EXAMINING THE ROLE OF AFFINITY GROUPS, INTERNSHIPS, AND UNDERGRADUATE RESEARCH IN SHAPING THE IDENTITIES OF WOMEN OF COLOR IN ENGINEERING

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ABSTRACT

There is a need for more research that focuses on helping women of color in engineering navigate through their undergraduate educational experiences. Specifically, we need to learn more about the activities—beyond the classroom—that have the potential to support the identity of women of color in engineering. The current study employed a mixed-methods design to examine whether and how affinity groups, internships, and undergraduate research experiences support the gender, racial/ethnic, and engineering identity of women of color in engineering. The quantitative strand included 116 engineering undergraduate students who were surveyed about their activities and their identity. The qualitative strand has 11 engineering undergraduate students and 8 engineering graduates who were interviewed about the role these experiences serve in negotiating their identities. The quantitative results showed that internships and undergraduate research experiences were positively related to engineering identity, and gender- and race/ethnicity-based affinity groups were positively related to gender and ethnic identity respectively. The qualitative strand was used to further evaluate these findings and to explore the roles these experiences might serve in negotiating identity among women of color in engineering. The qualitative findings articulate sources of tension and support for identity development in students' educational experiences, in affinity group spaces, in internships and undergraduate research, and in post-baccalaureate work experiences. Salient themes across contexts include discrimination, isolation, and lack of belonging; seeking community and engineering support; and navigation of the self in engineering. Altogether, the themes identified in this study suggest that affinity groups and profession-based experiential learning opportunities like internships and undergraduate research provide distinct, but complementary supports in the navigation of identity among women of color in engineering.

To the most influential people in my life, Kimberly, Dad, and Cô.

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CHAPTER 1: INTRODUCTION

In recent decades, the field of engineering has actively responded to a diverse range of global challenges ranging from identifying sustainable energy sources to reducing carbon emission to designing machines that monitor individuals' health; yet the engineering field has been less successful at responding to the lack of diversity in the field itself. Specifically, women of color (WOC) are severely underrepresented in engineering (Riegle-Crumb & King, 2010; Seymour & Hewitt, 1997). WOC include, but are not limited to, individuals who identify as a woman and as an Asian or Asian American, Black or African American, Chicana or Hispanic or Latina/Latinx, Native American or American Indian or Alaska Native, Native Hawaiian or Other Pacific Islander, or mixed race/ethnicities (Miles et al., 2022; Ong et al., 2020). In 2017, WOC age 18 to 24 comprised approximately 20.6% of the U.S. population (National Science Foundation/National Center for Education Statistics, 2019), yet during approximately this same period, WOC accounted for only 7.6% of the undergraduate students earning engineering degrees in the United States. By contrast, 12.7% of engineering degrees were awarded to White women and 79.1% were awarded to men regardless of race/ethnicity (NSF/NCSES, 2019). These disparities in degree attainment illustrate that an understanding of opportunity gaps must move beyond a consideration of race/ethnicity or gender, and instead should consider intersectional identities that include race, gender, and engineering.

The diverse perspectives shared by WOC are essential for supporting the innovation and advancements that are necessary for addressing many of the world's most pressing issues (Morton et al., 2019; Naphan-Kingery et al., 2019; Ortiz et al., 2019). By narrowing opportunity gaps among WOC in engineering, it will address current personnel shortages; yet it requires an introduction of critical perspectives into the field (National Academy of Sciences, National

Academy of Engineering, and Institute of Medicine, 2011). Critical perspectives are needed as they provide a sociohistorical lens on people's experiences and prioritize the voices of the individuals (Few, 2007). Opportunity gaps are a reality for many WOC throughout their lifetime and college is another setting that has perpetuated these inequities. For this research, I choose to focus on supports that WOC in engineering are involved in during college as one strategy of helping marginalized students through education systems.

One strategy employed by universities to support and sustain WOC in engineering is to provide organizational opportunities that are purposefully designed to support one or more aspects of students' identities. Organizational experiences may include student organizations (e.g., identity affinity groups) and profession-based experiential learning experiences (e.g., internships and undergraduate research). For instance, identity affinity groups could support students' gender, racial/ethnic, and/or engineering identities by connecting people who share similar background and interest, whereas engineering internships and research experiences could support students' engineering identities through building discipline-specific competence and confidence. Research has documented academic and personal development benefits to student participation in affinity groups (e.g., Banda, 2012) and profession-based experiential learning experiences (e.g., Powers et al., 2018), but given that identity is a multifaceted construct (e.g., Abes et al., 2007; Patrick & Borrego, 2016), there may be unique benefits to students' simultaneous participation in multiple organizational experiences to receive a range of support and promote different aspects of their identity. For example, the competence and confidence that WOC are supposed to develop in an internship/co-op or research may be less instrumental in supporting entry into an engineering career if the experience affords no opportunity to interact with colleagues or mentors who look like them. Similarly, the identity supports that WOC may

experience through participation in affinity groups focused on gender or racial/ethnic identity may be less powerful in shaping career development if these experiences do not put them in contact with other engineers and engineering-relevant opportunities for development. Therefore, WOC in engineering may seek support and guidance from different experiences to fulfill their unique social and academic needs (Ong et al., 2020).

Since affinity groups, internships, and undergraduate research may offer different supports related to one's identity, students may benefit in unique ways from involvement in multiple experiences relative to one experience alone. Also, more research is needed to examine identity affinity groups, internships, and undergraduate research through an intersectional approach. Understanding these experiences together and through this approach may provide valuable insight for universities wishing to increase WOC persistence in engineering by examining what supports and how the supports shape their identity holistically with opportunities for professional and personal growth. This is one type of strategy that universities may use to support students while there continues to be broader changes to address systemic inequities in education. The proposed study seeks to understand how identity is supported and/or thwarted among WOC who are pursuing engineering at a predominately White institution (PWI), with particular focus on the role that involvement in identity affinity groups, internships, and undergraduate research may play in this process. There is the need to understand the aspects of identity relative to one another, while simultaneously consider the broader societal influence that may challenge the development of WOC in engineering. The proposed study may provide broader insights into how WOC in engineering navigate and negotiate their gender, racial/ethnic, and/or engineering identities during their undergraduate experience, which could inform university attempts to provide effective supports for a diverse student body.

CHAPTER 2: LITERATURE REVIEW

I aim to study how affinity groups and profession-based experiential learning supports the identities for WOC in engineering. In examining this dissertation topic of experiences shaping identity, I need to first understand WOC perceptions of their identity, which includes their perspectives of being a WOC (broadly) and insight on aspects of their identity (e.g., gender, racial/ethnic, and engineering identity). I specifically use theoretical frameworks of intersectionality and the reconceptualized model of multiple dimensions of identity to explore identity and identity development. Additionally, I need to investigate the undergraduate engineering "chilly climate," especially at a PWI, to understand what barriers and challenges may be hindering the academic success and retention of students who identify as WOC in engineering. Finally, I explore the literature on participation in affinity groups and profession-based experiential learning to understand the unique—or even complementary—supports these organizational experiences provide for students. The literature review chapter focus on identity, contexts, and how it may be examined to provide insight into the lived experiences of WOC in engineering.

Defining Terms: Gender, Race/Ethnicity, and WOC

Gender and Race/Ethnicity as Identity Markers

This study is rooted in critical theoretical frameworks that center on gender and race/ethnicity as identity markers that people use to define themselves. Before discussing these frameworks, I want to clarify the use of these central terms and the nuances within them. First, gender identity can be described as a multidimensional construct of knowledge of group membership, compatibility within group, pressure to conform to societal standards, and attitudes within group (Egan & Perry, 2001). Since gender includes a full spectrum of identities, I

recruited people to participate in the study who self-identified as women which includes women, transgender women, genderqueer women, genderfluid women, etc. In acknowledging how gender identity is defined and operationalized, I hope to address Miles et al. (2022) call to transparency in discussing how gender identity is defined by researchers and participants, and how the meaning of women extends beyond cisgender women.

Second, race is a social construct that groups people according to their ancestry (Haney Lopez, 1994) or skin color (Omi & Winant, 1994), whereas ethnicity is a shared group experience based on culture (Omi & Winant, 1994; Phinney & Ong, 2007). While there is ongoing scholarly debate about the extent to which these terms overlap or are distinct, within the field of educational psychology, DeCuir-Gunby and Schutz (2014) take the position that race and ethnicity are related but distinct. They further discuss the importance of acknowledging the sociopolitical context in which race was originally used, which was to invoke a hierarchy among groups of people (Omi & Winant, 1994). Yet, people may find it challenging to draw a distinction between race and ethnicity as identities in how they think about themselves and others despite scholars arguing for clear distinctions. As Miles et al. (2022) highlight in discussing racial/ethnic identities, "For some, being a WOC relates to both race and ethnicity; for others, being a WOC may be more of a matter of race over ethnicity or vice-versa" (p. 245). Therefore, I choose to frame this study without drawing clear distinctions between race and ethnicity (referring instead to race/ethnicity). One of the goals of the study, in fact, is to learn about how participants think about their identity. Keeping an open framework allowed me to learn how WOC understand the racial and ethnic facets of their identities and to prioritize participants own self-descriptions.

Defining WOC and Salience of Intersectional Identities

Who is represented by the term, women of color? Rivera Maulucci and Mensah (2015) discuss the important and necessary practice of naming and defining the term, WOC, to make visible the experiences of people who identify as WOC. Thus, I identify WOC to mean individuals who self-identify as a woman and identify as Asian or Asian American, Black or African American, Chicana or Hispanic or Latina/Latinx, Native American or American Indian or Alaska Native, Native Hawaiian or Other Pacific Islander, or mixed race/ethnicities (Miles et al., 2022; Ong et al., 2020). Although, these individuals may fall under the broader category of WOC, I do not assume that they have homogeneous experiences. It is expected there will be unique academic, familial, and cultural experiences within and between groups of individuals who identify with these various markers. For instance, a Latina woman could have a similar experience to a Black woman, while having a different experience from another Latina woman and an Asian American woman. While collectively WOC share the experience of being underrepresented in the field of engineering, it is important to acknowledge, honor, and attempt to represent the diversity of experience that exists within this broad group.

Prior research examines WOC in science, technology, engineering, and mathematics (STEM) through different samples of identity markers, such as an intersectional collective (e.g., WOC), specific identity groups (e.g., Indigenous women), or single-axis identity groups (e.g., racial identity, gender identity; Miles et al., 2022). Although there may be other important identity markers (e.g., religion, disability status, nationality, etc.) that are also important to consider, race/ethnicity and gender are arguably broad salient identity markers within engineering (Thomas et al., 2021). Since engineering has been traditionally represented as a White, male-dominated field (e.g., Riegle-Crumb & King, 2010; Seymour & Hewitt, 1997), this

representation is likely reinforced and reproduced for WOC in their engineering coursework and related experiences at a PWI. For instance, WOC engineering students may be reminded of their gender and racial/ethnic identities through instances of sexism, racism, tokenization, and microaggressions (Espinosa, 2011; Lord et al., 2009). I choose to focus on gender and race/ethnicity as the intersecting identities because they may be the most observed and salient for minoritized students, especially within engineering.

Theoretical Framing

Identity development is a complex phenomenon as it involves multiple perceptions of the self and others around the self, all of which are shaped by one's experiences throughout their lifetime. To help me represent how WOC in engineering negotiate their identities and understand the ways that contexts such as identity affinity groups, internships, and undergraduate research may shape this process, this work is currently guided by three frameworks focused on: a) engineering identities (adapted from Hazari et al., 2010); b) intersectionality (Crenshaw, 1991); and c) a reconceptualized model of multiple dimensions of identity (Abes et al., 2007). Together, these frameworks provide grounding for building an understanding of how WOC make meaning out of their identities while pursuing engineering.

Engineering Identities: Adaptation of Science Identities

Engineering identity is broadly defined as the extent to which one views oneself as an engineer (Godwin, 2016). Contemporary models of engineering identity are based primarily on models developed to represent science identity more broadly (e.g., Carlone & Johnson, 2007; Hazari et al., 2010; Shanahan, 2008). Hazari et al.'s (2010) student identity model in particular provides a useful framework for the purpose of this study.

Hazari et al. (2010) examined high school students' physics identities in predicting students' interest in pursuing a physics career. Their work expanded upon Carlone and Johnson's (2007) scholarship on a broader science identity model. Hazari et al. (2010) suggest how students' identities consist of three parts: personal identity, social identity, and identification with physics. *Personal identity* is the individual characteristics that one self identifies (e.g., I am respectful). *Social identity* is the group characteristics shared by common experiences and background (e.g., woman, person of color). Finally, *identification with physics* explains the characteristics of a physics student, which includes *recognition* (i.e., being recognized as a physics person), *competence* (i.e., being able to understand physics concepts), *performance* (i.e., academic achievement), and *interest* (i.e., experiencing a desire to learn about physics). A person with a strong physics identity has all these dimensions rated highly by self and others; however, many students express varying degrees of each of these dimensions. In addition, the different identities may influence each other positively or negatively. For instance, a person may have a strong *identification with engineering* and *personal identity* qualities that matches engineering (e.g., I am a problem solver), but then have a *social identity* that is less represented in engineering (e.g., WOC in engineering). This may suggest dissonance among students about whether engineering would be the right fit. Therefore, a framework that considers the complementarity of identities is useful for conceptualizing the synergies and tensions a WOC may experience while pursuing engineering.

This model suggested by Hazari et al. (2010) is suitable for the current study as an identity framework for a few reasons. First, this model examines a science identity, which can then be expanded to other STEM identities. This model has been widely used and examined in multiple disciplines such as engineering and mathematics (e.g., Godwin, 2016; Lock et al.,

2013). Second, there has been extensive research in examining STEM identity models and its relation to positive outcomes, such as persistence and engagement (e.g., Carlone & Johnson, 2007; Wade, 2012). Third, the authors acknowledge the inclusion of personal and collective identities that are part of a student's overall identity. Other STEM identity models are restricted to the STEM identity construct themselves. For example, McDonald et al. (2019) examined a STEM identity using a single-item measurement where students select a picture that best describes the overlap of themselves and a STEM professional identity. This research only evaluated STEM identity and did not consider the social identities that make up one's self. Fourth, prior literature rarely defined or described how individual characteristics (e.g., race/ethnicity or gender) are connected to students' science identity (Carlone & Johnson, 2007), which limits the discussion on social contexts. Instead, Hazari's model acknowledges that students hold identities that co-exist with one another.

Despite the model's affordances, one limitation of the research supporting this model was that they only examined gender as part of students' social identity. Race/ethnicity was used as a control variable instead of being considered as another point of intersectionality. Since social identities were not observed together in the model, it may overlook students' intersectional experiences. Examining one social identity alone would not be a representative portrayal and discussion of experiences shared by WOC. Instead, both gender and race/ethnicity should be examined to uncover the nuances of identities that compete and suggest tension with one another. Thus, for the current study, I aim to examine both gender and racial/ethnic identities as part of WOC identities within engineering.

WOC Identities: Critical Race Feminism and Intersectionality

The phrase, "women of color," focuses on two socially constructed identities: race/ethnicity and gender. Having a framework that acknowledges both identities simultaneously is necessary to build understanding of the unique experiences of students who identify as WOC. Critical race feminism (CRF) is a perspective that discusses how WOC identities and systems of oppression impact their experiences (Wing, 1997; Wing, 2003). This perspective stemmed from work in Critical Legal Studies (CLS), Critical Race Theory (CRT), and feminist theory. CLS, for example, worked to expose and criticize the role of legal systems in upholding oppressive social systems (Yosso, 2005). Scholars, such as Derrick Bell, Alan Freeman, and Richard Delgado, declared that since race and racism were not part of CLS analyses, social changes advancements would not be made (Delgado, 1995; Delgado & Stefancic, 2001; Ladson-Billings, 1998). Thus, the need for race and racism to be centered as the main analysis.

Critical Race Theory (CRT) emerged in response to these early frameworks to center race, racism, and White supremacy observed in social systems including educational institutions (Delgado & Stefancic, 2012; Ladson-Billings & Tate, 1995; Yosso, 2005). The goal of CRT is to promote social change and justice, which addressed the gap in CLS (Crenshaw, 1995). CRT has advanced to be both a theoretical and analytical framework in education (e.g., Duncan, 2002; Lynn et al., 2002). Within this research, I leverage CRT as a theoretical framework for considering and challenging systems of oppression enacted by higher education (especially within engineering) and as an analytical framework of examining students' intersectional identities as part of the research question.

In addition to CRT making contributions to challenging racism and promoting racial consciousness, there was the need to concentrate on gender. Feminist theory has multiple

branches and is not monolithic (Flax, 1987). Although there is no concrete definition, scholars tend to agree that feminist theory examines gender construction and interactions including highlighting gender inequalities and inequities (Ramazanoğlu & Holland, 2002). One of the major critiques of feminist theories, however, is the privileging of perspectives of White women over those of WOC (Evans-Winters & Esposito, 2010). In addition, feminist and antiracist practices tend to "expound identity as woman or person of color as an either/or proposition" (Crenshaw, 1991, p. 1242). There was a crucial need to highlight WOC lives where both gender and racial/ethnic identities play an important role in individuals' experiences. Therefore, CRF places WOC at the center of discussion and is multidisciplinary in theory and practice (Berry, 2010). CRF combines the approaches of challenging systems, racism, and discrimination against women.

A main component of CRF is intersectionality, which examines how race and gender identities intertwine with each other simultaneously to influence individuals' experiences in a larger system of oppression (Crenshaw, 1991). Intersectionality stemmed from legal cases and how issues of racism were often presented as cases from African American men and issues of sexism were presented as cases from White women (Crenshaw, 1989). For WOC, they had to choose whether they wanted to be represented as a woman or a person of color. Yet, this is not representative of minoritized women's experience where they may simultaneously face racism and sexism, also known as the double bind (Malcom et al., 1976; Malcom & Malcom, 2011; Ong et al., 2011). Crenshaw (1989) emphasizes marginalized identities are multiplicative, not additive. In other words, marginalized intersectional identities is a unique experience and not just double of one identity's counterpart (Museus & Griffin, 2011). If identity is explored as a monolithic perspective, it is problematic and not representative of the experience of WOC

(Richeson & Sommers, 2016). Some critiques of CRF include that it is difficult to measure feminist concepts and it cannot predict individual or group behavior (Few, 2007). However, the goal is not to change individuals' behavior, but instead provide context to understand the experiences of these individuals.

The current study is purposefully framed under CRF as it directly acknowledges the intersectional identities of WOC, which may help better understand and represent experiences of WOC in higher education. Some important affordances of exploring intersectionality include more accurate representation of the individuals of interest, an opportunity to listen to people's voices and stories, suggestable actions to address the inequality brought about by systems, and to ensure groups are included in equity discussions (Museus & Griffin, 2011). Although intersectionality has often been explored within higher education, there is progress to be made on research on intersectionality that explores WOC in engineering (Cross et al., 2017), specifically regarding the exploration of the unique contexts that shape students' intersectional identities.

Intersecting vs. Intersectionality. So far, I have been explaining identity with an "intersectional" lens, which is different from an "intersecting" lens. Intersecting implies of multiple identities and the interactions of aspects of identity together such as—but not limited to—being a woman, a person of color (POC), and an engineer. Yet, there are consequences of viewing identity only through this lens because it does not provide further context of way one lives that is based in societal discrimination and oppression. Simply, it is not enough to perceive one's identity as consisting of more than one aspect (Bešić, 2020). Instead, we need to examine the identities as multiplicative and interwoven with societal influence of power and privilege that invokes further marginalization of groups.

For my dissertation project, I discuss examining identity and experiences through both intersectionality and intersecting approaches. There may be two ways this distinction may emerge in my study through methodological and descriptive ways. First, certain approaches—by virtue of how data is treated—results in representations of identity as intersecting, such as measuring one aspect and another aspect of identity distinctly. Other approaches may afford space for the intersections and instead focus on understanding the larger context of how power and systems of oppression operates. Second, these distinctions could show up in my study in how participants talk about their identity. My study allowed participants to use their own words to talk about identity, so I could gain a sense of the extent to which they represent their own identity as an intersectional whole vs. a number of distinct co-occurring parts. I discuss the implications and tensions of both approaches in Chapter 5.

Identity Development: Reconceptualized Model of Multiple Dimensions of Identity (RMMDI)

One's identity is likely influenced by their educational and extracurricular experiences. For example, identity affinity groups, internships, and undergraduate research are examples of typical organizational experiences that most universities have that may contribute to students' personal identity development. Additionally, these experiences may be particularly pertinent to WOC since they relate directly to their gender, racial/ethnic, and/or engineering identities. Abes et al's (2007) reconceptualized model of multiple dimensions of identity (RMMDI) provides a useful framework for considering how these university-based contextual influences may shape and support students' identities (see Figure 1). This model stems from earlier work by Jones and McEwen (2000) who proposed that college students' identities are constructed by different aspects of identities (e.g., race, gender, social class, etc.) within changing contexts (e.g., current experiences, sociocultural conditions, etc.). They operate where "no one dimension may be

understood singularly; it can be understood only in relation to other dimensions" (Jones & McEwen, 2000, p. 410). This implies that aspects of identity cannot be understood separately. Abes et al.'s (2007) reconceptualization of this model includes the addition of a meaning-making filter, which refers to the process whereby certain contextual experiences may vary in their relative salience to students' social and core identities. The focus of this model is on how experience may shape identity and represents understanding identity through intersectionality.

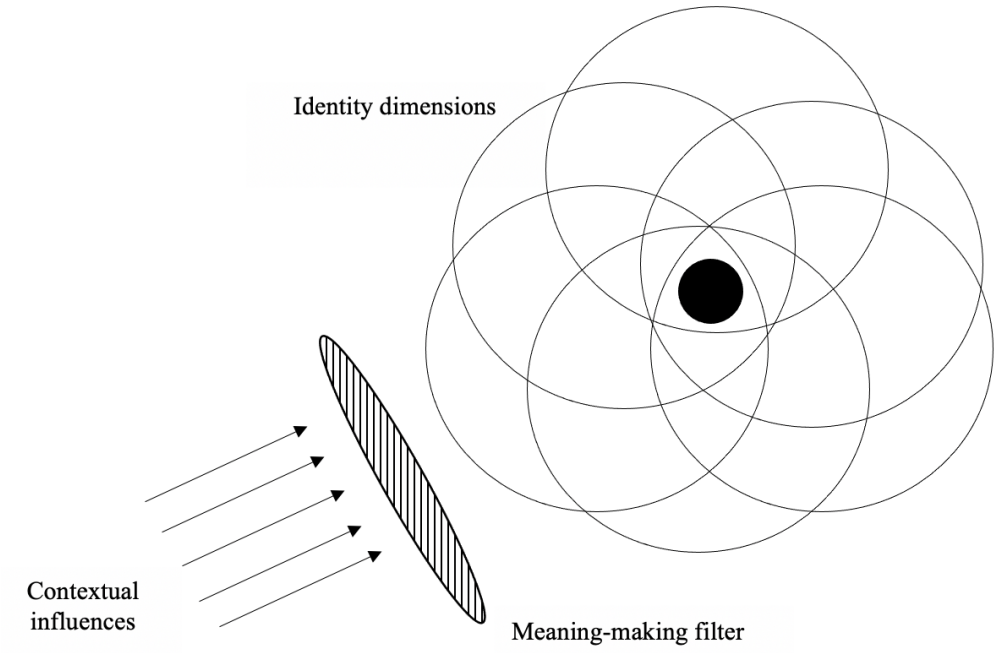

Figure 1. The reconceptualized model of multiple dimensions of identity by Abes et al. (2007).

The variation in context influencing identity depends on the complexity of the meaning making, such as the depth and permeability of the meaning-making filter. Depth can be described as the range of whether the contextual influences shape the reinterpretation (thin) or fail to change (thick) one's identities, whereas permeability can be described as the size of the opening and whether a person is likely to be susceptible to contextual influences impacting a person's identities. If the meaning-making filter's depth is thick and the permeability of the filter is small, it would be an example of a student engaging in complex meaning making where the student

would be less susceptible to contextual events influencing their core identity. For example, if a WOC student was surrounded by mainly White and/or male peers in engineering experiences, but had strong positive engineering, gender, and racial/ethnic identities (depth is thick), they may still feel secure in pursuing engineering despite the stereotype of "who" does engineering (permeability is small). Considering the meaning-making filter "provides a richer portrayal of not only *what* relationships students perceive among their personal and social identities, but also *how* they come to perceive them as they do" (Abes et al., 2007, p. 13).

