The Social Engineer: Women engineering students' identity construction as modern engineers

by

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Abstract

Research has shown that students' identity development is important for students' retention in engineering (Madsen, & Holmegaard, 2010), but for women the cultural representations of the field can create a disconnect that limits their potential identities with engineering (Carlone & Johnson, 2007; Faulkner 2006; 2007; Goldman, 2012; Malone & Barabino, 2009, Tonso 2006). Engineering is considered a masculine field where the technical aspects of the work are the most valued (Faulkner, 2006; Faulkner, 2007). These cultural beliefs are a misrepresentation of the practice of engineering, which is both technical and social (ABET, 2017; Huff, 2014), but women can still be constrained by the available narratives and expectations that traditionally define what it means to be an engineer and a woman. Therefore, it is important to understand how women construct themselves against these overarching narratives.

This study was framed through a feminist narrative approach to examine how women engineering students constructed identities within their major and how the ideas and expectations of traditional gender roles were integrated into those identities. The purpose of this study was to better understand how undergraduate women in engineering constructed their identities. Data were collected from open-ended interviews and the identity models of five junior and senior class women in mechanical engineering. These women were also in uniquely privileged positions. They had familial and community connections to engineering that provided them insider information, as well as important opportunities to understand and envision themselves within the field.

Findings showed that the five women identified as social engineers, and situated themselves against two prevalent stereotypes in engineering: that engineers were nerdy people

who could not communicate and that engineering is purely technical. In contrast to these representations, the participants felt the social aspects of their identities made them better engineers in the classroom and future workforce compared to their more stereotypical classmates. This portrayal of engineering switches the narrative by demonstrating how the social roles that have previously been feminized and devalued in engineering are precisely the characteristics needed to be successful in the field. The findings from this study present a different narrative of women's experiences in engineering and show a potential shift in the field. Perhaps due to their unusually supportive background, the participants did not see a mismatch with being a woman and being an engineer. They felt that their social characteristics made them better engineers, and it situated them with the more modern view of engineering (Villanueva & Nadelson, 2016) as well as the actual practice of engineering (ABET, 2017; Huff, 2014) highlighting that the field is technical and social.

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CHAPTER I: INTRODUCTION

Background

In the United States, there is a gender-based disparity in representations in science, technology, engineering, and mathematics (STEM) education with the gap increasing through the progression of education and into the workforce (Miller, Eagly, Linn, & 2014). Accordingly, there has been a push by researchers and government agencies to understand how to better recruit and retain women, as well as other underrepresented students, in STEM majors (Heybach &Pickup, 2017). Researchers have presented various reasons for the underrepresentation of women in STEM fields. One of the earliest explanations for the gender disparity was based on academic ability, but recent research has shown that this is not the case, that women perform well in STEM related areas (Eccles, 2011; Mann & DiPrete, 2013; Ulricksen, Madsen, & Holmegaard, 2010; Wang & Degol, 2012). Although men still tend to be represented at the highest scoring end in standardized testing, the overall gender gap in math achievement on standardized tests has diminished (Mann & DiPrete, 2013). Women students also have slightly higher math and science grades in high school (Wang & Degol, 2012). Even within higher education, women students tend to have high GPAs in STEM fields (Vogt, Hocevar, & Hagedorn, 2007; Matusovich, Streveler, & Miller, 2010). Research has shown that intellectual aptitude does influence a student's career choices, but it is not the sole underlying reason for the underrepresentation of women in STEM fields, especially considering women perform well overall (Wang & Degol, 2012). Factors such as the culture of STEM (Gayles & Ampaw, 2016; Seymour & Hewitt, 1997; Shapiro & Sax, 2011), students' identity development with the field (Merolla & Serpe, 2013; Ulricksen, Madsen, & Holmegaard, 2010), and students' motivational orientations (Eccles, 1987; Wang & Degol, 2012) contribute more to students' success and

persistence in these fields than academic ability. Importantly, all of these explanations are related to overarching sociocultural beliefs about what it means to be in STEM and who should be in STEM.

The culture of STEM fields, in particular engineering, is seen as White, masculine, and competitive, contributing to the conception that STEM is a place for White, straight, and cisgender men (Heybach &Pickup, 2017; Seymour & Hewitt, 1997; Sinnes & Loken, 2014). Although many STEM students face similar unpleasant conditions, including the competitive "weed-out" culture, those students who persist are more willing to tolerate the culture or have an advantage to acclimating to it (Seymour & Hewitt, 1997). Essentially, STEM fields are easier to navigate if you are a White, cisgender man because your identity marks you as congruent with the stereotypical representation of the field. Alternatively, women often face a chilly climate (Vogt, Hocevar, & Hagedorn, 2007) and are more likely to view their STEM academic environment as threatening than their man classmates (Casad, Petzel, & Ingalls, 2018). Women also have a more difficult time constructing a meaningful identity with the field because their identity as a woman signals that they do not fit with the masculine stereotypes of the field (Faulkner, 2006; 2007; Hatmaker, 2013).

Further, gendered expectations in career roles influence women's initial decisions to major in STEM fields, whereas oftentimes women do not see STEM careers as a potential option for them due to gender socialization (Eccles, 1987, 2011). Therefore, sociocultural expectations influence women students' experiences, potential identification with the field, and their choices to persist and enter into STEM. In recent research, the role of identity in students' retention in STEM has been a major area of interest. For the purpose of this study, engineering majors will be the central focus.

Identity

For the purpose of this study, identity will be conceptualized as a narrative construction. In this perspective, individuals speak to "*who they believe they are*" (Doucet & Mauthner, 2008) through narrative. It is through narrative that we construct our identities and make sense of our social world:

> It is through narrativity that we come to know, understand, and make sense of the social world, and it is through narratives and narrativity that we constitute our social identities… all of us come to *be* who we *are* (however ephemeral, multiple, and changing) by being located or locating ourselves (usually unconsciously) in social narratives *rarely of our own making* (Somers, 1994, p. 606).

Therefore, individual's stories or narrations are a way for individuals to construct their identities and inform others as to whom they believe they are. An essential part of this perspective is that an individual's narrative account of their identity is both shaped and constrained by the prevailing meanings present within the larger and local society (Taylor & Littleton, 2006). Accordingly, narrative constructions of identity take into account context, social positions, and power. Narrative identities are formed from the specific context, both temporal and spatial, and these contextual influences come with their own culturally constructed stories that have specific rules and practices that inform who people should be (Somers, 1994).

Therefore, identity is not seen in "essentialist terms, but as multidimensional and connected to social, historical, political and cultural contexts" (Smith & Sparkes, 2008, p.15). This means that identities are constrained by the context in which they are constructed (Riessman, 2008; Somers, 1994; Woodiwiss, Smith, & Lockwood, 2017) as well as the larger societal forces that signal to individuals who they should be (Lockwood, Smith, & Woodiwiss,

2017, Somers, 1994; Smith & Sparkes, 2008; Taylor & Littleton, 2006). Therefore, identities are a situated construction based on the available narratives and contextual influences that are influenced by power structures (Somers, 1994; Woodiwiss, Smith, & Lockwood, 2017). This is an active and continuous process (Taylor & Littleton, 2006) where individuals use these prevailing and available narratives to construct their identity and sense of self (Smith & Sparkes, 2008). These dominant narratives direct individuals to tell or understand their experiences in particular ways that oftentimes do not represent the spectrum of experiences, and silence alternatives (Lockwood, Smith, & Woodiwiss, 2017).

With this perspective in mind, an individual's identity will be conceptualized as an active process where they narratively construct and present themselves based on prevailing narratives that are the product of the broader context and sociocultural forces. This perspective recognizes that individuals have some agency and control in how they chose to construct and present themselves, but larger sociocultural forces primarily constrain the options available to them. For the purpose of this study, I will examine how the participants construct their identity with engineering based off of the prevailing narratives of what it means to be an engineer and a woman.

Student Identities and Engineering

Research has shown that students' identity development can be more important for retention than academic ability (Merolla & Serpe, 2013; Ulricksen, Madsen, & Holmegaard, 2010). Therefore, when examining retention in engineering, it is important to understand how students form identities with the field. If students can see themselves as an individual who can do science and has self-efficacy in those abilities, it leads students to develop an identity with the field (Eccles, 2009). Researchers have found that the main factors that lead to students

identifying as engineers are: competence/ performance, interest in the field, and recognition (Godwin, Potvin, Hazari, & Lock, 2016; Patrick, Borrego, & Prybutok, 2018). However, gendered sociocultural forces (Cech, 2015; Faulkner, 2006; 2007, Rhoton, 2011), as well as the saliency of students' other dimensions of their identity (Carlone & Johnson, 2007; Malone & Barabino, 2009) influence this process. Ultimately, students are not free to develop any identity with the field; they are constrained by the positions made available to them by the culture and expectations of the field that signal who can be recognized as a "real" engineering student (Carlone & Johnson, 2007; Faulkner 2006; 2007; Goldman, 2012; Malone & Barabino, 2009, Tonso 2006).

Engineering is viewed as a masculine field in society (Hatmaker, 2013), but there is also a deep social/technical dualism present that engineers work with "nuts and bolts and people" (Faulkner, 2006; Faulkner, 2007). However, the technical side of engineering is the most valued, and most associated with masculine roles, whereas the social side is seen as feminine and devalued. This binary has implications for engineers' potential identities with the field and can produce a mismatch in what is valued within engineering, the technical role, and the roles associated with stereotypical gender roles (Cech, 2015). Because of this, engineering majors can seem gender inauthentic for women (Faulkner, 2006; 2007) and they must negotiate their gender identity with their possible engineering identities (Goldman, 2012; Hatmaker, 2013). Oftentimes this process reinforces stereotypical gender differences, where women are more likely to identify with the more feminized identities in engineering (Cech, 2015). STEM cultures encourage and reward gender performances that maintain gender binaries in the field and conform to traditional gender roles (Rhoton, 2011). However, when women take on the more social and feminized roles

in engineering, they are accepting less valued positions within engineering (Cech, 2015) and they may further struggle to maintain their status as a "real" engineer (Faulkner, 2006; 2007).

Therefore, women must negotiate and justify their presence in a masculine field. The choices they make on who they are in the field have implications on how they are viewed in engineering. Women can be constrained by the available narratives and expectations of what it means to be an engineer and a woman. Although these cultural beliefs inform their identities, it is a misrepresentation of the practice of engineering which is technical and social (Huff, 2014). Nevertheless, these overarching narratives inform individuals' decisions to enter a career field and how they situate themselves with the field. Therefore, it is important to understand what narratives they perceive to be available for them and how it informs their identities and experiences with the field. To better understand women's identity and experiences in engineering, researchers need to examine how their identities are constructed and used to navigate engineering. In particular, we need to examine how ideas of traditional gender roles intersect with the cultural constructions of the field to influence individuals' identity construction and experiences within the field.

