the transfer process is that this concern persists irrespective of their current GPA. Jasmine, a first-generation immigrant Asian woman who also aspired to transfer to computer science program, shared that she had “decent grades,” but she was “still scared” that she was “not competent enough to get into the four-year computer engineering program” she wanted to transfer to.

As the women in this study juggled various roles and responsibilities alongside their student identities, finding the time to comprehend the intricacies of the transfer process and allocate sufficient time for submitting their applications emerged as a significant concern. For example, Lilly—a Hispanic woman with caregiving and work responsibilities—and Olive—a White woman returning student with caregiving and work responsibilities and a disability—highlighted the time constraint as a significant challenge in the transfer process. Lilly aspired to attend a chemical engineering program, and Olive’s aspiration was to become a civil engineer. They both expressed concerns about the time required to thoroughly understand and fulfill all the requirements of the institution they were transferring to. Time management and timely completion of all necessary tasks emerge as crucial aspects of the transfer process they recognized and viewed as potential challenges. Aspiring to transfer to a four-year computer science program, Rere—a bisexual Black woman with caregiving and work responsibilities—also shared,

Other than maintaining my grades, which has not been too hard, um, I think maintaining the timeline of you know, there is a process to apply in the schools. You submit your FAFSA, you submit your essays and stuff like that, and that is a very long process. In doing that, while you are in school while you are working while you are doing life stuff,

it is so difficult to manage. I am actually looking at starting my essay soon, just because February 15 is my deadline. But even then, I just feel like that is not enough time.

Transferring to a four-year institution was not also free from financial constraints and concerns. Birdy, a bisexual White woman, wanted to transfer to a public four-year engineering program, but it was still more expensive than the community college, and therefore, she was expecting some financial challenges. Olive, a returning student White woman, shared concerns about where she would reside after the transfer and the prospect of relocation, she also reported how accommodations for her disability became a stressor, exacerbated by the financial aspect of the rigorous documentation of the disability (e.g., the need for additional testing, including cognitive assessments), as required by four-year universities. Navigating these challenges was crucial not only for securing admission to the four-year engineering program she wanted to transfer to but also for ensuring success in obtaining her bachelor's degree. She said:

What I have is wearing me because the universities require a lot more documentation, and which is fine, but if you have to go get retested because the university requires it for you to have those accommodations, my insurance will probably not cover that. I'm expecting around \$1,000, just for that, to be successful on that ending and get that bachelor's degree (Olive, a White woman).

This section presented a discussion of women's challenges and concerns regarding the transfer process. Their experiences reflected the centrality of their life experiences in informing their challenges and concerns. The following section will address how their intersecting identities are at the center of their transfer aspirations and support needs as they choose a transfer institution.

Intersecting Identities, Transfer Aspirations, and Support Needs: “I really want to go to a HBCU.”

While most women in this study aimed to transfer to the largest predominantly White institution in the state, some women of color had different priorities in selecting a four-year institution. In this section, I discuss the intricate interplay of women’s intersecting identities as they navigate the decision-making process for selecting a four-year institution. I also examine how these multifaceted identities shape their preferences and priorities, illuminating the nuanced considerations guiding their choices in this pivotal selection process.

For women of color, intersectionality was also at play in selecting a four-year transfer institution which would offer a community for them. For example, Mary, an African American woman, wanted to transfer to a mechanical engineering program in one of the Historically Black Colleges and Universities (HBCU) in another state. She previously attended a predominantly White institution (PWI), and she realized “it did not align with her educational aspirations.” While she was considering her transfer options, she visited the HBCU she wanted to transfer to and felt a profound connection to the engineering department. The tour and interaction with the institution’s engineering environment convinced her that this institution would provide the challenges and motivation she sought, a sentiment they did not experience with local HBCUs or PWIs. Ultimately, she knew where she wanted to go. While making this decision, Mary’s engineering advisor, an African American man, played a pivotal role in guiding and supporting her. His assistance extended to helping her identify transferable classes and introducing her to the prospect of attending that specific HBCU. Also influenced by her mother’s positive experiences at an HBCU and her network of friends at HBCUs, she felt a stronger personal connection to the university. This network provided an avenue for her to seek advice and insights

on a more personal level, fostering a sense of familiarity and alignment with her aspirations, ultimately contributing to the decision to choose an out-of-state HBCU. However, because she wanted to transfer to an out-of-state institution, this was making the process more complicated.

She cited,

If I was going to be in the state, these support systems would be really helpful because everything would transfer. So, it is just kind of like as long as you took the courses here, you would not have to take them again. For the out-of-state HBCU I want to transfer to, you would still have to apply and stuff like that. That is probably the biggest difference I would say.

Similarly, Rere, a bisexual Black woman, cited a nuanced exploration to identify the most suitable engineering program and institution where she could excel both academically and personally. This process involved meticulous research, where she considered various factors such as student life, daily campus routines, and other critical aspects. As an individual navigating the intersection of her race, sexual orientation, and academic pursuits, Rere recognized the pivotal role of diversity in shaping her decision. Her commitment to avoiding feelings of isolation reflected the intersectional lens through which she approached her university selection. Seeking an informed perspective, she sought guidance from counselors and individuals with firsthand experiences at the prospective universities. Despite still considering a predominantly White institution (PWI) in her state, Rere acknowledged the importance of exploring alternative options that could offer the supportive and inclusive community she sought. This intersectionality dimension emphasizes how Rere's identity, encompassing race, sexuality, and academic aspirations, came together in her decision-making process for transfer.

While women navigate the transfer process, support from four-year institutions is also empowering. Olive, a returning student White woman who is also a first-generation college student, shed light on the significant challenges she faced in the application process, particularly the daunting task of filling out applications due to anxiety and concerns about her writing abilities. She grappled not only with the intricacies of applying to four-year institutions but also with the additional layer of anxiety related to her disability. Her positive encounter with an enrollment officer at the four-year institution she planned to transfer to exemplified the significance of personalized guidance in alleviating anxieties. Referring to the enrollment officer, Olive said, “she was very encouraging. I really appreciate that. She took the time and answered all those questions and concerns.” Olive’s narrative highlights the fact that while support from community colleges is significant, involvement of four-year institutions in planning the transfer process also helps women with multifaceted backgrounds and needs.

In conclusion, the journey of women in community college engineering programs seeking to transfer to four-year institutions is marked by a myriad of challenges, met with varying degrees of support. These challenges extend beyond academic pursuits and encompass intricate layers of identity, including race, gender, sexuality, and, in some cases, disability. The significance of tailored support systems from both community colleges and four-year institutions becomes evident in mitigating these challenges.

Financial Support Systems: “It’s just me working two jobs.”

Navigating their academic journey in the Associate in Engineering degree programs in community colleges, women faced a myriad of financial challenges that significantly impacted their experiences in the program. A big majority of participants held part-time or full-time jobs,

and in some cases, they were working two jobs at the same time. For example, when I asked them about their financial support systems, Mary shared:

Like FAFSA a little bit, but most of the time, it is just me working. It is just me working two jobs, going to school and trying to work, trying to get a balance so I can study but then also have enough money so I can pay to continue going to school (Mary, African American woman, returning student, first-generation college student).

Just like Mary, the biggest challenge for Lilly was handling school and her full-time job:

The challenge is having my full-time job. I am trying to get to class, complete my homework, sometimes projects, and meet with people to do the projects. Doing all these are the most challenging (Lilly, a Hispanic woman).

The intersectionality of participants' social locations such as immigrant status and economic disadvantage has profound implications for individuals navigating various spheres of life. For instance, the challenges faced by those who were both children of immigrant parents and economically disadvantaged illuminate the interplay between familial background and financial need. For example, Martha, a Hispanic immigrant who is also a first-generation college student, was working 30 hours a week to be able to afford her college expenses. In her interview, it was clear that working 30-hours a week created an additional burden on her, amplifying the challenges of pursuing education at the same time. She said:

I feel that I need to work that amount, because of my parents' immigration status. I mean, you know, I do not want to put any extra financial burden on them. It makes it hard to balance all my classes and clubs.

Participants also highlighted the academic consequences of financial challenges they experienced. One example came from Jasmine. Jasmine was an international student, and she did

not have any financial support systems. She said, “I’m an international student, so I cannot really get any support because the support is always for green card holders, permanent residents, or citizens.” She continued, “if you are an international student, you do not get any support.”

Jasmine wanted to have more time to study to feel academically competitive in the program.

However, this was not possible because she needed to work to earn money. Underscoring having financial support from parents as a privilege, she said:

I want to be competitive enough and to have the time to study more. You know, you have to work if you do not have enough money... Yeah. That is why I feel like people with good grades have the privilege to study. They can focus on studying, which is a privilege for Yeah. Having your parents to support you is a privilege.

Kate’s story clearly exemplified a similar academic consequence. Kate is a first-generation college student White woman who is also a returning student. When she first started community college, she could secure a Pell Grant, which provided essential financial support for her education. However, when she faced some challenges in her personal life, she had to withdraw from school, putting her academic pursuits on hold. When she decided to return to school, she realized that she no longer did qualify for the Pell Grant due to her earlier withdrawal. In this scenario, financing her education became a personal responsibility, and without parental and institutional financial support, she had to rely on working to sustain herself. Kate shared,

For me, it has just been paying out of pocket because I do have to work and I do have to support myself, I do not have parents or anyone to rely on. It has taken me longer than normal to get my associate’s degree that would take two years; for me, I have been doing three. So that is where that came from.

Her extended deadline to complete her associate's degree is a reflection of the challenges and complexities she faced while having extended work hours and schooling along with her other life commitments and responsibilities. She was also taking care of her younger sister. Her journey in the engineering program has been really stressful for her, making it feel like giving up is an option. She added,

Stressful, stressful, and it makes you want to give up and every time you can get a little bit of confidence and your success, then you lose it, because there is some other challenge coming up ahead of you. It is very stressful. But it is something that I feel like I can do. I just have to keep going.

The inherent stress in Kate's journey, as expressed in the quote, aligns with the additional pressures placed on women in engineering who come from low-income backgrounds.

The narratives presented thus far vividly illustrate the intricate paths women navigate while confronting the financial challenges of being a student. To truly grasp the multifaceted nature of women's financial needs, it is imperative to employ an intersectional analytical approach. In understanding these intersectional experiences, it becomes equally crucial to highlight alternative scenarios, particularly those where women in the study benefit from parental financial support.

Sarah is a White woman working a part-time job, and her mother is a college graduate while her father is not. In her interview, when I asked her what challenges she encountered in her studies, financial challenges or the challenges of balancing work and school were not mentioned. Then I specifically asked if the part-time job she shared in the demographic survey causes any challenges for her. She shared that it did not really cause any challenges for her and added:

My parents always have a college fund for me. My workplace is willing to work with me even when I ever need some time off or I need to work around the schedule. In the

summertime I am able to work more full time or a lot more hours. Whenever I am in school, I work either one or two days, so that I am still making some money. That helps me be able to do that. I am able to say “Hey, I cannot come in.” I need that at least sometimes. They are still fully understanding and knowing that my school does come first.

In other words, where women have parental financial support, a notable privilege emerges: the flexibility to structure their work hours according to personal and academic needs. This advantage extends to the freedom of choosing when to engage in employment and the ability to select positions that provide the desired flexibility. However, the analysis of the student interview data revealed that what can reverse these scenarios is institutional financial support. This underscores the transformative potential of institutional backing in mitigating financial challenges and fostering a more equitable landscape for all students. Olive is a good example of how institutional financial support systems can compensate for missing parental financial support and coming from a lower socioeconomic background. Olive is a White woman returning student who is also a first-generation college student. She explained how federal and institutional financial support systems help her navigate the challenges of her academic journey. She shared:

Thank God for financial aid, just because there are times where I am not able to work full time. This week, for example, I went to work for about 10 hours. Then I needed something to supplement that, and financial aid has been awesome. So have the scholarships and grants. Especially if you are a woman, and especially if you stay on top of your grades, you try your best to try to get that GPA up, you know, it is worth it. Because, honestly, that is where a lot of it came from, for me, and I cannot thank those donors more, because their support helped me so much to be able to say, “OK, I am OK,

this month, we are good.” I could study, and I do not have to stress out about work. You know, the only reason the only time I start stressing out about work is if I am getting less than those hours for my health benefits. Other than that, I mean, those scholarships and grants have been awesome.

In conclusion, while institutions may not have control over students’ diverse financial resources and parental support systems, this study unequivocally demonstrates the transformative impact of institutional financial support mechanisms. Women’s narratives in this study underscore the critical role these systems play as game-changers, especially for those lacking parental financial backing. Institutional financial support allows students to redirect their focus toward education with greater ease, reducing the burden of stress and anxiety.

DEI and Other Support Systems: “I do not recall any kind of a specific process for that.”

In this section, I present findings regarding how women in this study accessed and used Diversity, Equity, and Inclusion (DEI) and other student support resources, as well as barriers they faced in accessing and using these resources. First, I discuss findings about accessibility services. Second, I discuss mental health support systems and challenges in using these resources. Lastly, I share findings about how women in the study reported sexual misconduct.

Accessibility Services: “Do you mind speaking a little louder?”

At research sites, support for students with disabilities is available through Accessibility Services or Disability Support Services. Both the examination of institutional websites and interviews with program directors unveiled that accommodations should be coordinated through these offices. Upon enrollment in classes each semester, students are responsible for requesting accommodations. This involves completing a *Semester Accommodation Request* to notify their instructors. It is crucial to emphasize that this procedural information is detailed on the

institution's website but is not readily accessible on the program-specific site. Following submission of the request, the office promptly reviews it and initiates the distribution of notices a few days before the upcoming semester begins.

Three women in this study disclosed having disabilities during the interviews. However, they did not uniformly seek accommodations from their institutions, primarily due to associated documenting costs (such as retaking tests) or a lack of awareness regarding their institution's disability support services. For instance, in Edith's case, she was unaware of the available institutional support services, leading her to request accommodations individually from each professor. Following her explanation of this process, I inquired whether there might be a more institutionalized support system in place that would not require her to seek accommodations from each person separately. She responded:

In high school, it was a lot more formal, but now, I do not recall any kind of a specific process for that. What usually happens is that I go to the classes, and I kind of see what challenges there are for me. For example, I might have a teacher speaking a little softly. So that is gonna be a little bit difficult for me. And then I just reach out and make him aware like, "Hey, I am looking forward to this class. I want to let you know that I have hearing loss. I am hard of hearing. I am not getting all your lessons and all your instructions." That usually makes them a little more aware of speaking up or I might have to ask them later like "Sorry, I cannot really hear you very well. Do you mind speaking a little louder? Like after classes and stuff like that. So yeah, usually it is like a case-to-case basis (Edith, a biracial woman).