The authors further provided different examples of peoples' complexity of the meaning-making filter to least (i.e., formulaic) to moderate (i.e., transitional) to most complex (i.e., foundational). To briefly summarize each type of meaning making, I start with *formulaic* meaning-making which is engaging in minimal filtering and how the contextual influences are closely connected to one's core identity. In other words, the beliefs of society, including the negative judgments and perceptions, are almost similar to what one believes as their identity. It is often a dichotomous way of thinking and has no reflection or filtering of the process. However, *transitional* meaning-making filter has more complexity in understanding the nuances of contextual influences in shaping identity. There is more tension with how one is labeled and why one is labeled through society's lens. Lastly, the *foundational* meaning-making filter is the most complex meaning-making. The relation between contextual influences and identity is constantly evolving with critiques and resistance of stereotypes. In general, these types of level of meaning making may be helpful to understand the way WOC are reflecting on their experiences and the ascribed meaning to their identity.

Overall, Abes' et al. (2007) reconceptualized model of multiple dimensions of identity most strongly acknowledges that educational contexts are going to shape one's identities. This

provides a potential framework that connects intersectionality and engineering identities to one's organizational experiences, which facilitate a more nuanced understanding of WOC identities and the experiences that shape and support them. In addition, the model's conception of a meaning-making filter provides a framework for understanding the process whereby particular university-based experiences may be salient influences for some students but not for others. For example, a WOC student may find the affordances of participating in different organizational programs as supporting their identities, while another student may view these experiences as less effective if one organizational program does not provide affordances for some degree of identity integration. Since individuals may have unique perceptions on organizations and the relations to their identities, it may be worth understanding more in-depth about how they navigate and negotiate their experiences. Together, the three frameworks described here (engineering identity, intersectionality, and reconceptualized model of multiple dimensions of identity) can inform a more complex and situated discussion of how organizational experiences might serve to support the intersectional identities of WOC in engineering.

Challenges Faced by WOC in Engineering

There is literature that suggests that the STEM experience is a "chilly climate." Flam (1991) used the terms "subtle and elusive" to describe the "chilly climate" that left women feeling "undervalued, ignored, or alienated" (p. 1604). This stemmed from the climate portraying external and internal messages that being a woman was a liability and unwelcomed in men-dominated spaces (Flam, 1991; Walton et al., 2015). Although, this is originally framed from a science setting and focused on gender, the ramifications extend to engineering and race/ethnicity, as well as other marginalized identities (Ong et al., 2011; Walton et al., 2015). This raises concerns about the harmful effects that these settings may have for WOC.

WOC in engineering face unique obstacles compared to their White female and male peers, especially at a PWI. Since WOC are confronted by a double bind, they face oppression and discrimination from both their gender and racial/ethnic identities, which positions students at risk of experiencing injustice and powerlessness (Malcom et al., 1976; Malcom & Malcom, 2011; Ong et al., 2011). As a result of this double bind, WOC may encounter severe challenges that would then influence their navigation of their social and academic environment. A literature review on the experiences of WOC in engineering in higher education identified four types of social pain students experience (Ong et al., 2020). The first is *being the only one,* where WOC described feeling a lack of belonging. Since the field appeared to be mainly dominated by White men, WOC had fewer opportunities to interact with people who shared the same gender and cultural background (Tate & Linn, 2005) and found it difficult to connect and be understood by others (Parker, 2013). The second social pain identified in the review was the feeling of *being ignored or made invisible.* WOC had the common experience of professors and peers being dismissive of their ideas, questions, and potential for excelling in engineering. For example, WOC reported that they were not recommended for the same opportunities as other students (Brown, 1995). Additionally, peers may talk over or provide them less responsibility for group assignments (Camacho & Lord, 2011; Parker, 2013). Third, WOC encounter *stereotype threat and being spotlighted*. Marginalized students may be concerned to confirm a negative stereotype; however, some WOC students in engineering may challenge and counter stereotypes as an act of resistant capital (Gorman, 2014; Lord & Camacho, 2013; Ong et al., 2020; Yosso, 2005). In addition, they face instances of feeling singled out, which promotes isolation. Fourth, some WOC students experienced *discrimination and harassment*, such as instances of racism, sexism, sexual harassment, and being questioned of their academic abilities. These intolerable acts may

have individuals consider leaving their major. Additionally, the structure of PWIs makes the environment difficult—and even hostile—to individuals' learning experiences. For example, the set-up of a large classrooms, the power dynamic between professors and students, and the promotion of a competitive academic environment suggest a detached and unapproachable environment (Seymour and Hewitt, 1997). Overall, WOC encounter explicit and implicit cultural messages based on their race/ethnicity and gender that make it challenging to obtain an engineering degree. These challenges have the potential to threaten the gender, racial/ethnic, and engineering identities among WOC (e.g., Tate & Linn, 2005).

Having strong gender and racial/ethnic, and engineering identities may be important in how students overcome challenges and navigate their engineering environment (e.g., Malone & Barabino, 2009; Tate & Linn, 2005). To build those strong identities, students may participate in experiences that build positive connection to their identities, such as identity affinity groups and experiential learning activities (e.g., internships and undergraduate research). These experiences may provide them a community of support and engineering skill that empowers them to persist in the field.

Identity Affinity Groups

Counterspaces are described as educational and social spaces that are led and facilitated by students who are marginalized, such as women, racial/ethnic minoritized groups, and women of color (Solórzano et al., 2000). Affinity groups based on gender or racial/ethnic identity represent one type of counterspace, allowing students to engage in critical conversations of identity while being supported by peers who share this aspect of their identity (Johnson et al., 2017; Ong et al., 2018). There are also affinity groups that focus on a shared interest, such as engineering. Some examples of identity affinity groups within engineering are Society of

Women Engineers (SWE), National Society of Black Engineers (NSBE), and Society of Hispanic Professional Engineers (SHPE). In addition, there are cultural organizations such as sororities or women's council. These are some examples of affinity groups that address intersecting identities, which is an interest in this study. Although the terminology can vary (e.g., affinity groups, ethnic student organizations, cultural organizations), they have in common the intention to provide connection among individuals who share an identity and interest. It is important to note these groups do extend beyond gender and race/ethnicity (e.g., religion, social organizations, etc.). However, the current study focuses on gender, racial/ethnic, and/or engineering identity affinity groups due to the intersectional identities examined for this study and the potential salience of these aspects of identity in engineering spaces (Thomas et al., 2021).

A number of studies show positive links between affinity group participation and a variety of academic and social outcomes. Among students generally, participation in these organizations is positively correlated to college adjustment (Ethier & Deaux, 1994), sense of belonging (Banda, 2012; Hurtado et al., 2007; Locks et al., 2008; Maestas et al., 2007), and college persistence (Banda, 2012; Flowers, 2014). In addition, participation in a STEM-related organization is associated with increased student retention (Banda, 2012; Chang et al., 2010; Garcia & Hurtado, 2011; Herrerra & Hurtado, 2011). A smaller body of research focuses specifically on the participation of WOC in affinity groups. Ong et al. (2018) interviewed WOC in STEM in higher education about involvement in counterspaces and one of their findings was that student organizations within and outside of STEM allowed WOC to connect with peers similar to them, while providing opportunities to develop their STEM skills and build professional skills. One student commented that she found a community within her Native American Drummers group and the engineers and scientists society for underrepresented

students: “I’ll at least have a group somewhere on campus, even if they’re in a different field, knowing that I could relate to them and go to them and feel that same sense of community” (Ong et al., 2018, p. 226). Even if the student organization is outside of one’s major, there can still be ways in which it promotes belonging for students. Yet, more research on affinity groups is needed to understand how one’s identities are sustained and supported among populations with these intersectional identities (Lira, 2022).

Despite the potential benefits, it is worth establishing that some students may not want or feel the need to participate in identity affinity groups. For instance, Banda & Flowers (2017) found that some Latina women in engineering participated in student organizations (e.g., SHPE, Latina-based sorority, Latina student organization) to fulfill academic and social needs and to seek a sense of belonging; however, it was not evident in all the women they interviewed. For example, some of the Latina women they interviewed did not feel the need to participate in student organizations. In explaining their reasons for non-participation, some women shared that they did not self-identify as a minoritized individual in engineering, and some perceived generational and cultural differences between themselves and participants in these organizations. Other barriers that may prevent or limit participation include the time commitment in midst of other responsibilities or failure to prioritize the organization or see value in it (Holzweiss et al., 2007). To understand the potential role of affinity groups as one of many potential sources of development of intersectional identities among WOC in engineering, it is as important to hear from those who participate in affinity groups and those who do not.

Profession-Based Experiential Learning (P-BEL): Internships and Undergraduate Research

Experiential learning is a term used to refer to experiences where one learns by doing (Jamison et al., 2022). Within this process, students participate in interconnected stages of experiencing, reflecting, thinking, and acting (Kolb & Kolb, 2008). Examples of experiential learning activities include—but are not limited to—internships, co-ops, undergraduate research experiences, service learning, study abroad, and project-based learning. Within these activities, students are gaining authentic experiences of understanding, reflecting, and applying their knowledge to solving a problem. Although experiential learning can be used to describe a range of different activities from undergraduate research to study abroad, the current study uses a narrow definition called *profession-based experiential learning* (P-BEL) to indicate experiences such as internships (or co-ops) and undergraduate research. Since these opportunities provide direct professional training experiences, students may use those experiences to gauge whether they can see themselves as an engineer (i.e., build their perceptions of an engineering identity). For example, if students feel confident, are doing well, recognized by other engineers, and have deep interest in their current engineering professional activities, it is likely they may see themselves as an engineer. Thus, it would be important to explore how P-BEL are relevant to engineers.

Undergraduate internships and research experiences show common benefits to engineering students. Broadly, P-BEL are associated with high self-efficacy, career ambitions, and development or interest in engineering (e.g., Carpi et al., 2017; Matusovich et al., 2019; McAlexander et al., 2022). For example, McAlexander et al. (2022) found in their qualitative findings that students often credited participating in their science and engineering internship

(focused on bioproduct/bioenergy) as reinforcing their career goals, forming their job preference, and increased exposure to different career options. Their quantitative findings showed that students had increased intention to pursue a bioproduct/bioenergy career. Furthermore, for Zydney et al. (2002), they explored the impact of undergraduate research among engineering alumni and found that they described undergraduate research as "very important" or "extremely important" experience, especially for students who participated in this experience longer. Through this experience, they gained higher cognitive and communication skills, such as understanding scientific findings, speaking effectively, analyzing and understanding merit of literature, and envisioning their clear career goals. Unlike the literature review on internships and co-op experiences, the literature review on undergraduate research in engineering remains more limited (Kaul et al., 2016). This may be due to a smaller sample of students participating in these experiences because of a strict degree path, low flexibility in degree requirements, and emphasis on math and science curriculum (Kaul et al., 2016). However, engineering students may seek these P-BEL activities to develop their knowledge and skillsets within engineering and use these experiences to assess whether they see themselves as an engineer.

There are some substantial reasons why students may not want or cannot participate in internships or research experiences. One reason includes students navigating their socioeconomic circumstances, which has students work and support their family instead of participating in internships or research experiences (Foor et al., 2007; Trenor et al., 2008). Another reason involves the lack of guidance during the programmatic experience, such as lack of mentorship, poor communication on projects and responsibilities, and time expectation conflicts (e.g., Stofer et al., 2021; Thiry et al., 2011). Furthermore, minoritized students (e.g., women or people of color) may face discrimination within these experiences. For instance, Strayhorn and Johnson

(2016) found in their interviews with underrepresented minority students participating in engineering co-ops and internships that most students mentioned how race/ethnicity or gender impacted their internships. For example, Black male students felt overlooked, ignored, or invisible, while the women (regardless of race/ethnicity) were given menial tasks stemming from mentors expecting less of them. These results suggest that internship/co-ops and undergraduate research opportunities should be carefully examined with an eye toward equity in the experiences of its participants. If WOC students find their social characteristics being challenged in a setting of developing an engineering identity, it may threaten—not only the development of their engineering identity—but their gender and racial/ethnic identities too. Since WOC students may have their own reasons to not participate in internships and research experiences, it would be important to further understand why that may be. Furthermore, it would be valuable to understand if there are any potential differences across their gender, racial/ethnic, and engineering identities of WOC students who do participate in these experiences compared to those who do not.

The hands-on experience gained from participation in internships and undergraduate research may increase students' perceptions of their engineering identity. However, the research regarding internships/co-ops and undergraduate research had little to no mention of intersectional identities of who was participating (e.g., WOC), even though it is suggested to examine intersectionality in these spaces to address inequities (Lira, 2022). One exception is Kusimo et al. (2018), who used an intersectional lens to examine students' self-efficacy while participating in research and internship experiences. One of their main findings was that underrepresented minority women who participated in both research and internships had similar self-efficacy scores compared to non-underrepresented minority men who had not participated in either

internship or research experiences. This highlights the unfair assumption that WOC need to "do more" to gain a similar experience to their male and/or White peers, which calls attention to how "many of these suggestions take an approach of 'fixing' the student instead of seeking solutions from an institutional stance" (Ong et al., 2020, p. 595). More efforts are needed to understand and narrow the opportunity gap, which may involve discussing with WOC in-depth about what occurs in P-BEL and how it is related to their identities.

Jointly Considering Identity Affinity Groups and Profession-Based Experiential Learning

Examining students' holistic experiences with affinity groups, internships, and undergraduate research experiences may provide us with a more contextualized understanding of how students' identities are developed and sustained. Yet, there has been limited research examining affinity groups and P-BEL together versus separately. One exception is McCormick et al. (2015) who evaluated engineering college students' participation in learning experiences (e.g., internships, research, and extracurriculars such as SWE and other enriching experiences) and the effects on students' self-efficacy towards sustainable engineering. They found that students who participated in internships and research had higher self-efficacy than students who only participated in extracurricular service clubs. However, students who participated in extracurriculars had higher affect and value scores. The findings highlight how there are different values in being involved in multiple activities, such as students' engineering skills and interest may be supported through participation in unique organizational experiences. While this study provides comparative information about potential impacts of identity affinity groups and P-BEL, there is little qualitative discussion of the experiences of WOC who participated in these learning experiences or the meaning they had to them. It would be important to understand the implications for WOC as these experiences together may play an informative decision of their

continuation in engineering. Therefore, the current study is needed to understand how affinity groups, internships, and undergraduate research together shape and sustain the identities of WOC in engineering. Through understanding the affordances of these organizations together, we may be able to identify the effective supports and promote them in multiple contexts.

Current Study and Research Questions

The current study employed a mixed-methods explanatory design participation selection model (Quant → QUAL) in which quantitative data were used to select cases of interest for the qualitative phase, which were then used to explain and expand upon the results of the quantitative phase (Creswell & Plano Clark, 2018). Unlike the typical explanatory design, the qualitative phase is the emphasis of the study by expanding the quantitative results and exploring nuances of intersectionality that the quantitative strand cannot address. View Figure 2 for a representable about the study's model. There were four main stages of this design. First, the quantitative strand was used to understand whether participation in identity affinity groups, internships/co-ops, and undergraduate research were related to the gender, ethnic, and engineering identities of WOC as measured on surveys. Second, I selected participants who reported different participation patterns from the quantitative strand to interview for the qualitative strand. Third, the qualitative strand was used to further explore relations and aspects of identity that could not be explored in the quantitative section, such as learning how students describe their identity with a focus on intersectionality. Lastly, the quantitative and qualitative strands were examined together in an integrated discussion.

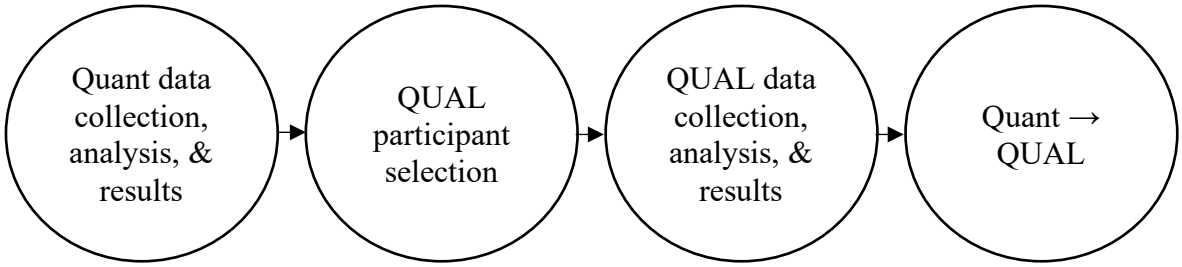

Figure 2. Explanatory design participation selection model from Creswell and Plano Clark (2007).

Through this mixed-methods study, I learned how women of color in engineering at a PWI navigate and negotiate their identities as WOC engineers, with particular focus on the role that identity affinity groups and profession-based experiential learning does or could play in this process. The study is proposed to be a mixed-methods study to explore 1) the association between participation in organizational experiences and the identities WOC hold, such as their gender, ethnic, and engineering identities (quantitative strand) and 2) how WOC understand the role that these experiences have played in shaping their identities (qualitative strand). Considering the participation of WOC in multiple extracurricular experiences may provide insight about how to better support the identities of these students throughout their undergraduate career. The following are the research questions for the study:

1. To what extent is participation in identity affinity groups, internships, and undergraduate research associated with the gender, ethnic, and engineering identities of WOC in engineering at a predominantly White institution?
2. What do WOC in engineering see as the potential role of identity affinity groups and P-BEL in helping them to negotiate their identities?

The first research question is explored through the quantitative data with emphasis on intersecting identities. The quantitative analysis provides insight into *whether* experiences like affinity groups and P-BEL are related to different aspects of identity, such as gender, ethnic, and

engineering identity among WOC in engineering. The second research question is explored through the qualitative data with emphasis on intersectionality (although perceptions about intersecting identity can arise). The interviews provide insight into *how* affinity groups and P-BEL shapes WOC in engineering identity holistically, which can also include learning how participants talk about their own identity rather than relying on three disparate constructs. Both approaches are needed and necessary to authentically and fully describe the tensions and the sources of support when it comes to being involved in these experiences.

Positionality Statement

I am an Asian American, cisgender female, first generation college student who studied psychology at a large, urban undergraduate university. As an undergraduate student, I was involved in a research program that aimed to support marginalized students who were invested in developing research knowledge and skills. Through this experience, I began to study motivational factors of marginalized students' intentions and experience in pursuing STEM degrees. In addition, I was involved in an identity-based affinity group based on my ethnicity to connect with peers and develop a sense of community. These two experiences were fundamental to shaping my identity as an undergraduate college student and onward. I have considered that these experiences may be important and extend to students in other contexts (e.g., PWI) and disciplines (e.g., engineering). Although I consider myself a woman of color, I acknowledge my experiences were different from the women of color in engineering I interviewed. For instance, I did not pursue an engineering degree, which means I cannot fully understand the complexities and challenges of being marginalized by gender and race/ethnicity within a field. Since I have limits to my interpretation, I positioned myself as the learner during interviews and trusted my participants and their experiences. In addition, I offered these interviews as an opportunity for

my participants to ask me questions about my background and my research. I use this positionality statement to address the history of developing my research question and how the experiences I learned through interviews informed my interpretation.

CHAPTER 3: QUANTITATIVE DATA STRAND

Chapter 3 focuses on the study's first research question (i.e., To what extent is participation in identity affinity groups, internships, and undergraduate research associated with the gender, ethnic, and engineering identities of WOC in engineering at a predominantly White institution?), which is answered through the quantitative data strand. The primary aim of the quantitative phase was to understand whether participation in identity affinity groups and P-BEL are related to students' gender, ethnic, and engineering identities as measured on surveys. The quantitative data were also used to identify participants with different participation patterns for interviews (more information will be described in Chapter 4).

Method

Institutional Climate and Context

It is noteworthy to discuss how the social and geopolitical climate during the current period of U.S. history may have important ramifications for the perspectives of study participants. Specifically, there has been an intense amount of hostility and tension centered around women and people of color in the U.S. during the COVID-19 pandemic. For instance, people who identify as Asian and Pacific Islander have faced increasingly high discrimination and xenophobia (Lederer et al., 2021). In addition, the disparities caused by institutionalized racism have been heightened during the pandemic for Black, Latinx, American Indian, Alaska Native, and Pacific Islander individuals (Hooper et al., 2020). Finally, based on the inequities that persisted and were even heightened during the pandemic, it is likely that WOC may face even greater attrition in educational and professional spaces from psychological stress (Burt et al., 2022; Shin & Hickey, 2021). With all the persisting barriers and injustice faced, these

identity markers may become even more salient during these times, which may have the result of challenging one's identities or creating stronger attachment to them.

Broader Study

Data used for the quantitative strand of this study were collected at a large predominately White midwestern public university. The quantitative data came from an extant longitudinal dataset focusing on motivation, curriculum, and campus support programs among student persistence in undergraduate engineering. The dataset includes eight different cohorts of undergraduate students in engineering, with cohorts entering college from 2015 (C1) through 2022 (C8). To gather a range of students' current undergraduate experiences and their more recent experiences after graduating, four cohorts were included in the study. Specifically, WOC students in cohorts 6 (C6; started Fall 2020) and 7 (C7; started Fall 2021) were included in the quantitative analyses. These students were currently enrolled students at the time data analysis for this study occurred (surveyed during Spring 2022). For the qualitative analyses, WOC students in cohorts 6 and 7 were recruited as current undergraduate engineering students and cohorts 1 (C1; started Fall 2015) and 2 (C2; started Fall 2016) were recruited as graduated engineering individuals (interviewed during Spring 2023). Including in the study students in their early years of college and students who have recently graduated may provide insight to how students see their identities as being shaped and sustained at multiple time points (i.e., current and retrospective).

Participants

Two cohorts (i.e., C6 and C7) were selected for inclusion in the quantitative strand. Students in these cohorts were first- and second-year engineering students during time of participation in the study. To be included in the current study, participants needed to self-identify

as a woman (e.g., woman, transgender woman, genderqueer woman, genderfluid woman) and identify within one or more of the racial/ethnic groups listed (e.g., Asian or Asian American, Black or African American, Chicana or Hispanic or Latina/Latinx, Native American or American Indian or Alaska Native, Native Hawaiian or Other Pacific Islander, or mixed race/ethnicities). View Table 1 for full list of demographics including gender, race/ethnicity, major, and parental education.

Table 1
Participant Demographic Characteristics

Demographics	Number of Participants (% Students)
Gender	
Woman	116 (100%)
Race/Ethnicity	
African American or Black	16 (14%)
Asian	69 (59%)
Hispanic or Latina	10 (9%)
Native American, American Indian, or Alaska Native	1 (<1%)
Other	4 (3%)
Mixed Race/Ethnicity	16 (14%)
Major	
Applied engineering sciences	3 (3%)
Biosystems engineering	11 (10%)
Chemical engineering	13 (11%)
Civil engineering	7 (6%)
Computational data science	1 (<1%)
Computer engineering	5 (4%)
Computer science	42 (36%)
Electrical engineering	8 (7%)
Environmental engineering	4 (3%)
Mechanical engineering	21 (18%)
Engineering - Exploratory	1 (<1%)
Parental Education	
Both parents completed high school or below	18 (15%)
At least one parent finished college	24 (21%)
Both parents finished college	74 (64%)

Note. Parental education can include mother/father/parent guardian/parental figure.

A total of 116 undergraduate WOC engineering students were included in the sample for the quantitative strand of this study. Among this sample, 39 students reported participating in affinity groups only at the time data were collected, 9 students had participated in P-BEL only (i.e., internships/co-ops or research), 18 students had participated in both types of experiences, and 50 students had not participated in either experience (these experiences are defined below). Among students who reported participating in affinity groups, 15 (13%) participated in only one organization, 24 students (21%) participated in two organizations, and 18 (16%) participated in three or more affinity group organizations.

Procedure

As part of the broader study from which these data are being drawn, engineering students were invited to participate in a self-report survey on motivation and campus supports in engineering during the end of their Spring 2022 semester. Data were collected through two methods. First, students were invited during their in-person introductory engineering courses for course credit. Second, students who were not enrolled in the course received an email and were compensated with a gift card incentive.

Organizational Experiences. The quantitative analysis included two types of organizational experiences within engineering: identity affinity groups and profession-based experiential learning.

Identity Affinity Groups. Students listed the names of all student organizations they have participated in. For the purpose of the study, I defined identity affinity groups as those organizations that explicitly focused on gender, racial/ethnic, and/or engineering identity. Some examples include organizations centered on women in engineering, a cultural community, or a sorority.

Profession-based Experiential Learning (P-BEL) Experiences. Students listed or described their participation in experiential learning (i.e., non-course related activities) in engineering. For the purpose of the study, I identified P-BEL as internship/co-ops and undergraduate research in engineering experiences.

Measures of Identity

The quantitative analysis included three broad measures of identity: gender identity, ethnic identity, and engineering identity. All identity items were on a 5-point Likert scale (e.g., 1 = strongly disagree, 5 = strongly agree). Composite mean scores were calculated across all measures. See Appendix A for full list of survey items. It is noteworthy that the framing of identity afforded by the design of this phase of the study is consistent with a conceptualization of identity as consisting of multiple intersecting components that can be considered distinctly. The design of the qualitative phase (described in Chapter 4) will afford a different perspective.