Study Purpose

Previous research has shown that women and students of color are often limited by the positions made available to them because of the culture and climate of the field that constrains their potential identities with engineering (Carlone & Johnson, 2007; Faulkner 2006; 2007; Goldman, 2012; Malone & Barabino, 2009, Tonso 2006). They must position themselves within the overarching narratives and expectations of what it means to be an engineer and a woman. Many previous researchers studying engineering and science identities account for how social forces, context, and privilege influence the identities students construct, but they still present a

more singular and static engineering identity. They focus on the end product and not the nuances of the production and performance of that particular identity. This perspective also does not account for how these science identities change in different contexts when other identity dimensions become more or less salient.

Additionally, researchers need to further interrogate the identities and narratives available for women in engineering. For women engineers, negotiations of gender roles and expectations influence their identity with the field, which in turn has occupational consequences (Cech, 2015). Additionally, their identity performances can work to trouble or reinforce gendered ideals of science (Powell et al., 2008; Rhoton, 2011). What identity women in engineering take on matters, and more research needs to be done to understand this construction process. Because of this, there needs to be an examination of the available narratives for women in engineering and how their identities are formed, negotiated, and then used in the different contexts in engineering.

Feminist Narrative Research

At the foundation of narrative research is "stories lived and told" (Clandinin & Connelly, 2000, p. 20). Narrative inquiry is a reconstruction of a person's experience and is an attempt to figure out the taken-for-grantedness of people's lives (Clandinin & Connelly, 2000) and the social world (Miller, 2017). Feminist narrative research pushes this further to focus on the taken-for-granted aspects of women's lives (Woodiwiss, Smith, & Lockwood, 2017). Feminist methods have the overt goal "to correct both the *invisibility* and *distortion* of female experience in ways relevant to ending women's unequal social position (Lather, 1988, p. 571). Therefore, to do feminist research means to put the social construction of gender at the center of the research process (Lather, 1988), and work to improve the lives of those who identify as women

(Woodiwiss, Smith, & Lockwood, 2017). Therefore, combining feminist and narrative approaches offers a fuller account of understanding women's lives by challenging researchers to take into account the various societal and contextual forces that shape the stories women tell and are told about them. It is about further questioning the dominant narratives, what stories can be constructed, and what larger purposes those narratives serve (Woodiwiss, Smith, & Lockwood, 2017).

Feminist narrative approaches acknowledge that women, in particular, are constrained by the current circulating narratives (Woodiwiss, Smith, Lockwood, 2017) because they tend to encourage the presentation of a particular gendered self (Miller, 2017). These narratives direct women to tell or understand their experiences in particular ways that oftentimes do not represent the spectrum of women's experiences, and silence alternatives (Lockwood, Smith, & Woodiwiss, 2017). Therefore, through a feminist narrative approach researchers can interrogate the narratives women use to understand their lives and examine how these narratives influence their experiences and identities. Therefore, through a feminist narrative approach, I can gain a deeper understanding of how women in engineering construct their identities by interrogating both the narratives they use to construct their identities and the various dominant narratives and expectations that constrain their potential options. Through the participants' narratives, I can examine the motivations and decision-making processes that go into the construction of their engineering identity. It is a way to make sense of and better understand the various processes that influence and ultimately lead to their constructions of an engineering identity. It also presents the opportunity to co-construct new narratives of women's experiences in engineering. Overall, a feminist narrative approach allows for a more in-depth examination of how women construct

identities with engineering and the gendered expectations that arise in the educational contexts that can limit their potential identities.

I aim to conduct a study that examines how women engineering students construct identities within their major and how ideas and expectations of traditional gender roles are integrated into those identities. This study will be framed through a feminist narrative approach because of its utility to privilege women's stories, interrogate dominant narratives, and because it is through narrative that individuals construct and makes sense of their identities (Somers, 1994). Through feminist narrative, I will examine how women construct their identities, paying particular attention to the different narratives they use to construct and make sense of their identity with the engineering. I will also examine how these storied accounts (Somers, 1994) of their identities change as different dimensions of their identity become more or less salient as they navigate the various contexts of their major. This approach allows for a deeper examination of what identities are possible for women in engineering because of its focus on the nuances of the identity construction process.

Research Questions:

1. What narratives do women engineering majors use to construct and make sense of their identity with engineering? Which dimensions of students' identity are most salient in this construction?
2. What role do gendered narratives play in the construction of their engineering identities?
3. How were their experiences influenced by the aspects of their identities that became salient in different contexts?

Change in Research Questions. I initially had two separate research questions to examine how their identities informed their experiences and changed in different contexts. I first asked:

How does the engineering identity they construct influence their experiences in their major?

Then my follow up question was:

How do these storied accounts of their identities change as different dimensions of their identity become more or less salient as they navigate the various contexts of their major? How does this influence their experiences?

However, I found throughout my interviews and analysis process that the better question was to combine the two questions and instead ask how their experiences were influenced based on what aspects of their identities became salient. I found that in different contexts aspects of themselves would become salient by their own doing or when placed upon them by others, which altered their experiences or how they viewed their identity. It was more of a joint, concurrent process. In their narratives what seemed salient for them was brought up by others or very situational. So I found the more interesting question was what identities became salient and how it changed how they felt about engineering and their experiences.

Significance

Because identity development is situated and jointly accomplished within educational settings (Hand & Gresafli, 2015), it has been suggested that it is imperative for the educational psychology community to further examine the nature of identity formation in educational settings (Kaplan & Flum, 2012). By focusing on how women engineering students construct their identities across educational settings, this not only addresses the call for the field to look at the identity construction in educational settings, but it also advances the current literature on women in engineering by examining the construction process more closely. Recently, Rodriquez, Lu, and Bartlett (2018) suggested that to expand the engineering education literature researchers need to move away from seeing identity as static and examine how it "can change with

environment and context, engagement and interest, and socialization and alienation experiences" (p. 261). In this study, I hope to contribute to this by examining how women in engineering construct identities with their major, paying particular attention to the narratives they use to construct their identities and the sociocultural forces that influence this process. Additionally, I will examine how their identities shift across their educational experiences, advancing the current literature on identity and women's experiences in engineering. The purpose is to try and understand the narratives available for women to construct an identity with engineering, how they use them, and how their different experiences as engineering students influence this construction process.

Much of the previous research on women's identity development with engineering has focused on a singular static science identity. The purpose was to see if they developed an identity with the field at all and how they defined it. It did not examine the nuances of the construction of that identity. Through this study, I hope to better understand the motivations and decision-making processes that go into this construction, how they see their identity, and what narratives they use in their construction. It is important to gain a deeper understanding of how participants negotiate and make sense of this because ultimately, the identity they take on influences their persistence, recognition as a scientist in the field (Carlone & Johnson, 2007), and their occupational outcomes (Cech, 2015).

Furthermore, the identity women in engineering take on is important for their individual experiences and collectively for how women are viewed in engineering. Their identity performances can serve to recapitulate further ideas of a masculine science that devalues the feminine or they can potentially trouble these binaries (Powell et al., 2008; Rhoton, 2011). To improve women's experiences in engineering and contribute to a more equitable science, we

need to better understand the nuances of how identities are constructed with engineering and what contributes to the identity decisions they make.

CHAPTER II: REVIEW OF THE LITERATURE

Introduction

Currently, in US society, and across cultures there is a gender-based disparity in representations in science, technology, engineering, and mathematics (STEM) education with the gap increasing through the progression of education and into career fields (Miller, Eagly, Linn, 2014). Due to the view that STEM fields are essential for the United States global success and competitiveness, researchers and government agencies have pushed to better understand how to recruit and retain students in STEM majors (Heybach & Pickup, 2017). In particular, much of the research in STEM has been dedicated to understanding how to recruit and retain underrepresented populations in STEM, such as women and people of color. Researchers have presented various reasons for the underrepresentation of women in STEM fields.

One of the earliest explanations for the gender disparity in STEM fields was based on student academic ability (Eccles, 2011; Mann & DiPrete, 2013; Ulricksen, Madsen, & Holmegaard, 2010). This is a deficit perspective (Eccles, 1987; 2011; Heybach & Pickup, 2017) as to why women do not major in STEM that has mostly been shown not to be the case. Although men still tend to be represented at the highest scoring end in standardized testing, the overall gender gap in math achievement on standardized tests has diminished (Mann & DiPrete, 2013), and women students have slightly higher math and science grades in high school (Wang & Degol, 2012). Even within higher education, women students tend to have high GPA's in STEM fields (Vogt, Hocevar, & Hagedorn, 2007; Matusovich, Streveler, & Miller, 2010). Research has shown that intellectual aptitude does influence a student's career choices, but it is not the sole underlying reason for the underrepresentation of women in STEM fields (Wang & Degol, 2012). Other factors such as the culture of STEM (Gayles & Ampaw, 2016; Male,

Gardner, Figueroa, & Bennett, 2018; Seymour & Hewitt, 1997; Shapiro & Sax, 2011), students' identity development with the field (Merolla & Serpe, 2013; Ulricksen, Madsen, & Holmegaard, 2010), and students' motivational orientations (Eccles, 1987) have more to do with retention and recruitment than ability. Importantly, all of these explanations are related to overarching sociocultural beliefs about what it means to be in STEM, and who should be in STEM.

STEM fields, in particular engineering, are seen as White, masculine, and competitive, (Heybach &Pickup, 2017; Seymour & Hewitt, 1997; Sinnes & Loken, 2014). This depiction of the field leads to additional challenges for underrepresented students because of the mismatch in their identity dimensions and the stereotypical representation of the field (Hatmaker, 2013). Women and students of color have a more difficult time integrating and constructing a meaningful science identity and sense of fit within these programs (Carlone & Johnson, 2007). Additionally, they may not see a STEM career as a viable choice for them because of gendered expectations in career goals and values (Eccles, 1987; 2009; 2011; Diekman, Brown, Johnston, & Clark, 2010; Diekman, Steinberg, Brown, Belanger, & Clark, 2017). Therefore, researchers mostly view retention in STEM fields as an issue with the culture and stereotypical representations of the field instead of the individual students' capabilities. Therefore to advance the field, there needs to be a better understanding of how STEM identities are linked to contexts and assumptions of the field, and how these influence students' identity and experiences within the field.