In Olive's case, her first college experience was hampered by a lack of institutional support. She did not receive the accommodations she needed to succeed in her math classes,

which led to her dropping out of the Associate in Engineering program. She said, “I just got nervous and psyched myself out.” However, when she returned to school at a different institution, she was provided with the support she needed and was satisfied with the accommodations she received. Her story is a reminder that not being able to receive the necessary accommodations can be a reason why students drop out of their programs.

In Elaine’s case, she did not officially or unofficially share her disability with her institution. She explained that documenting her disability at her institution could be a quite demanding task, as the procedures varied from state to state. She did not have the required documentation because they were tested years ago, and she moved from another state. Considering the costs and time, she had not taken the tests to renew her disability documentation. However, she mentioned that she needed some extra time for some assignments, especially when the assignments were timed, to check if she flipped numbers or letters.

In summary, this study revealed a gap between available institutional disability or accessibility support services and the participants’ awareness of them. Some participants thought documenting their disability was an expensive process. Some participants did not have any knowledge regarding the institutional reporting process.

Mental Health Support Systems: “I have a lot of anxiety.”

The analysis of institutional websites for the research sites indicated that counseling services were categorized under either wellness services or student services. Access to these links was occasionally challenging, as services were sometimes grouped with others or labeled differently. All three institutions provided mental health counseling and referral services for students. These confidential sessions aimed to tackle personal and academic challenges using

short-term, goal-oriented counseling approaches. In instances requiring continuous counseling, students were directed to external providers.

In this study, women characterized the engineering field as high-pressure, and the majority of participants reported elevated stress levels and anxiety. Edith, a biracial woman, exemplified the added burdens faced by individuals from minoritized groups within engineering. She articulated a constant feeling of heightened scrutiny, shedding light on the nuanced challenges experienced by biracial women in this field. Edith further discussed the impact of external expectations and her self-imposed pressure to excel:

It can be a bit overwhelming sometimes. Just like the stress that comes with wanting to do well in like high-pressure fields. When you are a woman or biracial and like you are minority and stuff in the STEM field, you kind of feel like you are kind of being looked at a little more closely than everyone else. I think there is a lot of dread that you might put on yourself, trying to perform as best we can. That can be a little overwhelming.

Participants used both on-campus and off-campus counseling services. Referring to on-campus counseling services, Nora, a bisexual White woman, highlighted the accessibility of multiple therapists, providing an option for individuals feeling overwhelmed or in need of someone to talk to. She appreciated “the opportunity to share their feelings and thoughts in a constructive manner rather than keeping everything bottled up.” She underscored the therapeutic benefits of having accessible and understanding professionals to talk to when needed. Ada was using an off-campus counseling service. Ada shared her fear of failure as her major stressor, especially when her workload is too much: “what stresses me out is to fail, especially. I am scared that my GPA is going to drop. I go to therapy to get myself to see the patterns. How can I change this?” She was seeing an external therapist as she thought she needed a long-term

approach to counseling. While the accessibility and constructive nature of on-campus mental health services are highlighted by Nora's positive experience, Ada's choice to seek external therapy suggests a potential need for broader and more specialized support options within the on-campus services.

Participants also highlighted the importance of having a holistic approach to well-being. This holistic approach meant improving the learning environments while also offering counseling services. For example, talking about her well-being, Hedy, a Middle Eastern first-generation immigrant woman, commented on the mental health services at her college: "I think they recently implemented more of the Mental Health Services, which is really good because I previously thought it was a little lacking." She continued to talk about the potential impact of the learning environment on her emotional well-being, describing the classroom as "emotionally draining." Her comment emphasized the significance of focusing not only on personal supports but also on enhancing students' learning environments and experiences. This comprehensive strategy is essential for better supporting women in the Associate in Engineering programs.

In summary, this study underscores critical insights regarding women's mental support needs within the Associate in Engineering programs. Women's mental well-being in the Associate in Engineering programs is intricately connected to their learning environments and experiences influenced by social stereotypes. While recognizing the significance of short-term, goal-oriented mental health services, it is equally crucial to embrace a holistic approach to enhance women's mental health by improving their learning environments. Balancing immediate assistance with a more extended, tailored approach could further strengthen the mental health support system for students in challenging academic environments.

Reporting Sexual Misconduct: “They are drunk, they call me, they ask if I am available.”

One participant in the study had an experience in which she had to deal with sexual harassment by her classmates. Jasmine, as an Asian woman who is also an international student, said that “I am gonna deal with Asian fetish. I need to deal with sexual harassment, calls in the middle of the night.” She said that her classmates called and texted her drunk in the middle of the night. She continued:

They are drunk, they call me, they ask if I am available, my voice is so attractive. I told them I am married. They do not believe me. I am so young, you know. So it is frustrating sometimes. I just need to deal with it. I cannot be aggressive because I do not know what that person can do. I need to be careful.

In this experience, both her racism and sexism both contributed to the specific forms of harassment she experienced, and her status as an international student made her even more vulnerable to exploitation. Jasmine’s carefully crafted responses to her classmates’ harassment reflected her awareness of the power dynamics at play. She was afraid of speaking out against her harassers for fear of retaliation, and she felt that she must be careful in her interactions with them. This highlights the silencing effect of sexual harassment, particularly for women who are members of marginalized groups.

When she shared this situation with her husband, her husband helped her file a complaint to the community college she was studying in. When I asked her if her institution was supportive, she said “yes.” At the time of the interview, there were still some email exchanges between her and her institution about her file. Jasmine’s husband’s support was crucial in enabling her to file a complaint against her harassers. Despite initial fears, when Jasmine felt supported and empowered, she could come forward and seek justice.

After Jasmine's interview, I looked at her institution's website to find some information about how to file a sexual harassment complaint. I saw that these resources were listed under employee resources. The institution's placement of sexual harassment resources under "employee resources" may also make it more difficult for students to find the information and support they need.

In summary, Jasmine's experience with sexual harassment sheds light on the complex interplay of racism and sexism in shaping women's vulnerability to such abuse. Her carefully crafted responses to her harassers highlight the silencing effect of sexual harassment, particularly for women from marginalized groups. That Jasmine was able to file a complaint after talking to her husband underscores the importance of social support. However, everyone may not have such social support. Institutions must be aware of this and take responsibility by providing clear and accessible resources for reporting sexual harassment, ensuring a safe and equitable campus for all students.

Summary of Findings

The first theme was about women's audacious entry into engineering education. Community college served as a financially sound and strategic gateway to secure a better future for women in this study. Participants' decision to enroll in the Associate in Engineering program entailed confronting and persevering through gender, racial, and class-based stereotypes. Regarding the program's recruitment strategies, this study identified a gap, leaving out those who do not follow the traditional high school pipeline. Participants experienced diverse decision-making journeys, with smoother processes for those with familial support. Conversely, women of color, first-generation college students, and immigrants encountered more complexity.

The second theme was about gendered and intersectional experiences in the curricular and extracurricular spaces in the Associate in Engineering program. The narratives underscored the dual nature of women's experiences, emphasizing both resilience and the emotional costs associated with navigating such environments. The study revealed how societal expectations contribute to internalized self-doubt and anxiety. The impact of male dominance extended beyond academics, affecting women's mental and emotional well-being, career aspirations, and sense of safety. The complex interplay of societal expectations, classroom dynamics, and intersectionality underscored the challenges women, contributing to a more cautious approach to class participation. In team projects, women faced gender-based and intersectional challenges, where they were often spoken over, given menial tasks, or questioned in their competence. Participation in extracurricular activities also involved gendered and intersectional patterns.

The third theme was about a lack of support networks for women in the engineering classroom, which stemmed from faculty diversity gap and peer support gap. The study underscored the significance of faculty diversity, with women of color expressing a desire for instructors who share their backgrounds, emphasizing the value of shared experiences in building support networks and offering insights on coping with challenges. Women in the study emphasized a collective desire for improved communication and connections among classmates, with a particular focus on gender dynamics. However, building these networks proved challenging, with factors such as age, caregiving responsibilities, and work commitments contributing to the complexity.

With the fourth theme, this study underscored the importance of tailored institutional support systems for women as they navigated intersectional challenges. The out-of-class academic support systems emerged as crucial, providing a secure space for women to seek

clarification, ask questions, and receive the academic support they needed. The participants shared aspirations and concerns regarding the transfer process, emphasizing the pivotal role of advisors and the support provided by their institutions' partnerships with four-year engineering programs, but barriers existed accessing and utilizing the transfer support systems. Furthermore, this study underscored the significance of robust institutional financial support systems for women. This study also revealed the benefits and barriers related to Diversity, Equity, and Inclusion (DEI) resources in Associate in Engineering degree programs.

Overall, this study offers a deeper understanding of the multifaceted experiences and challenges faced by women in Associate in Engineering degree programs. It revealed the intricate interplay of societal expectations, systemic biases, and the intersectionality of gender, race, and class. This study provides evidence that supports a comprehensive and intersectional approach to addressing the challenges faced by women in Associate in Engineering programs, urging institutions to prioritize inclusivity, diversity, and equity in order to create a supportive and empowering educational environment for all.

CHAPTER 5: DISCUSSION, IMPLICATIONS, AND CONCLUSION

The Associate in Engineering degree programs in North Carolina community colleges aim to support women and students from racially and socioeconomically minoritized populations as they enter the engineering education and workforce (Meardon & Vestal, 2019). Given the gap between the program goal to support women and women's enrollment rates in the program, it was imperative to study women's experiences as they entered the program and within the program. Therefore, this study aimed to understand how women decided to enroll in the Associate in Engineering programs in North Carolina community colleges, what their experiences in the program were, and their transfer aspirations. My purpose in this study was to answer the following research questions:

1. How do women with different intersecting identities decide to pursue an Associate in Engineering degree program?
2. How do women with different intersecting identities describe their experiences in male-dominated Associate in Engineering degree programs in North Carolina community colleges?
3. What are the transfer aspirations of women in Associate in Engineering degree programs in North Carolina community colleges?

This chapter starts with a discussion of key conclusions drawn from this study. Then I make meaning of the findings using the lens of feminist intersectionality, focusing on its significant contributions as a theoretical and analytical framework. Next, I will discuss the recommendations for policy and practice to improve women's experiences in the Associate in Engineering degree programs in North Carolina community colleges and beyond. Lastly, I will discuss the implications for future research and conclude the chapter.

Key Conclusions

Conclusion 1: Associate in Engineering Degree Programs Have a Complex Role, Serving as Cost-Effective—but Perhaps not Straightforward—Pathways for a Brighter Future

Driven by the promise of a brighter future, women in this study strategically opted for the Associate in Engineering degree program, a cost-effective educational path compared to the traditional four-year route to an engineering degree. This key conclusion shed light on the significant role of community colleges in providing opportunities for educational and economic advancement of women from diverse backgrounds. Community colleges provide access to STEM education, which would be otherwise impossible for many students (Hagedorn & Purnamasari, 2012). This critical role of community colleges is notable, as, in many cases, participants' parents did not have college funds for them, making the community college a preferred choice to reduce the costs associated with attending higher education.

Despite the fact that the participants' pursuit of economic advancement (i.e., seeking a better life, financial independence, and stability) was evident in their decision to enroll in the Associate in Engineering program, community colleges remain a subject of debate in the literature concerning their role in either perpetuating or disrupting inequities in access to higher education (Schudde & Goldrick-Rab, 2015). Community colleges are criticized for providing a “meandering route” to social mobility (Schudde & Goldrick-Rab, 2015, p. 28), a notion that resonates with the experiences of some participants in this study, such as switching programs or extending transfer deadlines due to having to prioritize work over school. Taking this meandering route meant staying in the community college longer before the transfer to a four-year engineering program could take place, extending the time required to get a bachelor's degree in engineering.

Despite these challenges, all women in this study aspired to transfer to a four-year engineering program, and the Associate in Engineering degree program demonstrated a commitment to training future engineers, as reflected in the satisfaction expressed by participants in the interviews regarding their engineering education and as reflected in my observation notes. Therefore, the debate surrounding community colleges and their role in higher education requires a more nuanced understanding of community colleges and their social mobility function (Schudde & Goldrick-Rab, 2015; Twombly, 2014). This study revealed the intricate experiences of women in a community college engineering transfer program, highlighting the dangers of perpetuating an either/or view that oversimplifies the pathways of diverse student populations and their goals as they attend community colleges (Twombly, 2014).

In this respect, intersectionality embedded in participants' experiences emerged as a key factor in the decision-making process to enroll in the program, shedding light on the complexities involved. For example, in the case of immigrant women, the decision to pursue engineering education was a journey about overcoming not only gender-related challenges but also challenges associated with immigration status and socioeconomic factors. Previous research with immigrant populations indicated that immigrant parents who come to the United States have the aspiration of providing a brighter future for their children (Abramitzky et al., 2021). Community colleges play a critical role in the economic advancement of immigrant families, attracting a larger number of immigrant students than any other type of postsecondary institution (Teranishi et al., 2011). In addition, immigrant populations are more likely to earn less than native-born workers, and they have a higher likelihood of working in more dangerous jobs and due to factors, such as low educational attainment and English language ability (Huang & Kathryn, 2019; Orrenius & Zavodny, 2009). When such lived experiences of immigrant parents

are considered, they explain what a Hispanic immigrant woman, Nikki, says “I am a second-generation immigrant here, and it was always instilled in me to go to college, get a good job, so I do not have to be working like the way my parents are working.” Similarly, it becomes easier to understand why and how Lilly’s decision to enroll in the program is also related to the goals of having a better career for herself and offering a better future for her daughters. All these experiences challenge simplistic views regarding the role of community colleges in higher education in the United States.

Another complexity in understanding women’s journey into Associate in Engineering degree programs is about the community college stigma. Some participants in this study found themselves grappling with the dilemma of lower higher education attendance costs and the societal stigma attached to community colleges that “they are of low quality, designated only for students of lesser intelligence, or simply larger versions of high school” (Griffith, 2021, p. 4). In their study with Black engineering students, Reyes and Coley (2022) portrayed the community college stigma as “fog shrouding the path,” finding “a way to permeate its way into every inch of the students’ mind and social circle causing severe doubt and uncertainty in the path they have chosen” (p. 10). The debate around community colleges suggest that while community colleges offer enhanced entry promises for many students, the potential benefits of this increased access might not effectively address or reduce inequities if students from marginalized populations are limited to institutions with lower prestige (Schudde & Goldrick-Rab, 2015). The concern, in this case, would be that if students from marginalized backgrounds only have access to community colleges, the overall impact on reducing educational inequities may be limited, as students from marginalized backgrounds might face challenges or barriers associated with the lower perceived prestige of these institutions. Most importantly, dealing with the community college stigma was

also an intersectional experience, primarily affecting students with lower academic achievements, students from racial/ethnic minoritized backgrounds as well as first-generation college students, even when these students have high aspirations (Holland, 2015). In Holland's study, these students had to deal with this stigma because these students might not possess the financial means to enroll in a four-year institution, could feel bewildered and daunted by the application procedures, or may make decisions during high school that did not optimize their chances of securing admission to four-year colleges (Holland, 2015). These experiences closely paralleled those of the participants in this study, as the majority did not have a college fund secured by their parents, some did not feel academically prepared for a four-year university, and some viewed the community college as an opportunity to prove their academic capabilities.