Gender Identity. Gender identity was represented by five items[1] (adapted from Sellers et al., 1998; $\alpha = .77$). An example statement includes "My gender is an important reflection of who I am."

Ethnic Identity. Ethnic identity[2] was represented by six items (Phinney, 1992; $\alpha = .90$). An example statement includes "I have a strong sense of belonging to my own ethnic group."

Engineering Identity. Engineering identity was represented by six items (Estrada et al., 2011; Pugh et al., 2010; $\alpha = .83$). An example statement includes "Being involved in engineering is a key part of who I am."

[1] The original scale contained eight items, but three reverse-coded items were dropped due to low reliability.
[2] The original survey prompt denotes ethnic group instead of racial/ethnic group. Ethnic identity will be the term used when discussing of the quantitative strand to match the survey measurement.

Data Analytic Strategy

Preliminary analyses included a confirmatory factor analysis and reporting of descriptive statistics. For main analyses, I conducted three separate 2 (affinity group participation) x 2 (P-BEL participation) ANOVAs to understand how participation in identity affinity groups and/or P-BEL is associated with the gender, ethnic, and engineering identities of WOC in engineering.

Results

Preliminary Analyses

Confirmatory Factor Analysis. I conducted a Confirmatory Factor Analysis for the full sample of participants (i.e., all students among two cohorts in engineering regardless of gender and race/ethnicity identification; $N = 1{,}223$) in the dataset from the spring 2022 survey to establish quantitative measures of gender, ethnic, and engineering identity. The results showed that the 3-factor measurement model fits the data well ($\chi^2(116) = 1024.92$, $p < .001$, RMSEA = .08, SRMR = .05, CFI = .91, TLI = .89). Items dropped were three reverse-coded items related to gender identity.

Descriptive Statistics and Correlations. See Table 2 for correlations and descriptive statistics (e.g., mean, standard deviation, etc.) for gender identity, ethnic identity, and engineering identity. There were moderate, positive associations among all identity measures. Gender identity was positively correlated with ethnic identity, $r(113) = .44$, $p < .001$, and with engineering identity, $r(114) = .22$, $p < .05$. Ethnic identity was positively related to engineering identity, $r(113) = .25$, $p < .01$.

Table 2
Correlations and Descriptive Statistics for All Variables (N = 116)

	1	2	3
1. Gender identity	–		
2. Ethnic identity	.44***	–	
3. Engineering identity	.22*	.25**	–
M	3.62	3.66	3.50
SD	0.66	0.84	0.66
Min	1.80	1	2
Max	5	5	5
α	.77	.90	.83

Note. *** $p < .001$, ** $p < .01$, * $p < .05$.

Main Analyses

Mean levels on each identity variable by participation status are shown in Figure 3. Prior to conducting the analysis, I checked the distribution for each dependent variable. Both gender identity and engineering identity were normally distributed, confirming that ANOVA is an appropriate analytic approach. The ethnic identity measure was a bit skewed however, so analyses were reproduced with nonparametric approaches (Mann-Whitney). Results were not statistically significant or substantively different than the ANOVAs so the ANOVAs are reported here for consistency.

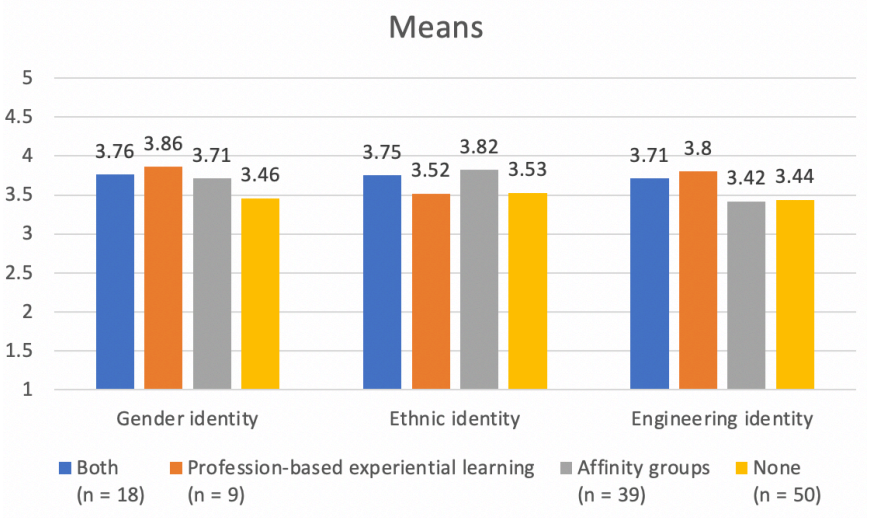

Figure 3. Means of gender, ethnic, and engineering identity scores across participation status.

Gender Identity. A two-way between subjects ANOVA was conducted to examine whether participation in affinity groups and P-BEL were related to the gender identity scores of women of color in engineering. Although students who reported no participation in any affinity groups or P-BEL had lower mean gender identity scores (M_{none} = 3.46) than students who participated in one ($M_{affinity}$ = 3.71, $M_{P\text{-}BEL}$ = 3.86) or both (M_{both} = 3.76) of these experiences, these observed differences were not statistically significant. There were no significant main effects on gender identity for affinity group participation [$F(1, 112) = 0.26$, $p = .614$, partial $\eta^2 = .002$] or P-BEL participation [$F(1, 112) = 2.11$, $p = .149$, partial $\eta^2 = .018$], and there was also no significant interaction effect [$F(1, 112) = 1.37$, $p = .245$, partial $\eta^2 = .012$].

Ethnic Identity. A two-way between subjects ANOVA was conducted to examine whether participation in affinity groups and P-BEL were related to the ethnic identity scores of women of color in engineering. Although students who reported participating in identity affinity groups had higher mean ethnic identity scores ($M_{affinity}$ = 3.82, M_{both} = 3.75) relative to students who did not ($M_{P\text{-}BEL}$ = 3.52, M_{none} = 3.53), there were no statistically significant effects. There were no significant main effects for affinity group participation [$F(1, 111) = 1.71$, $p = .194$, partial $\eta^2 = .015$] or P-BEL participation [$F(1, 111) = .04$, $p = .849$, partial $\eta^2 < .001$], and there was also no significant interaction effect [$F(1, 111) = .03$, $p = .872$, partial $\eta^2 < .001$].

Engineering Identity. A two-way between subjects ANOVA was conducted to examine whether participation in affinity groups and P-BEL were related to engineering identity scores among women of color in engineering. Unlike the results for gender and ethnic identity, there was a significant main effect of participation in P-BEL on engineering identity scores, $F(1, 112) = 4.67$, $p = .033$, partial $\eta^2 = .04$. In other words, women of color engineers who participated in P-BEL had higher engineering identity mean scores ($M_{P\text{-}BEL}$ = 3.80, M_{both} = 3.71) than those who

did not participate in P-BEL ($M_{affinity}$ = 3.42, M_{none} = 3.44). There was no significant main effect of participation in affinity groups on engineering identity [$F(1, 112) = .13$, $p = .724$, partial $\eta^2 = .001$] and the interaction effect of P-BEL with affinity group participation was also non-significant [$F(1, 112) = .04$, $p = .844$, partial $\eta^2 < .001$].

Additional Analyses

Though most of the statistical tests did not reach the level of statistical significance, the trends observed in the mean scores for gender, ethnic, and engineering identity (see Figure 3) may be interesting to explore further. For instance, students who participated in affinity groups were observed to have higher mean ethnic identity scores compared to other groups, though this difference was not statistically significant. Since identity-based affinity groups may focus on various aspects of one's identity (e.g., gender, ethnicity, engineering), it is important to dig more deeply into the group's focus to disentangle whether certain organizations may be related to the gender, ethnic, and engineering identities of women of color in engineering. The following analyses explore the extent to which students' identity ratings are appreciably related to the specific focus of the organizations they participate in.

Affinity Group Focus and Identity. Each affinity group in which students reported participating in was dummy coded across three different focus areas: gender (n = 44), race/ethnicity (n = 24), and engineering (n = 49). Because many affinity groups focused on integrating aspects of student identity (e.g., women-focused engineering organizations) and many students participated in multiple affinity groups (e.g., a sorority and the Black student association), dummy categories were not mutually exclusive within students. Thus t test comparison within any given focus area does not take into account students' potential involvement in affinity groups in the other focus areas. For example, I compared mean scores on

gender identity among students who reported participation in any type of gender-focused affinity groups to that of students who reported no involvement in gender-focused affinity groups, regardless of whether they were involved in ethnicity- or engineering-focused affinity groups. Table 3 displays a detailed view of the various affinity group participation combinations reported by students, and Figure 4 presents mean identity for dummy-coded participation (e.g., mean gender identity among students who did vs. did not participate in gender-focused affinity groups, regardless of other types of participation).

Table 3
Frequency and Type of Affinity Group Participation (N = 116)

Type of Affinity Group Experience	Number of Participants
None	59 (51%)
Gender organization only	3 (3%)
Race/ethnicity-based organization only	5 (5%)
Engineering organization only	4 (3%)
Gender and engineering-based organizations	26 (22%)
Race/ethnicity and engineering-based organizations	4 (3%)
Gender, race/ethnicity, and engineering-based organizations	15 (13%)

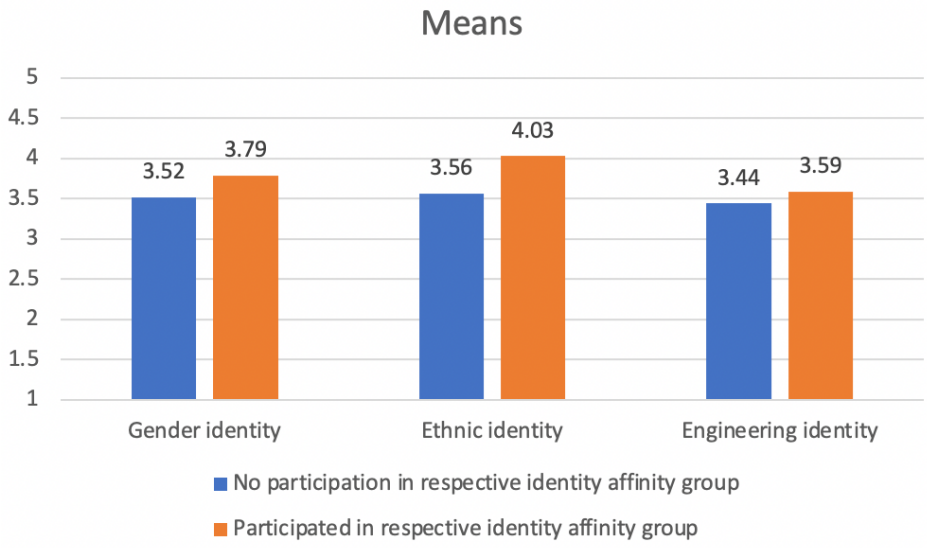

Figure 4. Mean gender- ethnic- and engineering identity scores for students who did (vs did not) participate in affinity group(s) focused on that aspect of their identity.

The identity scores among the participants appeared to be systematically related to the focus of the affinity group(s) to which they belonged. Students who participated in one or more women-focused organizations had significantly higher mean gender identity scores (M = 3.79) compared to students who did not participate in any women-focused organizations (M = 3.52), $t(114) = -2.19$, $p = .031$. Likewise, students who participated in one or more race/ethnicity-focused organizations reported significantly higher ethnic identity scores (M = 4.03) compared to students who did not participate in any race/ethnicity-focused organizations (M = 3.56), $t(113) = -2.45$, $p = .016$. The difference in mean engineering identity among students who participated in engineering-focused affinity groups (M = 3.59) vs. not (M = 3.44) was not statistically significant, $t(114) = -1.26$, $p = .212$, though the trend was similar to that observed for the other focus categories. Overall, these results suggest an association between participation in affinity organizations and the discrete dimensions of participants' identity that the organizations were designed to address.

Discussion of Quantitative Strand

For the quantitative portion of this mixed-methods study, I examined whether participation in identity affinity groups and P-BEL experiences were associated with the gender, ethnic, and engineering identities of WOC in engineering. The significant main effect of P-BEL on engineering identity indicates that women-identifying students of color in engineering who participated in P-BEL tended to report higher engineering identity compared to their peers who had not had these experiences. Prior studies have identified links between experiences like internships/co-ops and undergraduate research and students' engineering identities and relatedly, engineering retention (Hughes et al., 2019, Morelock, 2017, Wylie et al., 2020). This research extends the finding for a group of WOC in engineering. Within a P-BEL experience, students are

exposed to an authentic setting and practice of engineering, which may support dimensions of engineering identity such as interest (e.g., finding the work enjoyable), competence/performance (e.g., high achievement in tasks) and recognition (e.g., interacting with other engineers and being recognized as an engineer; Patrick & Borrego, 2016). For WOC in engineering, P-BEL experiences may be especially important as they may increase students' sense of belonging in these spaces (Irgens, 2019). Therefore, if universities want to enhance WOC engineering students' perceptions of their engineering identity, it may be important to actively present opportunities to engage in P-BEL or share information that will help them secure P-BEL experiences.

While there were no significant main or interaction effects of P-BEL and affinity group participation on gender and ethnic identities among WOC in engineering, there were some descriptive patterns that may merit further inquiry using qualitative methods. For example, even though there was not a statistically significant main effect for P-BEL on gender identity, the gender identity mean value scores for students involved in P-BEL were higher compared to other students. There is research that suggests women or people of color may have different P-BEL mentorships and experiences from men and White peers (Strayhorn & Johnson, 2016), however, there is little literature indicating how these experiences may support gender or ethnic identity aside from engineering identity—let alone exploring an intersectional identity. The qualitative phase allowed me to explore how participants talk about their P-BEL experiences in relation to how it did or did not support their identity.

The finer-grained analysis into the specific identity focus of affinity groups is suggestive of the potential of these groups for identity support. For instance, after categorizing the different types of identity affinity groups, I found that students who participated in affinity groups that

were women-focused recorded higher average gender identity when compared to students who did not participate in women-focused affinity groups. Similarly, students who participated in race/ethnicity-focused affinity groups recorded higher average ethnic identity compared to their peers who did not participate in race/ethnicity-focused affinity groups. Within these identity-focused organizations, these spaces are described to promote a space for students to connect culturally, develop and express their identities, and support and be supported by peers like them (Ong et al., 2018). This supports the notion that the focus of the identity affinity groups affirms the related respective identities. So far of what I identified are associations—and not causation. Thus, it is possible for students with a strong gender, race/ethnicity, or engineering identity to seek out organizations that may focus on those aspects of identity. In other words, it may not be the organizations that help initially support their identity, but rather sustain it. I explored this idea more deeply about the role these organizations have through the qualitative strand.

Together, the pattern of significant and nonsignificant descriptive results suggests that engineering identity may be strongest among students who participate in P-BEL, whereas ethnic identity may be strongest among students who participate in affinity groups. Gender identity on the other hand appears to be positively associated with participation in either P-BEL or affinity groups. Since the quantitative strand was only able to explore intersecting identities, there were some methodological and theoretical limitations to examining identity holistically. First, there is the critique of identity being measured as three discrete constructs (e.g., gender identity, ethnic identity, and engineering identity) and not simultaneously (e.g., gender, ethnic, and engineering identity collectively; Crenshaw, 1991). This is due to the way the survey was developed about asking these types of identity independently and not simultaneously within one question. Second, due to the way that identity was measured in the surveys and the fact that many affinity groups

addressed differing intersectional identities, the small sample in this study did not permit quantitative analysis of intersectionality in any meaningful way. Instead, this was examined in the qualitative strand. Additionally, the interviews in the qualitative strand allowed me to explore the significant and non-significant patterns I observed in the quantitative data. For more information on an integrated discussion of the quantitative and qualitative strand, view Chapter 5.

CHAPTER 4: QUALITATIVE DATA STRAND

Chapter 4 focuses on the study's second research question (i.e., What do WOC in engineering see as the potential role of identity affinity groups and P-BEL in helping them to negotiate their identities?), which is answered through the qualitative data strand. Using participants' survey responses in the quantitative data strand, I identified WOC who reported different participation patterns in organizational experiences to invite them to be interviewed about their experiences. The qualitative strand affords the opportunity to both explain and extend the quantitative results by exploring: 1) how students describe their intersectional identities, and 2) if or how students see participation in affinity groups and/or P-BEL supporting their understanding of their identities. The quantitative data permits an examination of simple associations between the participation of WOC in engineering in affinity groups and P-BEL with discrete dimensions of identity focused on gender, ethnicity, and engineering. The qualitative data, on the other hand, expands the exploration of identity to include representations of participants' identity in their own words, which affords the opportunity to understand the intersectional identities of WOC in engineering in more depth. Within the qualitative data strand, current students and graduates elaborate on their experiences being a WOC in undergraduate engineering, the organizational experiences in which they participated, and their current work experiences (if graduated).

Method

Institutional Context

As a reminder, undergraduate students took the survey during the midst of the pandemic in 2022 as a first- or second-year student and spent most or all of their undergraduate school years in a pandemic. Graduates were affected by the pandemic towards their last years of

undergraduate school and within their current working experiences. Thus, there was the potential for undergraduate students' experiences to be different than the graduates considering the effects of the pandemic and the related tensions with identity and ability to actively learn and participate. At the time interviews were conducted (one year after survey administration), the threat of the COVID-19 pandemic was still present, though the infection rate, mortality rate, and impacts on daily life were significantly reduced relative to when surveys were administered. However, during the semester in which I conducted interviews, there was a mass shooting that occurred at the institution's campus. When recruiting participants and before starting the interviews, I acknowledged the tragic event and centered students' well-being first before proceeding with recruitment and interviews. I offered acknowledgement of this tragedy to both current and graduated participants as it was a community stressor for past and present students.

Participants

I interviewed 19 WOC participants with ties to engineering. Specifically, my qualitative sample included eleven current students (recruited from survey responses about their activity participation) and eight individuals who graduated with an engineering degree (not represented in quantitative data strand). The current students included individuals in their second year (n = 6) or third year (n = 4) or sixth year (n = 1) of undergraduate education during the time of the interview. Graduated participants (n = 8) received their engineering degree during 2019 through 2021. Following graduation, three individuals were working in an engineering role, three individuals were working in an engineering-adjacent role (e.g., working as a postbaccalaureate fellow in design and management, working in a law firm that focused on engineering patents, and working as a plant quality manager), one individual was a graduate student in human computer interaction, and one individual was not working during the time of the interview. All

participants identified themselves as either a woman or female and used she/her/hers pronouns. View Table 4 and Table 5 for a list of interview participants' demographic information including race/ethnicity, major, summary of organizational experiences, and year in school/graduated year or work experience.

Table 4
Interview Participants of Current Students

Pseudonym	**Year in School**	**Race/Ethnicity**	**Major**	**Affinity Groups**	**P-BEL**
Samantha	2nd year	Mexican/Latina/ Hispanic	Applied engineering sciences	NA	NA
Lucy	2nd year	Half Mexican	Environmental engineering	Women-focused engineering organization	Upcoming internship
Jess	3rd year	Asian	Electrical engineering	Women, race/ethnicity, and engineering organizations	Research and internship
Crystal	6th year	African American	Civil engineering	Women, race/ethnicity, and engineering organizations	Multiple internships
Mina	3rd year	Indian	Computer science	Women-focused engineering organizations	Research and internship
Amy	2nd year	Indian	Computer science	Race/ethnicity-focused organizations	Research and internship
Esmee	2nd year	Black	Computer science	Women, race/ethnicity, and engineering organizations	Multiple research and upcoming internship
Melanie	2nd year	Asian	Computer science	Women, race/ethnicity, and engineering organizations	Multiple research
Erica	3rd year	Latina/Mexican	Biosystems engineering	Race/ethnicity-focused engineering organization	Internship transformed into undergraduate job
Ali	2nd year	Black and Guyanese	Mechanical engineering	Women-focused engineering organizations	Internship summer before college
Rose	3rd year	South Asian	Computer engineering	Women, race/ethnicity, and engineering organizations	Multiple internships

Note. Crystal was a sixth year student and Mina was a third year student graduating the year the interview was conducted. Erica identified herself as a third year student but mentioned this is her second year at the study's university. All participants identified as either woman, female, or both. Race/ethnicity were based on participants' description of themselves. The list of affinity groups focused on student organizations about gender, race/ethnicity, and/or engineering (though some participants expressed being involved in other organizations). The list of P-BEL focused on internships and undergraduate research (though some participants expressed being involved in other activities).

Table 5
Interview Participants of Graduates

Pseudonym	Graduated Year	Race/Ethnicity	Major	Work	Affinity Groups	P-BEL
Emma	2020	South Asian	Biosystems engineering	Postbaccalaureate fellow in health	Women-focused organization	Research and internship
Lynn	2020	Black	Electrical engineering	Law firm on engineering patents	Race/ethnicity-focused engineering organizations	Research and internships
Louisa	2020	African American	Mechanical engineering	Plant quality manager	Women, race/ethnicity, and engineering organizations	Internships
Jade	2021	Black American	Electrical engineering	Automation and process engineer	Women, race/ethnicity, and engineering organizations	Research and internships
Danielle	2020	Black	Mechanical engineering	Associate engineer	Race/ethnicity-focused engineering organization	Multiple research
Jennie	2021	South Asian	Mechanical engineering	Production engineer	Women, race/ethnicity, and engineering organizations	Internship
Anne	2019	Asian	Computer science	Graduate student	Race/ethnicity-focused organizations	Research and internship
Maddie	2020	Asian	Electrical engineering	Not working during time of interview	NA	NA

Note. All participants identified as either woman, female, or both. Race/ethnicity were based on participants' description of themselves. The list of affinity groups focused on student organizations about gender, race/ethnicity, and/or engineering (though some participants expressed being involved in other organizations). The list of P-BEL focused on internships and undergraduate research (though some participants expressed being involved in other activities).

Unlike the survey that only focused on current students, the qualitative section afforded the opportunity to also learn from experiences of people who graduated. The significance of interviewing graduated individuals was to gain a broader reflection across their entire undergraduate years and how organizational experiences may have impacted their current work life and identities.

Interview Procedure

Recruitment and Response Rate. To recruit participants, I emailed individuals using records from the original project's contact list across C1 and C2 (graduated individuals) and C6 and C7 (current students) of engineering students who self-identified as a woman (e.g., woman, transgender woman, genderqueer woman, genderfluid woman) and identified within one or more of the racial/ethnic groups listed (e.g., Asian or Asian American, Black or African American, Chicana or Hispanic or Latina/Latinx, Native American or American Indian or Alaska Native, Native Hawaiian or Other Pacific Islander, or mixed race/ethnicities) within their cohort survey. As a reminder, the current students were recruited from the same sample as the quantitative strand. In total, recruiting emails were sent to 116 current students and 169 engineering graduates. In the recruiting email, I introduced myself, explained the purpose of the research study, shared a link to sign up for an interview time slot, explained the compensation for participation (i.e., $50 Amazon gift card), and offered my contact information. After the participants filled out the sign-up link, I contacted them again to confirm the interview time slot and shared the consent form and Zoom information details. A reminder was sent a day before the interview.

Among the current students emailed, 29 people (25%) volunteered to be interviewed within the first two days of the recruitment email being sent. At that time I closed the sign up

portal for current students and emailed those who had not yet responded that I had reached capacity for participants. Of the 29 volunteers, 11 were selected for interviews based on the following criteria (as reported in surveys they completed a year prior). I selected at least two participants who were involved in the following experiences: 1) affinity group(s) only, 2) P-BEL only, 3) both affinity groups and P-BEL, and 4) neither affinity groups nor P-BEL. Participants were also selected to represent a range of racial and ethnic backgrounds and in cases where multiple participants satisfied all criteria, I randomly selected participants from the list. Volunteers who were not selected for participation were notified via email.

Of the 169 graduates who were sent recruiting emails, six people (4%) volunteered to be interviewed after three recruitment email attempts over three weeks. To seek out more participants, I used snowball sampling by asking graduated participants to recommend other WOC from their program who might be willing to be interviewed. Snowball sampling is "Developed as an original solution to overcome problems of data sampling in the study of hidden populations" (Faugier & Sargeant, 1997, p. 792). Since there is a small group of people who may identify as WOC in engineering, it is important to utilize their connections of similar individuals to learn deeper of their experiences, specifically the individuals who graduated. Through this snowball sampling approach, I was able to recruit two more participants. Since I had few volunteers among graduates, their participation patterns were not used as a sampling criteria. The final sample for graduated individuals included eight participants.

Interview Structure and Guideline. I conducted semi-structured interviews with all 19 participants. The interviews lasted between 60 to 90 minutes (average was 72 minutes). Interviews were conducted online through Zoom. Before the interview started, I introduced myself and asked to fill out the consent form (if not completed in advance). The participants

were reinformed of the purpose of the study, the consent form, and I answered any questions they had before conducting the interview. Participants chose a pseudonym for themselves or (if they declined to do so) were later given a pseudonym by me. The interviews were audio-recorded and transcribed.