STEM Culture

The culture of STEM fields is highly influenced by the traditions of scientific knowledge and the stereotypical ideas of who can be a scientist. As feminist philosophers of science have noted (Harding, 1988; Harraway, 1988), the production of scientific knowledge used to be

endeavor exclusively allowed for White men, privileging the masculine in the construction of meaning and knowledge. These traditions in scientific knowledge have continued to influence the ideas of what it means to do science, who is seen as capable of doing science (Heybach &Pickup, 2017; Sinnes & Loken, 2014), and influences the culture of STEM fields. Therefore, STEM fields are structured according to White, masculine norms and values (Heybach &Pickup, 2017, Sinnes & Loken, 2014; Seymour & Hewitt, 1997) hidden in an ideology of meritocracy (Carlone & Johnson, 2007). They not only promote a culture of hegemonic masculinity (de Pillis & de Pillis, 2008) but are also spaces of white male privilege (Douglas, 2015). These values and norms are enacted in the learning environments (Carlone & Johnson, 2007, Shapiro & Sax, 2011, Tonso, 2006), peer and professor interactions (Robnett, 2016; Vogt, Hocevar, & Hagedorn, 2007), as well as in the course syllabi (Parson, 2016), and department mission statements (de Pillis & de Pillis, 2008). Assumptions of gender and race are present in many aspects of STEM, making identity dimensions such as race and gender signals for acceptance and recognition before their academic ability is even considered (Carlone & Johnson, 2007; Madsen, Holmegaard, & Ulriksen, 2015). Furthermore, this contributes to a STEM culture that privileges White masculine norms (Heybach & Pickup, 2017; Sinnes & Loken, 2014; Seymour & Hewitt, 1997).

Seymour and Hewitt (1997) provided an early examination of STEM fields and found that they were structured around White masculine norms and values, characterized by a competitive, "weed out" culture. They concluded that the culture and norms of the field contributed to students leaving, not their academic capabilities or motivation. The students who left STEM fields were very similar to the students who remained. The authors explained that many students faced similar unpleasant conditions, but that those who persisted were more

willing to tolerate the culture or had an advantage to acclimating to it. Essentially, STEM fields are easier to navigate if you are a white man because your identity marks you as congruent with the norms of the field. STEM classrooms are seen as masculine, competitive, and individualistic (Shapiro & Sax, 2011), a culture and learning environment that is not welcoming or conducive to underrepresented students. Many students of color (Andersen & Ward, 2014) and women (Shapiro & Sax, 2011) not only prefer more cooperative learning environments, but also have negative experiences in these more masculine, competitive, and individualistic settings.

STEM classrooms have been described as chilly climates for women that can produce feelings of isolation, intimidation, insecurity, and discrimination (Shapiro & Sax, 2011; Vogt, Hocevar, and Hagedorn 2007). Women in STEM are also more likely than their man classmates to view their academic environment as threatening (Casad, Petzel, & Ingalls, 2018). Researchers have found that women students feel that man peers do not respect them as equals and that men have an advantage in their fields (Vogt, Hocevar, and Hagedorn 2007). Similarly, Robnett (2016) found that it is not uncommon for women to encounter man peers in STEM who openly question women's presence in the field because of their biological sex. Additionally, other researchers have found that the discourses surrounding the field, particularly those coming from man classmates, are restrictive and discriminatory towards women, resisting their participation in STEM (Lynch and Nowosenetz 2009). These discourses produce barriers for women's entry in STEM, by marking social territories of gender exclusion (Foor & Walden, 2009). The chilly climate for women in STEM influences women's intentions to enter and persist in the field. Additionally, sociocultural and motivational factors also constrain these academic choices.

Expectancy-Value Theory

The leading framework for examining the role of motivation and choice in the

underrepresentation of women in STEM fields is Eccles and her colleagues' expectancy-value theory (Eccles, 1987,1994, 2009; Wigfield & Eccles, 2000). For the past 30 years, expectancy-value theory has been one of the most comprehensive theoretical frameworks for examining the psychological and contextual factors underlying gender differences in STEM representation (Eccles, 2011; Wang & Degol, 2012). From this framework, the STEM pathway is comprised of multiple choices that lead to an ultimate entry and persistence in a STEM occupation (Wang & Degol, 2012). As Eccles (1987) explains, "many of the most significant sex differences occur on achievement-related behaviors that involve an element of choice, even if the outcome of that choice is heavily influenced by socialization pressures, gender-role beliefs, and cultural norms" (p. 141). This emphasis on constrained choice sets expectancy-value theory apart from other theoretical perspectives on the underrepresentation of women in STEM fields and moved the literature away from more limiting perspectives. Importantly, expectancy-value theory takes into account how individuals have some agency in the choices that they make, but they are always constrained by larger sociocultural forces that encourage gendered choices. As Eccles (1987) articulates, this approach "takes us beyond the question of 'Why aren't women more like men?' to the question 'Why do people make the choices they do?'" (p. 141). This change legitimizes the achievement related choices for both men and women, recognizes the influence of larger sociocultural forces on those choices, and moves the focus of analysis away from deficit explanations of why women are underrepresented in STEM fields.

Expectancy-value theory links achievement-related choices such as course enrollment and major selection, to two main sets of beliefs: expectations for success and subjective task value, "the importance or value individuals attach to the various behavioral options they think are available"(Eccles, 2011a, p.195). In this perspective, students make choices based on the options

they perceive to be available to them which are often illusory, based on their expectations for success, how the options relate to their values and goals, and how the perceived cost of the activity compares to other perceived options. Each of these factors is also heavily shaped by individuals' experiences, the behaviors and beliefs of their parents, teachers, and peers, and by cultural norms, in particular, gender role socialization (Eccles, 1987; 2011b). This perspective takes into account the choices individuals make and the various factors that influence those choices showing that achievement decisions are not made independently of other factors. These choices are situated in larger sociocultural and developmental contexts (Eccles, 1987, 1994, 2011).

Through expectancy-value theory gender differences in STEM fields are explained by differences in choices and the personal values and goals individuals bring to those situations. Expectancy-value theory "legitimizes females' choices as valuable on their own terms rather than as a reflection or distortion of male choices and male values" (p.166). This perspective has had a profound impact on gender equity by switching the focus to the role of choice and socialization, instead of the idea that women are somehow deficient men. At the foundations of the model is the need to study women's achievement-related choices from the women's perspective (1987, 2011b). Expectancy-value theory also places men's and women's achievement choices on more equal footing, by highlighting that many of the differences in choice stem from the fact that men and women are socialized to have different goals and values for their lives (Eccles, 1987). Therefore, through their work on expectancy-value theory, Eccles and her colleagues helped to establish a more equitable research focus for women in STEM that remains today (Eccles, 1987, 2009, 2011; Wigfield & Eccles, 2000).

Educational psychologists have continued to use expectancy-value theory to explain

gender differences in STEM and reinforce that it is gender differences in subjective task value and expectations that lead to differences, not ability. Over the past 30 years, researchers have consistently found empirical support for this claim (Lauerman, Tsai, & Eccles, 2017; Wang, Eccles, & Kenny, 2013; Wang & Degol, 2012). Ultimately it is not ability that causes the gender gap, its motivational factors relating to students' interest, identity, and values (Lauerman, Tsai, Eccles 2017, Matusovich, Streveler, & Miller, 2010; Perez, Cromley, & Kaplan 2014). For example, Wang, Eccles, & Kenny (2013) found that math ability by itself was not an overriding factor for women's underrepresentation in STEM, that oftentimes women with high math ability also have high verbal ability. Therefore, women who have high math ability are more likely to have a larger range of occupational choices compared to their men counterparts who often do not have high ability in both math and verbal skills. These women with both high verbal and math ability often chose occupations that have equal status to STEM but were not math intensive. It again goes back to choice and the individuals' values and goals.

The role of values and identity has taken a central focus in the current literature on women in STEM. Similar to Eccles (1987) initial findings that women are more likely to value more helping and social roles, current research has shown that woman adolescents tend to aspire to careers that involve helping others (Watt et al., 2012) and that women are more likely to have altruistic career goals (Diekman, Brown, Johnston, & Clark, 2010; Diekman, Steinberg, Brown, Belanger, & Clark, 2017). Although this is primarily due to socialization processes that lead women to value more nurturing roles and goals (Eccles, 1987; 2011), it has an impact on what career fields they see as congruent with their personal values and goals. STEM fields overall, particularly engineering, are consistently viewed as affording more status goals, making these fields appear to be incongruent with altruistic values and goals, which leads women to opt for

fields that match their values (Diekman, et al., 2010; Diekman et al., 2017). Values are one part of a larger gendering of career fields that influence major choice.

Career fields are also gendered along the care/technical divide to be congruent with traditional gender roles (Barone, 2011, Charles & Bradley, 2002; Charles & Bradley, 2009; England, 2010). This perspective posits technical fields such as engineering are masculine because men are more analytical and better at working with things; whereas careers such as nursing and teaching are feminine because women are better at nurturance and interpersonal relations (Charles and Bradley, 2009). These dichotomies in roles are seen as natural, and they encourage men and women to seek careers that align with traditional gender roles. In this way, major choice is seen as a way to "indulge your gendered self " (Charles & Bradley, 2009) and not break from gendered expectations. This is encouraged by the pervasive gender role socialization in our society and education (Barone, 2011; Charles & Bradley, 2002; Charles & Bradley, 2009; Eccles, 2011; England, 2010). So from this perspective, gender segregation in education is seen as natural because men and women are viewed as fundamentally different, and they should be in career fields that mirror those differences (Barone, 2011; Charles & Bradley, 2002; Charles & Bradley, 2009; England, 2010). Therefore, women entering STEM fields is seen as problematic, because of the mismatch of appropriate gender roles which causes women in STEM fields to have to negotiate their gendered identity and presence within the field (Faulkner 2006; 2007; Goldman, 2012).

Engineering Identity

Engineering majors will be the central focus of the study. The role of identity in students' retention in engineering has been a major area of interest within the engineering education literature (Perez, Cromley, & Kaplan, 2014; Matusovich, Streveler, & Miller, 2010, Ulriksen,

Madsen, & Holmegaard, 2010). As reviewed before, identity researchers believe it is important for students to see themselves in the field, or perceive a potential identity. Therefore, many researchers in engineering education have focused on understanding what makes an engineering identity and what factors influence students to form an identity with the field.

Researchers have found that when you ask students what constitutes an engineering identity, they focus on specific content knowledge and skills that are needed in engineering practice. Meyers, Ohland, Pawley, Silliman and Smith (2012) asked students to report if they identified as an engineer and what factors were necessary to be an engineer. They found that students focused on more individual and intangible factors. The most common student responses were: being able to make competent design decisions, being able to work with other by sharing ideas, accepting responsibility for the consequences of actions, speaking/communication using accurate technical terminology, completing an undergraduate engineering degree, and making a moral/ethical decision considering all factors. These attributes related to the students' perceptions of the necessary knowledge and skills they associated with being an engineer.