These findings contribute to the scholarly debates around the role of community colleges by urging us to move beyond the "either/or view of community colleges" as solely beneficial or detrimental to social mobility (Twombly, 2014, p. 854). Community colleges have a complex role in social mobility, and even when women in this study were taking a meandering route, the study demonstrated that participants still aspired to transfer to four-year engineering programs, reflecting their commitment to their educational goals and the program's commitment to training future engineers. Therefore, it is imperative to recognize the value of community college education. This recognition is particularly significant for ensuring equitable support for students, especially women and students from racially and socioeconomically minoritized backgrounds, who often enter higher education through community colleges (National Academies of Sciences, Engineering, and Medicine, 2016; St. Rose & Hill, 2013).

Conclusion 2: Women's Underrepresentation in Associate in Engineering Programs is a Systemic Issue

Before moving into the discussion of each systemic aspect of women's underrepresentation in the Associate in Engineering program, I would like to situate this key conclusion within the historical and institutional context of engineering education. As discussed in the second chapter, engineering education in the United States has been historically a White and male-dominated field (Penprase, 2020). Even in the early 1900s, women could only audit engineering courses, but they did not have the permission to enroll in these courses, and when they were allowed to enroll in some courses in land-grant higher education institutions, they were seen as "invaders" (Bix, 2014, p.1; Sloan, 1975). This historical gap has still not been closed, and a White class-privileged masculinity is ingrained in the discipline's history and current situation, manifested through language, social exclusion, marginalization, and male dominance (Bastalich et al., 2007; Cheryan et al., 2015; McLean et al., 1997; Secules, 2019; Seymour, 1995).

Women's underrepresentation as a systemic issue in this study traces back to this historical White class-privileged male domination in engineering, rooted in social and institutional patriarchal norms, which intersect with other forms of oppression such as racism and classism (Heise et al., 2019). Early socialization, inadequate enrollment, stereotyping, and limited role models all contribute to this systemic issue and perpetuate the male domination in engineering (Fetzer et al., 2014; Joy & Marco-Bujosa, 2013; Wallace & Sheldon, 2013).

Women's underrepresentation as a systemic problem goes beyond individual attitudes or actions, indicating a need for structural and institutional changes to address the root causes of this persistent gender inequity. In this section, I discuss how women navigate gender-based

challenges in choosing to study engineering, the recruitment gap that Associate in Engineering degree programs has in targeting women, that gendered and intersectional stereotypes, bias, and marginalization exist in the classroom, and limited support networks for women in engineering. I also discuss how all these factors systematically disadvantage women in the Associate in Engineering degree programs.

Women Navigate Gender-Based Challenges in Choosing to Study Engineering

Although community colleges offer diverse programs, there has been a historical trend regarding the concentration of women in fields like education and nursing (St. Rose & Hill, 2013). St. Rose and Hill (2013) attribute this trend to gender stereotypes, biases, and a lack of support for women pursuing science and engineering studies. Gender stereotypes imposing gendered occupational interests start in early childhood and can contribute to later occupational decisions in life (Master et al., 2021). Especially women who grow up with the pervasive stereotypical perceptions may consider their gender as inferior in the realms of math and science (Fetzer et al., 2014). Given the perception that women will need to exert greater effort than men to achieve comparable outcomes, women might feel dissuaded from pursuing a STEM field as they face a perceived higher academic threshold compared to men when seeking entry into STEM disciplines (Fetzer et al., 2014; Marco-Bujosa et al., 2021). The stereotype that engineers are geniuses, and the perception that men are superior in science, together with the fear that they will be the only women in the engineering class can discourage women from studying engineering (Fetzer et al., 2014). Similarly, women in this study faced significant challenges related to gender, race, and socioeconomic biases as they considered enrolling in the Associate in Engineering degree program. They encountered both explicit and subtle societal messages about who should become engineers and faced increased scrutiny when considering engineering as a

career. Overcoming personal doubts and social expectations rooted in sexism, racism, and classism required a strategic and courageous commitment to their engineering aspirations.

This study builds upon our current understanding of gender-based challenges regarding women's decision to study engineering in two critical ways. The first contribution is expanding the limited literature on how women decide to study engineering in a community college. In the previous literature, gender remained an important predictor of pursuing STEM degrees in a community college, with women demonstrating a lower likelihood of enrolling in engineering and engineering technologies programs (Evans et al., 2020; Wang, 2013). However, these studies did not specifically explore how women decide to enroll in an engineering transfer program in a community college, which is essential to understanding what encourages or deters women from pursuing engineering in a community college. This study builds upon these findings by revealing the audacious decision-making process behind women's enrollment in the Associate in Engineering degree program. Characterized by audacity, women's decisions to pursue the program were both strategic and courageous. Their strategic decisions involved a thoughtful consideration of finances and an evaluation of their diverse needs arising from multiple intersecting roles and identities. Simultaneously, their agency and courage was evident as they navigated gender-based and intersectional challenges, making enrollment in the program a strategic and courageous decision.

The second contribution is related to offering a comprehensive insight into the intersectionality of multiple social and systemic biases that discourage women from studying engineering. The complexity of stereotypes and bias in the current study is rooted in their intersectionality, which encompasses aspects of gender, race, and class. For example, women of color and women who were first-generation college students in this study consistently confronted

racial and class-based stereotypes linked to their respective racial/ethnic groups' intelligence, along with stereotypes insinuating that their social class was incongruent with the field of engineering, traditionally perceived as a field reserved for economically advantaged White men (Rodriguez & Blaney, 2021).

Women in this study, despite facing the weight of these intersecting biases, made a courageous decision and have demonstrated resilience and determination. Remarkably, they harnessed the power of these challenges as a driving force to become agents of change. Their experiences served as a catalyst for their aspiration to break down stereotypes, advocating for greater representation of women in the field of engineering. Nonetheless, it is crucial for this study to underscore the challenges they face when deciding to study engineering, highlighting the need for more institutional support to facilitate their journey and empower them as future engineers. While women can certainly act as change agents, it is important to recognize that expecting them to bear this burden on their own without the presence of institutionalized support systems to encourage their entry into the engineering field is overly taxing, as demonstrated by the current study. The interview data in this study revealed the fatigue and difficulty participants faced in consistently needing to be assertive and repeat their words to ensure their voices are heard in the male-dominated landscape of the classroom. Therefore, this study underscores the necessity of creating an environment that not only recognizes and applauds their resilience but also actively works towards easing the challenges they face as they consider studying engineering.

Associate in Engineering Programs Have a Recruitment Gap in Targeting Women

This study revealed that gender-based, racial, and class-based stereotypes and biases continue to pose challenges for women who consider studying engineering in a community

college. When these stereotypes and biases persist at the social level without targeted institutional interventions to promote women's enrollment in the program, they transform into systemic hidden biases, perpetuating the historical pattern of women's underrepresentation in engineering (Simmons & Lord, 2019). They also hinder equal opportunities for women who aspire to pursue a degree in engineering (see Simmons & Lord, 2019).

This study identified a gap in the recruitment strategies in the Associate in Engineering degree program that failed to actively engage and support a diverse range of potential women candidates. For the purposes of this study, I excluded dual-enrollment students, who were high school students simultaneously enrolled in the Associate in Engineering degree program. This participant selection criteria helped identify this recruitment gap in the program because the program's primary recruitment strategy was to target high schools. In this context, participants described the decision-making and enrollment processes as a self-driven effort, involving independent research using online resources. In the presence of family members in STEM, some women in the study found the process relatively smooth. However, it was more challenging for certain women in the study, especially for women of color, first-generation college students, first-generation immigrants, and women with disabilities. Accessing information about Associate in Engineering programs took longer for them, and the overall enrollment and decision-making processes were more intricate, sometimes involving initial enrollment in a different major before switching to engineering.

Participants' unconventional routes into the Associate in Engineering degree program challenged the routine recruitment strategy employed by community colleges, which traditionally focuses on visiting high schools and college transfer programs to reach out to prospective students (Reisser, 1980). Six women in this study were older than the traditional

college-age group, surpassing the age of 21. Additionally, some of them, both those under 21 and over 21, had experienced interruptions or gaps between their high school education and their enrollment in community college for various reasons. As a result, their transition to community college did not follow the conventional route from high school to college, even when they were still within the typical college-age range. For students coming from such nontraditional routes, the prevailing approach has been to anticipate their initiative in walking in to inquire, assume their ability to decipher college catalogs and course schedules, and navigate the unfamiliar campus environment on their own (Mabry & Hardin, 1992; Reisser, 1980).

Hagedorn (2014) classifies such institutions whose recruitment efforts only focus on high school students as *adult-ignored institutions*, enrolling dual enrollment students without intentionally seeking adult participation. When enrollment initiatives primarily focus on high school students, women with experiences similar to those in this study are often overlooked or excluded. This study revealed how this oversight can disproportionately affect women of color, first-generation college students, first-generation immigrants, and women with disabilities, making their enrollment processes more intricate.

While this study acknowledges the current challenges faced by community colleges, being both understaffed and under-resourced, in developing targeted recruitment strategies for women, it emphasizes that the absence of such strategies in engineering programs is indicative of a systemic issue. These findings call for some changes in recruitment strategies in the Associate in Engineering degree programs, highlighting the need for women-targeted recruitment strategies that extend beyond high school students. Otherwise, the program perpetuates the underrepresentation of women in engineering by overlooking a potential student pool who come into the college from more nontraditional educational routes.

Gender Stereotypes, Bias, and Marginalization Continue to Exist in the Curricular and Extracurricular Spaces

This study reveals that societal and cultural gender biases and stereotypes persist in the engineering classroom and extracurricular spaces, creating a chilly climate for women. Hall and Sandler (1982) introduced the concept of a “chilly climate” to encompass both subtle and overt forms of gender discrimination in traditionally masculine fields like engineering. In this study, women consistently used terms like “intimidating,” “daunting,” and “isolating” to articulate their experiences within the predominantly masculine community college engineering program. These descriptors resonate with the findings of Dasgupta et al. (2015), illustrating how women entering engineering education, whether individually or in small groups (as tokens), experience an intensified sense of isolation due to their numerical underrepresentation.

Failing to acknowledge women’s gender-based challenges, such as the heightened sense of isolation within both the curricular and extracurricular spheres of the Associate in Engineering degree program, perpetuates systemic gender inequities by depriving women of valuable opportunities. In this study, women hesitated to ask questions or seek help due to fears of potential misrepresentation of their gender and other social identities and due to the fear of appearing less competent than their male peers in class. Furthermore, as highlighted by participants, their discomfort in extracurricular spaces like the engineering club led to missed opportunities crucial for strengthening their applications for four-year engineering programs. Participants in this study could not fully benefit from the engineering clubs, but they were aware that they needed this experience to be competitive as they applied for four-year engineering programs. This study demonstrates that this failure to recognize and address these gender-based

challenges not only exacerbates gender disparities but also inhibits women from fully participating and thriving in the educational and professional realms.

Teamwork projects remained another significant area that reflected gender-based and intersectional stereotypes, bias, and marginalization in this study, and some participants considered that men were naturally better equipped to perform tasks like calculating unit conversions. Similarly, in Campbell-Montalvo et al.'s (2022) study, both men and women are found to harbor such beliefs that include the perception of women as less intelligent than men, making studying engineering unnatural for women. Using thematic analysis, the authors also explored the role of stereotypes and relationships in shaping the experiences of women and minoritized students in engineering. Women reported how men's assumptions about women's roles in engineering informed their roles in the class. Women shared stories in which they could not use lab equipment because of men, and they were assigned note-taking duties and took on less technical parts of the assignments. Women were expected to need help, and their ideas were not taken seriously in team projects. Most importantly, men did not recognize the impact of gender and racial stereotypes on women (Campbell-Montalvo et al., 2022). While Campbell-Montalvo's study was in the four-year engineering education setting, this study adds valuable insights to our knowledge of community college engineering classrooms. Women in this study reported experiencing both overt and subtle discrimination, including being assigned secretarial tasks, being ignored in team projects, and facing challenges in having their perspectives and ideas acknowledged. Recognizing the presence of societal and cultural gender biases and stereotypes in the community college engineering classroom is crucial for understanding the societal and systemic challenges contributing to women's underrepresentation in engineering education.

Despite the significance of gender-based challenges influencing women's experiences in team projects, insights from program director and faculty interviews indicated that the faculty did not always consider gender as a critical factor in the organization and functioning of teams. Even when there was limited consideration of gender, such consideration may not necessarily contribute positively to addressing challenges faced by women in these contexts; especially when women are assigned to teams for the purpose of educating their peers about women's capabilities, implying a burden on women to dispel stereotypes rather than effectively addressing systemic issues. These findings aligned with Beddoes and Panther's (2018) study, where they conducted 39 interviews with engineering professors to explore their perceptions of gender in engineering education. Gender was rarely taken into account in teamwork, and some professors believed it was beneficial for women to have negative experiences in teamwork as preparation for future workplaces. A gender-neutral understanding of teamwork was found to perpetuate gender biases in engineering education, which was also observed in the current study. This is because these stereotypes and biases already existed in the community college engineering classroom, and ignoring them, as if they did not exist, contributed to their uninterrupted survival. Therefore, it is important that faculty members recognize these structural barriers and intentionally work to eliminate their impact on students' classroom success. To illustrate, in Johns et al.'s (2005) study, when women were made aware of stereotype threat and the anxiety it could induce while taking a math test, they did not underperform as expected, as understanding stereotype threat allowed them to externalize their anxiety. Beddoes and Panther's and Johns et al.'s studies together demonstrate the need for intentional efforts by faculty to recognize and dismantle structural barriers, fostering an inclusive and equitable learning environment in engineering education.

Beddoes and Panther's (2018) and Johns et al.'s (2005) studies were conducted within the context of four-year engineering programs, and we have a broader understanding of how gender stereotypes and bias impact women's experiences in the four-year engineering classroom due to the number of studies conducted in the four-year setting (Blosser, 2020; Camacho & Lord, 2011; Dortch & Patel, 2017; Ong et al., 2020; Rincón & George-Jackson, 2016; Thomas et al., 2021). However, our knowledge of women in the community college engineering programs are more limited (Baker et al., 2015). The current study contributes to these scholarly conversations by bringing in data from understudied community college engineering classrooms. The current study indicates that overlooking gender-based challenges women experience in the community college engineering classroom contributes to women's systemic marginalization and reveals the importance of intentional interventions in addressing these gender-based challenges.