The interview contained questions on the following main topics: description of self, intersectionality of identities, and identity-relevant experiences. I began the interview by asking people to describe themselves with words that are meaningful to them. I also asked them about their major and decision to pursue engineering, as well as how they identified themselves in terms of gender and race/ethnicity (if this information was not already spontaneously provided). Next, we discussed aspects of their identity that were most salient to them and conditions in which these aspects were salient. I then asked participants about their experiences as WOC in engineering and broadly about the spaces in which they experienced support or tensions around their identities. If not mentioned already, I asked participants to reflect about the ways affinity groups and P-BEL did, did not, or could shape their identity. Since I found in the quantitative strand that participation in P-BEL was associated with engineering identity and that participation in women-based and race/ethnicity-based organizations was associated with gender and ethnic identity respectively, I asked participants to elaborate on how their experiences may be related to their identity as a whole or specific aspects of their identity based on the participants' description. This may help clarify *how* aspects of identity or identity as a whole are related to experiences and even whether participants viewed this relation as evident in their own experiences. Lastly, participants were asked to reflect and provide advice to future engineering students and if they had any questions or comments to add. In addition to these questions, participants who had graduated were asked about their current working experience, to reflect on

their undergraduate experience, and their current participation in affinity groups or professional organizations after college. See Appendix B for the interview guideline.

All interviews were transcribed by a transcription service. Transcripts were reviewed for accuracy and corrected (if needed) by a research assistant and me. Participants' names were replaced with pseudonyms and other identifying names were removed. All participants received a copy of the interview transcript with the option to add or clarify any responses. Audio files and transcriptions were stored securely on a password protected server.

After each interview, I wrote procedural and analytical memos to keep record of my ongoing reflections, choices, developing definitions, connections, and understandings. These memos were later used to help code and/or used to generate new codes for the interview data (Saldaña, 2016).

Data Analytic Strategy

I used thematic analysis to make meaning of the interview responses. The purpose of thematic analysis is to identify, analyze, and report patterns of qualitative data through an iterative and recursive process (Braun & Clarke, 2006; Braun & Clarke, 2021). A typical thematic analysis proceeds in six stages: 1) familiarizing yourself with the dataset, 2) coding, 3) generating initial themes, 4) developing and reviewing themes, 5) refining, defining, and naming themes, and 6) writing up. The following explains in greater detail how this general procedure was employed in the current study.

Stage 1: Becoming Familiar with the Dataset. After interviews were transcribed and cleaned, I reviewed my entire qualitative data corpus including interview transcripts and the initial memos I wrote after each interview. During this reread, I jotted potential pattens to be

developed into codes and further flagged unique responses that may be useful observations to track when coding. Jottings included patterns that were observed within and across participants.

Stage 2: Coding. After the reread of transcripts and memos, I developed an initial codebook and coding plan. For the codebook, I used both a deductive (i.e., structured by aims, research questions, and interview questions) and inductive (i.e., codes developed from patterns and observations of participants' responses) process in organizing and developing the codes. Codes were established to characterize: 1) participants' description of themselves and their engineering major and 2) intersectionality of identities, and 3) experiences shaping their identities (within school and work). Codes were initially developed regardless of how salient or frequently they were observed as long as it applied to answering the research interests. Initial codes were then categorized into higher-order categories and sub-categories with definitions and examples.

MAXQDA was used for data coding purposes. For the coding plan, a total of eight transcripts (four current and four graduated participants) were coded by a research assistant and me. Discrepancies across coders were discussed in meetings and tracked in a decision log to establish consistency in coding and inform coding decisions. The final codebook was iteratively developed based on reviewing and coding the interview transcripts.

Stage 3: Generating Initial Themes. Themes are described as "a pattern of shared meaning organised around a central concept" (Braun & Clarke, 2021, p. 78). After coding was complete, I collated the codes into different topics of interest which included identity, educational experience, affinity groups, P-BEL experiences, and professional life after college. These topics were selected to aid in addressing the research question and to describe a broad spectrum of individuals' perspectives and experiences. To help identify patterns in participants'

responses within these five broad areas while retaining the context around codes, I organized a table with the central codes among each topic and added text to further highlight the context. Afterwards, I compiled the participants' descriptions or snapshots of experiences and organized them into "theme-piles" (Braun and Clarke, 2006). Initial themes were then developed within each topic, which consisted of both identity supports and challenges.

Stage 4: Developing and Reviewing Themes. In this stage, I extended the work of stage 3 to "review the viability of the initial clusterings, and explore whether there is any scope for *better* pattern development" (Braun & Clarke, 2021, p. 97). After identifying initial themes, I examined the themes in relation to each other and to the data corpus, while having the research question in mind. To help with theme development, I used Braun & Clarke's (2021) questions to guide the development and review of themes which included naming the central concept, identifying the boundary of the theme, suggesting meaningful evidence, questioning whether the data is too diverse, and discussing the general importance. During this process, I began forming initial thematic maps around topics of identity, educational experience, affinity groups, P-BEL experiences, and life after college. Themes addressed the broader experience (e.g., identity, educational experience, life after college) or the roles that organizational experiences serve (e.g., affinity groups and P-BEL experiences).

Stage 5: Refining, Defining, and Naming Themes. Within this stage, I reexamined the names of my themes and provided a definition about each theme. View Table 6 for list of the themes and descriptions. Following the suggestions of Braun and Clarke (2021), before deciding on theme names, I asked myself a series of questions about whether I can describe the central concept, identify the boundary of the theme, state the uniqueness, and how it contributes to the overall analysis.

Table 6
Themes and Definitions Across Contexts

Category	Theme	Definition
Educational experience	Lack of representation and belonging	Described how there is a lack of people who share the same identity and challenging sense of belonging in engineering
	Engineering as a neutral space	Viewed engineering as not accounting for social identities like gender and/or race/ethnicity
	Educational journey as overcoming	Learning experience was focused on overcoming the challenges within engineering
Affinity groups	Discovery of sense of belonging	Whether one experiences a sense of belonging in a women-focused, race/ethnicity-focused, and/or engineering-focused organization(s)
	Provide social support	Consisted of different types of socio-emotional and physical resources across informational, instrumental, and emotional support
	Ambivalence	Mixed feelings or tension about an experience
P-BEL	Improving engineering skills and characteristics	Consisted of enhancing engineer competence, interest, and recognition
	Affirming how I fit in	Validated feelings of one's identity in an engineering space
	Facing discrimination and isolation	Encountered biases and further experiences of exclusion
	Difficulty of applying and importance of timing	Challenges of applying to a P-BEL experience and the significance of starting a P-BEL experience at the best time for the individual
Professional life after college	Encountered lack of representation	People in the work environment did not often share the same identity as the participants
	Encountered bias	Faced explicit and subtle acts of discrimination
	Code-switching	Altered behavior to "fit in" to work culture and environment
	Importance of finding a mentor	Needed to search for a mentor to guide them through engineering
	Participation in identity supportive activities	Engaged in activities related to their values and identity

Stage 6: Reporting Through a Thematic Map. Through this process, I produced one Venn diagram (Figure 5) and four thematic maps (Figures 6 through 9). Thematic maps are a broad representation of participants and not tied to specific individual participants. More details about each theme are explained in depth in the results.

Results

The results are organized by the following sections of identity, educational experience, reasons and role of affinity groups, reasons and role of P-BEL experiences, and life after college to help address the research question. We need to first understand how participants are describing their identity to determine how experiences shapes their identity. Additionally, we need to investigate the engineering climate of a PWI in relation to affinity groups and P-BEL to understand the roles these organizational experiences serve. In this chapter, the patterns and themes that were identified for current students and recent graduates are reported together. These groups of participants were initially considered separately, but it became apparent during coding and theming that both groups described very similar experiences within their undergraduate experience. Despite being a number of cohorts apart, this similarity may suggest that very little in the engineering cultural climate has changed over the years. Ong et al. (2020) conducted a systematic thematic synthesis on WOC in engineering experiences from 1999 to 2015 and similarly found great consistency in experience across cohorts during a much longer time span. The only instance in which I separately considered data from current students and recent graduates was in my exploration of the working experiences after college, which involved only data from graduates.

Identity in Participants' Own Words

Prior to describing themes that I identified to characterize participants' description of how their experiences shaped their identity, it is important to provide a simple descriptive account of how these individuals responded to broad questions about their identity. When asked about which aspects of their identity most characterize who they are, without additional prompting participants' responses largely centered around some combination of their gender, their race/ethnicity, their focus on engineering, and/or their roles as family members or friends. Eleven individuals immediately characterized themselves by centering all of the aforementioned aspects of their identity. Four individuals centered gender, race/ethnicity and engineering in their descriptions. Two centered only engineering and their family role, and two centered their race/ethnicity and family role. View Figure 5 For a Venn diagram of participants' descriptions of their identity. In the sections that follow I explore in greater detail the varied ways participants talked about these aspects of their identity.

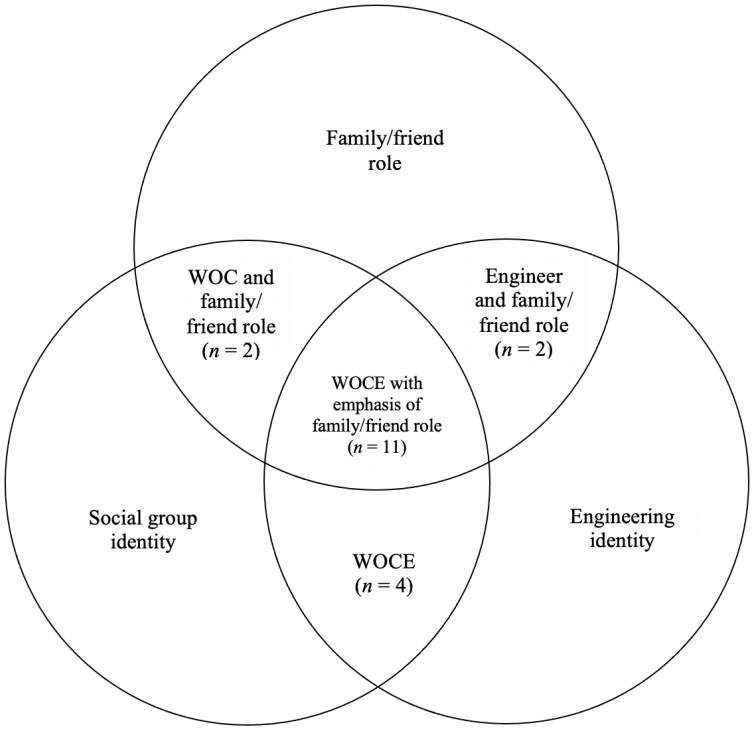

Figure 5. Initial main descriptions of identity.

Gender and Racial/Ethnic Identity. When describing their identity, nearly all participants would highlight their gender and/or race/ethnicity. Some of them used language that fore-fronted intersectionality such as being a "Black woman," "Mexican woman," and "Asian woman," whereas others described themselves in terms of a list of identity characteristics such as being a "woman," a "person of color," or their specific race/ethnicity. When discussing the importance of their gender and/or race/ethnicity, some participants framed their reflections in terms of the context of the country they are from, their upbringing, or the social climate of engineering. For example, Jess shared that she considered her gender and race/ethnicity to have different salience in different contexts. She described feeling that her gender identity was more salient to her in her home country (India) and her race/ethnicity feels more central in the United States. She described how in India, she noticed women faced more sexual harassment, whereas in the United States, she noticed there were more racially motivated shootings. Ali similarly

commented on the social climate of the world and engineering to highlight why she thought her gender was important:

> "Yeah. So especially with all of the stuff that's been going on in terms of reproductive rights and even being a woman in engineering, it's a pretty... I don't know. I notice in my classes that I'm like the seldom person pretty often. Which I don't know, it makes me happy to be able to represent, but I definitely wish I could see more representation." (Ali, Black and Guyanese[3], current student)

Finally, some participants explicitly acknowledged that their social identity was so ingrained in them that it is difficult to reflect on their impact. For example, in reflecting on her gender and race/ethnicity, Crystal shared:

> "I don't know, those two, I kind of feel like they're just built in. Not that I don't think about them, but they're kind of just already programmed in me so I don't think about them, I guess, as much as the other ones. But I definitely think they're built into my framework where I consider those all the time or consider them when I'm interacting with other people or making decisions." (Crystal, African American, current student)

Only two individuals (Anne and Maddie) did not initially center their gender or their race/ethnicity in their descriptions of self. Anne identified how being a "human" is the foremost descriptor of herself as it is first, a "neutral" term and secondly, she described feeling pressured with gender and race/ethnicity labels. Maddie expressed a similar sentiment and emphasized the value of prioritizing happiness over relying on gender and race/ethnicity identifications as important to her.

[3] Descriptions of participants' race/ethnicity employ the language they chose to describe themselves.

Engineer. When describing their identity, participants highlighted being an "engineer" or an "engineering student." Participants explained that they identified as an "engineer" because they see themselves acting or thinking like engineers, because they are employed as or studying to be an engineer, and/or because they feel proud of pursuing engineering. Identifying as an "engineering student" stemmed from discussing how they are learning to be an engineer, but not yet equipped with the working experience and skills to be identified as an engineer yet. What was interesting was that two individuals who graduated and were not currently working in an engineering role initially expressed hesitancy towards identifying as an engineer but ultimately affirmed their identity as an engineer. For instance, Louisa (who works as a plant quality manager) mentioned that she does not have the title of engineer; yet, she felt that her experience studying engineering and the lessons she learned in her program played a key role in her becoming a plant quality manager, which to her established being an engineer as a "big part" of her identity.

Family/Friend Role. The family/friend role was salient across participants with the added meaning it had with their pursuit of being an engineer. For instance, participants used descriptors such as "friend," "partner," "daughter," "sister," "aunt," "niece," and "granddaughter" to describe their identity. Participants described the relational importance of these types of roles in terms of being a role model to family members, making the family proud of their accomplishments and giving back to them one day, and being a person of support and being supported by friends and family. International students in particular expressed the importance of wanting to bring reassurance to their family for the decision of studying out of the country. Although many participants reflected on being grateful for their family and friends' support, some participants shared that they experienced significant pressure and tension in

balancing their engineering school/work life with these more relational aspects of their identity. For instance, Erica shared that she felt great pressure to successfully pursue engineering and make the right choices as the first-generation American in her family. Jess shared that her family expected her to prioritize school instead of a social life while studying in America.

It is important to mention that these identities were not the only aspects of identity that participants described with their identity. Some other aspects of identity that participants mentioned were their personal characteristics (e.g., "independent," "driven," "communicator"), religion, sexuality, international status, socio-economic status, and so on. Thus, there are more aspects of identity that are important to the participants aside from what is shown in the Venn diagram in Figure 5. However, for the purpose of this research, I focused on social identities and engineering identity due to its salience in the context of WOC in engineering.

Utility of "Woman of Color Engineer" Term. In addition to understanding how participants conceived of their identity broadly, I also wanted to learn more specifically about their perspective of the term, "woman of color engineer." I wanted to hear their perspectives about the utility of this characterization and whether it was representative of them, while also exploring the extent to which this term elicited for them intersectionality. I asked the participants how they viewed the term, "woman of color engineer," and whether it represents them (i.e., "Do you think the term, woman of color engineer, represents you? Why or why not?"). Out of 19 participants, 14 participants agreed that the term "woman of color engineer" was an accurate representation of them. However, five participants pushed back on this characterization or stipulated that it was only appropriate in particular situations/contexts. For instance, Jess explained that the label sometimes impeded on her advancement of her engineering career, such as when applying to internships as an international student. Maddie, on the other hand, found that

highlighting social identity was not necessary in an engineering setting, and instead suggested how the atmosphere is "Solves problem is the first one. Your color and the male or female, it's not the problem I think. It's the professor always focus on your skills." Jennie felt the term was too general to be useful and posited that people's experiences and specifically, their struggles, were so individualized that such labels were not a useful way to group people. Instead, Jennie sees herself as an engineer without the social labels. In contrast, Emma felt some degree of resonance for the term "woman of color" but felt less connected to the "engineer" aspect and did not see it as intertwined with other facets of her identity. She explained how her interests aligned more with studying health—hence her future pursuit of medical school: Thus engineering was only a major to her but was not an identity. Both Emma and Melanie expressed some ambivalence about whether they even identified as a "person of color," particularly in an engineering setting because of how often Asians are associated with positive stereotypes about their success and how there are a lot of Asians pursuing engineering. In understanding that tension, I was careful to use the participants' descriptor of self when appropriate, such as "engineer" or "woman engineer," throughout the rest of the interview.

While there were some individuals who did not see the intersectional term "woman of color engineer" as representing their identity, most found this identity to resonate with them. The reasons consisted of being able to label their experiences, how it intertwined with their daily life, and the distinctive experience that WOC in engineering shared with one another. For instance, Anne explained how in undergraduate school, she did not see herself as a "woman of color engineer," but now she identifies with the term because it helps with contextualizing her experiences: "I think that shift kind of helps me in finding a place for myself in this area, and it gives me a lot of the answers for the questions I could not resolve back in undergrad school." It

was important for her to now use the term to provide clarity to why her engineering experience occurred the way that it did. Similarly, Mina also felt the need to use the term to summarize her experience and promote a sense of belonging to a group in the United States. Overall, these individuals used the term to empower (e.g., Ali emphasized how it is a "barrier almost that's been broken down just by having that title"), clarify, and represent their experiences. Framing "WOC engineer" as intersectional was a meaningful and useful way for participants to understand their identity.

Educational Experience

Having given voice to the complexity of participants' own descriptions of their identity, I now turn to an exploration of their educational experiences in an engineering program in a predominantly White institution. Understanding their educational experience more broadly provides important context for their perceptions about the role of affinity groups and P-BEL in supporting their identity. I initially identified six themes that represented the participants' (current students and graduates) educational experience of pursuing engineering: 1) discriminating and isolating experiences, 2) stereotype threat and model minority stereotype, 3) community support, 4) giving back to community and being a role model, 5) coping mechanisms, and 6) focus on performance over identity. I then consolidated initial themes to three broader themes with sub-themes: 1) lack of representation and belonging, 2) educational journey as overcoming, and 3) engineering as a neutral space. View Figure 6 for the final theme mapping of educational experience.

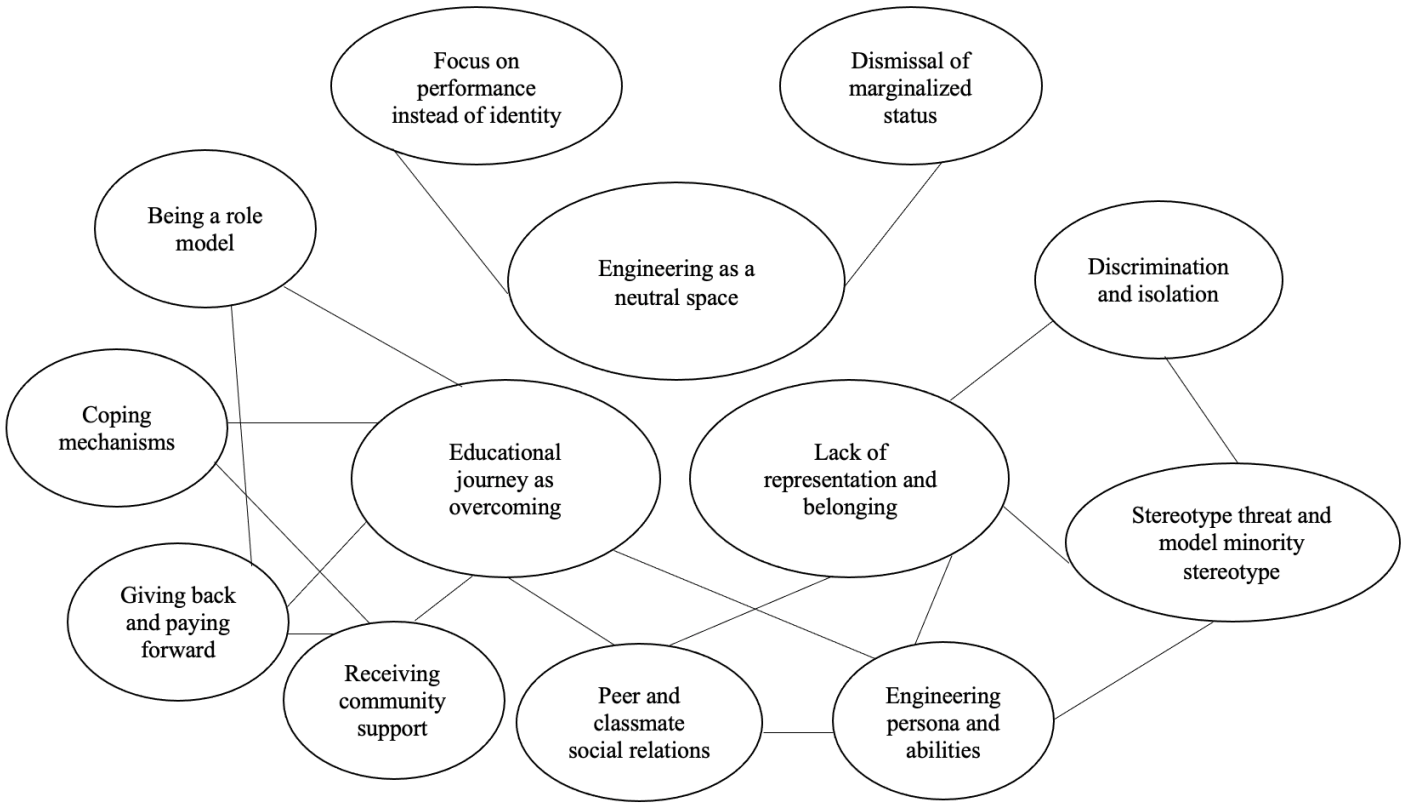

Figure 6. Themes of educational experience shared by women of color in engineering.

Lack of Representation and Belonging. The main climate in engineering spaces that participants noted was the lack of representation of individuals like them (e.g., racially/ethnically and gender-wise). Out of 19 participants, 17 participants made a direct comment about on how they do not see many people like them in these spaces with comments such as "there's not that many of us," "I'm the only [gender and race/ethnicity] person," or "there's barely any [gender and race/ethnicity]." The participants especially noted this stark lack of representation as they approached their higher-level engineering courses. They described facing discrimination, racism, sexism, and isolation while pursuing their engineering degree. Only five participants (Erica, Esmee, Emma, Jennie, and Amy) mentioned having an overall "good" experience while studying engineering, although four out of the five of them (Erica, Esmee, Emma, Jennie) also mentioned at least one negative experience related to their gender and/or race/ethnicity in their engineering studies.

Lucy, Anne, Mina, Esmee, Ali, and Erica all expressed a consistent struggle during group activities of classmates undermining their capabilities or talking over them. Classmates would be surprised when Lucy and Anne solved an engineering problem. Lucy further expressed her frustration when her classmates would dismiss her ideas, only to suggest the same idea to the group the next day. Mina, Ali, and Erica discussed instances where they would try to add to the discussion but then classmates would talk over them and not let them join in the conversation. Erica faced another obstacle of people making "snarky" comments about her accent because English was not her first language.

Several participants shared that it was especially difficult to make friends in their classes. Only one participant (Mina) attributed this difficulty to online schooling (recall the study took place during the COVID-19 pandemic), while the others noted it was difficult in general because

people did not want to be grouped with them in the first place. Jade discussed her struggle in groupwork, which is often facilitated in engineering courses: “Group work, as a Black woman, as a minority and a woman, I can't decipher which it is. But you do not want to be worked in with a group. People do not want to participate in group work with you. Every time I was not wanted to be in a group.” Even when participants were in a group with peers they thought they trusted or with whom were comfortable, some inappropriate comments came out. For example, Mina confronted one of her friends who was making stereotypical jokes about women during a group project. She admitted to struggling with confronting the problem in that bringing it up would make her seem like “she can’t take a joke.” However, she realized she would rather not waste her time and thus, has no tolerance for insensitive jokes and has been clearer on her boundaries: “I also don't want to surround myself with people who feel like they need to put you down in order to feel much better about themselves.” Anne recalled an instance when studying remotely with a partner online. She felt that her classmate had trust in her until he found out that she was a woman, then he did not treat her the same way.

Beyond injustices perpetrated by their classmates, participants also encountered bias and discrimination from their professors as well. Emma recalled how a professor confused her paper with another South Asian student in the class, despite it being a small class. Jade openly shared how her professor was deliberately marking her answers incorrect, even though they were identical to those of a White man, who received credit for correct answers. She spoke passionately about her disappointment, stating that it not only impacts her advancement, but also other minoritized students:

> “It's serious because this is actively preventing minority students from progressing, which is a huge issue. Now is it just my paper that I'm the only person correcting this issue? Or

> is it every minority student that they're actively failing essentially? This could be the make or break between passing and failing a course or graduating or repeating a course. This is thousands of dollars per class on the line and then an entire degree on the line." (Jade, Black American, graduate)

Lynn elaborated on a challenging instance of a professor telling her during office hours, "Well, if you don't know this question, there's really no point in you being in my class. And there's really no point of you being in engineering. You might want to consider changing your major." This instance challenged her belonging and competence, which led her conclude to "I didn't feel like they wanted me there." Overall, these women were describing a lack of belonging and feeling singled out.