In a similar study, Villanueva and Nadelson (2016) asked students to define their perception of engineering, if they identified as an engineer and the students' goals with the field. They found that the participants presented engineering in three ways that also coincided with the historical definitions of the field. The students framed engineers as tinkerers, which aligns with the definition from the pre-industrial era. Other students saw engineers as those who apply science to practical problems, which aligns with the typical engineer from the industrial era. Lastly, some students saw engineers as 21st-century problem-solvers with a social impact, the modern definition of the field (National Academy of Engineers, 2008, 2013, 2015). The researchers argued that this more modern definition was more productive for the current field and the skills

needed to be successful in the field. In a recent project with Auburn engineering students, we used a similar method and found that the students largely situated their definitions and goals with engineering within these three conceptualizations of the field (Lakin & Hill, 2017)

Additionally, the students in Lakin & Hill (2017) who identified as engineers explained that it was because they had the mindset, necessary skills, or they felt they already solved problems like engineers. There was a smaller group of students who identified as engineers in training, and they focused on how they did not have all the necessary skills or coursework to consider themselves engineers. The results from these projects show that students' definitions of an engineering identity are strongly tied to knowledge, skills, and their perception of what engineers can do with those abilities.

Another line of research has focused on what factors lead students to identify as an engineer (Carlone & Johnson, 2007; Hazari, Sonnert, Sadler, & Shanahan, 2010). Carlone and Johnson (2007) found that a science identity developed from students' beliefs of their performance ability and competence, as well as their perceived recognition as scientists by others. Hazari et al., (2010) expanded this framework to include the influence of students' STEM interests on their development of science identities. Current researchers have built from this work to examine engineering specific identities. Godwin, Potviwn, Hazari, & Lock (2016) as well as Patrick, Borrego, & Prybutok (2018) found that the main factors that led to students identifying as engineers were: competence/ performance, interest in the field, and recognition (Godwin, Potvin, Hazari, & Lock, 2016; Patrick, Borrego, & Prybutok, 2018). The following sections describe each of these factors.

The first factor is competence and performance beliefs and they are closely linked. Patrick et al. (2018) defined performance as "the student's belief in their ability to perform in

their classes or when conducting engineering tasks" (p. 353). They defined competence as "student's belief in their ability to understand engineering material" (p. 353). Competence and performance are viewed as one construct because researchers have found that competence and performance are theoretically equivalent constructs, that students' beliefs about their competence tend to align with their performance (Patrick et al., 2018). Therefore, students who perceive they are capable of doing engineering work and perform well are likely to build an engineering identity.

However, it is also important for students to be interested in the content. Therefore, Hazari, Sonnert, Sadler, & Shanahan (2010) added interest to Carlone and Johnson's (2007) framework. Interest is the second factor that influences students' identity with engineering and describes how "motivated a student is in the content and career they are pursuing: often encompassing the motives a student has for pursuing engineering" (Patrick et al., 2018). It is the students' desire to do STEM-related activities and the extent to which they find them enjoyable (Godwin et al. 2016, p. 34). Therefore, to develop an engineering identity, students need to be interested in the subject and believe they are capable of doing engineering work.

The final factor that influences students' engineering identity is recognition. Researchers have found that it is crucial for students to be recognized from their peers, instructors, and family members as science or engineering people to build an engineering identity (Carlone & Johnson, 2007; Godwin et al., 2016; Patrick et al., 2018). It is harder for students to see themselves as an engineering person if others do not recognize them as such. Overall, the literature on engineering identity suggests that "those who are interested in engineering, recognized as engineers by their friends and family, and have feelings of ability to do and understand engineering have the strongest engineering identities" (Patrick et al., 2018, p. 359) and are more likely to develop an

identity with the field. However, the stereotypical representations of engineering fields and the larger sociocultural forces heavily influence this identification process. Not all students are afforded the same opportunity to see themselves within engineering and thrive in the culture (Andersen & Ward, 2014; Carlone & Johnson, 2007; Heybach &Pickup, 2017; Sinnes & Loken, 2014).

The culture of engineering makes it more difficult for students who do not match the White masculine norms of the field to develop an engineering identity (Carlone & Johnson, 2007; Faulkner 2006; 2007; Goldman, 2012; Malone & Barabino, 2009). Women and students of color have a more difficult time integrating and constructing a meaningful engineering identity because of a mismatch in their identity and the norms of the field (Carlone & Johnson, 2007; Cech, 2015; Faulkner, 2006; 2007; Goldman, 2012). Researchers have found that students are constrained by the positions made available to them by the masculine culture and expectations of the field that signal who can be recognized as a "real" engineering student (Carlone & Johnson, 2007; Faulkner 2006; 2007; Goldman, 2012; Malone & Barabino, 2009, Tonso 2006). Therefore, the current literature has examined the various ways students develop identities with engineering and the sociocultural factors that influence this process. Researchers have looked at how engineering identities are related to gender performances (Cech, 2015; Faulkner, 2006; 2007, Rhoton, 2011), and how the saliency of students' other identities influences if they are recognized as a scientist (Carlone & Johnson, 2007; Malone & Barabino, 2009).

Gender Identity Performance within Engineering

Professional identity development does not take place in a vacuum. Self-concepts and sociocultural forces influence the professional identities students take on (Cech, 2015). Overall, engineering, like other areas of STEM, is viewed as a masculine field (Faulkner, 2006; Faulkner,

2007). So for women, there is often a mismatch in expectation of gender roles, causing engineering majors to seem gender inauthentic (Faulkner, 2006; 2007). Women then must negotiate their gendered identity with their possible engineering identity (Goldman, 2012). This can be similar to a filtering process (Cech, 2015), where gendered self-conceptions filter their potential engineering identities. This process reinforces stereotypical gender differences, where women are more likely to identify with the more feminized identities in engineering such as social consciousness, and men are more likely to identify with the masculine typed technical identities. Importantly, the women take on the less valued conceptions of engineering which can further influence their experiences. Women in the field have a more difficult time maintaining the identification as a "real" scientists and belonging in the field because of their gender, while men can fall back on their identity as a man to ground their identification as a "real" engineer (Faulkner, 2006; 2007).

STEM cultures encourage and reward gender performances that maintain gender binaries in the field and conform to traditional gender roles (Rhoton, 2011). For example, Powell, Bagilhole, and Dainty (2008) found that women engineering students performed gender to gain men's acceptance through behaving normatively feminine, or acting like 'one of the boys', or even taking on an 'anti-woman' approach. These performances helped them gain acceptance but did not challenge the gendered culture of engineering. The authors suggested that these performances ultimately contribute to maintaining the hostile environment for women in engineering that does not value femaleness (Powell et al., 2008). Similarly, Rhoton (2011) found that women engineers who found acceptance in the profession would distance themselves from other women engineers who conformed to more feminine ideals, also implicitly rejecting femaleness.

Further, their gendered performances have consequences to how they are viewed in the field and how women overall are valued in the field. This puts women in a difficult position between multiple choices. Both society and the culture of STEM encourage more traditionally feminine performances (Barone, 2011; Charles & Bradley, 2009; England, 2010, Rhoton, 2011) but in order to gain acceptance from their peers they may need to distance themselves and devalue the feminine (Powell et al., 2008; Rhoton, 2011), or they may feel pressured to present themselves in a way that fit the masculine ideals (Hatmaker, 2012). As Bystydzienski and Brown (2012) explain, "the implication here is that while women exercise agency by making choices regarding how they do gender, both gender and engineering structure choice, in that only limited options are possible" (p.3). This experience can be even more difficult for women of color because they most negotiate two identity dimensions that do not match the ideal engineering individual.

Recognition and Identity Salience

Recognition by peers, professors, and family members is one of the critical factors relating to an engineering identity (Carlone & Johnson, 2007; Godwin et al., 2016; Patrick et al., 2018) but this is highly influenced by the cultural norms of the field. In engineering and other STEM fields, students' identity dimensions outside of being an engineering student can influence how they experience their environment and how others perceive them. These identities can be privileged campus positions (Tonso, 2006), gender, or race (Carlone & Johnson, 2007; Madsen, Holmegaard, & Ulriksen, 2015). Assumptions of gender and race are present in many aspects of engineering, making identity dimensions such as race and gender signals for acceptance and recognition before their academic ability is even considered (Carlone & Johnson, 2007; Madsen, Holmegaard, & Ulriksen, 2015). Recognition is essential for students to build an engineering

identity (Godwin et al., 2016; Patrick et al., 2018), but for women and students of color, this can be difficult (Carlone & Johnson, 2007). Their work, academic contributions (Grunspan, Eddy, Brownell, Wiggins, Crowe, & Goodreau, 2016; Hirshfield, 2017), and even physical presence are oftentimes not recognized as legitimate (Carlone & Johnson, 2007, Faulkner 2006; 2007, Gayles & Ampaw, 2016; Malone & Barabino, 2009).

These privileged identities, such as being White and a man, can provide students with higher status and recognition in the classroom that is not always backed up by merit. For example, Tonso (2006) found that the campus culture produced power relations the reemerged in engineering teamwork settings influencing which students were in positions of power, regardless of academic ability. These students who had privileged campus identities were seen as more "deserving" of status, and they frequently used it to control and exploit other students. For example, some students would take credit for others' findings and would do the bare minimum of work. This left the majority of the group projects to be completed by those who were not in the high-status positions, which was often women students, but they would not receive recognition for their work.

Similarly, Hirshfield (2017) found that women's science expertise was challenged or ignored by their classmates. Women had to work harder to be recognized as a valuable contributor through their work whereas; men students were looked to as the experts. Additionally, men students tended to reinforce their appearance of science knowledge through being more aggressive in interactions, interrupting, and questioning their peers (Hirshfield, 2017). Oftentimes, women students are not viewed as equal contributors. Grunspan et al., (2016) found similar results in that men were more likely than women to be named by their classmates as being knowledgeable about course material, and in general, more men were named as

exemplary in the content. The results from these studies illustrate that women in STEM have to work harder to be recognized as a valuable contributor through their work whereas men students are looked to as the experts or the standard. Consequently, recognition is important for developing an identity with the field (Carlone & Johnson, 2007).

The work of Carlone and Johnson (2007) was foundational in illustrating the importance of recognition for science identity and overall experiences in STEM departments. In their study of women of color in STEM, they found that science identity accounts for how women make meaning of their experiences, and importantly, what meanings they are allowed to make because of the underlying social structures of what it means to be a scientist and a woman of color. In their model of science identity, a student must have competence, performance, and importantly recognition from others as a scientist to fully integrate a science identity. In their study women frequently had disrupted science identities. Due to an intersection of their other identities, many women in their study were unable to get recognition as scientists from others. Participants discussed how they felt that established members of their science departments saw them as members of stigmatized groups and not a scientist, "they perceived that their behaviors, or even just their appearance, triggered racial, ethnic or gender recognition that overwhelmed their chances of being recognized as good science students" (p.1202). They found that the students whose identities marked them as farthest away from the white male norm of STEM had the most difficult time being recognized as scientists and building a traditional science identity. They had to negotiate culture and identity in order to be recognized, or they had to try and comply more with other aspects of what counted as doing science. Therefore, students who are not white men, especially women of color, only have some positions made available to them because of the conceptualizations of science (Malone and Barabino, 2009). Sometimes students struggle to

construct an identity with the field at all because of these limited positions. Therefore, recognition influences how students experience STEM departments, facilitating identity negotiations with the field because dimensions of their identity signal that they do not fit the stereotypical expectations.