This contribution is significant for two reasons. First, it increases the visibility of women's marginalization at the intersection of power structures such as sexism, racism, and classism in the curricular and extracurricular settings. The interview data with women enrolled in the program demonstrated that discrimination and marginalization women face in the curricular and extracurricular spaces of the Associate in Engineering program were not always overt. Participants underscored the difficulty in discerning when they were marginalized by their male peers, and they usually blamed themselves for not being assertive enough when their male peers did not listen to their ideas. The marginalization was sometimes in the form of missed opportunities, which also made it difficult to notice. Second, while marginalization and bias continued to exist in subtle and overt ways, the faculty interviews revealed a conception that faculty reported treating all students the same, overlooking the necessity of recognizing structural barriers to women's experiences in the program. It is worth noting that "treating all students the

same narrative” prevents intentional targeted interventions that can address women’s marginalization in the curricular and extracurricular spaces. By focusing on this underrepresented and understudied group in the existing literature, this study broadens our understanding of gender biases in the curricular and extracurricular settings of the community college engineering program through an intersectional lens, providing valuable insights that can inform efforts to address women’s systemic underrepresentation in the field.

Women Have Limited Role Models and Support Networks

Similar to most STEM disciplines, while there is a disproportionate representation of White men among engineering faculty as role models for White men in the class, the representation of women of color among the faculty is almost nonexistent (Nelson et al., 2007), and this disproportionate White male representation stands out as one of the reasons why women in the current study “experienced a sense of isolation stemming from being the only one of their gender and/or race/ethnicity in engineering classrooms that were populated mostly by White men” (Ong et al., 2020, p. 596). In this study, women reported a deficiency in support systems from both peers and faculty. While the majority of women found the faculty to be helpful, supportive, and attentive to their needs, they also reported a need for a more diverse engineering faculty to receive the support and mentoring they needed.

This study demonstrated that greater representation of women of color among faculty can have an inspiring and motivational effect for women in the Associate in Engineering degree program, demonstrating to them an example of attainable professional success in their field. In addition, women of color can also serve as mentors and support women in their battle with racism and sexism (Fletcher et al., 2023). For instance, a Black woman in this study mentioned that it would be beneficial to have a woman of color instructing in the field of engineering.

According to her, this instructor would likely comprehend when a Black woman approached her and conveyed that the men on her team did not listen to or value her ideas. Additionally, the participant stated that having a woman of color as an instructor would be inspiring, as she could demonstrate how she has successfully overcome similar challenges.

Furthermore, strong peer support networks offer social and academic benefits for women in STEM, especially women of color, by helping them counter the individualistic and competitive nature of the broader STEM culture, which can, in turn, enhance women's persistence and sense of belonging (Ong et al., 2017; Robnett, 2015). However, research also suggests that especially male peer networks in a STEM classroom can also be a source of microaggressions for women pursuing these fields. White male peers can make the racist and sexist assertions that can make women question their competence, and these peers may refuse to help women in the classroom (Ong et al., 2017; Rodriguez & Blaney, 2021; Stitt & Happel-Parkins, 2019). Similarly, Nguyen and Riegler-Crumb (2022) found a gendered peer support pattern in the experiences of women in STEM. Women peers had a positive impact on their engineering identities, while peer support from men did not yield a significant effect. Women in this study also reported lacking peer support systems, and being more cautious when interacting with men in the classroom.

The focus group interview also demonstrated that when both faculty and peer support systems are missing, women may be more likely to withdraw from a class. Rere, a Black woman who identified as bisexual, shared an instance of a course withdrawal and how the absence of faculty and peer support systems led to this decision for her. Holloway-Friesen's study (2021) also demonstrates that faculty support plays a crucial role in women's social integration. It assists in enhancing peer-to-peer interactions by bolstering women's self-confidence, motivating

them to engage actively in classroom discussions, and proactively seek peer assistance when tackling demanding academic assignments and tasks. For program directors and faculty in this study, *treating all students the same* was synonymous with *fair treatment* in the classroom, so they preferred to treat every student the same. McCoy et al. (2015) examined White faculty members' perspectives on mentoring students of color in STEM, employing a multisite case study design. The authors shared that the faculty members did not want to be considered as racist in their mentoring relationships, and they underscored they treated everyone the same, just like the faculty in the current study. However, this one-size fits all and race-neutral approach perpetuated racial biases by deterring faculty members from acknowledging "structural or institutional barriers that might influence students' of color experiences" (p. 236).

In conclusion, this study highlights the substantial challenges that women face regarding support systems in the community college engineering classroom. While the faculty was generally seen as helpful and supportive, the notable lack of diverse faculty as mentors and role models in engineering courses posed a significant challenge for women seeking tailored support. The absence of relatable role models, peer support networks, and the presence of negative stereotypes perpetuated by male peers in the classroom contributed to feelings of isolation and compounded the difficulties women already encountered. Furthermore, the practice of treating all students equally, without acknowledging the structural and systemic barriers women confront in engineering, underscores the pressing need for a more nuanced understanding of gender-specific challenges within the discipline. The unique contribution of the current study is to expand our knowledge of the importance of faculty and peer support systems for women in the Associate in Engineering degree program and increase the visibility of structural and systemic gender-based and intersectional challenges they face in accessing these support systems.

Conclusion 3: The Effects of Being Underrepresented Extend into Women's Psychological and Emotional Well-Being

This study highlights that women's underrepresentation in the Associate in Engineering degree program has a substantial impact on women's engineering education, affecting more than just the classroom environment. Women in this study reported having feelings of a lot of anxiety and thoughts of self-doubt. The anxiety experienced by women in the Associate in Engineering degree program is multifaceted, beginning with their initial decision to enroll. Women in this study expressed having fears about being the only woman in the program, and this fear persisted into their classroom experiences. Moreover, women encountered challenges in navigating extracurricular activities, where they often felt marginalized or overlooked. In addition, when seeking institutional support, they feared their competence being questioned. All these experiences underscore the pervasive nature of anxiety among women in the Associate in Engineering degree program.

It is worth noting that women's fears and anxieties were not genuinely tied to their actual performance, but they were more closely related to gender bias, stereotypes, and messages they have been hearing about who belongs in engineering. As noted by Wilson and VanAntwerp (2021), women in engineering encounter social identity threat when they are subjected to unfair treatment or devaluation because of their gender identity. Gender identity threat can arise from gender bias and stereotypes, leading women engineers to feel as though they are being closely scrutinized due to their gender, rather than their genuine professional competence (Wilson & VanAntwerp, 2021).

Carrying the constant pressure of proving themselves, feeling under constant scrutiny, constantly trying to explain themselves were not an easy task for the participants. These

experiences represented the invisible part of the iceberg, below the surface. On the surface, professors saw successful and hardworking women. Below the surface, there was a lot of anxiety. McGee and Bentley (2017) explored the experiences of three high-achieving Black women in STEM by employing a phenomenological approach. Participants experienced racial battle fatigue due to being a Black woman in White male-dominated STEM. McGee and Bentley (2017) borrow the concept *racial battle fatigue* from Smith (2004), who defines it as a reaction to the challenging psychological and emotional effects stemming from daily encounters with racism. Black women in McGee and Bentley's (2017) study had experiences of significant stress and anxiety and pushed their work harder. Their feelings of being underrepresented were ignored by their institution, which meant they experienced both resilience and trauma in the absence of institutional support systems. One of the goals of their study was to reveal the frequently unnoticed mental effects of racism, sexism, and racial and gender biases in the lives of high-achieving Black women. McGee and Bentley (2017) suggest that the readers may unintentionally overlook the many challenges these Black women face by labeling these Black women as resilient, when institutions could offer support and more equitable services.

Similarly, all women in the current study were also highly resilient, successful, and determined to transfer to a four-year engineering program. However, it is worth noting that one contribution of this study is to explicitly demonstrate that the influence of being in a predominantly masculine engineering classroom extends beyond the immediate academic environment and has consequences for women's mental and emotional health and feelings of security. Therefore, it is critical to shift the focus from student success to student wellbeing to better understand women's needs in fields where they are underrepresented.

Conclusion 4: Women Have Diverse Needs and Challenges in Accessing and Using Student Support Services in the Associate in Engineering Program

This study examined the multifaceted challenges faced by women, emphasizing the interconnected nature of their experiences as they navigate academic, transfer, financial, and DEI (Diversity, Equity, and Inclusion) support systems. Women in this study had gender-based and intersectional needs and challenges in accessing and using student support services. The following sections discuss these key conclusions.

Academic Support Services beyond the Classroom are Significant for Women

In alignment with previous research (Jackson & Laanan, 2011; Packard et al., 2011), women's experiences with academic support systems in this study, including faculty, advisors, success coaches, and tutoring services, were generally positive, but barriers persisted. The intersection of social structures such as racism, classism, and sexism created challenges rooted in feelings of insecurity and self-doubt. Some participants, especially those who were first-generation college student White women and women of color, feared that they could inadvertently invite questions about their competence by asking for help.

These findings are significant because they shed light on the unique challenges faced by women in the community college engineering classroom and highlight the importance of providing alternative avenues for support. Instead of having their questions answered during class time, women in this study were more likely to seek help in one-on-one relationships with faculty and tutors. In the focus group interview, women's own explanation was that as they were not always comfortable with asking questions in the male-dominated engineering classroom, it was easier for them to seek help outside the classroom. The findings demonstrated that academic

support services like office hours and tutoring can provide a safe space for them to seek clarification and build confidence in their abilities.

Women's Transfer Aspirations and Support Needs are Intertwined with their Life Experiences

All women in this study aspired to transfer to a four-year engineering program, which also means that they enrolled in the Associate in Engineering program with the goal of achieving at least a bachelor's degree in engineering (see also Jackson & Laanan, 2011). Similar to Packard et al.'s (2012) study, women in this study had positive perception of their community college with regards to transfer to a four-year engineering program, fostering a sense of optimism about their future prospects. Undoubtedly, community colleges play a vital role in propelling students forward in their transfer pathways, as also demonstrated by Packard et al. (2012). While all participants in this study reported both positive experiences and some concerns related to the transfer goal, it is important to acknowledge that their experiences also had intersectional aspects. For example, women at the intersections of being a returning student and first-generation college student expressed additional concerns about the competitive nature of the admission process although all participants found the partnerships between their community colleges and four-year public universities helpful. Some had doubts about whether their GPA would be sufficient, and worried about how admission officers would perceive their application essays, particularly if their educational journey was non-linear due to being returning students. Consistent with the findings revealed by Wickersham and Wang's (2016) study, this study demonstrated that college experiences that influence women's transfer aspirations are intertwined with their life experiences, illustrating their interdependence.

In another instance, a woman of color expressed her desire to transfer to an out-of-state Historically Black College and University (HBCU) to find a community better aligned with her

needs. However, this aspiration was hindered by the absence of tailored support systems to facilitate this goal because the predominant transfer narratives in her community college were focused on transferring to predominantly White institutions. Her aspiration to transfer to an institution that aligns with her social and cultural needs is an indicator that women in the program may have diverse educational goals at the intersection of their multiple identities and lived experiences. This finding underscores that transferring to a specific type of institution can be isolating and challenging without tailored support systems in place.

In the current literature, what we know about women's transfer goals and aspirations comes from studies that take a monolithic approach to studying STEM fields (Acevedo et al., 2021; Herrera et al., 2022; Jorstad et al., 2017; Myers et al., 2015; Reyes, 2011; Wickersham & Wang, 2016). It is noted that women are less likely than men to have STEM transfer aspirations (Myers et al., 2015); however, within the unique context of the Associate in Engineering program, this was not the case. All women in this study aspired to transfer to a four-year engineering program, which may be related to why they chose to enroll in this program in the first place (i.e., the pursuit of financial independence and stability, which they thought an engineering career could offer). The current study also extends this body of knowledge on women in STEM by developing a more nuanced and in-depth understanding of how women's transfer aspirations are shaped within the interlocking power structures of community college engineering programs. As another unique contribution, this study also unveils the intersectional nature of women's transfer aspirations. Additionally, the study sheds light on the limitations of prevailing transfer support systems that assume that students will want to transfer to predominantly White institutions, particularly for women of color seeking institutions that better align with their social and cultural needs. Gaining a deeper understanding of women's transfer

aspirations and challenges is significant because the challenges this study identified may have motivational consequences, deterring or discouraging women from applying for transfer to four-year engineering programs.

Institutional Financial Support Systems are Significant in Mitigating Women's Challenges

Financial support systems were another key subtheme informing women's experiences in the program. In alignment with previous research (St. Rose & Hill, 2013; Wickersham & Wang, 2016), one common challenge faced by the women in this study was the delicate challenge of juggling multiple roles and responsibilities as students, workers (both full-time and part-time), and caregivers, among other duties. Institutional financial support systems played a pivotal role in relieving the financial challenges faced by women in the Associate in Engineering program, particularly when viewed through the lens of intersectionality. These women often grappled with a complex web of disadvantages, including gender-based disparities and, in many cases, racial or ethnic disparities as well. Financial concerns are particularly pronounced for specific groups of students, such as returning students who had previously forfeited their financial aid and were thus ineligible for further assistance, or first-generation immigrants who were not yet U.S. citizens and faced limitations in accessing financial aid programs, and some first-generation college students who did not have the financial backing of their families. Some participants in this study were situated at these intersections, and the findings revealed that when robust institutional financial support systems were available, their financial challenges were notably alleviated. In cases where the institutional financial support systems were not robust or comprehensive, significant challenges arose, particularly for women who were unable to access essential financial resources.

Therefore, the findings of this study demonstrate a crucial fact: institutional financial support systems are significant in mitigating the challenges faced by women in community college resulting from their multiple responsibilities and roles. This emphasizes the urgency of expanding and building financial support systems for women. This step can serve as a critical intervention to create more equitable and inclusive pathways for all women pursuing community college engineering programs.

Women Face Challenges in Accessing and Using DEI and Other Support Systems

Institutional DEI and other support systems were crucial in addressing various issues faced by women in the study; however, some women in this study faced challenges in accessing and using these resources. For example, one participant shared an unsettling experience of being verbally harassed by male classmates, which she attributed to both racial and gender-based stereotypes. When she filed a complaint with her husband's help, she shared receiving support from her institution, but at the same time this story underscores the need to enhance the visibility and clarity of procedures for filing sexual harassment complaints within the university.

Three women participating in this study disclosed having disabilities that could impact their learning in the Associate in Engineering program. One participant chose not to disclose her disability in the program, while another participant disclosed her disability to faculty members for necessary accommodations, and in the third case, there was a need for institutional collaboration to address the student's accommodation needs. When discussing the obstacles to accessing support systems related to their disabilities, the primary concerns were financial constraints and time limitations to seek support. In addition, the findings in this study also align with Lightner et al.'s (2012) research as participants exhibited a lack of awareness regarding available institutional support, extending to their knowledge about the available services and

procedures for accessing campus support resources. This interconnected web of challenges underscores the multifaceted nature of the obstacles they confronted in seeking support for their disabilities. Finding time to explore institutional support systems for their situation was an additional burden for them when juggling school, work, and other commitments was considered. Through these findings, this study addresses a critical question about the reasons why women may not effectively utilize disability support services. Providing answers to this question within the unique context of the Associate in Engineering degree program constitutes a significant contribution to existing literature, as research has shown that students with disabilities who utilize universally-available and disability-related support services are significantly more likely to persist in their two- or four-year college programs (Newman et al., 2021).