A few participants shared that even family members displayed microaggressions against them based on their gender and academic pursuits. Melanie shared how when men received higher grades, her mother would make a comment about knowing why that happened (implying her lower grades were related to her gender). Also, her cousins who are in computer science would make jokes about her learning about computers and coding at a young age. Melanie described how these instances partly motivated her to pursue computer science: "it was a reason for me to go into computer science, just to prove them, prove to them that I can do this, and I can probably do it better." Furthermore, Rose expressed uncertainty about finding a job in the future, yet her brother stated something similar to "don't worry, you're a girl and you're Brown, you'll be fine," which Rose found to be problematic.

Alongside the lack of representation and the pressure of being the only few people representing their gender and race/ethnicity, these women faced stereotype threat and/or struggled with the model minority stereotype. Stereotype threat is the fear or experiencing

psychological distress of confirming a negative stereotype about their gender and/or race/ethnicity (Steele & Aronson, 1995), while model minority stereotype is the assumption of Asians and Asian Americans as high achieving individuals who were able to overcome acts of discrimination (Lee, 1996). Esmee experienced stereotype threat when she encountered career fair recruiters and their assumptions of people within her social group and how "nerve wracking" it was to be under those assumptions. Mina illustrated the consequences of the model minority stereotype when she did well on a task:

> "People just assume that girls or women are dumb in tech, or you don't know what you're talking about, that sort of thing, and then you show them that you know what you... Like, oh, yeah, I know what I'm doing, that sort of thing. And then they're not as impressed as they would be if you weren't a woman of color, because as an Indian, they just expect it from you. So then it's like, I'm losing on two ends." (Mina, Indian, current student)

Altogether, the women felt the need to challenge or combat negative stereotypes concerning their gender and race/ethnicity. These pressures were also compounded by instances of imposter syndrome or inferiority complex that the participants faced regarding their engineering competence. Some participants questioned whether they were selected in engineering based on need (i.e., enhancing diversity) instead of merit (Lynn, Anne), whereas others grappled with feeling behind when others in the program appeared to be performing better or had more engineering experience (Esmee, Jennie, Melanie). Overall, these stereotype threat and model minority stereotypes challenged participants' view of themselves and whether they were fit to pursue engineering.

Engineering as a Neutral Space. A small number of participants articulated a view of engineering as a neutral space in which gender or race/ethnicity is not central, but instead takes a

backseat to one's ability as an engineer. For example, Maddie spoke about how she does not see the professors or students treating people differently based on their race/ethnicity or gender. Instead, she emphasized the focus is solely on *how* to solve the problem instead of *who* can solve the problem.

> "So in the classmates I don't see because you are male or female, we feel too many difference. And whatever your color, I don't feel too many difference. If you have any problem, they'll help you. I think because in electrical engineering, the problem is so difficult you can't just solve it by yourself. So we're almost like a group to solve this problem." (Maddie, Asian, graduated)

Samantha, on the other hand, explained how she tried to not look at her classes from a marginalizing lens: "I feel like I don't really think about all of those things where I don't want to make myself feel even more vulnerable than I already am… Unless I think about it and then I look at it, but it's not a thought that I'm walking into a class with kind of thing." These individuals viewed their engineering performance without consideration of their identity for their success or challenges. Specifically for Samantha, although she was aware of the lack of representation, she actively sought out ways to avoid being reminded of her marginalization.

Educational Journey as Overcoming. Despite the challenges faced in the engineering school experience, there were instances where the women's narrative centered on overcoming the lack of representation and developed feelings of belonging: Their story was one of triumph rather than one of struggle. These stories often included a description of developing their own community supports through peers, teammates, and involvement in a variety of organizations. The role of organizations (specifically affinity groups and P-BEL) will be taken up in greater detail in the next section but peers more generally played a central role in narratives of

overcoming. For some, like Emma and Crystal, the peers who supported their overcoming had a shared identity (being one of the few WOC in the space) and this shared identity was critical. For others, like Melanie, it was important just to have support from people and did not necessarily matter if an identity was shared:

> "The female friends that I do have on campus, and the ones that I've made in this industry, are generally so supportive of me, and I'm so supportive of what they do. I never felt the gap in between the male and the female part of the engineering aspect. Even the male friends that I made here are super supportive." (Melanie, Asian, current student)

Participants who shared a narrative of overcoming consistently emphasized the importance of finding a role model. Some found their role model/mentor in a professor/advisor role and others found them through organizations in which they were involved (to be described momentarily). For some individuals, beyond just finding any person who will listen and understand, it was pivotal for them to have found a mentor who they perceived as similar to themselves. For example Lynn, Anne and Crystal all attributed their overcoming stories in part to mentors who were in a higher position than they were and excelled in engineering, but also shared the same gender and race/ethnicity. Lynn described how she finally found her "Black unicorn," which was a Black woman in the electrical engineering department: "I will say once I finally found someone who actually looked like me, and who was down to earth and not high-and-mighty, it just really changed my life. Yeah. Yeah. That's the highlight of undergraduate." Anne also discussed how finding a role model who she perceived as similar to herself positively impacted her experience, "And for me personally, having a role model like that in a way gives me a different perspective on thinking about my identity. Because before that, the identity of

being a female student in engineering college, the female part is kind of missing. But having a professor has kind of helped me fill that blank."

Participants also recognized that they too have the honor of being a role model to others by pursuing engineering. They understood that they are currently or soon will be a role model for their family members, their peers in organizations, and to the youth who they get to connect with through engineering experiences. For example, Louisa explained how she gets to set an example for younger students she taught and her former teammates from high school. She expressed getting a sense of fulfilment being the type of "go-to" person that people can reach out to when needed. Crystal, Jade, Danielle, and Ali shared that although they are the only few people of their identity within these spaces, they are honored and happy to represent. Beyond the satisfaction of being an engineer, participants who shared a narrative of overcoming also held hope that their status as a role model could lead to greater diversity in their field.

Finally, participants described a variety of coping mechanisms that they learned that helped them through engineering which is intertwined with the community support. There were four ways that participants engaged in coping mechanisms: 1) talking about the problem, 2) learning more about the topic and their identity, 3) confronting the problem, and 4) passively accepting the situation. It is important to note that there is no right or wrong way to cope with personal challenges and my discussion here does not intend to present any of these strategies as "better" or "worse." For most individuals, their way of coping involved talking about the problem. This meant that they confided in someone, such as a friend, family member, or mentor, to seek advice or sought to be understood. Crystal initially felt that she did not belong because she was a different race, gender, and age ("super senior") than most of her peers, but talking with her advisor (who is also an African American woman) and peers, she began to change her

mindset about how she should approach school: “I'll say not until recently that I actually look at it from a different perspective of I'm glad I can be that person and I know that I put in the work to be there, so I deserve to be there and I shouldn't put those thoughts in my head because I made it this far.”

Many of the people who did not have a mentor (e.g., Danielle, Emma, Lucy) mentioned relying on family and friends. Rose, Anne, and Lucy emphasized the importance of being friends with people and sharing stories with people who are not in engineering (which stands in contrast to students’ need in some instances to connect with folks inside engineering). Lucy described these friends as supportive and encouraged her to keep going or “stick up for yourself.” Rose described shifting her perspective in thinking, such as how there are other majors who are also experiencing a lack of women of color in these educational spaces or learning from experiences of people who have diversity in their educational spaces. Anne emphasized how competitive the engineering field is and that she is more willing to share her personal experiences with people outside of engineering:

> “Yeah, well, being in the engineering department, you feel like you are competing with other people, especially when knowing that that student is also an engineering student. So sharing the experience, especially unpleasant ones, still put you in a vulnerable position. But when being outside of that field, you have more, I guess, freedom in doing so because everyone is from different backgrounds. People are not a competitor of yours, so I felt more comfortable doing it.” (Anne, Asian, graduate)

Aside from generally sharing their challenges with someone they trust, some sought to learn more about defining or labeling their challenges. For learning more about the challenges, Anne and Jess wanted to dive deeper to uncover what discrimination and biases they went

through during their educational experience. For Anne, it was the importance of being able to identify and label what she went through, which even motivated her to take courses that focused on the topic of diversity. Jess talked to a therapist to overcome an experience with a biased mentor from her internship. She learned more about how to deal with the situation and how to approach it as to how her identity should be used as a strength.

Some participants were torn between confronting biases or passively handling the situation. In confronting the problem, these individuals took matters into their own hands (as Lucy stated, “I literally took this out of my group member's hands and fixed it”) or courageously brought up the issues to their professors or supervisors. In passively handling the situation, it was a mixture of acceptance and surrender of the idea that there will not be many WOC in engineering, as Danielle stated, “it's something that I think that I'll just forever have to overcome.”

Role of Affinity Groups: “This is How I Can Be Me”

In their description of their educational experiences as women of color in engineering, participants spoke about the importance of seeking spaces where they felt they belong and their identity is supported. As described above, these spaces were often created by informal friendship networks, faculty members, or other mentors. For many participants, formal affinity groups also served this important role. These types of organizations are of central interest to this study: In interviews I explored with participants the role that affinity groups did or could play in supporting their identity as they defined it. The reader will recall that interview participants were selected based on their survey reports of engagement (or lack thereof) in affinity groups and P-BEL. Because one year elapsed between the survey administration and the interviews, many participants had different participation profiles than they reported in the survey, with all but two

(one current student and one recent graduate) reporting having engaged in both affinity groups and P-BEL. They described reasons of feeling "lazy" to participate or a strong sense of obligation to only focus on engineering studies. Analysis focus on the themes that emerged from participants who did have affinity group experiences to draw upon in the interviews. Tables 4 and 5 represent participants' engagement experiences as reported at the time of the interview.

Through coding of the discussions of participants' reasons for engaging with affinity groups and their reflections on how these experiences may have supported their identities, I initially identified four themes to represent participants' reflections on the role of affinity groups: 1) social support, 2) belonging, 3) confident and prouder version of myself, and 4) ambivalence. After some refinement and review of the themes, I consolidated to three themes: 1) provide social support (with subthemes of informational, instrumental, and emotional support) 2) discovery of sense of belonging and 3) ambivalence. These themes also inferred instances of supporting and/or challenging identity. Figure 7 presents a map representing these themes. Participants participated in a number of different affinity group experiences, such as cultural or international organizations, academic programs with a focus on a shared identity, engineering organizations, or an intersection of organizations (e.g., women-based engineering organization).

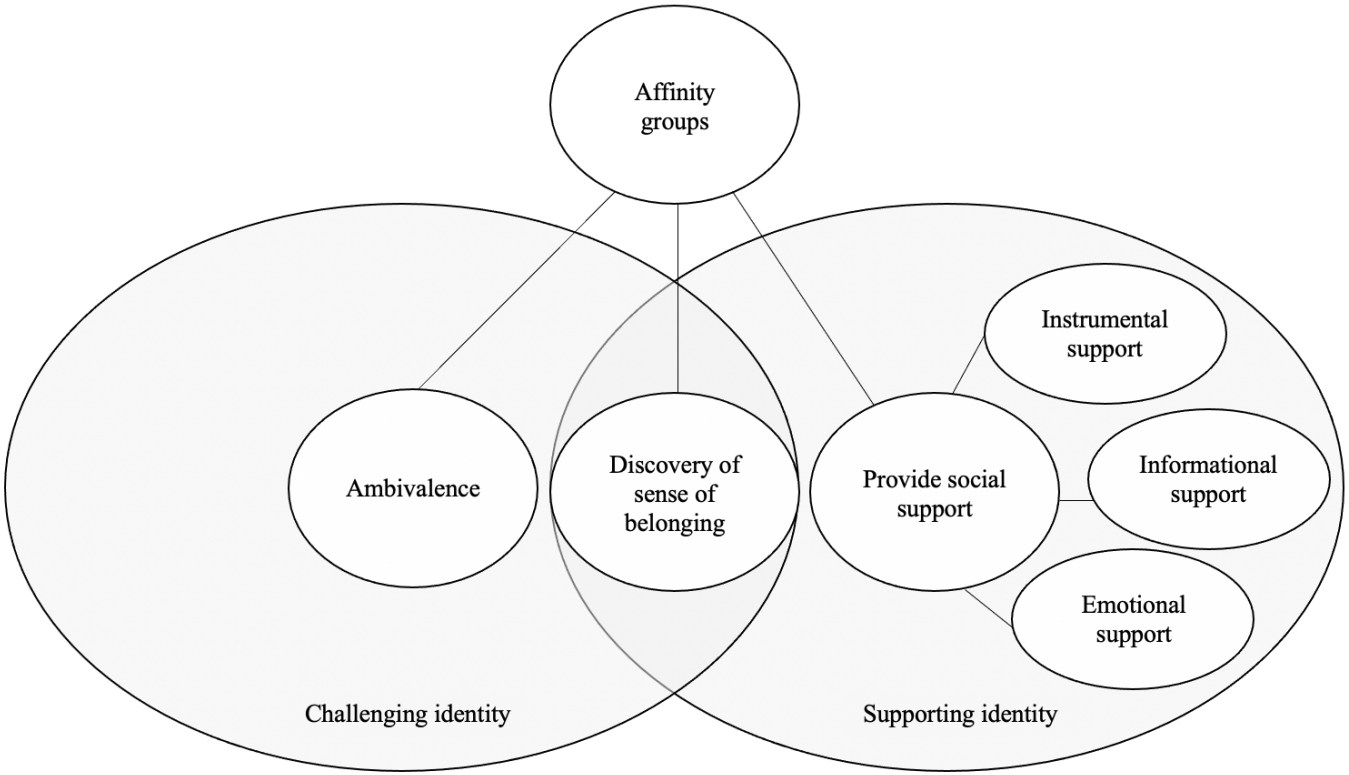

Figure 7. Themes of affinity groups and role among women of color in engineering.

Discovery of Sense of Belonging. Participants reported experiencing a deep sense of belonging, often at their first encounter with identity-based affinity groups. For example, Lynn shared:

> "They had a meet and greet. It was my freshman year on campus, because I had never heard about [Black and engineering-focused organization] before I got to college and the people were so warm. They were so high energy and I'm like, 'Man, I want to be a part of this,' but it was just a community. It was just like, 'Come as you are. Just be who you want to be.' It was so refreshing to see just Black women and men that willingly wanted to be an engineer and willingly wanted to help you with your classes and pass down their old recommendations for who to take as a professor or where should you go study, those things that you don't really think about. Yeah, it's the best thing ever." (Lynn, Black, graduate)

She eventually became a board member of the organization to continue promoting that supportive community, which aligns well with her view of herself as a helper. Amy sought out an identity affinity group as a strategy for combating homesickness. She described the Indian organization she was a part of as feeling like home: "because it's surrounding by our own people and the food and the music, the ambiance, and everything. That made me really get attached to them."

When participants reflected on the ways that affinity groups that centered their gender, race/ethnicity and/or professional interests shaped their identity, they all mentioned the importance of being surrounded by people similar to them. Lucy discussed the importance of participating in a women-focused engineering organization, which, as it turns out validated her as a woman and as a person of Mexican heritage:

> “I think it's really refreshing to look around the room during club meetings and seeing other women of color and other women that I know for a fact are supporting me. It's also nice because there are times when we get to know each other and I'll mention something about how I speak Spanish or how my family lives in Mexico, just little things about me being Mexican and how interested these people are to learn more about me, I think that's really cool. And also just having other girls on my side that I know I could always go to if for any reason I have an issue or if I need help or advice. It's just really nice to have that network of girls that are just very supportive and always willing to help and always willing to answer questions.” (Lucy, Half Mexican, current student)

Despite the feelings of belonging that many participants attributed to affinity spaces, becoming involved in them was not always easy. Jennie and Emma expressed a sense of insecurity or hesitation about participating in organizations that centered engineering or gender. Emma described how since she had different interests (health professions), she felt that she would not be good enough to be surrounded by what she thought were successful engineers. Jennie described a similar struggle connecting with other students in a women-focused engineering organization, which prevented her from joining:

> “I went there and I spoke to all these girls and they were all so nice and so confident. They weren't... It's the same thing from [women-focused engineering organization]. They were really great, but I felt like I just could not, I wasn't there yet. They were miles ahead of me and I was trying to run and catch up, but I felt like I just was not going to get there. I ended up not doing it.” (Jennie, South Asian, graduate).

For Emma and Jennie, it was hard to feel like it was the right fit for them to connect with others because they lacked confidence in their engineering skills. Although Jennie did continue

on an engineering path, Emma decided to lean into her interest in health and pursued a different career. Crystal expressed the feeling of imposter syndrome ("I don't think I'm smart enough to do these things,") and further expressed genuine concern that these supposed "safe spaces" that also had an engineering focus would be replicative of her classroom experiences: "Oh, it might be the same function as how my classes are. So I might feel uncomfortable or inadequate in these different spaces." She expressed her hesitation in terms of her social identity conflicting with her engineering identity. Anne described similar tension between aspects of her intersectional identity that led to her non-participation in organizations that are explicitly designed to support it, and even went so far as suggesting that involvement in such organizations may result in further vulnerability:

> "And also it felt weird to me that there's no such groups like male in engineering, but there is a grouping, female in engineering. Personally, I feel like it puts me in a vulnerable position for just joining those groups. So for me, not participating in those just makes me feel I was being normal. I know it's a bad word to use in this scenario, but I guess, at the time, what I really wanted was to be like other students, especially other male engineering students." (Anne, Asian, graduate)

Therefore, for some participants, this discovery of sense of belonging supported their identity or brought to question of their identity. Affinity groups were seen as both a source of belonging for students with intersectional identities and potentially a space where their marginalization may be further spotlighted. Although, there were some types of affinity groups that participants did not connect with, they were able to find support in other affinity groups for developing what they wanted or needed.

Provide Social Support. Beyond simply creating a space where others "look like me," participants described affinity groups as sources of different types of social supports including informational, instrumental, and emotional support. Whether they were describing their experiences in affinity groups based on gender, race/ethnicity, engineering, or some combination of the three, participants often spoke about the impact of their affiliation in terms that suggested all three types of social support. It is noteworthy that the lines distinguishing these types of support are not always clear, based on my own coding efforts and literature that is included in my discussion. It was at times challenging to define the boundaries of these particular sub-themes because there was some overlap. Nonetheless I have chosen to retain these subthemes because they do capture some of the complex ways participants talked about support, and this particular framing as some conceptual basis in the literature.

Informational Support. Louisa, who grew up not having an engineer to look up to, had a program mentor or leader who was also a Black woman who taught her about professionalism and gave her advice. The advice not only helped her to become socialized to the field of engineering, it also supported her pride in being a Black woman. Jennie wanted to learn more about different career options in engineering and used mentorship credits in her women-focused collegiate engineering program to connect to women in the engineering field and leverage their expertise, peppering members with questions like: "So how's your experience been? Do you have any advice for me? What are three things that you think I should know before I start my first job?" The knowledge she gained about her career options and navigating her path proved to be incredibly helpful.

Instrumental Support. Participants shared that their affinity groups provided them with various types of instrumental support including services (e.g., connecting to physical and human

resources) and physical goods (e.g., financial expenses). For instance, Amy shared about learning how to do taxes through her international organization. Crystal and Lynn gained financial support, for instance, to help with buying books, scholarships, or funding to study abroad. Additionally, the organization connected them to valuable human resources (from within and outside of the organization) that could help with studying or answering questions. Crystal shared about an organization she participated in high school and continued in college that helped her connect to people who will best answer her questions. Additionally, Melanie was in a women-focused engineering organization that provided a formal mentor/mentee peer opportunity. Danielle had study groups with people she met through her Black and engineering-focused organization.

Louisa gained both instrumental and informational support from participating in an engineering program which supported students financially and provided opportunities for research-based professional development and a cohort experience. During her senior year, Louisa was unsure whether she would be able to graduate due to financial concerns. When she described her concerns to her mentor of the program, the mentor reassured her how the program can help with the financial support for her to graduate and encouraged her to ask for help when she needed it. This instrumental (financial) and informational support (advice) helped her "break down the stereotype" of acting like a strong, Black woman who did not depend on asking others for help. Louisa recalled the life lesson she learned from that moment:

> "From that day on, they don't know how big that was for me, just knowing that, hey, people don't know you're struggling if you don't tell them. Yes, you have everything together, that's the personality you want to portray to people. But at the same time, if you

need help, ask for it. They don't know how big that was. That taught me not to be superwoman anymore." (Louisa, African American, graduate)

Emotional Support. For some participants, being involved in affinity groups was a way to socialize and decompress while studying engineering in college. Beyond that, they sought shared understanding and empathy among their peers and mentors/advisors. For instance, Amy who was close to facing an academic dishonesty report was able to confide to her international advisor and gained comfort in the situation. From experiencing bias and discrimination, participants went to peers to share their encounters. Through sharing these stories, they received reassurance that the problem was not on them, but the person being discriminatory. For example, when faced with friends who made insensitive jokes, Mina drew support from a women-focused engineering organization: "And they've been really supportive and told me that you are not really wrong for thinking that. And yes, any person would be annoyed in that situation. It's not just you, so you're not just being this person who cannot take a joke." Mina also discussed the importance of being able to provide the same emotional support towards others in the organization as a mentor role.

The broad social support provided by affinity groups clearly supported participants' identity. Amy participated in organizations and events focused on her Indian culture and being an international student, where she found friends and a community of people to support her. She shared that attending these events made her "proud to be an Indian." Crystal described her experience in a Black women organization in terms of reassurance and encouragement: "We always uplifted each other, gave each other encouragement, gave each other opportunities whenever we seen one. So I think it just felt like it functioned as a safe space for me to be a STEM major, engineering major, and also just a woman." Mina described a different way her

identity got affirmed through participating in affinity groups and how she learned she could be herself:

> "I feel like a big problem I had initially, and even right now, is I don't know how to behave in a lot of situations, a lot of new situations, and the only people around me are boys…That's not me. It's just not a part of my personality to behave in that way. So I don't know who to look at. I don't know who to emulate. That's the issue, is that I don't know who to look at to pick up on the cues, to understand how to behave in certain situations, whether it's hackathons or career fairs, or just different social instances like that, or how to ask for help and help room, how to portray myself, things like this…Okay. So being a part of [women-focused engineering organizations] all of these things helps you pick up on those cues because you are surrounded by other females. And I think that's another reason why I feel so connected…This is how I can be me and not trying to emulate this other guy or these boys." (Mina, Indian, current student)

Participants often described affinity groups as affirming their identity or allowing them to better express who they are in an identity space. It was important for the participants to be in a space where they felt more represented and heard. Alongside these identity-supportive descriptions, several participants' descriptions also suggested a degree of ambivalence about the role of affinity groups in developing or supporting their identity. I turn to a discussion of this theme next.

Ambivalence. Out of 17 participants who were involved in an affinity group, seven mentioned experiencing ambivalence within the organizations. Specifically, participants described a disconnect between their expectations and their experience in these groups. Several participants expressed surprise and disappointment that even within organizations that are

specifically designed to provide a supportive environment for women and/or persons of color, they found themselves the target of insensitive comments or bias based on their gender and/or race/ethnicity. This even extended to earlier prior educational experiences. For example, when Jade first entered an engineering club during her community college years, people assumed she was lost. She reflected on having similar encounters in other STEM spaces too. Although, she saw value in the club and even eventually held the office of vice president and president of the club, she expressed feeling embarrassed and feeling like she did not belong there, which is directly contradictory to what these organizations are intended to provide. Thus, this shows that there is no space completely free from people's biases—even ones that tries to promote a uniting front.

For some participants like Esmee, Melanie and Jade, their ambivalence stemmed from the fact that the affinity groups to which they belonged supported some aspects of their identity but not others. For example, Esmee acknowledged that the women-focused engineering club she belongs to was important to her, but still wished for more diversity: "That's one of my favorite clubs to be in. But I'm the only Black person." Melanie discussed how challenging it was to find women willing to participate in a hackathon, despite her active recruitment, she justified it may have been personal preference but wishes to see more women in general involved. Jade mentioned how during a women-focused engineering panel, a person asked the panelists of White women whether they encountered any obstacles because of their gender and identity. They responded that they did not, which left Jade unsettled knowing that these women's experiences were likely not representative of or similar to WOC.

In general, these ambivalent feelings seemed to challenge or create tensions related to their maintenance of a wholistic, intersectional identity. Altogether, it was their gender,

racial/ethnic, and engineering identity being challenged when participating in certain types of affinity groups. This ambivalence prevented some participants from initiating or sustaining participation in certain affinity groups, whereas others sustained participation while acknowledging ongoing tension.