Disconnect with Engineering Practice

However, the practice of engineering does not always align with the prevailing cultural and stereotypical representations of the field. There is oftentimes a disconnect in how engineers view their identity with the field and the actual practice of engineering (Huff, 2014). Specifically, engineers do not solely exist in the technical realm; engineering work is embedded deeply in the social world (Huff, 2014). Although technical skills are essential, social interactions are how technical work expertise is distributed and problems are solved (Trevelyan, 2007). Social skills are also needed for project coordination and management (Brunhaver, Korte, Barley, & Sheppard, 2018). In practice, engineering is sociotechnical problem solving (Huff, 2014). In a similar finding, Anderson, Courter, McGlamery, Nathans-Kelly, and Nicomete (2010) studied engineering practice in six firms. They gathered narrative examples of it meant to be engineers at all these locations. They found that the engineers viewed their work as, "problem solving, almost always done in explicitly organized teams or informal collaboration with others. Engineers cited clear communication as the most important skill" (p. 153). This also works to suggest how engineering stereotypes and representations of STEM as individualized, competitive, and deeply technical is a misrepresentation for the actual practice of engineering.

Summary and Future Directions

Previous research has examined the various factors that influence women's underrepresentation in STEM fields. Overall, sociocultural factors such as the culture of STEM

and gendered career expectations influence students' choices to enter and persist in these fields (Eccles, 2009; 2011), their experiences in these fields, and importantly their identity development with the field (Carlone & Johnson, 2007). Increasingly, researchers have focused on the role of identity, because students' identity development is more important for retention than academic ability (Merolla & Serpe, 2013; Ulricksen, Madsen, & Holmegaard, 2010). Engineering education researchers have found that students' interest in the field, competence and performance beliefs, as well as being recognized as a science/engineering person (Godwin et al., 2016; Patrick et al., 2018) are important for building an engineering identity

The culture of engineering makes this process difficult for students who do not match the White masculine norms of the field (Carlone & Johnson, 2007; Faulkner 2006; 2007; Goldman, 2012; Malone & Barabino, 2009). Previous researchers have shown that women and students of color are not free to develop any kind of science identity, that they are limited by the positions made available to them by the culture and climate of these fields (Carlone & Johnson, 2007; Faulkner 2006; 2007; Goldman, 2012; Malone & Barabino, 2009, Tonso 2006). In particular, the previous literature illustrates how identity dimensions such as race and gender become salient in engineering departments, influencing how students' experience and develop identities with the field. Previous researchers illustrated how multiple identities and power structures interact and influence how students experience engineering departments, and what potential identities are available to them.

Due to the ideas of traditional gender roles and the masculine conceptualization of science, women in engineering majors can seem gender inauthentic (Faulkner, 2006; 2007), and they must negotiate their gender identity with their possible science identities and available narratives (Goldman, 2012; Hatmaker, 2013). Oftentimes this process reinforces stereotypical

gender differences, where women are more likely to identify with the more feminized identities in engineering (Cech, 2015). Therefore, women's science identities are limited by the positions made available to them by the culture and expectations of these fields (Carlone & Johnson, 2007; Faulkner 2006; 2007; Goldman, 2012; Malone & Barabino, 2009, Tonso 2006). They must negotiate their identity within the available narratives and expectations of what it means to be both a woman and an engineer. To better understand women's identity development and experiences in engineering, researchers need to examine the available narratives for women in engineering, how their identities are constructed and used to navigate the field. We need to better understand how students' multiple identities, and in particular ideas of traditional gender roles, intersect with the cultural constructions of the field to influence individuals' identity development.

By focusing on how women engineering students construct their identities across educational settings, advances the current literature on women in engineering by examining the construction process more closely. Many of the previous studies account for how social influences, context, and privilege form identities, but they still present a more singular and static engineering identity. They focus on the end product and not the nuances of the construction of that particular identity. This perspective also does not account for how these engineering identities change in different contexts when other identity dimensions become more or less salient. Accordingly, Rodriquez, Lu, and Bartlett (2018) suggested that to expand the engineering education literature researchers need to move away from seeing identity as static and examine how it "can change with environment and context, engagement and interest, and socialization and alienation experiences" (p. 261). Researchers need to examine how identities are formed, negotiated, and then used in the different contexts in engineering. This approach

allows for a more in-depth examination of what identities and narratives are available for women in the masculine setting of engineering.

CHAPTER III: METHODOLOGY

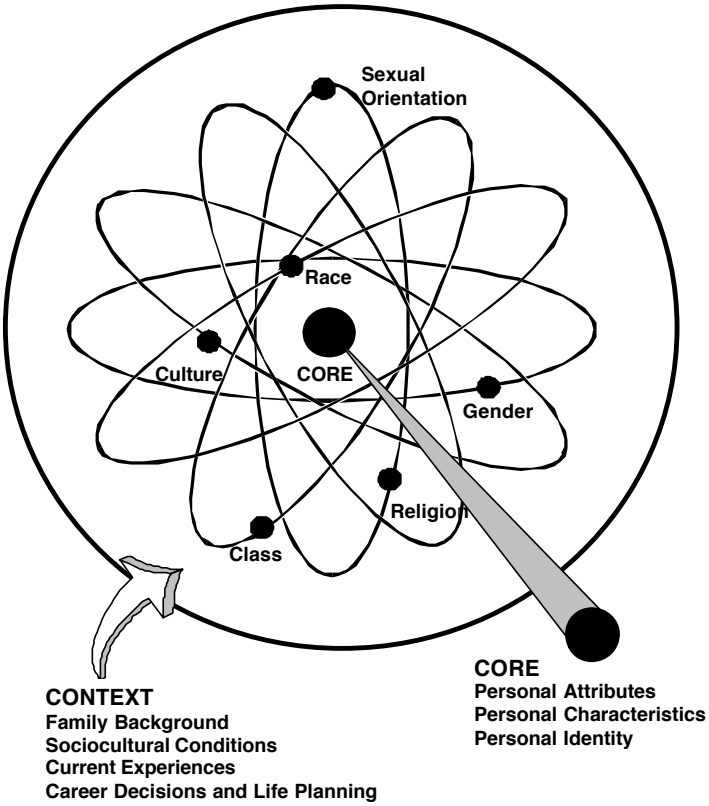
Purpose of the Study

This study sought to examine how women construct identities as engineers and how ideas and expectations of traditional gender roles and conceptualizations of "engineer" are integrated into those identities. In order to do this, the study was framed through feminist narrative research because of its utility to privilege women's stories, interrogate dominant narratives (Woodiwiss, Smith, & Lockwood, 2017), and because it is through narrative that individuals construct and makes sense of their identities (Somers, 1994). I used a feminist narrative approach to examine how women constructed their identities, paying particular attention to the different narratives they used, and the potentially new narratives that are produced when we focus on women's lived experiences. Feminist narrative has the potential to challenge androcentrism, and the marginalization of women's accounts of their experiences (Fraser & MacDougall, 2017). Feminist narrative is about exploring new insights and narratives about social processes that have previously been silenced (Fraser & MacDougall, 2017; Woodiwiss, Smith, & Lockwood, 2017). I also examined how these storied accounts (Somers 1994) of their identities change as different dimensions of their identity become more or less salient in the various contexts of their engineering experience. The overarching research questions were:

1. What narratives do women engineering majors use to construct and make sense of their identity with engineering? Which dimensions of students' identity are most salient in this construction?
2. What role do gendered narratives play in the construction of their engineering identities?
3. How were their experiences influenced by the aspects of their identities that became salient in different contexts?

I addressed these research questions through a series of semi-structured interviews utilizing the Model of Multiple Dimensions of Identity (MMDI) (Abes, Jones, & McEwen, 2007; Jones & Abes, 2013; Jones & McEwen, 2000) (Figure 1) as an additional tool to co-construct the data. Ultimately I hoped to better understand the nuances of the construction of their engineering identities across their educational experiences. In particular, I hoped to understand better the prevailing narratives that informed how they constructed their engineering identity and influenced their experiences as engineering students. This approach allowed for a more in-depth examination of what identities are possible for women in the masculine setting of engineering, how it influenced their experiences, and allowed for the telling of narratives that may have previously been silenced.

Figure 1
MMDI Jones & McEwen 2000



Feminist Narrative Methods

This study was framed through feminist narrative methods following the assumptions of narrative constructions of identity. A distinctive feminist narrative approach is now being articulated in the methodological literature (Woodiwiss, Smith, & Lockwood, 2017). However, feminism and narrative inquiry have always been linked (Stanley, 2017) At the core of narrative inquiry are foundational contributions from the women's movement and feminist theory, such as the "personal is political", that encourages a problematization of universal identity categories and the privileging of individual stories and experiences (Reissman, 2008; Somers, 1994).

At the foundation of narrative research is "stories lived and told" (Clandinin & Connelly, 2000, p. 20). Narrative inquiry is a reconstruction of a person's experience and is an attempt to figure out the taken-for-grantedness of people's lives (Clandinin & Connelly, 2000) and the social world (Miller, 2017). The taken-for-grantedness aspects of individuals' lives are the commonplace and normative experiences that are underappreciated or go unexamined (Clandinin & Connelly, 2000). Feminist narrative research focuses on those underappreciated everyday aspects of women's lives (Woodiwiss, Smith, & Lockwood, 2017) because the overt goal of feminist research is "to correct both the *invisibility* and *distortion* of female experience in ways relevant to ending women's unequal social position" (Lather, 1988, p. 571). Therefore, to do feminist research means to put the social construction of gender at the center of the research process (Lather, 1988), and work to improve the lives of those who identify as women (Woodiwiss, Smith, & Lockwood, 2017). Therefore, combining feminist and narrative approaches offers a fuller account of understanding women's lives by challenging researchers to take into account the various societal and contextual forces that shape the stories women tell, can tell, and are told about them. Feminist narrative approaches are about further questioning the

dominant narratives and what stories can be constructed and what larger purposes those narratives serve (Woodiwiss, Smith, Lockwood, 2017). Feminist narrative approaches are a way to examine how dominant narratives inform and constrain women's storytelling, and for the purpose of this study, I examined how those narratives informed their identities.