In summary, this study underscores the multifaceted nature of women's experiences within the Associate in Engineering degree program, revealing diverse needs and challenges in accessing and utilizing student support services. Given the male-dominated landscape of the engineering classroom and women's gender-based challenges in the class, academic support services beyond the classroom prove to be of significant importance for women. Furthermore, the study illuminates the inherent intertwining of women's transfer aspirations and support needs with their unique life experiences, emphasizing the complexity of their transfer goals. Notably, institutional financial support systems play a crucial role in mitigating challenges faced by women in the program. Despite the overarching goal of diversity, equity, and inclusion (DEI), challenges persist for women in accessing and utilizing DEI and other support systems, emphasizing the ongoing work needed to create inclusive educational environments. This study serves as a valuable contribution, providing insights into the nuanced experiences of women in

the program and advocating for tailored support systems to address their diverse needs and aspirations.

Implications for Theory

Intersectional feminist theory, rooted in the work of Crenshaw (1989), provided a theoretical and analytical framework to study the interconnectedness of women's social positions such as race, class, sexuality, ability, and nation, within complex power structures (McCall, 2005). Guided by intersectional feminist theory, this study consciously avoids universal claims about women's experiences and acknowledges the heterogeneity of their experiences. In this way, it contributes to a more nuanced understanding of women's experiences in the Associate in Engineering program, which is crucial for addressing their distinct needs and challenges.

One fundamental tenet of intersectional feminist theory in this study involves revealing the interlocking systems of privilege and oppression. Employing an intersectional approach facilitated the recognition of the simultaneous operation of diverse power structures—particularly sexism, racism, and classism—shedding light on how these dynamics inform women's experiences. The interplay of these power structures creates unique and multifaceted encounters for women, contingent on the intersections defined by their social locations. To illustrate, during Kate's interview, the concurrent operation of sexism and classism was evident, prompting her to question her role in engineering as a first-generation college student woman—an arena historically dominated by class-privileged men. Similarly, Alice grappled with navigating both sexist and racist stereotypes as a Hispanic woman in the program. In Jasmine's case, the intersection of racism and sexism manifested in the form of sexual harassment and the troubling phenomenon of Asian fetishism. These examples underscore the intricate ways in

which intersecting systems of privilege and oppression impact women's experiences within the engineering domain.

The second key tenet of intersectionality in this study was revealing women's multiple realities and disrupting epistemic erasure. Intersectional feminist theory provided valuable epistemological insights by uncovering the multifaceted dimensions of women's experiences. This is exemplified by the differing perceptions of faculty diversity among White women and women of color in the study. While Nora and Margaret, two White bisexual women in the study, were content with faculty diversity in the same institution, Mary—an African American woman—expressed her frustration at the lack of representation of individuals sharing her racial and gender identity within the faculty, leading to a profound sense of isolation. Her experience highlights the inadequacy of relying solely on gender as an analytical category. By embracing intersectionality, the study is better equipped to capture the unique challenges faced by individuals like Mary at the intersection of sexist and racist power structures, enriching our understanding of the intricate aspects of their experiences.

The third tenet of intersectional feminist theory was revealing multiple contextual layers at play. This study revealed that pervasive gender-based, racial, and class-based stereotypes infiltrate the community college engineering classroom. The engineering class and extracurricular spaces are undeniably situated within the broader context of racist, sexist, and classist social structures. This interconnectedness signifies that these educational environments are not independent entities but rather deeply influenced by and reflective of the prevailing societal biases. The data underscored the need to recognize and address the systemic nature of these stereotypes, highlighting their impact on the experiences of individuals within the community college engineering setting.

I acknowledge that, in this study, participants' all identities are inherently intersectional—a theoretical choice consistent with Huijg's (2012) argument stressing the need not to limit the theoretical and political dimensions of intersectionality solely to marginalized identities. This study's approach to employing intersectionality as a theoretical and analytical framework contributes to broadening the scope of intersectionality by examining the interplay between privilege and oppression across various social categories. Intersectionality has traditionally focused on individuals with multiple marginalized identities (Sibbett, 2020), but the reality is often more intricate, with individuals usually belonging to both privileged and marginalized social categories simultaneously (Goodman, 2015, Huijg, 2012). Privilege in one social category can relieve marginalization in another social category, or within a privileged social category, marginalization can diminish or negate those privileges (see Coston & Kimmel, 2012). The data in this study shed light on how privileges in certain social categories can influence experiences of oppression in others. For example, Kate's story as a White first-generation college student can offer insight into how social class can diminish racial privileges. Similarly, Edith's marginalization experiences in team projects can exemplify how her racial marginalization can negatively impact her experiences of other forms of privilege, such as her social capital derived from having family members in STEM fields. These findings suggest that our application of intersectionality, primarily framed by multiple marginalized identities, may not be as complete as it could be. This insight underscores the need for reevaluation of the dominant approach to intersectionality, urging a broader framework that recognizes the intersections of our privileged and marginalized identities.

In addition, this study contributes to the advancement of intersectionality as a theoretical framework by expanding the understanding of identity beyond traditional structures of

oppression. In other words, while intersectionality sheds light on how various systems of oppression intersect and inform individuals' experiences, it may not fully account for the complexities of how individuals construct their own identities within these intersecting systems, as discussed by Singh (2015). This study continues to offer insight into Singh's argument. While intersectionality theorists have a valid point in avoiding identity politics due to its essentialist and depoliticizing effects (Singh, 2015), the interview data in this study reveal the significance of acknowledging the co-constructed nature of identities, indicating a collaborative process involving both individual agency and societal influences (see Rebughini, 2021). Identity categories like gender, class, age, and ethnicity are heterogeneous, and individuals can transform them in response to personal or external circumstances (Rebughini, 2021). To illustrate, as a researcher I would normally have a more negative perception of adult learner identity because it is a marginalized identity in an adult-ignored institution (see Hagedorn, 2014). However, one of the participants, Ada, attributed a positive meaning to being an adult learner, and having an older age compared to her classmates meant being more determined and coming to college with a clear mindset about what she wanted. In another case, Lilly shared how being an Hispanic woman in a White masculine engineering space motivated her to become a change agent for her daughters and other women she pioneered in the program. Therefore, it is essential to explore how individuals actively shape and assign meaning to their identities within established social structures, recognizing the co-constructed nature of identities. Such an approach encourages a more holistic perspective and aligns better with the complexity tenet of intersectionality. Instead of completely setting aside individual identities in favor of solely discussing systems of power, privilege, and oppression to avoid identity politics, it recognizes that both individuals themselves

and these social structures construct identities, acknowledging the agency and empowerment that individuals can derive from their identities and social locations (Rebughini, 2021; Singh, 2015).

Overall, feminist intersectionality enriched the study's theoretical depth by providing a comprehensive and inclusive framework that goes beyond simplistic categorizations. It has allowed for a more nuanced exploration of women's experiences in engineering education in community colleges. Uncovering the interplay of intersecting power structures, this study advocates for interventions that address the diverse and unique needs of women in this field.

Recommendations for Policy and Practice

Before I discuss the recommendations for policy and practice, I would like to acknowledge the program directors' and faculties' openness to understanding and addressing the unique experiences of women in the Associate in Engineering degree program. Their willingness to engage with these facilitated my access and admission to the research sites and underscores their commitment to fostering an inclusive environment. It is in this spirit of openness and collaboration that I offer the following recommendations, which are intended to further enhance and support the experiences of women in the program.

In light of the study's findings, I present two sets of key policy and practice-related recommendations to enhance support for women students enrolled in Associate in Engineering degree programs. The first set of recommendations calls for a heightened emphasis on proactive recruitment strategies aimed at increasing women's enrollment in the program. The second set of recommendations centers on enhancing women's experiences within the program while providing comprehensive support to help them achieve their transfer goals.

Develop Recruitment Strategies to Increase Women's Enrollment in the Program

While one of the primary objectives of the Associate in Engineering programs is to provide support for women, first-generation students, and racially minoritized populations (Meardon & Vestal, 2019), the findings from the current study, including observations and interviews, as well as enrollment statistics from the North Carolina Community College System dashboards, reveal a notable disparity between the program's goals and women's actual enrollment in the program. Nonetheless, it is crucial to emphasize that these two-year engineering transfer programs offer a legitimate, accessible, and cost-effective pathway for students who prefer not to start their engineering education in a four-year university program due to high costs. This study's findings reveal that women choose to enroll in this program as a means to improve their prospects, yet gender-based and intersectional biases persist. Importantly, women navigate the decision-making process to enroll in the program without the benefit of institutionalized support strategies. The interviews with program directors indicate that the program primarily relies on recruitment through high schools. Yet, interviews with women students demonstrate that this strategy falls short in reaching potential students who feel stuck in their jobs or other life circumstances while striving to improve their life prospects.

In light of these findings, community colleges should consider crafting a variety of recruitment approaches and strategies to enroll more women in the Associate in Engineering degree programs. Illuminating women's experiences at the intersection of economic disadvantage, gender and racial bias, this study advocates for a comprehensive approach to developing recruitment strategies aiming at women's higher enrollment in the program. Such an approach should take into account women's diverse identities, motivations, and concerns and address both the economic and social dimensions of their decision-making process. This might

involve promoting and increasing the visibility of the program among women through community organizations and online platforms in addition to high schools. In addition, the Associate in Engineering programs can also consider organizing women-focused recruitment events, information sessions, workshops, and campus tours to introduce potential students to the program. As some women in this study found it difficult to ask questions in the male dominated engineering spaces, these women-focused events may provide women with a safe and supportive environment to have their questions answered and get their concerns addressed.

As I propose these solutions, I would like to be mindful that some community colleges are more under-resourced and understaffed, which can make organizing recruitment events challenging. In such cases, the program directors can explore virtual engagement strategies for the recruitment of women. This may include hosting online webinars, virtual campus tours, and online forums to overcome logistical barriers and reach a broader audience. Additionally, the Associate in Engineering degree programs may consider establishing peer mentor programs, matching prospective students (mentees) with current students in the program. This initiative could provide a safe space for women to connect, share experiences, and address their questions and concerns. This could include establishing mentorship programs, creating online forums for prospective female students to connect and share experiences, and providing financial aid resources specifically addressing the economic challenges faced by women.

As participants also expressed a lack of role models and the need for representation to demonstrate that women can achieve their engineering goals, it is essential to create marketing and recruitment content that prominently features success stories of women who have graduated from community college engineering programs. It is equally crucial to ensure that these

promotional and recruitment materials are inclusive of various racial, age, and class backgrounds. For example, Jasmine, an international student, said:

They (referring to the program) can post more about the engineering program on their school website about what to expect and what women can do in the future. We need words of encouragement. Women can do it. Show us what is possible. Yeah. It is possible even when you think you are not good at it.

In situations where the program faces constraints due to being under-resourced and understaffed, the program directors and faculty can address the challenge of developing marketing materials by opting to tell women's success stories during recruitment events and settings. Another effective strategy is to invite successful women students, particularly those who have transferred to a four-year engineering program or current women students who are willing to share their journey, to these recruitment events. This approach not only overcomes resource limitations but also adds a personal and relatable aspect to the recruitment process.

Considering the significant role of economic factors in women's decision-making process to study in the Associate in Engineering programs, it is also significant to promote grant programs, scholarships, financial aid programs as part of the recruitment efforts. Seeing the availability of financial support systems in place can help alleviate financial barriers for women who want to study engineering. While building and promoting these programs and financial support systems, women who are not yet US citizens should also be kept in mind, as they have access to a more limited set of resources.

This study also indicates that community colleges are an underutilized cost-effective pathway to US higher education for international student populations. To further attract more women international students, the Associate in Engineering program websites can include

information about whom international students can contact with their questions. These advisors can provide tailored guidance to international students from around the world, offering support with visa applications, language requirements, financial documentation, and cultural adjustments. This proactive approach can help women international students navigate the enrollment process into the Associate in Engineering programs more smoothly, expanding the program's reach and fostering a diverse and inclusive educational environment. In cases where resource limitations pose challenges to having additional staff for international student recruitment, an alternative approach could involve pairing current international students with prospective counterparts. This mentorship initiative not only addresses resource constraints but also establishes a supportive network, leveraging the experiences of existing international students to guide and assist newcomers in navigating the intricacies of the enrollment process.

In addition, it is essential to provide training for faculty and staff who attend the recruitment events to help them gain a deeper understanding of women's motivations, challenges, and concerns when making decisions about their community college majors. In this way, they can offer a more comprehensive support and encouragement to attract more women to enroll in the program. However, within the political context of North Carolina, there may be specific constraints on these aspects of institutional policies as the state forbids higher education institutions from requiring diversity, equity, and inclusion trainings for faculty and staff (Robinson, 2023). In this case, the program may consider incorporating inclusive practices in professional development opportunities for faculty and staff who do the student recruitment work. Integrating an awareness of needs, challenges, and concerns of diverse student populations into these professional development opportunities without explicitly labeling them as DEI training can benefit all students from more marginalized backgrounds, including women. This

also helps faculty become more knowledgeable about their prospective and current students. Another strategy may be promoting open dialogues in department meetings or professional development sessions. This may create a safe space for faculty and staff to share perspectives and experiences related to gender dynamics without a need for mandatory training.

In conclusion, the pervasive messages dictating who belongs in engineering, warnings about its male-dominated nature, and the additional weight of community college stigma can collectively jeopardize women's support networks as they consider enrolling in this program. It is imperative for institutions to counter these challenges by showcasing diverse role models, alleviating financial concerns, and establishing institutionalized support mechanisms throughout the decision-making and enrollment phases. The Associate in Engineering programs and community college enrollment offices can also consider soliciting feedback from current women students to identify and address any issues or concerns they had during the recruitment process and continuously assess and improve recruitment strategies based on the outcomes and feedback received. By addressing these issues, community colleges can be a part of the solution to bridge the gender gap in engineering by creating a more inclusive environment for women to confidently pursue engineering programs.

Improve Women's Experiences in the Program

In light of the findings of the current study, the second set of policy and practice recommendations center on how to improve women's experiences in the program.

Build a More Inclusive Engineering Classroom

When I learned that students were expected to complete peer assessments after completing team projects in one of research sites, I asked one Black woman participant if including questions about gender or intersectional dynamics on the peer assessment form would

be helpful to overcome the problems she was having during team projects. Her response was clear and straightforward: “Educate men!” Therefore, faculty can consider spending some classroom time at the beginning of each semester to talk about gender, race, class, age, and linguistic bias in an engineering classroom and teams. In doing so, they should create a safe and supportive environment for discussions, provide support and resources for women in the classroom, and offer concrete examples and strategies for addressing bias and discrimination when students in the class realize that they are happening.