Most of the participants I interviewed had experiences with affinity groups that were characterized by a sense of belonging and social support. At the same time, some of these women also had experiences in affinity spaces that left them feeling ambivalent about the extent to which these organizations could effectively support their intersectional identities as women of color in engineering. For some, these spaces left them doubtful about their competence as an engineer, which threatened their sense of belonging in these spaces and at times, even prevented their engagement in affinity groups at all. In engineering programs, students are often encouraged or required to engage in any number of profession-based experiential learning (P-BEL) opportunities like internships and research experiences to enhance their engineering understanding in authentic contexts, which could potentially ameliorate (or exacerbate) student concerns about their competence for and identification with the field of engineering. I now turn attention to analysis of the role that P-BEL might play in supporting identity among WOC in engineering.

Role of P-BEL Experiences: "This is Exactly What I Needed to See"

Participants' reflections about how their P-BEL experience influenced who they are as a person were coded, and themes were identified using processes defined in the method section of this chapter. I initially identified three themes: 1) supporting engineering persona, 2) navigating social environment, and 3) timing of securing a P-BEL experience. After some refinement and review of the themes, I narrowed to four themes: 1) improving engineering skills and

characteristics, 2) affirming how I fit in, 3) facing discrimination and isolation, and 4) difficulty of applying and importance of timing. Navigating social environment got separated into two themes instead (affirming how I fit in and facing discrimination and isolation) because how salient participants highlighted both encounters of facing a challenging situation while navigating their engineering journey. These themes also inferred instances of supporting and/or challenging identity. View Figure 8 for a thematic map on P-BEL experiences. Participants participated in internships or undergraduate research or research internships or other apprentice type of experiences. Tables 4 and 5 summarize the P-BEL experiences of current students and graduates, respectively.

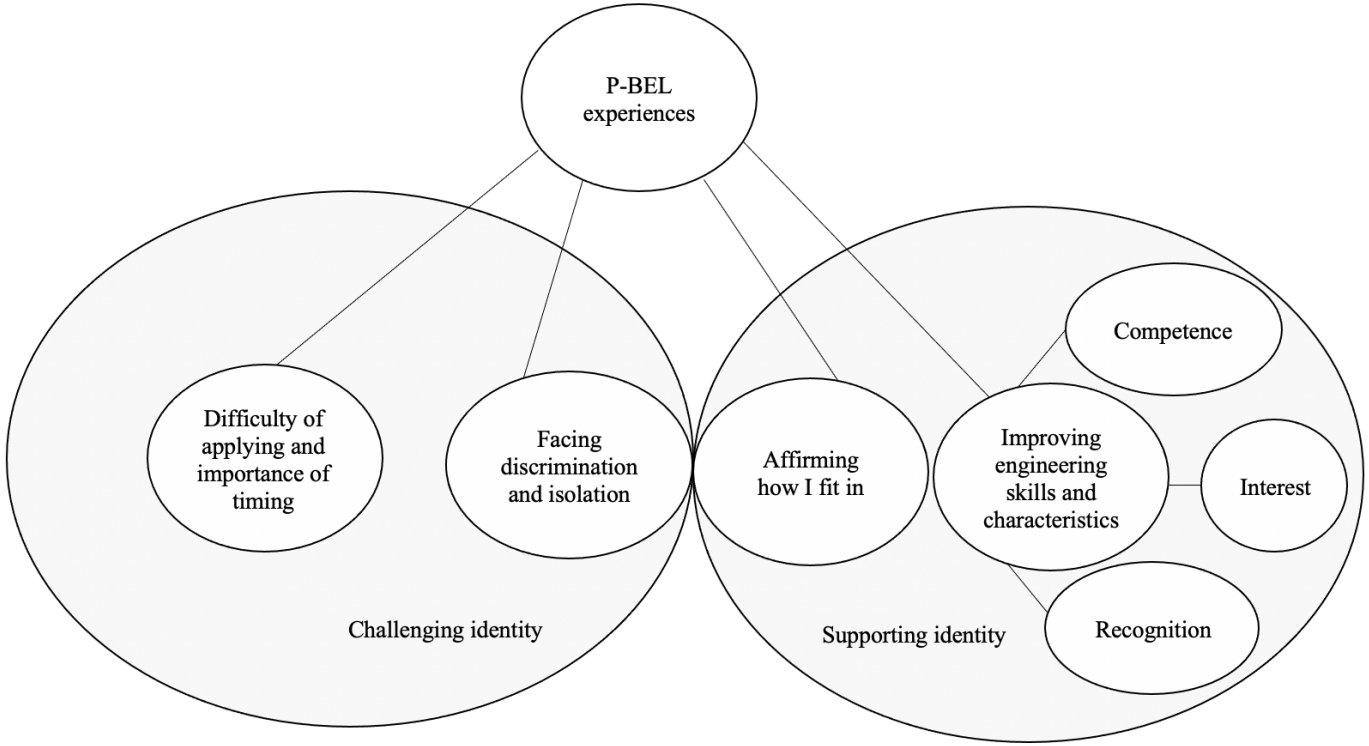

Figure 8. Themes of P-BEL and role among women of color in engineering.

Among all the participants interviewed, only two reported having no experience in any form of profession-based experiential learning. These were the same two women (Samantha, a current student and Maddie, a recent graduate) who reported having no experience with affinity groups. Both women expressed that engagement in P-BEL is important for one's career development. Maddie shared that she was not aware of this importance as an undergraduate until it was too late to take advantage of such opportunities. Samantha, a second-year student, aspired to hold an internship before graduation, and at the time of the interview was focused on an upcoming study abroad program, which will be focused on engineering.

Improving Engineering Skills and Characteristics. Perhaps unsurprisingly, one of the most common themes in the interviews was that their P-BEL experiences served to make them better engineers and set them up for career success. Participants acknowledged their desire to participate in P-BEL because they knew it would look good on a resume and help them get a job. Beyond serving as a valuable credential on one's resume, participants also talked about how their engagement in P-BEL helped them develop their identity as engineers through dimensions of perceived competence, interest, and recognition.

Competence. Crystal shared how her internship gave her the opportunity to develop a degree of trust and confidence that she was an engineer. She was given the responsibility of making plans and talking to contractors, which she described as follows: "I think that molded me to feeling more confident as an engineer." Melanie and Anne also shared that participating in engineering research and their internship strengthened their confidence about doing well in the field.

Interest. P-BEL experiences (internships in particular) also served to affirm participants' interest in engineering and/or provided them opportunities to develop new interests related to

engineering. Jess held a series of contiguous internships in the automobile industry, primarily because she became increasingly interested in self-driving cars. Participants like Mina were interested in gaining more general experience in industry. Esmee, on the other hand, became very interested in a particular company, and this drove her desire to pursue an internship there. Melanie learned through a research assistantship that she preferred coding over theoretical computer science, and this resulted in her moving to a different research lab. For these participants, P-BEL experiences was their way of figuring out their interests and furthering their development.

Recognition. Beyond the development of particular skills and interests, participants described how P-BEL experiences helped them to earn recognition from others as an engineer and even build reassurance of seeing oneself as an engineer. Louisa, who participated in a teaching position for a math class through a program, had students perceive her as an engineer, which led her to also reaffirm her belief that she was an engineer. Mina was also a teaching assistant for a math course in college and she expressed the feeling of satisfaction when she was able to assist the students in their math problems. She explained how there are many instances where one has to prove themselves in engineering, and this is one that felt that she was an engineer. Esmee shared how it was important for her to tell others she was an engineer and that it was important for her to identify by that term.

Overall, one of the reasons participants expressed for participating in P-BEL was to gain engineering experience. Learning the skills and qualities of an engineer supported their feeling of personifying an engineer. Participants even sought out more experiences like internships or undergraduate research or a combination of both to gain more engineering experience.

Affirming How I Fit In. Participants described using internships and undergraduate research experiences to explore how the engineering work environment might suit them. For some participants, they were surrounded by someone they could look up to and/or developed productive peer relationships within the experience. For instance, Lynn shared how she met a kind recruiter in her internship and was welcomed in the space. This allowed Lynn to process that there was space for her in this engineering working industry. Rose shared how there were two internships she participated in and how being in those experiences together helped her gain a better understanding of navigating the working environment. For instance, she learned how more questions would be asked about her background because she was one of the only WOC in the space:

> "And so we had a lot of interesting conversations that weren't necessarily work related. And it was everything from just hobbies, to politics, to backgrounds. And again, a lot of questions about my background just because I was the one that was kind of the outlier in that environment." (Rose, South Asian, current student)

Rose learned how to facilitate conversations of what she feels comfortable in sharing with colleagues. A few participants discussed having a mentor or advisor that shared a similar identity to them and the importance of seeing someone like them in a higher position in the engineering working environment. There was only one person (Lynn) who matched by gender and race/ethnicity within her undergraduate research experiences in college. Louisa, however, shared how even seeing someone who was a woman plant manager was enough to prompt her confidence in becoming a plant manager at her current company:

> "That's where I was able to see they had a female plant manager. I was like, wow, this is exactly what I needed to see. I said I wanted to be a plant manager, but I didn't see any

women doing it yet, and she did it flawlessly, and that made me even more comfortable stepping into the role that I stepped into with the company that I'm at now." (Louisa, African American, graduate)

Anne and Erica described the experience as feeling comfortable because of how their manager or team were more aware of diversity. Anne described how being in the internship, she was surrounded by people who just focused on the work and were attentive to her ideas. She described it may be that the people she was surrounded with had professional experience. Erica similarly shared how her boss was someone who was aware of social issues and was educated on the struggles and being someone to help the community.

Facing Discrimination and Isolation. With a few notable exceptions, affinity groups were typically seen as safe spaces where participants could seek advice and support about their experiences with discrimination. In contrast, several participants described their internships and research experiences as places where they experienced discrimination and isolation. Jess was one of the participants who mentioned going to therapy to seek counseling to help her deal with a research internship where she was the only woman in the space. During her internship, she faced a mentor who laughed at her for not knowing an answer, who distrusted her work by checking every detail (assuming it was incorrect), and questioned her office etiquette. With the help of her therapist, Jess was able to discuss these concerns with her supervisor and the situation improved afterwards, but she was clearly and understandably disappointed that this happened in the first place.

Amy similarly shared about working with a research graduate student who is a man and how he ignored her efforts in setting up meetings to present her work. Anne's internship advisor was a man that provided suggestions about how to be more successful in the field being a woman

while also advising "not to do certain things or try something else." Ali described an experience at a VA hospital where she would get "dirty looks" from the patients which she attributed to her being a person of color. Crystal's internship experience involved what she referred to as "locker room talk"—insensitive remarks that made her feel uncomfortable and needed to address those issues with her supervisor.

P-BEL experiences stood out as presenting unique tensions for many participants. On the one hand, they provided WOC with invaluable professional experiences that strengthen their resumes, build up their confidence, help them begin to see themselves as "real engineers," and help them identify ways they can belong in an engineering space. At the same time these experiences expose them to discrimination and isolation that may have challenged their identity as a WOC in the space pursuing engineering. In addition to these broadly positive and negative depictions of the P-BEL experiences themselves, an additional theme emerged among a number of participants regarding the challenge of planning and timing one's engagement in P-BEL experiences. This theme is discussed next.

Difficulty of Applying and Importance of Timing. Some participants described the process of securing their P-BEL experience as challenging, mostly referring to internship experiences. International students shared how difficult it was to secure an internship as an international student because of funding and visa constraints. Thus, additional barriers to access exist for WOC who are also international students. Erica, a U.S. citizen, described a different kind of challenge in securing internships. She stated how despite having a strong resume, she struggled with finding an internship and even compared resumes with her boyfriend who is a White man:

> "I was applying, applying, applying to a ton. And I only heard back from a few of them and I barely got interviews. But when I compared it to my boyfriend's, who is your, I guess, stereotypical White man in engineering, his resume was worse than mine…I think he got interviews for every single one that he applied to with worse skills than mine. That's something definitely that I did notice. I don't know for me if it was because I was a woman or because I was a Latina." (Erica, Latina/Mexican, current student)

A different challenge concerned carefully timing internships at a point in students' development when they were ready to benefit from them. Esmee and Melanie lamented that they may have applied to research experiences too early in their educational career. They described how they did not feel prepared to participate in research because the topics were too advanced for beginning college students. During lab meetings, they explained the feeling of not having anything to contribute and not learning anything of importance. Both students stopped attending meetings and ended up switching labs where the focus of the new lab tasks appeared to be better matched to their current skill set, which also enhanced their interest.

Maddie, on the other hand, acknowledged applying to internships or research experiences later than she would have liked. For most of her undergraduate career she was under the impression that classwork must always take priority over any "extracurriculars." It was not until her senior year that she realized how critical internships were to her career, and at that point it was too late for her to get involved. She discussed how in her culture, working experience was often associated with the first job one receives after they graduate college.

These examples illustrate the difficulty of securing an internship or undergraduate research when the people applying are a WOC and ways timing might affect their experience. Despite their hard work and efforts to apply and be invested in their learning, external

circumstances may interfere and compromise their perceptions of their identity. To some individuals, these experiences may challenge their identity with not being able to secure an experience because of their identity or timing interfering with their engineering learning development.

Overall, participants who were involved in P-BEL experiences gained further engineering qualities to help develop their future engineering career, which also involved reassuring there was a place for their identity to be accepted with instances of shared identity or validation of identity. Aside from learning more about engineering and gaining some work experience, participants also had to face biases when applying and during their internships or undergraduate research. The timing of when to participate was also critical as it affected their engineering learning progress. Thus, participants persisted in how they navigate through their environment in their P-BEL experiences and continued to navigate within their current working experiences. The following section explores those current working experiences and ways they are continuing to further support their identity.

Professional Life After College Experience

While there were almost no discernable differences between current students and recent graduates in the perspectives they shared about their undergraduate experience in affinity groups and P-BEL, interviewing recent graduates (n = 8) allowed me to gain some insight into the professional life of WOC in engineering after college. When talking about their work experiences, the conversation was based in three different areas about experience of being a WOC engineer at work, activities related to their identity outside of work, and connection to being a WOC engineer. I initially identified four themes: 1) lack of representation, 2) encountered bias, 3) codeswitching, and 4) identity supports. Identity supports was separated into

two themes for the final version of themes. I narrowed to five themes to describe their work setting and how it feels to be a WOC engineer (or other title/position): 1) lack of representation, 2) encountered bias, 3) codeswitching, 4) importance of finding a mentor, and 5) participation in identity supportive activities. View Figure 9 for a thematic map on professional life after college experience.

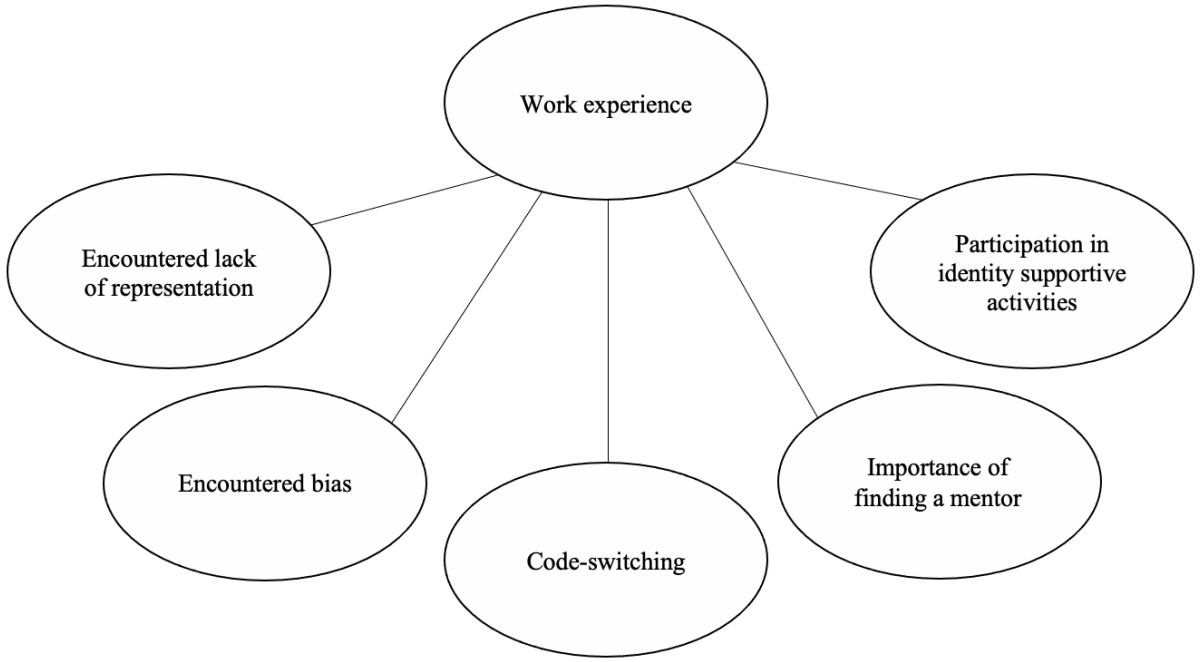

Figure 9. Themes of professional life after college experience among women of color in engineering.

Encountered Lack of Representation. Without probing, nearly all of the participants brought up the lack of representation in the workforce. Six of the eight graduates (Louisa, Danielle, Jade, Jennie, Emma, and Lynn) noted a lack of WOC or POC or women more generally in their workplace. Most did not have another person in their workplace who shared their particular identity in terms of gender and race/ethnicity. Although Emma feels represented in terms of gender by virtue of working in a women's center, she wished there were more people of color in the space. She acknowledged though her director shares the same identity (e.g., Indian woman), she still feels like she stood out in the workplace. She did share that her experience of this representation gap motivated her to work hard in her field to make healthcare accessible to marginalized groups. Louisa explained that instead of deterring her from taking the position, the lack of representation she observed in her workplace motivated her to accept the job to increase diversity, knowing that she can do well in the position. She also saw that the headquarters was more diverse and felt comfortable in knowing that the "I've never felt like my race was going to hinder me from doing anything with them." This helped solidify her decision to accept her manager role.

Encountered Bias. Four women spoke about encountering discrimination or undermining efforts as an engineer (Danielle, Jade, Jennie, and Louisa). Danielle was unsure whether people were not listening to her because of her race or the fact that she was younger than her colleagues. Danielle was the most experienced individual among her team and yet, she explained: "I wasn't really taken seriously, because I don't know if it was because the way I looked, or because how I talked, or what it was." She could not figure out how to improve the situation and was given the advice from her mom about the importance of time.

Louisa phrased her experiences as “I've never had anyone be directly racist to me, but I've talked to racist people.” However, she does recall experiencing discriminating comments from an LGBTQ+ perspective. Louisa, who identifies as a bisexual African American woman, felt conflicted about whether to point out a person’s false judgments when the comments made were not directly stated against her. She described this tension with the following:

> “It would be times to where it's like, they would say something, it would be very judgmental and kind of tense. It's just like I'd look at them and I'd be like, is this a battle I want to fight today? It wasn't said directly about me, but it's just like, it's a community I identify with…that's why I've always been torn about when to speak up and when not to, but it's been times where something has been said about the community, like a false judgment, and I've had to step in and say, ‘That's kind of harsh to make that judgment about a person just because of their sexuality.’ Of course, that leads to me coming out and then saying, ‘Would you have those same judgments about me because I'm a part of the community? What you just said was they were an awful person, just because of that.’ I was like, ‘Did I change your mind at all or do you feel the same way?’ So it is more so those situations.” (Louisa, African American, graduate)

She described how she has the tools and personality to be able to handle these confronting conversations where she challenges stereotypes and educates people on the topics. Jade faced an instance where someone assumed she was a janitor or that she did not know what tools like a screw or a hammer was despite being an engineer. Jennie encountered a similar experience with engineering equipment and a man taking her wrench kit. During the time, Jennie described going through an engineering identity crisis of “what if I'm not a good engineer, what if they don't respect me as an engineer? What if they see me as a silly Indian girl?” She was

confronted whether to tell her manager, but did not want to have the image of a girl who cries or complains at work, even though she experienced distress. To then combat anyone taking her toolkit again, she decided to paint the end of her wrench kit pink and felt proud of her action and how nobody wanted her tools after that incident. For the discriminatory actions faced, these women had to manage finding some way to cope to sustain any sense of belonging in engineering.

Code-switching. To cope with being discriminated against or facing increasingly more difficult situations, Lynn and Louisa both described how they altered their behavior at work to fit into the work culture or engaged in code-switching. Lynn described the experience of being a Black woman working in a law firm with engineering patents. She discussed the "draining" process she has with her identity in the workplace and how she feels the need to change parts of herself in order to feel accepted. For example, she described wearing her hair less curly, changing the tone of her voice, and closely monitoring her way of speaking (to not use slang) to fit into the work environment. Louisa also expressed feeling the need to conform to her environment, but clarifies to say, "I wouldn't say fighting with or struggling with, it's just something that I've been figuring out." She mentioned examples of what she does to adjust to the environment, such as altering her written communication and how she talks through phone calls. Alongside these alterations to her behavior, she also connects it to how she cannot act her (younger) age since she is in a mid-level management role.

Importance of Finding a Mentor. With every workplace, there is often the managers and the colleagues that help to define the experience. Jennie described one of the mentors she had that gave her advice about being a woman engineer:

> **"**And at my first one-on-one she told me, 'You need to have a coping mechanism. If you feel like crying, if something bad happens and you feel like crying, you need to have a coping mechanism in place so that you don't cry.' Because she basically gave an example of when she was a new engineer, something happened, she got yelled at, she cried and her manager said that, 'oh look, this is why we don't hire women.' She didn't give that advice to the male engineers." (Jennie, South Asian, graduate)

Jennie described how her mentor is someone who has been in the industry for a long time (10 to 15 years) but was able to overcome it. Thus, her mentor wanted to share advice from that perspective. Anne, who went to graduate school, became more surrounded by women professors who were open to sharing their experiences with students. Through connecting to her professors, she felt greater awareness of her position in this space and what it means to be a woman of color in the field, a term she only found resonated with her more recently in graduate school.

Participation in Identity Supportive Activities. Half of the participants (Emma, Danielle, Anne, and Maddie) did not have time outside of work at this stage in their career to engage in regular formal activities or organizations related to their identity. However, the other half of the participants (Lynn, Jade, Jennie, Louisa) did share some experience they were involved in that was related to their identity. Jennie was involved in mentoring new interns and volunteering with Girl Scouts through her job. Through volunteering with Girl Scouts, she opened up about being excited to meet other women in different departments and get to know them. Lynn and Jade mentioned how they were involved in tutoring outside of their work. Furthermore, Jade after seeing the lack of representation at her company, she was in search of a resource for connection to others. To illustrate the severity, she stressed how she works in about a 300 employee facility, but only has about eight women in the facility. She discussed how she

found out that her company has employee resource groups for women and LGBTQ+ groups. She mentioned the importance of continuing to be involved in organizations similar to the ones she was in as an undergraduate student: “But I do think my participation in undergrad did help me have an eye for, oh, let me ask if there is something like that. Rather than just being like, oh no, there's only eight women and oh well. So I think it definitely gives me the thought to even inquire.” Jade suggested how it was her experience as an undergrad that gave her the tools to inquire about resources to help combat the lack of diversity in her company.

Discussion of Qualitative Strand

The purpose of the qualitative strand of the study was to examine the role affinity groups and P-BEL may help negotiate the identities of WOC in engineering. To answer the research question, I summarized participants’ reflections about their identity and I identified themes across contexts of educational experience, affinity groups, P-BEL, and professional life after college. In this discussion, I focus on meta-themes (themes across all contextual influences) explored within the qualitative portion of the study and explain how the reconceptualized model of multiple dimensions of identity (RMMDI) is applied to help understand how the experiences shape identity and vice versa. As a reminder, the RMMDI model explains how contextual influences are passed through a meaning-making filter to shape individuals’ identity (Abes et al., 2007). The meaning-making filter is especially meaningful in understanding the experiences because of how they interpret contextual influences to shape identity through varying ways of complexity (Jones & Abes, 2013). For clarity, I frame the rest of the discussion from the perspective of the model and discuss in the following order of identity, contextual influences, and meaning-making filter with respective to intersectionality (view Figure 10). I conclude the discussion of the qualitative strand by pushing back on the original model by arguing for cyclical

arrows for how identity may also shape the experiences and cycle to experiences shaping identity. An integrative discussion that incorporates the qualitative and quantitative strands is provided in Chapter 5.