Narrative Constructions of Identity

It is through narratives subjects speak to "*who they believe they are*" (Doucet & Mauthner, 2008). It is also through narrative that we make sense of our social world and construct our identities, "all of us come to *be* who we *are* (however ephemeral, multiple, and changing) by being located or locating ourselves (usually unconsciously) in social narratives *rarely of our own making*" (Somers, 1994, p. 606). Therefore identities are a situated construction based on the available narratives and contextual influences. Individuals' identities are limited to the available narratives that are largely influenced by power structures (Somers, 1994; Woodiwiss, Smith, & Lockwood, 2017). Narrative constructions of identity also take into account context, social positions, and power. Overall, narrative inquiry "shares a commitment to viewing self and identity not in essentialist terms, but as multidimensional and connected to social, historical, political and cultural contexts" (Smith & Sparkes, 2008, p.15). This is of particular concern for feminist narrative approaches because women, in particular, are constrained by the current circulating narratives (Woodiwiss, Smith, Lockwood, 2017), which tend to encourage the presentation of a particular gendered self (Miller, 2017). These narratives direct women to tell or understand their experiences in particular ways that oftentimes do not represent the spectrum of women's experiences, and silence alternatives (Lockwood, Smith, & Woodiwiss, 2017). Therefore, through feminist narrative approach researchers interrogate the

narratives women use to understand their lives and examine how these narratives influence their experiences and identities.

Onto-Epistemological Assumptions of Feminist Narrative Inquiry

Narrative is both an ontology and an epistemology. Narrative is a way of knowing and a way of being. We make sense of our lives through narratives, we construct our identities; therefore, our being through narrative, and life is a storied existence (Smith & Sparkes, 2008; Somers, 1994). Researchers come to know participants from the narratives co-constructed in the research process, but there are limits to what can be known (Doucet & Mauthner, 2006; Clandinin & Connelly, 2000; Riessman, 2008). Researchers can never fully understand or know the participants' experiences (Doucet & Mauthner, 2006; Smith & Sparkes, 2008; Taylor & Littleton, 2006). As Mauthner and Doucet (2008) explain, "all we can know is what is narrated by subjects, as well as our interpretation of their stories within the wider web of social and structural relations from which narrated subjects speak" (p. 404). Narrative inquirers reconstruct individuals' stories. Therefore, it is a shaky (Clandinin & Connelly, 2000) and removed construction from both the participants telling and from the "real event" they are narrating about (Riessman, 2008). Therefore researchers cannot claim a "true" representation of participants' narratives (Riessman, 2008).

Current Study

Participants

The participants in this study were five women upperclassman majoring in mechanical engineering. I chose to include upper classman because I wanted to include women who had been in engineering long enough to potentially develop an identity with the field and have more

experiences within the field, such as co-ops or internships. Table 1 provides a brief overview of the participants.

Table 1
Participant Information

	Academic Standing	Experience in the Field	Ethnicity
Anna	Senior	Co-op	White
Lee	5th-year senior	Co-op	White
Mary	Senior	Internships	White
Olivia	Junior	Internships	Asian American
Sara	Senior	N/A	White

These participants are also unique in that all of them had at least one family member who was an engineer, and they were encouraged to enter the field from their families. Additionally, three out of the five participants were from the Huntsville/Madison area. This area of Alabama is known for engineering and its connection to STEM fields overall. Accordingly, the two high schools the participants attended had multiple A.P. science and math courses and offered engineering-specific coursework. Due to their family and community connections, they had access to information and opportunities that most people do not, such as the ability to visit engineers at work and have exposure to engineering coursework before college. They were in a privileged position to have access to insider information and the tools needed to help them see engineering as a potential career and to be successful in their transition to college. Researchers have shown that students' knowledge of engineering, exposure to engineering, and contact with actual engineers is important to building and identity and persisting in the field (Pierrakos et al., 2008). So for these participants, those opportunities were readily available through family members, their schooling, and surrounding community. Although, women are underrepresented in engineering and STEM fields overall, these women had access to social capital, alongside their whiteness, that helped them be successful in the field. Therefore, this study is unique in that

I am "studying up" by examining how women from privileged positions in engineering construct their identities with the field.

Nader (1972) suggested in her seminal piece that it is important for researchers to "study up" focusing on those individuals who are at the upper to middle end of the social power structures and who have a significant amount of privilege (Becker & Aiello, 2013). Studying up is valuable research to help us understand how those with power and privilege navigate their experiences. It can help us develop more adequate theory and understandings to see how those with and without power experience their social world (Nader, 1972). Additionally, by studying up "researchers can identify the conceptual practices of power and how they shape daily social relations" (Harding & Norberg, 2005, p. 2011). Therefore, it is important to research individuals from more privileged positions to understand a full spectrum of experiences, instead of only those who power is enacted upon.

Recruitment. I recruited the participants through a gatekeeper. A gatekeeper is an individual from the population of interest who helps researchers gain access to potential research participants (Buch &Staller, cited in Hesse Biber, 2008). I choose to use a gatekeeper because I did not have direct access to engineering students and I hoped by going through one of their peers I could potentially build more initial rapport and trust.

My gatekeeper, Taylor, was a recent graduate in mechanical engineering and I knew her through multiple mutual friends. She was working on her masters in engineering and still had contact with some undergraduate women in the major. Taylor was a key person to help me access the population because during her time in the major she had made efforts to reach out to younger women students to try and build a community, and she still had connections to many women in the major. She had also always been outspoken about women's issues in engineering

and society so one day when we were together, I told her about my dissertation and research interests. She was excited about the topic so I asked her if she knew of any women in engineering who might be interested in speaking with me. She expressed that she was willing to ask the people she knew, so I sent her the recruitment materials describing the purpose of the study. She then sent me the contact information for five women in mechanical engineering who had expressed interest in the study. I then followed up by emailing them the recruitment materials describing the study and all five of the women agreed to participate.

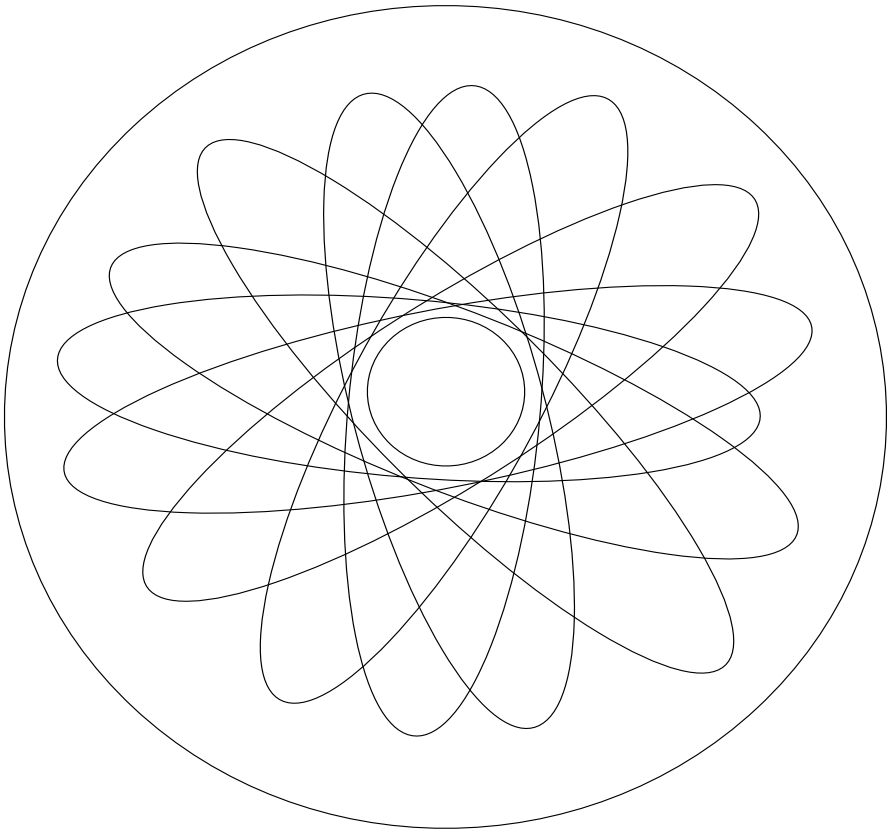
The potential limits to my sampling procedure are that the women I interviewed are most likely all Taylor's friends or women she works closely with. This makes it very likely that my sample and subsequent results are of one particular social group, more similar to each other in terms of socioeconomic status, political beliefs, or other social factors (including their home town). But also from the narrative perspective, this can strengthen my findings and help me create a more collective narrative. Because the women are all mechanical engineers around the same academic standing and within the same social circles, the women would have taken almost all of the same classes, interacted with the majority of the same professors, and many of the same peers. This helped me to analyze the narratives collectively where I could make conclusions from across their stories. In the narrative tradition, narratives with similar contexts and plots can be clustered together to deepen the analysis (Fraser & MacDougall, 2017).

Data Collection Tools: Model of Multiple Dimensions of Identity (MMDI)

The study sought to examine how women constructed their identities with their engineering major, paying particular attention to the different narratives they used to construct and make sense of their identity with the field. This was done through a series of semi-structured interviews where I also used the Model of Multiple Dimensions of Identity (MMDI) (Abes,

Jones, & McEwen, 2007; Jones & Abes, 2013; Jones & McEwen, 2000) as a tool to co-construct the data. The participants were given a blank copy of the model to fill out during the interviews, and it is included in Figure 2. I intended to use it as a tool to help the participants talk through and make sense of the aspects of themselves; they believed made up their identity. The MMDI presents a conceptual model of multiple social identities situated within a changing context (Abes, Jones, & McEwen, 2007; Jones & Abes, 2013; Jones & McEwen, 2000).

Figure 2
Blank MMDI



Background of the MMDI. This model was developed from a grounded theory study from a group of diverse college student women. The authors' purpose was to examine "students' understanding of their own identity and experiences of difference and the influence of multiple dimensions of identity on an evolving sense of the self" (Jones & McEwen, 2000, p. 405). The

authors not only wanted to understand the influence of multiple dimensions of identity better, but they also wanted to develop a conceptual model of this process. In particular, this was influenced by the new perspectives on identity informed by intersectionality (Crenshaw, 1991) and postmodern ideas such as identity and gender performance (Abes, Jones, & McEwen, 2007). This perspective moves away from viewing identity as a singular entity, and conceptualizes it as fluid, socially constructed, performative, and made up of multiple dimensions. The conceptual model was developed to provide a visual representation of their findings that was taken directly from the participants' words and understandings. They tried to capture the complexity of the identity development process, and visually constructed the model to illustrate the dynamic relationship between context and multiple intersecting identities (Jones & McEwen, 2000).