Women in this study also emphasized the importance of a more racially and gender-diverse faculty in engineering classes. This diversity was seen as crucial for receiving the necessary support and ensuring that their unique challenges as women students in engineering were understood. Building an inclusive engineering classroom might also involve providing diversity and inclusion training to faculty, staff, and students in the program to ensure a supportive and respectful learning environment for all. In navigating the political climate of North Carolina, as discussed earlier, the program may also consider establishing professional development opportunities for faculty. These initiatives could focus on sharing insights into classroom experiences of diverse student populations and exploring effective strategies to address their unique needs, ultimately fostering an environment conducive to enhanced learning in the classroom.

Faculty may also consider using team-building activities and help students develop teamwork protocols to ensure everyone in the team can contribute to the success of the team. Team-building activities can assist students in recognizing each other’s strengths and understanding the diverse ways in which they can contribute to the team. Faculty members can further encourage students to establish teamwork protocols, guaranteeing equal opportunities for

every team member to contribute. For example, these protocols could include guidelines like “Designate roles when all team members are present” and “Ensure that everyone shares their ideas before taking action on the task.” These guidelines hold particular significance, as illustrated by Ada’s experiences, where she was assigned unimportant roles without her knowledge and found herself trying to catch up with tasks that were assigned without her approval.

To create more inclusive classrooms, the program should intentionally encourage faculty to build strong relationships with students, being approachable, supportive, and actively engaged in their progress. Building those relationships, faculty can also consider soliciting regular feedback from students to provide input on the teaching methods and learning experiences to understand what is working and what is not working with specific student populations. For example, the competitive nature of engineering projects was not working well for Hedy, and she shared her preference for more collaborative tasks:

I sometimes feel people can take over all the work because they do not think you will do as good of a job as them, as it is just a lot of competition. An environment where everyone trying to help everyone, just get the job done, and understand the concepts could encourage everyone to be helpful to each other (Hedy, a Middle Eastern woman).

Professors can use such feedback to design classroom activities that promote teamwork, mutual support, and a shared understanding of concepts. Ultimately, integrating feedback from students into the teaching design contributes to a more inclusive and positive learning experience for all students.

Increase the Visibility of Women Role Models

Another pressing concern that women in this study mentioned is about the lack of women engineer role models. Therefore, in light of the interview data and findings, the Associate in Engineering programs can consider collaborating with women engineers in engineering organizations to host events, featuring women of diverse backgrounds. Inviting diverse women professionals and academics as guest speakers to share their experiences in and insights about the engineering profession can inspire and motivate students by making women's presence and achievements tangible for women engineering students. For example, when I asked Edith, a biracial woman, about the ways the program could support her better, she referred to the importance of having women role models and said:

Just having more interactions with more women of color in those fields who can kind of tell you their experiences, maybe like some advice and tips and just kind of some stories about what they go through. I definitely think that would be a wonderful thing to have.

Furthermore, women in the study also reported they would benefit from peer mentor programs. For example, Rere, a Black woman, said "I would have loved to have a peer leader in my first year, and that could just help navigate through my first year in the program." Women peer leaders or mentors can become role models for their peers, showcasing women's achievements and capabilities in the program. Such a mentorship program also increases women's visibility in the program by encouraging women students to take on peer mentor roles and to be more involved in the program. A peer mentorship program can also strengthen women's networks in the program.

Create Flexible Course Schedules

A key finding of this study was the challenge of juggling multiple responsibilities as students, parents, caregivers, workers, among other commitments. To support the diverse needs of women in the Associate in Engineering program, it is essential to implement flexible scheduling options. For example, when I asked Lilly, who was also a parent with a full-time job, about how the program could support her better, she said:

Offering a flexible schedule, different times of classes can help me live through my challenges on the timing. So, it should not be just one class in the morning, but multiple classes, different days, so that I can get into one of them (Lilly, a Hispanic woman).

Women in this study highlighted that the development of online or hybrid engineering programs can greatly enhance flexibility. These steps collectively contribute to a more inclusive and accommodating educational environment for women students in the Associate in Engineering program, relieving their stress and burden while pursuing their academic and career goals.

Support Women's Participation in Extracurricular Spaces

Another significant finding in this study was about women's underrepresentation in the extracurricular spaces like engineering clubs. One participant in the focus group interview shared that it was understandable for women not to attend such activities because, if going to class was stressful for them due to male domination, the participant questioned why they would take on extra stress by attending optional extracurricular activities. Therefore, the Associate in Engineering programs can consider developing support systems such as "women in engineering clubs or societies."

Some participants were not also fully aware of the presence of extracurricular opportunities. When I asked Sarah, a White woman, about how the program could support her better, she shared, “maybe an engineering club where we can just come together and either work on building something new or expand exploring what some other stuff that we are interested in.” When I shared with her that her institution already had an engineering club, she said:

I have not been to it if we have it. It is because of the spam I get so much of. Sometimes I have emails that I do not see it. Sometimes they will get mixed in with emails from the community activities. I have been trying to look more into like the emails.

In light of this finding, club activities might be more effectively promoted through eye-catching posters, utilizing social media, sending regular emails, and collaborating with other campus organizations.

Lastly, soliciting feedback from women about their absence in these spaces can be helpful. In this way, women can express their needs, interests, and preferences, helping clubs tailor their activities to the needs and expectations of a more inclusive student body. For example, based on such feedback and given women’s multiple roles and responsibilities in addition to their student identity, the faculty and staff organizing such activities might consider scheduling club meetings and events at times that align with most students’ schedules, or consider offering alternatives for those who cannot attend in person.

Support Women’s Transfer Goals

Another significant finding in this study is that all women who participated in interviews were very determined about their transfer aspirations. However, students also acknowledged some knowledge gaps regarding the transfer process and about the institutional resources available to them. To address these knowledge gaps, Sarah, a White woman, suggested that an

extensive Frequently Asked Questions (FAQ) database specifically focused on the transfer process would be helpful to them as they navigate the process.

Because I am starting to work on the transfer process and looking into all that recently, I guess a frequently asked questions document can help. I know that they have one but did not have any the answers for any of the questions that I was looking at: What steps do I need to take, maybe?

This FAQ should include detailed information about the steps involved in transferring to various four-year universities, the documentation required, application deadlines, and relevant resources. Similarly, another participant shared that the Associate in Engineering degree programs can offer transfer planning guides that outline the specific steps and required courses for transferring to commonly chosen four-year universities. These guides should include application checklists and deadlines.

Recognizing that women in this study identified the competitive nature of the transfer process as a significant challenge, the program should explore avenues to address this concern. One effective approach is to organize workshops or seminars dedicated to enhancing the competitiveness of applications for engineering transfer programs. Alternatively, if resource constraints are present, the program can leverage existing online resources, such as documents, webinars, or lectures, to deliver valuable insights about submitting competitive applications. These sessions may empower participants with knowledge on crafting standout applications, strategies for showcasing unique strengths, and guidance for overcoming potential challenges in the application process.

Due to the lack of peer support systems for most women in this study, connecting students with other women who have already transferred to a four-year engineering program

would be a valuable initiative. This initiative can provide aspiring community college students with essential insights into what their programs look like and what to expect when they transition to a four-year university. The Associate in Engineering degree programs might also consider inviting representatives from diverse four-year engineering programs to expose students to a wide range of engineering disciplines, including civil, electrical, mechanical, aerospace, chemical, and more.

Considering women's diverse educational trajectories and needs informed by their varied life experiences, roles, and social locations within intersecting systems of power, privilege, and oppression, the Associate in Engineering degree programs should also ensure tailored guidance and regular communication between advisors and women in the program to support their transfer needs. For example, Mary, an African American woman in this study, wanted to transfer to an out-of-state HBCU, but her support systems and available resources were more limited due to her unique choice. Advisors should be trained to understand the unique needs and challenges faced by women of color, offering personalized advice that aligns with their individual goals and circumstances.

Finally, the Associate in Engineering degree programs should also consider regularly tracking retention, graduation, and transfer rates of women in the program and seek feedback from students who could and could not transfer to four-year engineering programs about the transfer process. This provides a measurable benchmark for evaluating the effectiveness of support systems and initiatives aimed at promoting women's success in the program. This type of data also provide evidence for advocating for structural adjustments, policy modifications, or additional resources to better support women pursuing engineering degrees.

Support Women's Engineering Career Development

Another significant finding in this study was the absence of role models for women enrolled in the Associate in Engineering degree programs. Therefore, program directors and faculty might consider connecting with organizations like the Society of Women Engineers (SWE) for networking opportunities and resources for women. These networking opportunities might include building mentoring relationships between women enrolled in the program and women in engineering jobs, having women engineers as guest speakers in the program, and benefiting from the resources these organizations have created for women in engineering.

Enhance Student Support Services

This study revealed challenges faced by women with disabilities, highlighting a significant knowledge gap between institutional resources and students' awareness of these available support systems. The Associate in Engineering programs may consider establishing a digital repository for students with disabilities, facilitating easy access to a comprehensive collection of information and resources for students with disabilities. This digital depository should consist of information about the procedures to request accommodations, students' rights regarding their accommodation needs, and any resources that may be helpful during their time in the Associate in Engineering program. This digital depository should be highlighted in the new student orientation handbook, program website, and any program handbooks shared with the students. This suggestion was also highlighted by Edith, a biracial woman with a disability, and she said, "it would be nice if they showed that they had resources for people with disabilities."

Another important finding in the study was about sexual harassment on campus. The program should also clearly communicate policies on harassment, discrimination, and reporting procedures. Institutions and programs should ensure that women, studying especially in

masculine-dominated programs like the program in the study, are aware of their rights and the resources available to them.

One noteworthy finding in this study pertained to the consequences of being within a masculine-dominated learning environment, impacting women's experiences beyond the classroom. Recognizing the potential mental health implications of such an environment, it is crucial to offer dedicated mental health resources to support the well-being of women navigating these challenging academic spaces. However, these mental health resources should acknowledge women's concerns as a systemic issue. When these systemic barriers are not acknowledged, mental health issues may be wrongly attributed to individual shortcomings rather than systemic issue, perpetuating a cycle of individualized responsibility rather than addressing the root and systemic causes of their difficulties. Incorporating a recognition of these systemic aspects of mental requires tailored mental health support systems. Providing accessible and tailored mental health support can significantly contribute to fostering a more inclusive and conducive learning environment for all students.

Implications for Future Research

This study revealed that women's experiences in the Associate in Engineering programs are far from uniform. Developing support systems for women in this masculine-dominated learning environment requires a deep understanding of their diverse educational experiences, motivations, and challenges and how all these inform their study paths. For example, women of color in this study had their unique motivations and challenges, shaping their distinct academic journeys. For example, Mary, an African American woman, aspired to transfer to a four-year engineering program at an HBCU, but the transfer support systems were not tailored to support her in the best way in her journey. Similarly, women who are international students had their

own set of challenges, motivations, and experiences, with Jasmine sharing the difficulties of accessing information about community colleges from another country. Likewise, immigrant women had their unique motivations for choosing engineering, which is embedded in their immigrant family history that aspired for a better life. Additionally, women who were also first-generation college students brought a set of distinct experiences and challenges, such as lacking family support both in academic and economic terms, further emphasizing the need for tailored support systems that acknowledge and address the multifaceted nature of women's experiences in the Associate in Engineering programs.

Although this study provides insights into the diverse educational experiences of women within Associate in Engineering programs, its capacity to offer in-depth insights into specific demographic groups is constrained by the limited sample size within each group. Consequently, there is a need for further research, particularly focusing on Black women, Hispanic women, women who are international students, immigrant women, first-generation college student women, and women with disabilities. For example, further studies could explore some research questions such as the ones below:

- How do Black women describe their transfer support systems in the community college engineering programs?
- What are the unique challenges faced by international women students who aspire to study engineering in a community college in the United States?
- How do the motivations of immigrant women in pursuing engineering education in a community college connect with their family's immigrant history, and how can this knowledge inform institutional strategies to enhance their experiences and success in the community college engineering programs?

- How do first-generation college student women describe their academic and economic challenges in the community college engineering programs?

Conducting additional research in these specific areas is essential to cultivate a more profound understanding of the richness and diversity inherent in women's experiences within community college engineering programs. Although I suggest conducting research with specific groups of women, I am also aware of the limited sample pool to recruit participants due to the underrepresentation of women in the program. Therefore, researchers who would like to explore these research questions may consider increasing the number of research sites.

Furthermore, in light of women's varied experiences within the program, further research should aim to evaluate the effectiveness of existing support systems for women in Associate in Engineering programs. For example, a sample research question can be "How effective are existing support systems in the STEM Learning Centers in accommodating women's diverse backgrounds and needs?" This evaluation should take into account women's diverse backgrounds and characteristics highlighted in the study. In this way, it can identify successful strategies and areas for improvement, contributing to the refinement of support structures that cater to the specific needs of different demographic groups.

In addition, further studies should look into the motivational consequences of women's gender-based and intersectional challenges for their transfer aspirations. While this study did not focus on these motivational consequences, their exploration provides insights into how women navigate and respond to the obstacles they encounter during their academic journey in a community college engineering transfer program. This knowledge can inform the development of targeted interventions and support mechanisms aimed at empowering women to overcome barriers and pursue their academic and professional goals. To this end, a sample research

question that future research can explore is “What are the motivational consequences of women’s gender-based and intersectional experiences in the Associate in Engineering degree programs?”

Finally, this study calls for longitudinal studies that meticulously trace women’s educational trajectories from community college enrollment through the transfer process to the completion of four-year engineering degrees. Some sample future research questions might be “How do women’s educational trajectories unfold from community college enrollment through the transfer process to the completion of four-year engineering degrees?” and “How effective are Associate in Engineering degree programs in preparing women for advanced studies?” This approach aims to provide a more profound understanding of women’s experiences within Associate in Engineering degree programs and assess the effectiveness of these programs in preparing women for advanced studies. These longitudinal studies can serve as valuable inputs for community colleges and four-year engineering programs to enhance their support mechanisms, ensuring a well-prepared and seamless transition for women entering four-year engineering programs.

Conclusion

This study sheds light on the intricate positioning of the Associate in Engineering degree program within the larger historical and institutional landscape of engineering education, which is dominated by White class-privileged men. The findings underscore that the challenges confronted by women in the Associate in Engineering program are not isolated incidents but are intricately linked to pervasive societal systems of oppression, spanning sexism, racism, and classism. Consequently, the study emphasizes that the underrepresentation of women in the

Associate in Engineering program and their associated experiences are indicative of a systemic issue, necessitating comprehensive systemic and institutionalized interventions.

This conclusion is particularly noteworthy, as interviews conducted with women enrolled in the program revealed personalized reactions to this deeply systemic problem. Women's self-esteem and self-confidence in their capabilities were, at times, negatively impacted, leading to instances of self-blame. Ignoring the systemic nature of this issue and not addressing women's unique experiences within the program only serves to perpetuate the problem. Therefore, acknowledging and addressing this broader systemic issue is imperative to cultivate a more inclusive and equitable environment within the Associate in Engineering program.