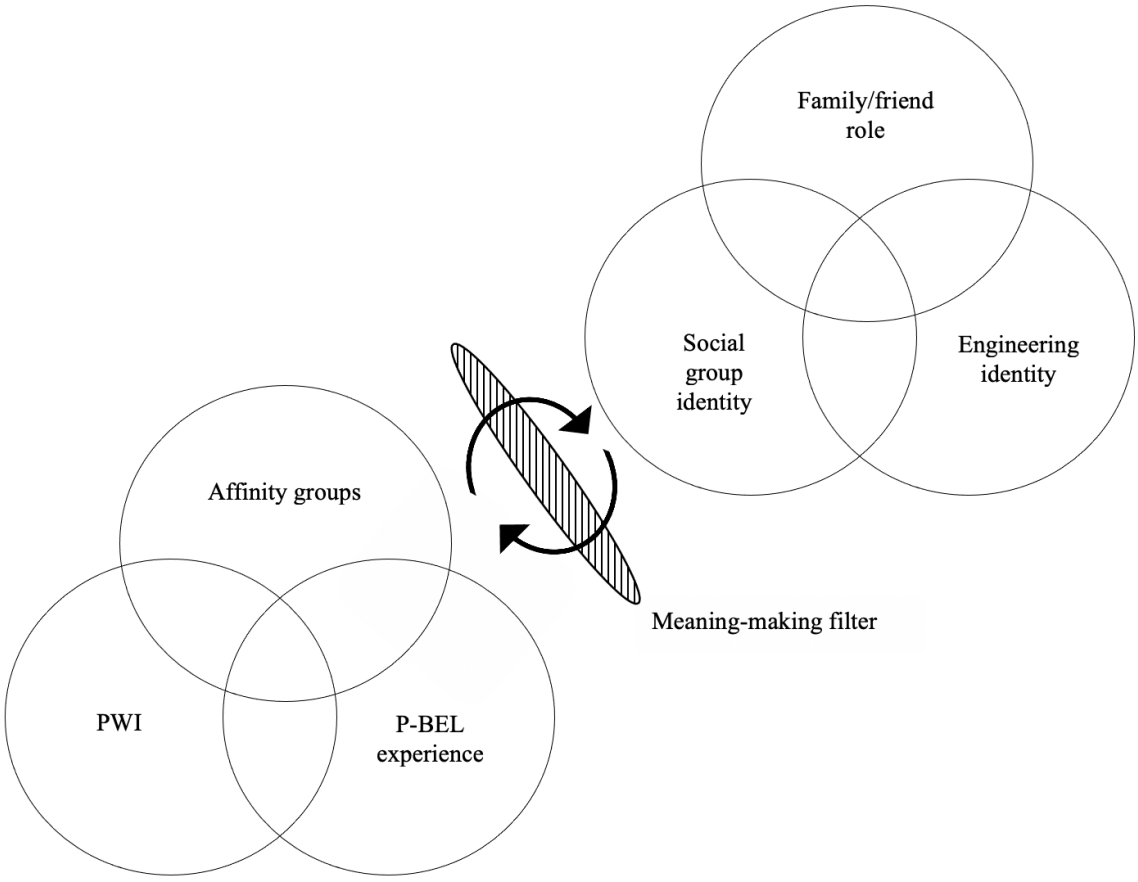

Figure 10. Cyclical meaning-making filter with consideration of intersectionality.

Identity: WOC Engineer, Tension, and Neutrality

To start off, I discuss how participants identified themselves and then the tensions they experienced with respect to their intersectionality. Participants described their identity as typically falling between these three areas: 1) social group identity, 2) family or friend role, or 3) engineer or engineering student. These common answers mostly aligned with the identity model suggested by Hazari et al. (2010) with the distinguishing factor of the family or friend role. Hazari et al. (2010) originally defined identity as including personal identity (i.e., personal characteristics that makes the person unique and highly individual) and instead grouped the family or friend role within social identity (due to "defined by shared experiences and histories" (p. 983)). However, participants pointed to the importance of the family or friend role label because of how it influences their upbringing, actions, and thought process. Thus, the family and friend role may stand out for participants who are WOC especially as this is a support system (Yosso, 2005). Furthermore, when participants described the importance of a family/friend role, they drew connections to the development of their engineering path. Some of the participants described that they embodied being a role model for their siblings or nieces or nephews since they were pursuing engineering (Gorman, 2014). Additionally, family was seen as a source of empowerment for first-generation college students who also described having a sense of honor and obligation to assure that their family was taken care of with their future engineering degree (LeBouef & Dworkin, 2021). When considering the aspects of identity that are important to the participants who are WOC, one cannot ignore the value of family and friends as these are the people who helped develop their interest and persistence in engineering.

When participants were asked about the term, "woman of color engineer," most participants viewed this term as representative of their experiences. However, some internal

tension arose for participants who identified within an Asian group because of how society depicts them in engineering. Essentially, participants felt compelled to discuss their identity with a caveat of being marginalized (i.e., marginalized by gender and not race/ethnicity). This extends Miles et al. (2022) point about the way people use the term, "women of color" in STEM settings and how Asian women were largely absent from the research literature even though they are broadly included in this group. For some individuals, the term could have created tension about being represented in one way for race/ethnicity but not their gender, and how that influences their interaction in classes and applying to engineering opportunities.

Some participants even described identity as bringing tension or even finding no connection to experience being related to identity. Additionally, participants struggled with the prevailing stereotypes about WOC in engineering and how that negatively impacted their broader experiences. For instance, participants faced stereotype threat and model minority stereotypes within the engineering education (Lee, 1996; Steele & Aronson, 1995). Similarly with literature on stereotype threat relating to underperforming, the model minority stereotype can also serve as challenging people's performance with set expectations (Cheryan & Bodenhausen, 2000). Participants across race/ethnicity wanted to disprove of negative stereotypes, while participants who identified as Asian felt compelled to also uphold the positive stereotypes. Altogether, participants' identity may receive significant pressure from society to maintain their stereotypes, while simultaneously experiencing tension trying to disprove it (True-Funk et al., 2021).

Contextual Influence: Discrimination, Isolation, and Lack of Belonging

Analysis of interview data resulted in the generation of themes related to educational experiences, affinity groups, P-BEL, and professional life after college. One of the more consistent themes across all these contexts was the pattern of WOC being in an engineering

environment consisting of mostly White men and the feelings of being an outsider that result from this reality. Most participants reported encounters with bias or discrimination from classmates, professors, mentors, and/or bosses. They experience these forms of harm in their classes, in affinity groups, in their profession-based experiential learning, and in their post-baccalaureate professional life. Even family members sometimes added to the tension with microaggressions. These results affirm the continuous depiction of engineering as a "chilly climate," which means that women and POC does not experience an environment that is welcoming or supporting a sense of belonging (e.g., Crawford & MacLeod, 1990; Foor et al., 2007; Walton et al., 2015). In considering the qualitative data as a whole, one gets the overall sense that the bias that WOC in engineering face is ubiquitous and not restricted to certain contexts or people, due to the persistent use of privilege, power, and self-interest in institutional and social contexts (Calmore, 1992, Solórzano, 1998).

One of the interesting areas that stood out from this type of meta-theme was how even knowing this was a common occurrence in engineering, two people chose to disregard this was a concern for different reasons. Maddie acted in denial or was uninformed about the role gender and race/ethnicity interacts in institutional structures. She believed that engineering did not consider race/ethnicity and gender in problems or in ways of different treatment of professors and classmates, which represents a contrasting view from other participants about the engineering climate. Samantha, on the other hand, did an act of resistance where she deliberately chose to ignore the marginalization as her way to cope with the idea that there were less WOC in engineering. She did not want to be in a position of vulnerability due to her gender and race/ethnicity. In considering the meaning-making filter, these participants may exhibit a minimal type of filtering (i.e., less complex and more susceptible to contextual influences in

shaping reinterpretation). This may imply that the participants view their identity as closely connected to the reflections of society's perceptions. Some individuals may choose to ignore gender or race/ethnicity to cope, but there may also be negative repercussions as a system in portraying this ideology. With the indirect suggestion of gender and color neutrality, it may further persist of gender and race/ethnicity issues and inequity (DeCuir and Dixson, 2004). It is worth noting that Maddie and Samantha also had no participation in affinity groups or P-BEL experiences. Within the affinity groups (if it was an intersection of identities like gender and engineering or race/ethnicity and engineering), people may discuss the importance and role of being a WOC in engineering and how to navigate the environment, or even connect with similar peers to help gain comfort in the shared experience (Ong et al., 2018). Within the P-BEL, people may be surrounded by individuals—whether shared identity or not—who can help navigate through the environment. In participating in these experiences, it may have changed their perspective about how to process being in an engineering environment when one's identity is salient, rather than an act of unawareness or ignorance.

Meaning-Making Filter: Navigation of the Self in Engineering by Seeking Community and Engineering Support

Most participants enhanced their classroom learning in the engineering program through engagement with affinity groups that brought students together with others who shared their gender, race/ethnicity, and/or engineering identity, or through participation in profession-based experiential learning that enabled students to learn about engineering work life through internships and research experiences. These are instances of contextual influences, but what is more important to understand is *how* these experiences shaped participants' identity through the internal process of the meaning-making filter. Although the engineering environment tends to be

more White men, how the meaning-making filter might have been used was that participants found other ways to be in a space that afforded numerous opportunities for identity affirmation and support among WOC in engineering. Affinity groups and P-BEL were two types of experiences that appeared to provide somewhat distinct and potentially complementary support. What distinguished and simultaneously complemented affinity groups and P-BEL were through these mechanisms of the support provided and the types of support one receives and the sense of fitting in or belonging.

First within affinity groups, participants reflected on receiving multiple kinds of support from their peers, mentors, and advisors (view Figure 7). House (1981) model of social support was useful for representing these types of support, which included informational, instrumental, and emotional support. Although there is a fourth type of social support called appraisal support (i.e., feedback for evaluation), I did not see evidence of this type of social support within participants' responses. In these types of settings, participants may be looking more for reassurance and value instead of how to self-regulate and improve. In other words, what may be most salient to participants was not the feedback on how to perform better, but instead the advice, tangible help, and care that was significant to the participants. These types of support utilize participants' social capital, which is connecting to the community's network and resources (Yosso, 2005). For example, participants described through being involved within their organizations, they were able to have peer-mentorship or mentor/mentee relationships and connections to other people or resources through shared contact. These types of connections are positively associated with students' retention and academic success (Daily et al., 2007). Furthermore, since the affinity groups were surrounded by people with similar identities, there

was a developed sense of security and comfort (Ong et al., 2018). This could support a sense of belonging and reassure that they can belong in the engineering environment.

Within P-BEL, participants reflected on gaining an authentic experience in an engineering industry that allowed them to develop perceiving themselves as an engineer (Harrisberger, 1976; Jamison et al., 2022). Participants gained engineering skills and characteristics (view Figure 8), which aligned with the model of engineering identity (Carlone & Johnson, 2007; Godwin, 2016; Hazari et al., 2010). Engineering identity is positively related to persistence and engagement (e.g., Carlone & Johnson, 2007; Wade, 2012). Though the model of engineering identity includes interest, recognition, and competence, it also considers performance (i.e., achievement). Yet, I did not find evidence of this within participants' statements. Instead, participants highlighted gaining confidence from these experiences instead of successfully achieving the tasks. In other words, the importance was whether they *think* they could do it instead of *knowing* that they could do it in these types of settings. This type of development of "being an engineer" utilizes participants' navigational capital, which is maneuvering through social institutions using social and psychological skills (Yosso, 2005). For the participants, they had to establish social connections and maintain their resilience to navigate through engineering spaces that were not optimized for WOC in these spaces. Furthermore, with some internships being aware of the importance of different perspectives and diversity, the people in the space itself tried to reassure individuals of their belonging. Even if within these engineering spaces, they were not surrounded by people like them, they sought out a mentor to turn to for guidance and to emulate how they should act in these engineering working spaces. Similar to their P-BEL experience, graduated participants shared about finding networks in their current working profession. Often those mentors were women among the participants whether or

not they shared the same race/ethnicity. Although, previous literature suggests that WOC were more likely to persist with having mentors despite not having a shared identity (e.g., Johnson et al., 2011; Perna et al., 2010). This highlights how a shared identity is not always needed to be affirmed or supported to persist in engineering. Instead the focus is on finding a shared connection and the guidance received.

Affinity groups and P-BEL experiences complementarily supported each other with both experiences providing personal and professional development and are not exclusive to one type of organizational experience (Banda, 2012; Powers et al., 2018). This development may support one's identity by receiving resources that allow them to reflect and understand how it is all connected to a broader societal influence. Affinity groups was where they received guidance about how to navigate and P-BEL was where they used those navigational skills in practice. Both are needed experiences for WOC in engineering to persist in the "chilly" environment.

Cyclical Model of the Mutual Influence of Context and Identity

According to the reconceptualized model of multiple dimensions of identity, experiences are what shape the identity shown by the illustrated model (view Figure 1). However, during the interviews, there was evidence to suggest that the students' identities also shape what activities they participate in and how they choose to participate. Thus, the influence of activity participation (context) and identity appears to be more cyclical than unidirectional (view Figure 10). Although perceptions of identity are not solely what motivates initial participation in affinity groups or P-BEL, when I asked participants to describe how they became involved in organizations or P-BEL experiences, explanations often called back to their identity. For example, they described in wanting to be surrounded by people who were similar to them (gender or race/ethnicity identity) or wanting to secure an opportunity to help support their

engineering abilities or wanting to learn or improve on skills (engineering identity). Additionally, participants explained joining experiences because they embrace certain aspects of identity (e.g., being a woman, being a woman of color, etc.). It may be that WOC have strong aspects of identity and are motivated to choose activities that center on that aspect of identity. Emma talks about the importance of her gender and being involved in a women's health organization over other identities that she was less invested in like engineering. This highlights how some participants who participate in these experiences may have a high perception of an aspect of their identity before being involved and then participation in identity congruent experiences further nourishes and strengthens that aspect of their identity. For instance, Jade initially sought out participation in an engineering club because she identified as an engineer and wanted to deepen her knowledge of the field, but then continued to build her identity as an engineer by becoming involved in leadership roles. Other participants also expressed similar instances of becoming peer-mentors or engaging in other leadership roles. This finding suggests an involvement-identification cycle, which describes how leadership roles can help support publicly identifying with their identity, which also increases more leadership opportunities (Renn, 2007). Though the original scholarship on involvement-identification cycles was based on individuals who identified as LGBT, the results may also extend to WOC in engineering. In other words, WOC may first engage in activities because they strongly identify with certain aspects of their identity (e.g., being a woman, a person of color, an engineer, or any combination of these), and then their participation serves to further strengthen and sustain their identity.

Furthermore, there may be a shift in how one perceives their identity and that influences the types of experiences one engages in. For instance, Anne initially explained how she shifted her perspectives about being identified as a WOC in engineering. In undergraduate school, she

did not see herself as a WOC, but now in continuing her graduate school education, she does view herself as a WOC and the related meaning and power of holding this identity. This then helped her seek out ways to increase her awareness of diversity in graduate school and further embrace an identity as a WOC. Students are not just placed in these experiences, they are actively choosing to participate in these types of experiences when it comes to affinity groups and P-BEL. While one arrow suggests developing identity (contextual influences to identity), the other arrow may suggest validating and sustaining their identity with what they value and embrace (identity to contextual influences). Thus, I am arguing for the arrows to be cyclical to further promote that one's core identity has to go through some meaning-making capacity to conclude about participation in certain contextual influences and has the potential to feed back into their perceptions about their identity.

CHAPTER 5: INTEGRATED DISCUSSION

Through a mixed methods approach, the current study examined how affinity groups and profession-based experiential learning (P-BEL) are related to the gender, racial/ethnic, and engineering identity of women of color in engineering. In the quantitative strand, I examined undergraduate students' involvement in organizational experiences, exploring *whether* participation in these types of activities was related to general measures of the gender, ethnic, and engineering identity of WOC in engineering. In the qualitative strand, I learned about *how* organizational experiences may be related to the gender, racial/ethnic, and engineering identity among these women by talking to both current students and recent graduates. I also gained a more complex understanding of how WOC in engineering view their identity, both in terms of the language they used to describe themselves and the extent to which their descriptions seem to reflect an intersectional view of their identity. Interview topics focused on perspectives on identity, undergraduate engineering educational experience, participation in affinity groups and internships or undergraduate research, and (for recent graduates) current professional experiences. Across each context, I identified themes which focused on areas such as discrimination, isolation, and lack of belonging; seeking community and engineering support; and navigation of the self in engineering. Chapters 3 and 4 offer separate discussion of the quantitative and qualitative findings, respectively. In this chapter, I provide an integrative discussion about what my findings collectively suggest about intersecting identities and intersectionality, persisting systemic inequities in engineering, and the potential of university-based affinity groups and profession-based experiential learning to support women of color who are trying to earn their degree in this field. The chapter concludes with theoretical and practical implications, limitations, and future directions.

Complexity of Studying Identity Among WOC in Engineering

The mixed method design afforded two different approaches to study the identity of WOC in engineering. The first, quantitative phase operationalized multiple discrete identities based on gender, ethnicity, and engineering that intersect to varying degrees among participants in this study. The second, qualitative phase attempted to create space for expression of and exploration of a more intersectional view of identity in which social categories like race and gender are considered interconnected and form systems of overlapping and interdependent discrimination or disadvantage (Crenshaw, 1991). Affordances and constraints about both types of approaches are discussed.

Quantitative: Intersecting Identities

In the quantitative strand of the study, I studied gender, ethnic, and engineering identity as intersecting identities (i.e., multiple, separate identities that happen to co-occur to various degrees in my sample). Within the survey, participants reported on their identities as a series of separate constructs and were not afforded the opportunity to represent their identity as holistic or interdependent. There were some potential affordances to exploring identity using this intersectional perspective in this study. First, it allowed for the exploration of whether there were any relations across organizational experiences and different aspects of identity like gender, ethnic, and engineering identity. Since oftentimes these organizations center one of these socially constructed categories and not multiple (e.g., gender, but not race/ethnicity and gender), I was able to examine relations between organizational experiences and identity in a way that "matched" (e.g., gender-based organizations and gender identity) and repeat the process across other aspects of identity. For the results, I found that P-BEL were related to positive engineering identity, while gender-focused affinity groups and race/ethnicity-focused affinity groups were

related to gender and ethnic identity, respectively. Thus, I was able to learn what type of relations were supporting certain types of identity. Second, there is less complexity with interpreting the data of how participation in activities were related to aspects of identity due to focusing on isolated and distinct variables. There was evidence that these identities were analytically distinct. Within my CFA, these identities were shown as distinct constructs (gender identity is conceptualized in a unique way from ethnic identity, etc.).

However, the literature is critical of only using an intersecting approach for describing peoples' identity, and especially marginalized groups, because it does not highlight on what having those intersecting identities may imply for different groups of individuals (Bešić, 2020). Intersecting focuses on the idea that there are multiple identities, but it should go beyond identifying identity as multifaceted. Instead, it is important to consider the interaction between different groups and the power relations that construct those identities. This is where intersectionality comes into play. Though an intersecting perspective may be a useful way to initially examine quantitatively to gather preliminary data or understand of *whether* a relation exist (to an extent); the emphasis should be on understanding *how* the relation exist, specifically through understanding the societal level of power and privilege and how that shapes the identities of WOC in engineering (Bešić, 2020; Sawyer et al., 2013). The second phase of the study addresses some of these constraints of examining intersecting identities.

Qualitative: Intersectionality

In the qualitative strand of the study, I attempted to invite exploration of the interconnected collective of being a "WOC engineer." Intersectionality provides an important perspective about looking at aspects of identities in the perspective of societal influence that may

further challenge people's identity through discrimination. This approach helped address some of the shortcomings of examining intersecting identities.

One of the affordances to examining intersectionality was to expand the descriptions of how one views identity. During the interviews, participants were invited to describe their identity to allow for descriptions that are less compartmentalized and discuss what aspects of self were salient. When participants were invited to construct their own descriptions of identity, participants acknowledged multiple components and discussed them as both compartmentalized and inextricably intertwined. In other words, sometimes participants described themselves in intersectional terms but did not always do this consistently across all aspects of identity or in relation to all contexts. For example, all participants talked about seeing their identity as comprised of multiple aspects. Participants mentioned at least one aspect of identity that was of primary interest to this study (e.g., gender, race/ethnicity, engineering) but also mentioned other aspects (e.g., family member, friend, first-generation, etc.) and acknowledged their interactions (e.g., being a woman, who is a specific race/ethnicity, is a daughter, and has values).

Another affordance to examining intersectionality was to learn how they view their identity in connection to the larger oppressive system of pursuing engineering as a WOC. Participants represented their identity as being due to their upbringing or values, but also the way that society perceives them and the meaning it may have while pursuing engineering. For instance, participants shared that certain aspects of identity were salient to them due to the racial and gender climate broadly (e.g., talking about socio-political climate). In addition, most participants described seeing themselves as a WOC engineer because of the significance of having this label empowers them and the shared experience with others. Relatedly, this created tensions with some participants as society portrayed them as not a "typical" engineer, were faced

with gender- and race-based stereotypes, and/or experienced tension with being marginalized by gender and not by their race/ethnicity (e.g., participants who identified as Asians). For example, participants shared about how people would dismiss them in learning engineering (e.g., undermining capabilities), encountered micro aggressive or discriminatory comments (e.g., stating stereotypes), and/or would feel conflicted about their identity (e.g., expressing their experiences are not as challenging compared to others and dismissing own experiences). These experiences found in the qualitative findings coincides with the "chilly climate" in STEM for women of color and how they need to confront multiple systems of oppression (Ong et al., 2011). Additionally, there was evidence across all the social pains that Ong et al. (2020) found in their literature review of WOC in engineering. Thus, their identity was connected to these larger oppressive systems represented by intersectionality and participants had to navigate ways that would support and avoid thwarting their identities. To overcome these experiences, participants sought for mechanisms to cope that could help explain these challenges or sought experiences to look for a shared understanding (will be discussed more in upcoming section).

Consequences of Ignoring an Intersectional Lens

There are certain consequences for ignoring an intersectional lens in research on identity. One of the main consequences for ignoring intersectionality is silencing marginalized groups by dismissing and simplifying differences (McCall, 2005). By only grouping women together or one racial/ethnic group together, we are not able to understand the gendered racism that occurs of identities intersecting in a gender and racial divide social context. Thus, I attempted to balance a narrative of shared identity as a WOC engineer while avoiding overgeneralization. To be inclusive of who is under the umbrella of "WOC engineer" (Miles et al., 2022), I contacted all participants who fulfill the identity as a woman of color studying engineering within the cohorts

I utilized for my study. The purpose of doing so was to set out to represent a large group of voices across WOC in engineering and include groups who may not be as highly represented within research on WOC in STEM fields (e.g., Asian women).

At the same time, I understand that a criticism to studying WOC is that most researchers group WOC as monolithic without distinctions to their unique racial/ethnic group (McGee et al., 2021; Miles et al., 2022). It is evident that the experience of a Black woman's engineering experience would be different from an Asian woman's engineering experience and then from a Latina/Hispanic/Mexican woman's engineering experience (Miles et al., 2022), which also aligned with what I found. For example, I found that women of Asian descent struggled with wanting to uphold the model minority stereotypes, while Black and Latinx participants struggled with stereotype threat. More specifically and in alignment with previous research, Asian women faced a stereotype that positions marginalized groups against each other in how they overcome discrimination and their success (e.g., Teranishi, 2010), Black women faced gendered-racism stemming from presumptions of inferiority across all groups (e.g., Ireland et al., 2018), while Latina/Hispanic/Mexican women faced race-gendered-ethnic-linguistic oppression (e.g., Cantú, 2012).

For the current study, I wanted to highlight how the struggles across these groups are prominent despite being different groups, even though the specific struggles are unique. I did not draw conclusions about specific struggles across different racial/ethnic groups because that has the power to potentially diminish each other experiences with "oppression Olympics" (i.e., competition about oppression across groups; Hancock, 2011; Warren et al., 2021). If I highlight too much about how these groups are distinct, it can position these women of different racial/ethnic groups against each other by saying one's struggle is more important or dominant

than another. No one individual or group was arguably "failing" or less successful than the other in pursuing an engineering degree (e.g., a deficit-oriented view). Instead, I present them together to account for all of them persisting through experiences. All participants were navigating through the system as a collective and capitalized each other's knowledge and resources to persist in the field (e.g., an anti-deficit view; Harper, 2010; Yosso, 2005). I highlight some of those ways that persistence was evident through their participation in affinity groups and P-BEL with connections to the quantitative and qualitative findings.

Organizational Spaces for Supporting or Thwarting Identity

Affinity groups and P-BEL experiences together were spaces that both supported and potentially thwarted identity. According to the quantitative strand, I found that P-BEL were related to positive engineering identity, while gender-focused affinity groups and race/ethnicity-focused affinity groups were related to positive gender and ethnic identity, respectively. This was helpful to learn about aspects of identity that may be salient within those types of organizations, and simultaneously, the aspects of identity that needs to be further examined about why they are or are not supported within those contexts. Qualitatively, I found that participants experienced both supports and challenges across all contextual influences of undergraduate engineering experience, affinity groups, P-BEL, and professional work experience. Through these organizational experiences, there may be insight about how these experiences shape the identity of WOC in engineering explained through the meaning-making filter of their varying complexity.