The MMDI uses an atom metaphor as a model (Figure 1) of student identity that represents a core sense of self, one's personal identity, surrounded by intersecting circles that represent other significant identity dimensions such as race, gender, sexual-orientation, and religion (Abes, Jones, & McEwen, 2007; Jones & Abes, 2013; Jones & McEwen, 2000). The different identity dimensions can move closer or farther away to the core to represent the salience of those identities in a particular context. In their model, participants placed a dot on each intersecting circle representing the importance of that particular identity dimension in that context. The distance to the core represents the salience of that identity dimension at that particular time and context. The model provides a snapshot of an individual's identity at a particular time.

MMDI as a research tool. For the purpose of this study, the MMDI was used as a tool, but it was not intended to be the only way participants could discuss their identities. It was to be the start of the conversation. It was a tool that set forth the potential for participants to talk about

their multiple identities and guide their meaning-making. The purpose of the MMDI is to better understand how participants make sense of their identity from their perspective and not the researchers' (Jones & McEwen, 2000). Therefore, I used the blank model as a conversational tool to help me understand how the participants made sense of their identity based on how they filled out the model. The goal was to work to a deeper understanding of how women constructed their identities with engineering, based on how the participants narrated themselves, their experiences, and by what they deemed salient. It also served as the starting point in talking about their participants' identities.

Research Process

After participants were recruited through the gatekeeper Taylor, they participated in one to two audio-recorded interviews about their identity with engineering and experiences in the field. These interviews lasted from one hour to one hour and a half. The guiding interview questions and script are included in Appendix A. The overall goal of the interviews was to help facilitate participants' discussion of their identity with engineering and to have them gradually reflect on how they constructed their identity in different ways with the field. Since the purpose of the study was to examine the repeated narratives they used to construct themselves with the field, the interview questions and identity models were used to help me identify and understand the narratives about engineering and gender they used. The interview first began with more introductory questions about how they came to major in engineering and what they considered an engineering identity.

Then the participants were introduced and prompted to fill out the first identity model about how they saw themselves overall. I described it as an identity model where the central circle was their core sense of self and that the surrounding circles where different aspects of their

identity that made up who they were that moved closer or farther away based on different situations and would be indicated by a dot on that surrounding circle. I then provided them the example of how my mother would have filled it out. I described how my mother was a teacher so her identity model would have a circle for teacher and mother and that while she was at work teacher would be very close to her core and mother farther out. Then I provided the example that when my mother was back home the teacher circle would be farther out and mother would be closer to her core. Overall the participants seemed to understand the model, but they did struggle to decide how to fill out their models.

To truly "follow their trails" (Riessman, 2008), I did not direct the participants to include specific identity dimensions such as race, religion, or gender that are included in the original MMDI. I left it open to them to include identity dimensions they felt were important, I wanted to understand how they made sense of and built their identity. As the participants filled out the model, they were asked to explain their thinking to help guide the interview process and help me understand their reasoning for including specific identities or characteristics. After they had finished filling out the circles, the participants were asked to place a dot on each circle for how salient they felt that identity or characteristic was to their core. Once they completed the model, they were asked questions about why they included certain factors and how it related to their identity as an engineer and their experiences in the major.

Then the participants were asked to fill out the identity model for how they saw themselves in the engineering classroom and again were asked to explain their thinking. They were then asked similar follow up questions to better situate how the identity dimensions they chose related to their engineering identity and experiences in the field. In the final interview, participants were given the different models they created and asked to reflect on which identity

dimensions they felt were the most salient to them overall, and as an engineering student. Copies of the participants' models are included in Appendix B.

Constraints of the MMDI as a Dialogic Tool

As previously stated, in order to truly "follow their trails" (Riessman, 2008), I did not direct the participants to include specific identity dimensions such as race, religion, or gender. I left it up to them to fill out their model with how they saw themselves. The downside of this decision was that the participants included a mix of identity dimensions and personality characteristics in their model. They primarily focused on identity characteristics such as daughter, Christian, and friend. I had to prompt the participants to include gender in their models. Besides, Sara's classroom model, none of the participants originally included gender. They focused mostly on the personality characteristics such as outgoing, funny, smart that they identified as central to who they were. Although the personality characteristics helped me understand how they saw themselves and what they felt was important to their identity, they were not identity dimensions that fit with the theory behind the MMDI, they represented core attributes. Therefore the models served more as a reference point to further discuss their identities. It was more of a literal look, or a visual representation, of how they constructed themselves.

I had also intended to have the participants fill out a model for different contexts in their major such as the classroom, group work, or anywhere else they felt their identities changed. However, the participants seemed to struggle to fill out the models and decide what to include. They were focused on what they thought I wanted them to put, that there was a correct answer. Additionally, in the interviews, I found that when I asked them to fill out the model for the engineering classroom they were thinking of all the contexts where they were in engineering

student. So the model was more how they saw themselves in the engineering classroom and as an engineering student as a whole. As with the overall identity model, they again focused on more on their personality characteristics and things they felt made them successful in the classroom.

Because of these things, I relied more on traditional interview methods to examine how their identities changed in different contexts. I found that the participants could easily talk about times they felt their identity changed and what became the most salient, if I asked them more directly. Similarly, when I asked them specifics about gender even though they did not initially include it in their models, they were able to provide examples of when gender mattered, and it influenced their identity as an engineer. It was potentially easier for the participants to make sense of their identity and experiences through their stories. They were less focused on being precise or naming characteristics correctly as they were with the models. Therefore it might have been a less restrictive way for them to think about their identities. This is in line with the narrative conceptualizations of identity that we make sense of who we are through narratives (Somers, 1994).

Analysis Process

Inline with feminist narrative methods and my research questions I examined the repeated narratives the participants used to construct their identities and influenced their experiences. I focused on what was said, the purpose, and how those narratives related to the overarching sociocultural ideas of engineering and gender. The interviews were transcribed verbatim. Then the student's identity narratives and MMDI models were analyzed through thematic narrative methods to understand the repeating narratives they used to construct and make sense of their identities with engineering. Thematic analysis focuses on what was said, "the told" and often builds on and extends prior theory (Riessman, 2008). Thematic analysis helps researchers

understand what is told through participant stories by further situating their narratives in theory and larger sociocultural ideas. Therefore, my first round of analysis focused on identifying the themes and repeated narratives the participants used to construct their identity with engineering and describe their experiences. The participant's models were incredibly important in this first round of analysis because it allowed me to see how they more literally constructed themselves and I was able to see the similar identities and characteristics the participants included more easily.

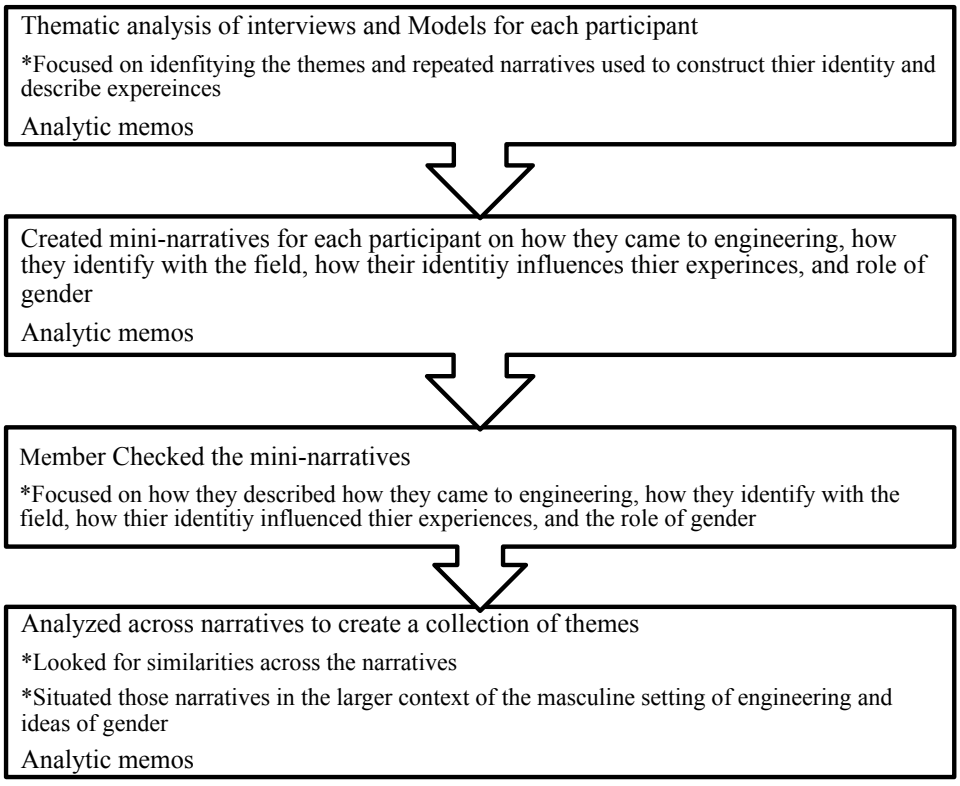
Once I identified the repeated narratives, I then situated them within the broader context of the masculine setting of engineering and ideas of gender. This was done to interrogate those narratives further and to see how the participants actively constructed themselves against or within those dominant narratives. It was a way to examine how larger sociocultural forces influenced the stories they told and the identities they constructed (Riessman, 2008). This is also one of the main goals of feminist narrative work, is to understand how dominant narratives are used in women's stories and how they potentially resist those narratives to construct new ones (Woodiwiss, Smith, & Lockwood, 2017).

In the narrative tradition, narratives with similar contexts and plots can be clustered together to deepen the analysis (Fraser & MacDougall, 2017). Therefore my goal was to present the findings from the thematic analysis of the participants' identity narratives as a collection of the repeated themes across the participants. In order to do this, I first analyzed each participant's interview and identity models separately. I identified the themes and repeated narratives focusing on what their story was telling. Then I created a mini-narrative for each participant about how they came to engineering, how they identified with the field, how their identity influenced their experiences, and the role of gender in their narrative. Once this was completed, I went back

through the mini-narratives and identified the repeated themes across the participants then situated them in the larger sociocultural ideas of engineering and gender. From this, I drafted the collection of themes present in the findings section. Similarly, it is drafted around how they came to engineering, how they identify with the field, how their identities influenced their experiences, and then the role of gender in their identities and experiences as engineering students.

Integral to my analysis process was analytic memoing. During data collection and analysis I used analytic memoing to document my sense making and reasoning behind my conclusions at each stage of the analysis process. Analytic memoing serves a way to help the researcher work towards a more in-depth level of analysis while providing more transparency in the research process. Analytic memoing helped me to create an intellectual workspace, and work towards solutions from my data (Saldana, 2016). Figure 3 summarizes my analysis process.