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APPENDICES

Appendix A. Observation Protocol

Observation notes will be taken based on Spradley's (1980) checklist:

- a) Space:
 - i) Describe the physical characteristics of the space
 - ii) Describe gendered and racialized aspects of the space
 - iii) What are the emotions that characterize the space?
- b) People:
 - i) Who is present?
 - ii) What are some distinctive characteristics of the people in the space?
 - iii) What are any unique observations about the people?
- c) Activities:
 - i) What are people doing?
 - ii) Who is talking?
 - iii) Any gendered or racialized aspects of the activities?
 - iv) What are some academic activities women engage in?
 - v) What are some extracurricular activities women engage in?
- d) Objects:
 - i) Billboards, screens, printed materials- What messages do they deliver?
 - ii) Any notable objects in the space?
- e) Events:
 - i) Who is present?
 - ii) What is happening?
 - iii) Why is the event important?

Ethical considerations: I will make sure that this initial site visit protocol is approved by IRB before I schedule any site visits. I will make sure that the program staff I meet is informed of the purpose of my visit and knows that I will have some questions and observations. In my notes, I will not use any identifiers of individuals. Based on the permissions for access to sites, I will build the observation protocols accordingly. If I am observing a specific group of people, their activities, or an event that is happening, I will make sure to inform them about the purpose of my presence there.

Appendix B. Document Analysis Protocol

Type of documents: Program and institution websites

Access to documents: No permission needed. Access to documents is possible with a computer and the internet.

Documents: Program websites, institutional websites about programming for women in engineering, STEM-related resources on the program and institution's websites

Purpose: To learn more about the institutional contexts and resources that shape women's experiences in Associate in Engineering programs

Document analysis: The nature of my study and my documents require me to conduct a thematic analysis. Therefore, important questions to ask the documents are:

- Who (Which institution or department) is the author?
- When was it issued and published?
- Whom is the document intended for?
- For what purposes the documents were produced?
- Considering the target group, who are they? What are their roles and identities? Who is included and who is excluded?
- Does the policy/practice/report document have any capacity to build benefits for women with different intersecting identities?
- What are the relevant emerging themes?
- What does the document communicate about the climate/culture that women in community college engineering programs experience?

Ethical considerations: Although these documents are not generated for research purposes, and access to the documents does not require the permission of the author, the documents do not reveal any personal information. Therefore access to these documents and using them for research purposes do not constitute violation of research ethics.

Appendix C. The Demographic Survey for Participant Screening

Contact information:

Name:

Phone:

Email:

- 1) What is the name of your institution?

- 2) What semester are you in your program?

- 3) Are you enrolled full-time or part-time?
 - Full-time
 - Part-time
- 4) Are you a first-time enrolled or returning student?
 - First-time enrolled (attends college for the first time)
 - Returning student (has dropped out of college before)
- 5) How old are you?

- 6) What is your gender identity?

- 7) What is your sexual orientation?

- 8) What are your pronouns?

- 9) What is your race/ethnicity?

- 10) Are you a domestic or an international student?
 - Domestic
 - International
- 11) Do you have an immigrant status?
 - I am a first-generation immigrant.
 - I am a second-generation immigrant.
 - No
- 12) What is your family status (e.g., single, married, with a partner, etc.)?

- 13) Are you parenting or do you have any care-giving responsibilities? If yes, please briefly describe.

- 14) Do you have work responsibilities outside of your school? If yes, please briefly describe.

- 15) Are you a first-generation student?
 - Yes, I am the first to go to college in my family. My parents did not go to college.
 - No, my parents are college graduates.

Appendix D. Interview Protocol

Interviewee:

Date and Time:

Interviewer:

Length of the interview:

The researcher: Ece Yilmaz is a PhD student in the Higher Education Opportunity, Equity, and Justice program at NC State University.

The study: This case study explores women's experiences in Associate in Engineering programs in North Carolina.

The purpose of this study is to provide an in-depth understanding of how women with different intersecting identities decide to enroll in the Associate in Engineering programs in North Carolina, how they describe their experiences in the program, and what their transfer aspirations are. Such understanding will shed light on the complexity of women's experiences in community college engineering programs while offering higher education practitioners a better understanding of how to address women's unique needs in these programs.

The interview questions will consist of questions about how you decided to enroll in the Associate in Engineering program, what your experiences and transfer aspirations are.

The interview will take around 60-90 minutes.

At the beginning of the interview, I will ask for your consent to record the interview. Without your consent, the recording will not start. Your identity will be kept confidential in all reports.

Please remember that participation in this interview is completely voluntary. You have the right to withdraw from the study if you feel uncomfortable at any point during the interview. If you have any questions, I am ready to answer them.

The interview starts with the warm-up questions after the informed consent of the participant is received.

Interview Questions

Warm-up Questions:

- 1) How is the semester going for you so far?
- 2) How do you spend your time in college?
 - a) What curricular and extracurricular activities do you enjoy participating in?
- 3) What pseudonym do you want to use in this study?

Questions related to Research Question 1 (How do women with different intersecting identities decide to pursue an Associate in Engineering program?):

- 1) How did you make the decision to enroll in college?
- 2) What factors led you to enroll in a community college?

- 3) You told me in the survey that you identify as (a list of identities students mentioned in the survey). What identities are most central to who you are and how you see the world?
- 4) How, if at all, have your identities shaped your journey to this program (i.e., Associate in Engineering)?
- 5) What challenges, if any, did you face in your journey to this program?
- 6) What feelings did you experience in the process?
- 7) What support systems did you utilize to enroll in this program?
- 8) What support systems would you like to have?
- 9) What was your exposure to science, engineering, technology, and math before college?
 - a) How did you feel about those experiences? What challenges or good experiences did you have?
 - b) How well did those experiences prepare you for the program you are in now?

Questions Related to Research Question 2 (How do women with different intersecting identities describe their experiences in male-dominated Associate in Engineering programs in North Carolina community colleges?):

- 1) As a [refer to the intersection of identities as self-identified by the participant], what are your experiences like in your program?

Example: As a first-generation Black woman, what are your experiences like in your program?
- 2) Can you describe the typical engineering course in this program (e.g., class size, student population, professors, attitudes toward teaching and learning)?
 - a) What characteristics do you find helpful in an engineering class?
- 3) Can you tell me a story of how being a (list the participants' central identities) has helped or hindered your success in the program?
- 4) To what extent, if at all, does the numerical male domination in the program have an impact on your experiences in the program? Why?

Probe: How do you describe the impact?
- 5) How are your relationships with faculty and campus staff? What are your experiences with accessing faculty and campus staff when you need them?
- 6) How do you experience your interactions with classmates, faculty and staff of different identities than you?
- 7) What, if any, are some of the barriers or challenges you've experienced as you continue your studies?
 - a) What financial resources do you utilize for your college education? What are some financial challenges for you?
 - b) How do you feel about your academic experiences in the program as a (list the participants' central identities)? Do you experience any academic challenges? What are they?
- 8) How do you cope with any challenges you experience in your program?
- 9) What support systems do you have to work through these challenges?
 - a) What, if any, social support systems do you have (e.g. family, peers)?
 - b) What institutional services do you find helpful?
 - c) What, if any, institutional supports do you utilize as you continue your studies?

Probe: Tell me more about your answer. In what ways, do you benefit from these institutional support systems?

Probe: Can you recall a moment/story when you needed institutional support, but you could not access it?

d) In what ways have institutional policies and practices shaped how you perceive your central identities? You could talk about campus culture, or attitudes toward diversity and inclusion in your program.

e) How could your institution support you as a (lists the participant's central identities) better?

10) What feelings do challenging experiences in your program bring about?

11) How do you feel about your extracurricular experiences in the program as a (list the participants' central identities)? Do you have opportunities to engage in extracurricular science and engineering activities? What are they?

12) How well do you think your program prepares you for an engineering career?

Questions Related to Research Question 3 (What are the transfer aspirations of women in Associate in Engineering programs in North Carolina community colleges?):

1) What intentions or plans, if any, do you have regarding transfer to a four-year institution?

2) What intentions or plans, if any, do you have regarding transfer to a four-year engineering program?

Probe: If yes, in which engineering program do you want to study?

a) What contributed to this decision?

b) As you plan to/intend to transfer to a four-year engineering program,

1. To what extent, if any, does your program and institution support you?

Probe: How do you describe your institutional support systems? Tell me more about them.

2. What social support systems (e.g., family, peers), if any, do you have? Tell me more about the support you receive from your family and peers.

c) What challenges do you have or expect while reaching these goals?

d) What are some supports that you need but you think you do not have access to?

If the participant says, they do not have transfer aspirations or if they want to switch out of STEM:

a) What contributed to this decision?

b) What support systems would have changed your decision? What do you need to consider transfer to a four-year engineering program?

c) How could your college and program support you better to prepare you for an engineering career?

Closing the interview: When I analyze the data, I plan to conduct focus group interviews with the participants to ask them questions about how well findings reflect their experiences, and how Associate in Engineering programs can support them better in the light of the findings. This will help develop some actionable steps for Associate in Engineering programs to better support women. Can I contact you again to invite you to these focus group interview?

Appendix E. Focus Group Interview Protocol

Interviewee:
Interviewer:

Date and Time:
Length of the interview:

The researcher: Ece Yilmaz is a PhD student in the Higher Education Opportunity, Equity, and Justice program at NC State University.

The study: This case study explores women's experiences in Associate in Engineering programs in North Carolina. The purpose of this study is to provide an in-depth understanding of how women with different intersecting identities decide to enroll in the Associate in Engineering programs in North Carolina, how they describe their experiences in the program, and what their transfer aspirations are. Such understanding will shed light on the complexity of women's experiences in community college engineering programs while offering higher education practitioners a better understanding of how to address women's unique needs in these programs.

In this study, I aim to answer the following research questions:

1. How do women with different intersecting identities decide to pursue an Associate in Engineering program?
2. How do women with different intersecting identities describe their experiences in male-dominated Associate in Engineering programs in North Carolina community colleges?
3. What are the transfer aspirations of women in Associate in Engineering programs in North Carolina community colleges?

In this phase of the study, I am conducting focus group interviews to hear your insights on how well the study's findings align with your experiences and how Associate in Engineering programs can offer better support to women enrolled in the program. These focus group interviews typically involve 3-7 participants, last approximately 60-90 minutes, and will be conducted virtually through Zoom.

Before we start the interview, I will go over the study objectives, theoretical framework, and methods sections of the member checking summary document. You will have the opportunity to ask any questions you may have about these sections.

At the beginning of the interview, I will ask for your consent to record the interview. Without your consent, the recording will not start. Your identity will be kept confidential in all reports.

Please remember that participation in this interview is completely voluntary. You have the right to withdraw from the study if you feel uncomfortable at any point during the interview. If you have any questions, I am ready to answer them.

Interview Questions:

1. During the initial round of individual interviews, I focused on exploring your journey towards joining the Associate in Engineering program. Asking questions about the decision-making process behind your enrollment, I was particularly interested in uncovering whether you discovered the program through its recruitment efforts, and furthermore, gaining insight into your support networks. This exploration is significant to develop recruitment strategies to reach out to women with limited resources and support networks, with the goal of encouraging and facilitating their participation in the program. The importance of family support was evident in the data, and numerous participants highlighted that the decision to enroll in the program was essentially a self-driven endeavor, in which they discovered the program and gained more information about the program on their own, primarily through online research.

When you read the first part of the preliminary findings,

1. How well do you think the findings reflect your experiences? Why?
 2. What are some significant stories missing from this summary?
2. Another goal was to understand your experiences in the program. The majority of the participants found professors to be very helpful, but the interview data also revealed the impact of gender-based and intersecting oppressive systems on the dynamics of curricular and extracurricular experiences.

When you read the second section of the preliminary findings,

3. How well do you think the findings reflect your experiences? Why?
 4. What are some significant stories missing from this summary?
3. During the initial round of individual interviews, I also wanted to understand your challenges and support system, both within the program and during the transfer process. The following section discussed the presence/absence of institutionalized support systems (e.g., institutionalized financial support systems, transfer support systems, advisors, success coaches, academic tutoring services, and mental health services) and how they can shape the intensity of challenges women experience in the program.

When you read the third section of the preliminary findings,

5. How well do you think the findings reflect your experiences? Why?
 6. What are some significant stories missing from this summary?
4. I created the implications for practice section based on your responses to the question “How could the program support you better?”
 7. How effective do you think these implications for practice would be in addressing your needs and challenges as you continue your studies?

8. In what other ways can the program support you better?

Concluding question: What are some other aspects of your experiences you want to lift up that are not reflected in the findings I have shared with you?

Appendix F. Program Director and Faculty Interview Protocol

Interviewee:

Date and Time:

Interviewer:

Length of the interview:

The researcher: Ece Yilmaz is a PhD student in the Higher Education Opportunity, Equity, and Justice program at NC State University.

The study: This case study explores women's experiences in Associate in Engineering programs in North Carolina. The purpose of this study is to provide an in-depth understanding of how women with different intersecting identities decide to enroll in the Associate in Engineering programs in North Carolina, how they describe their experiences in the program, and what their transfer aspirations are.

In this phase of the study, I am conducting interviews with program directors and faculty to gain deeper contextual insights into the study's findings. This interview protocol has been developed based on the preliminary study findings. At the end of the interview, we will have a conversation about how the preliminary findings of the study shaped these questions.

At the beginning of the interview, I will ask for your consent to record the interview. Without your consent, the recording will not start. Your identity will be kept confidential in all reports.

Please remember that participation in this interview is completely voluntary. You have the right to withdraw from the study if you feel uncomfortable at any point during the interview. If you have any questions, I am ready to answer them.

Interview Questions only for Program Directors:

1. What recruitment strategies do you utilize to attract students to enroll in the Associate in Engineering program?
 - a. What strategies or efforts, if any, has the program taken to encourage and increase women's enrollment in the program?
2. What strategies or efforts, if any, has the program taken to encourage and increase women's retention in the program?
 - a. Have you observed any specific challenges or barriers that women students in our program may face, and if so, how is the program addressing these issues?
3. How does your program currently support and promote gender diversity and inclusion among students and among faculty?
 - a. Can you provide examples of any initiatives or resources offered by the program or institution that have helped address gender-related issues or promote diversity and inclusion?
 - b. Are there any initiatives, mentorship programs, or support systems in place to specifically assist women students in their academic and professional development within the program?

- i. What are they?
 - ii. How do you promote these programs among women enrolled in the program?
 - c. What are some extracurricular activities in the program?
 - i. What are your observations regarding the composition of students who participate in these activities in terms of gender and diversity?
 - d. Are there plans or goals for further improving gender diversity and inclusivity within the program in the future?
4. Can you share any success stories or notable achievements of women students who have gone through this program?
 5. What is the institutional procedure to receive accommodations for students with disabilities?
 6. What are some institutional transfer support systems students have access to?
 7. How, if at all, does the program solicit feedback from women students to better understand their experiences and continuously enhance their academic journey?