Spaces of Tensions

I uncover some of the quantitative findings of the tensions expressed in organizational experiences. Some that aligned with previous research about the experiences across affinity groups and P-BEL.

Affinity Groups. For affinity groups, a participant expressed not wanting to participate because she would have been reminded of her marginalization (and thus, making her more vulnerable). This aligned with Banda & Flowers (2017) findings of how few participants chose not to participate in student organizations because of not identifying as minoritized or were under the impression that women or POC cannot succeed and needed to participate in these types of groups. Additionally, a couple of participants expressed being "lazy" or prioritized their activities elsewhere like studying or doing homework. This finding coincides with Holzweiss et al. (2007) findings of how there may be commitments to other responsibilities or not being interested in these experiences.

Additionally, they described how an intersection of their identity was not being supported, while other aspects of their identity may be supported and what that may imply navigating in engineering. For example, participants stated before deciding to actively participate in an organization, they simultaneously faced a lack of fit or concern of repeating negative classroom experiences as a woman of color who is pursuing engineering. Furthermore, a participant described acknowledging the importance of the organization, while being reminded that she was one of the few Black women. This exemplifies the tension of some aspects of identity being represented or uncertainty about what being in these spaces will mean for their identity. It would have been interesting to understand the different types of affinity groups in relation to identity. Due to the methodological constraints of the quantitative design, I cannot

capture engineering organizations alone without taking into consideration of the other aspect of identity (e.g., gender or race/ethnicity) since it is also being emphasized as part of the organization.

P-BEL. For P-BEL, a participant expressed facing discrimination, biases, and isolation within their internships or undergraduate research. This reaffirms how salient these experiences may be within internships or undergraduate research in connection to their formal educational experience. Previous research also explained that people do not participate due to poor mentorship and poor communication on projects and responsibilities (e.g., Stofer et al., 2021; Thiry et al., 2011), which was also evident with the experiences of the participants. Although, what was not explained within those studies was how discrimination and biases may have also impeded the quality of mentorship and communication. For example, if the person held biases towards WOC in engineering, then their mentorship and communication working with a WOC in engineering would be negatively and harmfully shifted.

P-BEL may not provide direct evidence for social identities, which may be that these spaces do not have much focus on race/ethnicity and gender. The amount of socio-emotional support given in internships or undergraduate research are not as apparent as much as affinity groups since there is no direct focus on gender and race/ethnicity within the internships (at least to the extent of what participants shared). Instead, gender and race/ethnicity may be salient when the participant is discriminated or feeling supported by someone with the shared identity. More research will need to be conducted to understand how P-BEL takes into account of gender and race/ethnicity into the setting, before applying and during the experience.

Spaces of Support

When the qualitative and quantitative strands are considered in tandem, they collectively suggest a number of ways that participants' identity was (or could be) supported.

Affinity Groups. Affinity groups supported areas of WOC identities (gender and race/ethnicity) through being involved with an engineering intersected organization or just independently of gender-based organization or race/ethnicity-based organization. One explanation is that participants were better able to develop and express their identity through these organizations, as well as being surrounded by people who share the same cultural background, and thus, having a sense of community over shared experiences (Ong et al., 2018), which is then related to positive perceptions of their social identities. This helped develop a sense of belonging for them and persist in college (e.g., Banda, 2012; Flowers, 2014; Hurtado et al., 2007). There was also a shared importance of being able to give back to the community that helped them, such as through participation in peer mentorships, which could further solidify their positive relationship with their gender or even their race/ethnicity (Ong et al., 2020). What they gained was invaluable to engineering skills, they learned how to navigate engineering with their being a WOC pursuing engineering through advice, encouragement, and tangible support.

P-BEL. P-BEL can also serve as a place for support for WOC in engineering, especially when it came to engineering identity and being able to be surrounded by supportive people to help navigate through the environment (supporting racial/ethnic and gender identity). Through these experiences, they enhanced their engineering identity with expanding on their understanding of engineering and the responsibilities of an engineer (Samuelson & Litzler, 2013), which is not surprising considering P-BEL is a space that allows students to develop their engineering abilities and was supported by the quantitative findings.

Second, although not significant, participation in P-BEL may also be positively related to the gender identity of WOC in engineering as it had the highest mean value scores compared to all other groups when examining the trend. This result and trend may imply that both affinity groups and P-BEL could support gender identity. The interviews helped provide more insight onto how P-BEL may be impactful among their gender identity. Within these spaces, participants shared about finding a role model to them, which were often women—and sometimes sharing a similar race/ethnicity. This means that to some participants, they described needing to be around others who are similar to them who are navigating engineering to be a positive influence to how they perceive engineering (Ong et al., 2018). This means that there is the potential for P-BEL to support aspects of identity beyond just engineering, it just means there needs to be work in developing resources that affirms their social identities in these spaces. Thus, P-BEL are another organizational experience where participants can—not only learn to be an engineer—but see someone like them be an engineer.

Both the qualitative and the quantitative strands showed some evidence that these organizations can potentially thwart identity, but more importantly can support identity. Previous research has also suggested the potential of these ideas to be spaces for exploring, navigating, and affirming identity (e.g., McAlexander et al., 2022; Ong et al., 2018; Lira, 2022). This research afforded the opportunity to examine what seemingly appears to be distinct experiences to be explored together with related experiences. However, more importantly, all the participants, except for one person (will be pursuing medical school instead), aimed to continue pursuing an engineering path or engineering-related path. Thus, 18 participants had some continuous thought process of securing their engineering identity, even though they all engaged in different combinations of opportunities (e.g., different majors, affinity groups, P-BEL, etc.). This

demonstrates equifinality which "depicts a situation wherein each of a different means leads to a single goal" (Kruglanski et at al. 2015, p. 70). In other words, different pathways (e.g., combinations of contextual influences and experiences) may generally lead to a similar outcome (e.g., engineering pursuit and career). This supports that there is no "right" way to pursuing engineering and that participants can achieve the same type of engineering degree despite how many or what types of experiences they are involved. Instead of pushing WOC in engineering to be involved in certain contextual influences (affinity groups or P-BEL) outside of school, the focus should prioritize on making sure they have experiences that aligns with those types of support and receiving those supports. Affinity groups and P-BEL are just examples of organizational experiences that provide these types of supports in engineering.

Life After College: Persisting Systemic Issues

Initially, I thought there may be differences in perspectives of undergraduate experiences among current vs. recently graduated participants considering that they were several cohorts apart and that the graduated participants are currently in a professional working stage. However, in terms of differences across current and graduated engineering students, there were not substantial differences in the way they talked about their undergraduate engineering experience or in the themes I identified.

One of the explanations is that the classroom experience and P-BEL serve as a reflection of the engineering work life experience (Adams et al., 2011). For instance, the associated challenges that comes along with the groupwork and mentorship, remains salient and almost consistent across all types of settings. The issues faced in undergraduate education are almost similar to the ones in the workplace. These mirrored challenges from undergraduate education to the workplace highlights how engineering continues to be rooted in systemic issues across PWI

and within the workplace (Smith & Gayles, 2018). There is research that discusses of the racism and sexism that occurs in the engineering workplace among WOC (e.g., Brown, 2022; Corneille et al., 2019). This contributes an important point about needing to challenge the social and systemic inequities and what current work is contributing to those efforts that is bringing substantial changes. By interviewing the people who graduated, I received an inside look at what persisting problems are experienced after life after college.

Although the experiences were quite similar of reflection of undergraduate education, there were some unique perspectives that the graduated individuals shared about life after college. For example, participants shared about engaging in code-switching in their work environment, which was shared among a couple of Black/African American participants. They explained in needing to be taken seriously in their work setting and get through the day-to-day work. Additionally, participants shared about ways that they continued to be in activities related to their identity. Some were a continuation of activities they engaged in as an undergraduate student, while some were based on wanting to give back to a community or be involved in an activity or group related to their identity. Overall, this could help provide insight into the life after college in engineering or engineering-adjacent roles or even shifts in careers.

Implications for Theory: Intersecting, Intersectionality, and RMMDI

This research adds to the literature on areas of intersectionality and the reconceptualized model of multiple dimensions of identity (RMMDI). First, we need to consider the way we as researchers construct and measure identity versus how people may describe their identity. Sometimes participants described their identities often as intersecting than intersectional with respect to gender, race, and engineering. My study suggests it is important for critical theorists to honor and center identity as individuals themselves define it, which may or may not heavily be

reflective of intersectionality. If a study, however, is interested in discussing intersectionality specifically, it may be helpful to define with the participant what intersectionality means to then provide participants a way to frame their responses with that lens in mind. Second, often people who use the term intersectionality means intersecting and vice versa. I drew more lines about how these approaches may be thought of critically across both quantitative and qualitative methods and with emphasizing that intersectionality takes into account the individual, group membership, larger social context, and systems of oppression (Bešić, 2020).

Third, there is more to be understood in how the meaning-making filter works in the RMMDI, specifically in which the direction the arrows imply. The RMMDI draws the model as experiences shape identity rather than identity is also what shapes the experiences through a cycle. Based on the participants' explanations, they actively chose to participate in certain experiences to develop or sustain their identity. Additionally, participants could experience a changed meaning to their identity, such as what it means to be a "WOC engineer," which could then shift their perceptions about engaging in environments (e.g., reflecting more critically about their role and the social implications of being in this space) and add deeper or different meaning to their identity. Therefore, I am suggesting that we also consider the arrows to be cyclical to further push back on the model that identity is not an outcome, but a process. There are ways identity gets shifted with certain experiences, and thus, may also influence the continuation or change of experiences. More research is needed to further explore the cyclical nature of the model and how students are considering how context shapes identity, as well as how identity also shapes context.

Implications for Practice: More than Just Participating

By revealing insights on how WOC in engineering at a PWI navigate and negotiate their gender, racial/ethnic, and engineering identities, the current study could provide recommendations to universities (researchers, organization directors, and higher education policy directors) on how to better support WOC in engineering. Due to the challenging experiences in engineering related to discrimination and stereotypes, there needs to be more efforts across the university to reduce biases, as well as better providing access to resources on how to address areas of discrimination and harassment (Smith & Gayles, 2018). Both students and faculty need training on reducing biases as participants described being discriminated across both classmates and professors. One example is to engage in required implicit bias training within the university, which may include education about the definitions, harms, and repercussions of discrimination to ensure psychological safety of the students and their peers (Newman et al., 2017). More than just labeling their experiences, participants also mentioned the need to deeply understand their experiences. One example to help increase their understanding of their experiences is through participation in intergroup dialogues. Intergroup dialogues focus on conversations about gender and race/ethnicity to help build relationships and provide an understanding of identity and inequalities with commitments to social change and justice (Gurin-Sands et al., 2012). Integrating these sessions into undergraduate education by offering degree credits may be helpful to have students reflect on the history of oppression and create space to further dissect the impacts today.

Furthermore, there should be a focus of integrating peer or advising mentorship opportunities within the undergraduate system, to create a formalized system of mentorship similar to what was often observed to occur in affinity groups. Participants described the

valuable informational, instrumental, and emotional support that was provided within these opportunities from peers and mentors or advisors. One can consider integrating these experiences within the classroom setting or making them more accessible outside of the classroom. For instance, classrooms could arrange panels of speakers from different backgrounds to share about their engineering experiences or developing formal mentorship connections with engineers. Developing peer mentorships can also be established within the engineering learning experience to develop mentees' sense of belonging and self-efficacy. Students may in turn become peer mentors themselves which may produce the involvement-identification cycle of starting as a mentee, which supports their identity as an engineer and then becoming further involved as a mentor (Renn, 2007).

Although internships and undergraduate research were not mandatory for students to participate in at the study's university, most participants took advantage of these opportunities at some point during their undergraduate education through the university's connections. Since most P-BEL opportunities are established through the university's connections, there is a need for the university to provide resources to help students find and secure P-BEL opportunities (Smith & Gayles, 2018). Participants noted wanting to learn of more P-BEL opportunities available and the expectations required of them. One suggestion to promote advertisement of opportunities is to utilize classroom time to promote different internships and research opportunities. Professors can also highlight the benefits to engaging in these opportunities too. This may help expand the number of options available to students. Furthermore, there should be more transparency within the opportunities about criteria used for selecting individuals for these experiences. Especially if the university is in coordination with these P-BEL, there should be established policies to check the requirements of hiring and the experience in general (Smith &

Gayles, 2018). The requirements and criteria used when hiring should be transparent and non-discriminatory towards students. Further, the experience itself should have mechanisms for reporting and mediation if discrimination or harassment occurs. These established policies may help address potential biases during the hiring process and during the P-BEL experience itself. Additionally, engineering programs can be more intentional about advising students about the timing of their internships and research experience, with a focus on maximizing both student readiness and benefit for obtaining future employment. Mentors, supervisors, or advisors should engage in practices to better integrate individuals in the early stages of their college careers, such as hosting an orientation meeting with clear expectations and roles defined, engaging in one-on-one meetings with check ins, and identifying profession-based experiential learning opportunities that are within students' zone of proximal development. This not only applies to early college students but can extend to across all years.

Lastly, there needs to be more opportunities that highlight supporting an intersection of identity. Out of 19 interview participants, 14 participants had been involved in an engineering organization in combination with an organization focused on their gender or race/ethnicity (11 of those participants were involved in an organization that specifically focused on gender and engineering or race/ethnicity and engineering). This highlights the importance of having these aspects of identity overlap as most participants utilized these types of experiences instead of only focusing on one aspect of identity. Since there are a small number of WOC in engineering at a PWI, it may be helpful to consider a way to collaborate across institutions to connect with similar peers and engineers. Overall, these were areas that participants suggested, implied, or may be needed of further supporting and sustaining these experiences.

Limitations and Future Directions

Since the study aims to understand the contextualized experiences of WOC who are current or recent undergraduates in engineering, I do not intend to draw conclusions about differences across engineering disciplines, gender identities, and racial/ethnic identities among participants. Furthermore, while the intended focus of this study was identity affinity groups and internships/research, study participants may also have been involved in other experiences that played important roles in shaping and sustaining their identities. In addition, there were some aspects of identity that were important to the individuals that were not the focus of the study. Some mentioned the idea of religion, sexuality, socio-economic status, international status, first-generation college student, and so on. While I allowed the participants space to initially define their identity—whether broadly or in terms of specific aspects of identity—and their college activities, my research itself centers on a narrower conception of identity that is specifically focused on gender, race/ethnicity, engineering, and the influential experiences that were specific to those aspects of identity (i.e., affinity groups and P-BEL). This may have resulted in a narrower view of identity and experiences than what is lived by participants. For example, though this study did suggest the importance of an aspect of identity that centered one's role as a family member or friend, the study was not designed to fully explore what this aspect of identity may mean in the context of engineering. Not all participants discussed specifics of their family/friend role during their college learning experience—though most identified the role as important to their identity initially. When they did discuss, comments were made about the balance of family/friend life and being an engineering student/engineer. For instance, a participant shared her hesitation to be involved in extracurriculars due to her family's emphasis on prioritizing schoolwork first. Thus, understanding the family/friend role within the context of

engineering may have significance for participants' involvement in activities and their identity. In future studies, it would be interesting to further investigate in depth different contextual influences and aspects of identity and how it may extend to their engineering journey.

Additionally, this study only involved participants who graduated with an engineering degree or are currently an engineering student. One potential direction for future work is to include participants who changed from an engineering major during their undergraduate education or changed fields after graduating with an engineering degree. It may be important to examine whether their participation in affinity groups and P-BEL were related to their identity and subsequentially, changing fields, through how their experiences shifted through the meaning-making filter.

Furthermore, I had a relatively small sample for the quantitative analysis. There was limited power to attain statistical significance in analyses and to examine specific subgroups of students or specific types of organizations. This necessitated analysis comparing means for dummy-coded groups of students that were not mutually exclusive, which does not allow explorations in patterns of participation across different activities or over time. Yet, even though statistical analyses were limited, the qualitative analysis allowed for more nuanced understanding, which may support the face validity of the quantitative findings in this study.

Additionally, this study did not permit qualitative exploration of singular types of participation in organizations (e.g., only internships or only affinity groups). Although, I initially recruited current student participants with different participation patterns at the time of their survey, one year later when they were interviewed, most had engaged in both affinity groups and P-BEL. Thus, it did not allow me to examine the idea of multiplicative effects (i.e., participating in both vs. one of the experiences vs. none) as I had originally intended. It may be important in

the future to interview participants close to the same time point as the survey. Future research may also want to assess whether participating in only those experiences are similar or different to persisting in engineering compared to participants who are involved in both types of experiences.

It was also important to note that the qualitative data strand involved current students and graduates, whereas the quantitative strand was based solely upon current students. This was due to availability of survey information from different cohorts on identities and participation in organized activities. Although, there were not many significant changes in undergraduate experience from current students and graduated participants, the graduated participants shared important insight into the work life experience, which should be further examined of intersectionality as a WOC—and more importantly—how the engineering work industry is supporting intersectionality and combatting systemic inequity and injustices.

Due to the global pandemic, there were—to an extent—limitations in students' participation in the organized activities of interest and the potential meaning they ascribed to these organizations. The pandemic was and continues to be isolating or challenging for individuals, which may invoke restrictions to students' participation. Particularly for this study's proposed sample, the current engineering students were affected by the pandemic starting from their first year of school, whereas graduated participants were affected by the pandemic during their fourth and fifth year of school. Participants described the pandemic to some extent within their classes or participation in organizations, such as difficulty in making friends or impacting their continuous involvement, so thus, this makes an important sociohistorical context to consider when evaluating participants' statements. Additionally, there was a mass shooting at the study's university before interviews were conducted. Even though only one participant made a

comment directly about this event and how it affected her conference experience, it should not be disregarded of how influential this event may be to participants.

Finally, this study examined a collective group of WOC instead of examining a specific group, as well as investigated a broader level of affinity groups. The purpose in examining a larger group was to learn how multiple groups of people may navigate a PWI with their identities and how participation in identity affinity groups, internships, and undergraduate research may inform their identities. Future studies may consider examining a specific group and distinctions across organizations focused on intersectionality vs. ones that focus on singular identities.

Conclusion

Through this study, I used mixed-methods to explore the synergies and tensions that WOC in engineering might experience when participating in affinity groups and P-BEL as they navigate through a PWI. Both quantitative and qualitative strands were necessary to further understand the complexity of identity and provide meaning about whether and how contextual experiences like affinity groups and P-BEL were related to identity. I found that participants experienced supports and challenges across all contextual influences of undergraduate engineering experience, affinity groups, P-BEL, and professional work experience. Challenges were rooted in systemic issues of discrimination, isolation, and low representation of belonging. Supports were based in finding security within their gender and/or racial/ethnic identity through affinity groups, while simultaneously finding confidence as an engineer through P-BEL. Exploring identity affinity groups, internships, and undergraduate research together and as examples of supporting gender, racial/ethnic, and engineering identity highlighted the importance for viewing these experiences as complementary. By learning about WOC in

engineering experiences that shape and sustain their identities, it offered context to their lived experiences and highlighted the supports that empowered their identities.

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APPENDIX A: SURVEY ITEMS

Gender, Ethnic, and Engineering Identity Items

Constructs	Items
Gender identity	
	My gender is an important part of my self-image.
	My future is tied to the future of other people of my same gender group.
	I have a strong sense of belonging to my gender group.
	My gender is an important reflection of who I am.
	I have a strong attachment to other people of my same gender.
Ethnic identity	
	I have spent time trying to find out more about my ethnic group such as its history, traditions, and customs.
	I have a strong sense of belonging to my own ethnic group.
	I understand pretty well what my ethnic group membership means to me.
	I have often done things that will help me understand my ethnic group background better.
	I have often talked to other people in order to learn more about my ethnic group.
	I feel a strong attachment towards my own ethnic group.
Broad identification with engineering	
	Being involved in engineering is a key part of who I am.
	I consider myself an engineering person.
	I have a strong sense of belonging to the community of engineers.
	I have come to think of myself as an 'engineer.'
	I feel like I belong in engineering.
	The daily work of an engineer is appealing to me.

APPENDIX B: INTERVIEW GUIDELINE

Introduction to Self

To start off this interview, I wanted to first learn more about you. I know people are really complex, but if you had to pick three words to describe yourself, what three words would you pick? You can take a few minutes to think about this if you need to.

1. Why did you pick that word? Why is it meaningful to you?
2. Is there any relationship between the words?

If undergraduate student:

1. What is your major?
2. Why did you decide to choose ___ as your major?

If graduated:

1. Where do you work and what is your position there?
2. What was your major in undergraduate school?
3. Why did you decide to choose ___ as your major?

For both undergrad and graduated:

1. Lastly for this section, how would you describe yourself in terms of race? How about ethnicity? Do you have a preference of whether you like to be identified by your race and/or ethnicity?
2. How would you describe your gender and your pronouns?

Identities

We can use lots of different words to describe ourselves, and we might consider at least some of these to be part of our identity. Some people may describe identity in terms of social group characteristics like their gender, race/ethnicity, or cultural background. For others, it is the roles they play in their life like an engineer or a sibling. Additionally, some may even describe it as their values. Of course, we are not only one of these things though. Identities can be described in many ways. For example, I might describe myself as having different aspects of identity that include being an Asian American woman, a caring daughter, sister, and friend, and researcher and educator.

1. While we all have different aspects of identity, some may be more central to who they are as a person. What aspects of identities shaped you into who you are? Why?
    a. Note: If they tend to focus more on a role or social group or value, ask about others.
2. Probe if not mentioned (can refer to major earlier): Do you see engineering or being an engineer as an important aspect of your identity? Why or why not?
3. Probe if not mentioned (can refer to gender earlier): Do you see gender as an important aspect of your identity? Why or why not?
4. Probe if not mentioned (can refer to race/ethnicity earlier): Do you see your race/ethnicity as an important aspect of your identity? Why or why not?

Intersectionality

As you know, there are a lot of aspects of identity. Yet, for this interview, I am particularly interested in learning more of the experiences of women of color in engineering.

1. Before I even ask about your experiences, do you think the term, woman of color engineer, represents you? Why or why not?
2. What is it like to be a woman of color engineer [or their other description depending on earlier response] in school (or at work (if graduated))?
    a. Could you walk me through an example of your experience. Or anything that stands out to you?
3. Do you see any of these identities as supporting each other or in conflict with one another? Why or why not?
4. Note: If graduated, ask about both work and school accordingly.

Experiences Shaping Identities

Thank you for sharing these descriptions about who you are and the interactions of aspects of your identity. The identities we hold are likely shaped by the experiences we have in and out of school [or work]. I am interested in learning more about how certain experiences shaped your perspectives about being a woman of color in engineering [or their other description depending on earlier response]. For instance, the university has some organizations or opportunities to help with supporting these identities. [Or if graduated also say: For instance, the workplace may have some connections to networks that help support people's identities.]

1. What experiences have you participated in that shaped your identity in relationship to engineering education? For instance, as a woman of color engineer [or their other description depending on earlier response]. It could be positive or negative. [for graduates: It could be something more recent or something that happened earlier like in undergraduate school.]
2. Probe: Ask about experience and value
    a. E.g., Why did you want to participate in this experience?
    b. E.g., How do you think it shaped your perspective as a woman of color engineer [or their other description depending on earlier response]?
    c. Probe: If start with positive experience, ask if there was any negative experience (and vice versa). If negative: Ask about major obstacles faced and how they overcome it
    d. Probe: Circle back if they mentioned tension they experienced with their identities, learn if it's related to their experiences
3. Probe if not mentioned: Did you participate in any student organizations or internships/co-ops/undergraduate research experiences? Why or why not?
    a. How do you see this as connecting to your identity as a woman of color engineer [or their other description depending on earlier response]?
4. If they did not participate in anything: Is there a reason you have not participated in an experience like a student organization or an internship/co-op/undergraduate research? What experiences do you wish you could experience?
5. Thank you for sharing about what shaped your identities, specifically in being a woman of color in engineering [or their other description depending on earlier response]. So the reasons why I am asking these questions stems from research showing certain experiences may support one aspects of identity and other experiences may support other aspects of identity. Of course, it is often that people participate in multiple experiences that relates to their identity holistically, which does get complicated, but interesting. I did

run some initial analyses, but there are limitations. So I wanted to talk to you to learn more of the full picture.

   a. Is there anything else you would like to add that talks about what shaped your role as a woman of color in engineering [or their other description depending on earlier response]?
   b. Were there any other experiences you wished you could have experienced?

Wrap up – End of Interview

1. As we are coming to the end of this interview, what advice would you give to students who are starting out as an engineering major who identify similarly to you (e.g., [insert gender and race/ethnicity])?
2. Before we end the interview, is there anything you would like to add or explain in another way?
3. Is there anything you would like to ask me?
4. Thank you for your participation.