Interview Questions for Engineering Program Directors and Faculty

1. How do you perceive the overall composition of your engineering classes in terms of gender and diversity?
 - a. Have you noticed any significant changes or trends in recent years? If yes, what are they?
2. How do you describe a typical engineering class in terms of delivery (e.g., lecture, project-based, etc.) and student interactions (e.g., student to student, student to professor, professor to student)?
 - a. From your perspective, what noticeable gender differences, if any, are there in the ways students engage in classroom discussions and interactions?
3. Can you provide examples of any challenges or issues related to gender and diversity that you have encountered in your teaching or within your department?
4. How are group projects typically organized in your classes?
 - a. What, if any, are any patterns or trends regarding the composition of these groups in terms of gender and diversity?
 - b. Have you observed any instances where gender or students' other identities (e.g., gender, race, class) have influenced team dynamics or the distribution of responsibilities within a group project? If yes, can you share more about these instances?
 - c. In your experience, do women students in engineering face any unique challenges or barriers compared to men, especially in team-based assignments? If yes, what are these unique challenges?

5. How, if at all, do you approach fostering a classroom environment that is supportive and inclusive for students from diverse backgrounds, especially with respect to gender and intersectionality?
 - a. How do you handle instances of gender bias or discrimination in your classroom?
 - b. Can you share any success stories or positive experiences related to addressing gendered and intersectional dynamics within your engineering classes?
6. Have you received feedback from women students, about their experiences in the engineering classes, and if so, what themes or concerns have emerged?
7. Based on your observations and experiences, what recommendations or changes would you suggest to enhance gender equity and inclusivity in an engineering classroom?

Appendix G. Phase 1: Informed Consent Form for Participation in Research

Title of Study: Women Community College Students' Experiences in Associate in Engineering Programs in North Carolina: A Case Study Exploration

IRB Protocol #25896

Principal Investigator(s): Ece Yilmaz

Funding Source: NC State University, College of Education

NC State Faculty Point of Contact: Dr. Alyssa Rockenbach

You are invited to take part in a research study. Here are some important things to know:

- Your participation in this study is voluntary. You can choose not to participate without penalty. If you decide to participate and change your mind, you can stop participating at any time without penalty.
- The purpose of this research study is to investigate how women decide to enroll in Associate in Engineering programs in North Carolina community colleges, what their experiences in the program are, and their transfer aspirations.
- You will be asked to participate in an interview if you agree to participate in this case study.
- You are not guaranteed any personal benefits from being in this study. Research studies may pose risks to those who participate.
- You may want to participate in this research to contribute to existing knowledge on women in community college in engineering programs. You may not want to participate in this research due to your time limitations.
- If you have questions about your participation in this research at any time, do not hesitate to contact the researcher(s) named above or the NC State IRB office via email at IRB-Director@ncsu.edu or via phone at 1-919-515-8754

Please read the rest of this consent form for more specific details of this research. If you do not understand something, please ask the researcher for clarification or more information.

What is the purpose of this study?

The purpose of this research study is to investigate how women decide to enroll in Associate in Engineering programs in North Carolina community colleges, what their experiences in the program are, and their transfer aspirations.

How many people will be in the study?

There will be 15-20 participants in this study.

Am I eligible to be a participant in this study?

In order to be a participant in this study, you must agree to be in the study and you must be at least in your second semester in an Associate in Engineering program in North Carolina.

You cannot participate in this study if you do not meet the inclusion criteria or if you are a dual-enrollment community college student.

What will happen if you take part in the study?

If you agree to participate in this study, you will be asked to do all of the following:

1. You will be asked to complete a pre-screening survey.
2. You will be asked to participate in an interview if you meet the eligibility criteria.

The total amount of time that you will be participating in this study is 60-90 minutes.

Recording in research

If you want to participate in this research, you must agree to be audio recorded and video recorded. If you do not agree to be audio recorded and video recorded, you cannot participate in this research.

I would like to use these recordings for transcription only. Your audio and video recordings will be destroyed after the researcher transcribes the interviews.

Benefits to participating in this research

There are no direct benefits to your participation in the research. The indirect benefits are inspiring women in Associate in Engineering programs by sharing your stories and contributing to the development of actionable steps to serve women in Associate in Engineering programs better.

Risks to participating in this research

There is minimal risk associated with your participation in this research.

Confidentiality, personal privacy, and data management

Trust is the foundation of the participant/researcher relationship. Much of that principle of trust is tied to keeping your information private and in the manner that I have described to you in this form. The information that you share with us will be held in confidence to the fullest extent allowed by law.

Protecting your privacy as related to this research is of utmost importance to me. There are very rare circumstances related to confidentiality where we may have to share information about you. Your information collected in this research study could be reviewed by representatives of the University, research sponsors, or government agencies (for example, the FDA) for purposes such as quality control or safety. In other cases, we must report instances in which imminent harm could come to you or others.

How we manage, protect, and share your data are the principal ways that I protect your personal privacy. Data that will be shared with others about you will be re-identifiable.

Re-identifiable. Re-identifiable data is information that can identify you indirectly because of our access to information, role, skills, combination of information, and/or use

of technology. This may also mean that in published reports others could identify you from what is reported, for example, if a story you tell us is very specific. If your data is re-identifiable, we will report it in such a way that you are not directly identified in reports. Based on how we need to share the data, we cannot remove details from the report that would protect your identity from ever being figured out. This means that others may be able to re-identify from the information reported from this research.

All data, including recordings, transcripts, and analyses, will be stored in Zoom cloud storage and Google Drive. At the conclusion of this study, all recordings will be deleted from all storage devices.

Right to withdraw your participation

Your participation is voluntary. Even if you agree initially, consent is an ongoing process. You can stop participating at any time for any reason. To do so, tell me immediately that you want to stop participating during the interview. You can also contact the student researcher, Ece Yilmaz at eyilmaz@ncsu.edu. You can also contact the faculty advisor for this research, Dr. Alyssa Rockenbach at alyssa_rockenbach@ncsu.edu.

If you withdraw, we will stop any procedures or data collection that may be happening. We will also delete any data that's already been collected from you whenever possible. We will not be able to delete your data if we cannot identify which responses are yours or if the data has already been published.

Future use of your research data

To help maximize the benefits of your participation in this project, by further contributing to social science and our community, your re-identifiable information will be stored for future research if you agree to the terms of the broad consent form.

Compensation

For your participation in this study, you will receive a \$25 Amazon gift card. If you withdraw from the interviews before they are completed, you will not receive any compensation. If you withdraw from the study after the interview is completed, you are still eligible for the compensation.

What if you are a student?

Your participation in this study is not a course requirement. Your participation or lack thereof will not affect your class standing, grades, or relationship with your instructors or advisors.

Sponsorship and funding

This research is funded by the College of Education at North Carolina State University. This means that the sponsor is paying the research team for completing the research. The researchers do not, however, have a direct financial interest with the sponsor or in the final results of the

study. If you would like more information, please ask the researcher(s) listed at the top of this form about the funding and sponsorship.

What if you have questions about this study?

If you have questions at any time about the study itself or the procedures implemented in this study, you may contact the student researcher, Ece Yilmaz at eyilmaz@ncsu.edu and 919-432-3185. You can also contact the faculty advisor for this research, Dr. Alyssa Rockenbach at alyssa_rockenbach@ncsu.edu, 919-515-5541.

What if you have questions about your rights as a research participant?

If you feel you have not been treated according to the descriptions in this form, or your rights as a participant in research have been violated during the course of this project, you may contact the NC State IRB (Institutional Review Board) office. An IRB office helps participants if they have any issues regarding research activities. You can contact the NC State University IRB office at IRB-Director@ncsu.edu, 919-515-8754, or [fill out a confidential form online](#) at <https://research.ncsu.edu/administration/participant-concern-and-complaint-form/>

Consent To Participate

Verbal consent will be obtained prior to the interview. By verbally agreeing, I am affirming that I have read and understand the above information. All of the questions that I had about this research have been answered. I have chosen to participate in this study with the understanding that I may stop participating at any time without penalty or loss of benefits to which I am otherwise entitled. I am aware that I may revoke my consent at any time.

Appendix H: Phase 2: Informed Consent Form for Participation in Research

Title of Study: Women Community College Students' Experiences in Associate in Engineering Programs in North Carolina: A Case Study Exploration

IRB Protocol #25896

Principal Investigator(s): Ece Yilmaz, eyilmaz@ncsu.edu

Funding Source: NC State University, College of Education

NC State Faculty Point of Contact: Dr. Alyssa Rockenbach, alyssa_rockenbach@ncsu.edu

You are invited to take part in a research study. Here are some important things to know:

- Your participation in this study is voluntary. You can choose not to participate without penalty. If you decide to participate and change your mind, you can stop participating at any time without penalty.
- The purpose of this research study is to investigate how women decide to enroll in Associate in Engineering programs in North Carolina community colleges, what their experiences in the program are, and their transfer aspirations.
- You will be asked to participate in an interview if you agree to participate in this case study.
- You are not guaranteed any personal benefits from being in this study. Research studies may pose risks to those who participate.
- You may want to participate in this research to contribute to existing knowledge on women in community college in engineering programs. You may not want to participate in this research due to your time limitations.
- If you have questions about your participation in this research at any time, do not hesitate to contact the researcher(s) named above or the NC State IRB office via email at IRB-Director@ncsu.edu or via phone at 1-919-515-8754

Please read the rest of this consent form for more specific details of this research. If you do not understand something, please ask the researcher for clarification or more information.

What is the purpose of this study?

The purpose of this research study is to investigate how women decide to enroll in Associate in Engineering programs in North Carolina community colleges, what their experiences in the program are, and their transfer aspirations.

How many people will be in the study?

There will be 17 student participants and 3-6 faculty participants in this study.

Am I eligible to be a participant in this phase of the study?

Student participants have previously undergone individual interviews and must consent to participate in the focus group interview to be included in this phase of the study.

Faculty participants in this study are faculty members who have teaching and/or administrative duties in the Associate in Engineering programs at the selected research sites in North Carolina.

What will happen if you take part in the study?

If you agree to participate in this study, you will be asked to do all of the following:

If you are a student participant, you will be asked to participate in a focus group interview with other student participants to discuss the preliminary findings of the study.

If you are a faculty participant, you will be asked to participate in an individual interview. The interview protocol for faculty and program directors is based on the preliminary findings of the study.

The total amount of time that you will be participating in this phase of the study is 60-90 minutes.

Recording in research

If you want to participate in this research, you must agree to be audio recorded and video recorded. If you do not agree to be audio recorded and video recorded, you cannot participate in this research.

I would like to use these recordings for transcription only. Your audio and video recordings will be destroyed after the researcher transcribes the interviews.

Benefits to participating in this research

There are no direct benefits to your participation in the research. The indirect benefits are inspiring women in Associate in Engineering programs by sharing your stories and contributing to the development of actionable steps to serve women in Associate in Engineering programs better.

Risks to participating in this research

There is minimal risk associated with your participation in this research.

Confidentiality, personal privacy, and data management

Trust is the foundation of the participant/researcher relationship. Much of that principle of trust is tied to keeping your information private and in the manner that I have described to you in this form. The information that you share with us will be held in confidence to the fullest extent allowed by law.

Protecting your privacy as related to this research is of utmost importance to me. There are very rare circumstances related to confidentiality where we may have to share information about you. Your information collected in this research study could be reviewed by representatives of the

University, research sponsors, or government agencies (for example, the FDA) for purposes such as quality control or safety. In other cases, we must report instances in which imminent harm could come to you or others.

How we manage, protect, and share your data are the principal ways that I protect your personal privacy. Data that will be shared with others about you will be re-identifiable.

Re-identifiable. Re-identifiable data is information that can identify you indirectly because of our access to information, role, skills, combination of information, and/or use of technology. This may also mean that in published reports others could identify you from what is reported, for example, if a story you tell us is very specific. If your data is re-identifiable, we will report it in such a way that you are not directly identified in reports. Based on how we need to share the data, we cannot remove details from the report that would protect your identity from ever being figured out. This means that others may be able to re-identify from the information reported from this research.

All data, including recordings, transcripts, and analyses, will be stored in Zoom cloud storage and Google Drive. At the conclusion of this study, all recordings will be deleted from all storage devices.

Right to withdraw your participation

Your participation is voluntary. Even if you agree initially, consent is an ongoing process. You can stop participating at any time for any reason. To do so, tell me immediately that you want to stop participating during the interview. You can also contact the student researcher, Ece Yilmaz at eyilmaz@ncsu.edu and 919-432-3185. You can also contact the faculty advisor for this research, Dr. Alyssa Rockenbach at alyssa_rockenbach@ncsu.edu, 919-515-5541.

If you withdraw, we will stop any procedures or data collection that may be happening. We will also delete any data that's already been collected from you whenever possible. We will not be able to delete your data if we cannot identify which responses are yours or if the data has already been published.

Future use of your research data

To help maximize the benefits of your participation in this project, by further contributing to social science and our community, your re-identifiable information will be stored for future research if you agree to the terms of the broad consent form.

Compensation

Student participants of this phase will receive a \$15 Amazon gift card. If you withdraw from the focus group interviews before they are completed, you will not receive any compensation. If you withdraw from the study after the focus group interview is completed, you are still eligible for the compensation.

What if you are a student?

Your participation in this study is not a course requirement. Your participation or lack thereof will not affect your class standing, grades, or relationship with your instructors or advisors.

Sponsorship and funding

This research is funded by the College of Education at North Carolina State University. This means that the sponsor is paying the research team for completing the research. The researchers do not, however, have a direct financial interest with the sponsor or in the final results of the study. If you would like more information, please ask the researcher(s) listed at the top of this form about the funding and sponsorship.

What if you have questions about this study?

If you have questions at any time about the study itself or the procedures implemented in this study, you may contact the student researcher, Ece Yilmaz at eyilmaz@ncsu.edu. You can also contact the faculty advisor for this research, Dr. Alyssa Rockenbach at alyssa_rockenbach@ncsu.edu.

What if you have questions about your rights as a research participant?

If you feel you have not been treated according to the descriptions in this form, or your rights as a participant in research have been violated during the course of this project, you may contact the NC State IRB (Institutional Review Board) office. An IRB office helps participants if they have any issues regarding research activities. You can contact the NC State University IRB office at IRB-Director@ncsu.edu, 919-515-8754, or [fill out a confidential form online](#) at <https://research.ncsu.edu/administration/participant-concern-and-complaint-form/>

Consent To Participate

Verbal consent will be obtained prior to the interview. By verbally agreeing, I am affirming that I have read and understand the above information. All of the questions that I had about this research have been answered. I have chosen to participate in this study with the understanding that I may stop participating at any time without penalty or loss of benefits to which I am otherwise entitled. I am aware that I may revoke my consent at any time.