Figure 3
Analysis Process



Ethical Considerations

Feminist research methods offer specific perspectives on ethical practices in research. The eight key aspects of ethical practice feminist researchers emphasize in their work are (Bell, 2014, p.89):

1. Do no harm (beneficence)
2. Confidentiality, privacy, anonymity
3. Informed consent
4. Disclosure and potential for deception
5. Power between researcher and subject
6. Representation or ownership of research findings
7. Ensuring respect for human dignity, self-determination, and justice, including safeguards to protect the rights of vulnerable subjects
8. Demonstrating that the researcher has engaged with the above six issues, in order to obtain required formal ethics approval and/or show adherence to professional codes/guidelines

Many of the ethical practices that feminist researchers emphasize overlap with those of other methodological approaches, but what is distinctive in feminist research is the focus on paying attention to context, relationships, and power issues (Bell, 2014, p. 84). This is not surprising, because feminist research methods overall are "concerned with issues of power relations, confidentiality, and anti-oppressive practices, which all involve consideration of ethics and personal values in research" (Bell, 2014, p.78).

Further, feminist methods view ethics as not a set of abstract principles, but as a set of situational and contextual dilemmas that take place during the research process (Edwards &

Mauthner, 2012). Ethical practices in research are characterized by how the researcher goes about addressing the ethical dilemmas that arise. Working through these dilemmas involves taking into account the values of care and emotions. Researchers need to approach these dilemmas with a sense of responsibility, reciprocity, and their own partiality. Edwards & Mauthner (2012) explain that researchers need to be reflexive and acknowledge the power differentials in the research process and how these influences the ethical decisions they make. Therefore, in feminist research methods, reflexivity is an ethical practice to help researchers be responsible and recognize their partiality (Edwards & Mauthner, 2012). The ethical considerations of reflexivity become increasingly important as researchers move to interpret and represent the experiences of others (Bell, 2014; Edwards & Mauthner, 2012).

One of the goals of feminist research is to "reveal the subjugated voices of women" (Bell, 2014, p. 78) and in particular, for feminist narrative approaches, the purpose is to try and tell better stories and representations of women's experiences. Although the goal is emancipatory, researchers still must grapple with how to ethically represent the stories of their participants, especially when their voices have traditionally been marginalized and unheard (Bell, 2014). Researchers must find non-exploitative ways to represent them, and be cognizant that different women "may be liberated and/or constrained" (Woodiwiss, Smith, Lockwood, 2017, p.8) by the new narratives the researchers represent. Telling different stories and creating a different narrative does not mean that other stories do not remain silenced (Lockwood, Smith, & Woodiwiss, 2017). Some stories may remain marginalized or silenced by the new stories you tell. So the challenge for feminist researchers is to try and tell better stories and to be reflexive on how they may still be partial. One way to ethically engage with these challenges is to bring work back to participants. Member checking is not only important for the researcher's credibility;

ethically it is a sign of respect to the individuals and their stories (Riessman, 2008). Ultimately as the researcher, you are presenting a representation of their stories, and it is your responsibility to be respectful of the individual's perspective and interpretations of their lived experiences.

In this project, I worked to maintain these perspectives for feminist ethical practice of research. First, I submitted a proposal to the university's Institutional Review Board for their approval to conduct the study. I amended my proposal according to their suggestions to keep my project in line with the institution's expectations for ethical research practice. To account for the more universal ethical practices of confidentiality and consent, I first formally consented participants before the first interview and asked the participants to chose pseudonyms. From that moment further, they were only referred to as their chosen pseudonym in all of the research documents. I also informally consented participants again before each additional interview and to ensure they still wished to participate and to make sure they understood they could drop out of the study at any time.

To further work toward their confidentiality, during the member check process I asked the participants to review parts of their narrative that might identify them to others. I asked them how they wanted that information to be presented and if there were anything they would prefer I left out. If the participants asked for changes in their narrative, I changed them accordingly. This was especially important since many of my participants could be more easily identified because along with being part of the underrepresented group of women in engineering, many of them worked for engineering in some way or held leadership positions on campus. I did not want them to be identified through my project and face any repercussions in their schooling or social experiences. This also relates to the feminist ethical practice of respecting your participants, the stories they tell you, and being reflexive about the impact your research could have in their lives.

Overall, I worked to make sure that in the decisions I made, I respected my participants and their stories.

Trustworthiness and Credibility of Qualitative Work

Narrative research is judged on its trustworthiness and meaning, not its validity. In narrative inquiry, narratives are not seen as "factual report of events, but instead one articulation told from a point of view that seeks to persuade others to see the events in a similar way" (Riessman, 2008, p.187). Therefore the focus is not on verifying the "facts" of the telling; the focus is on the meanings that can be derived from the stories people tell of their experiences (Riessman, 2008) and the "better stories" they strive to tell (Lockwood, Smith, & Woodiwiss, 2017). Therefore, credibility in narrative research is not about the "truth of the telling" it is about the meaning derived from the work and if the participants recognize their narrative in the author's retelling (Riessman, 2008). Trustworthiness of research is gained through the actions of the researcher and is about transparency throughout the research process. In feminist narrative research methods, trustworthiness and credibility are gained through reflexivity and member checking.

Narrative and feminist methods stress that the researcher is reflexive, and carefully document their methodological path and grounds for their research claims (Riessman, 2008). Clandinin and Connelly (2000) discuss reflexivity, in terms of "confronting your own stories" (62) that arise in the research process. Simply put, reflexivity is a critical self-awareness from the researcher where they position themselves in the research process and discuss how their background may influence the decisions and interpretations made (Riessman, 2008). Researcher reflexivity adds strength to the research, allowing readers to situate the researcher in the process and see how the researcher's beliefs and identities influenced the process (Harding, 1989).

Therefore, in feminist research methods, reflexivity is a way for researchers to be responsible and recognize their partiality and how it can influence the interpretations they make from the data (Edwards & Mauthner, 2012). It adds credibility to their claims and the trustworthiness of their research process.

In order to be reflexive and transparent about the research process, I used analytic memoing throughout the analysis to document my sense making and reasoning behind my conclusions. I also used this space to be reflective and write through my thinking. Analytic memoing serves a way to help the researcher work towards deeper levels of analysis while providing more transparency in the research process. Analytic memos help create an intellectual workspace and help the researcher to work towards solutions from their data (Saldana, 2016). Analytic memoing bolsters the trustworthiness of the analysis, providing documented accounts of the researchers' meaning making while situating them in the research process.

As a feminist researcher, I also strove to respect my participants' stories through member checking. One of the challenges of feminist narrative approaches is to tell better stories, but ultimately, as the researcher, I am the one who presents my representation of their story. My partiality can influence this process. This makes it important for me to be reflexive of my partiality throughout the data collection and analysis and also member check with participants. Member checking is not only important for the researcher's credibility; ethically it is a sign of respect to the individuals and their stories (Riessman, 2008). Member checking also helped me to ensure I was presenting the participants' stories in a way they felt was representative of their experiences. A major claim of credibility in narrative research is for participants to recognize their experiences in the stories the researchers present (Riessman, 2008). It is a way to bolster the credibility of my claims and the trustworthiness of my research process.

Once I drafted my mini-narratives for each participant, I contacted them to try and member check. I was able to member check with Anna and Lee in person and with Sara over the phone. I focused our conversations on checking my findings about their identities and experiences in the field. I framed it around the main parts of their mini-narratives: how they came to engineering, how they identified with the field, how their identity influenced their experiences, and the role of gender. I was not able to member check with Mary because of repeated scheduling conflicts. We had set a meeting time on three separate occasions that had to be rescheduled twice for school-related reasons from Mary, and once because I had car trouble and was not going to be able to make our set meeting time. We then set a time to do a phone call, and that also fell through. I gave her the option to review a summary of my findings. I sent her an outlined version of her mini-narrative, but she never sent me any feedback or corrections. Wendy did not respond to any emails asking if she was interested in meeting with me to go over the findings.

Positionality: The influence of my hometown

As a researcher, it is important to be transparent and reflexive about the research process and what aspects of your narrative you bring to the table that will inevitably intertwine with the research process. I am a white, cisgender, and heterosexual, middle-class woman. Throughout the research process, I will reflect on how these identities potentially interfere and influence my research process.

Gender has a central role in my study, and I came to understand myself as a gendered subject largely through my schooling experiences. I can remember questioning at a young age why being a girl placed assumptions on my academic success. I did not understand why I was supposed to be bad at math or prefer English just because I was a girl. As I moved to high school

and college, these feelings grew to anger and frustration. I sought out classes and theories to help me make sense of it. I settled on stereotypes. As a developed a more critical consciousness and identity with feminism I began to understand that it was more complicated and systemic than just stereotypes, that these larger ideas of stereotypical career fields were highly socialized and tied to ideas of gender essentialism. I also recognize that research has shown that many undergraduate students are not aware of how gender distinctions characterize their experiences in higher education (Francis, Burke, & Reed, 2014). So I approached the participants' narratives from a developmental perspective. We are not socialized to think in these ways and question larger ideas of gender. Therefore I believe that a critical consciousness and understanding of gender are learned and develop over time. I came in with these understandings because of my efforts to understand these processes.

Since I am not an engineer, nor have I ever majored in engineering, I also feel it is important to explain why I am studying engineering and my connection to the field. I'm from Huntsville, Alabama, the Rocket City. Throughout my schooling, the majority of my classmates had a parent who was an engineer for NASA, the Department of Defense, or an engineer for a contractor. In my hometown, most people's parents are engineers who then raise children to be engineers. Accordingly, my five closest women friends from high school (and three guy friends) all majored in engineering or STEM. I was the only one that did not major in STEM. Even now my four closest women friends are in STEM fields; two are currently engineers. So although I'm not an engineer, engineering has always been in the background. Because of that, I bring with me memories of conversations with my friends about being a woman in STEM, my hometown's value placed on engineering degrees, and the jokes and engineering stereotypes that get discussed in an engineering town. However, I also acknowledge that it is a potential limitation of

my project that I have not been in an engineering field. That is why, outside of it being good research practice, I used member checking to make sure my interpretations and understandings represent as best as they can my participants' experiences.

I found throughout the research process that being from Huntsville served as a huge benefit to me and a more significant part of the research process than I expected. Because I am from the area, I had access to recent engineering graduates through mutual friends and peoples' siblings. This helped me locate a well-connected gatekeeper that helped me reach my goal of five participants. Subsequently, three of the five participants were from the Huntsville/Madison area. To people in engineering in the area, they know Huntsville and its connection to engineering. Therefore, being from Huntsville helped me build rapport with my participants even though I was not an engineer. When I would say I was also from Huntsville, they would respond with "oh you get it then." In many of their narratives, they discussed how their hometown influenced their decision to be engineers and how they saw the field. Therefore, being from Huntsville provided me resources and information I would not have known if I grew up somewhere else. Parts of their narrative could easily have been taken-for-granted.

Huntsville also became a character of its own in the participants' narratives and during the analysis process. They spoke of how "everyone is an engineer," "you can always find a job as an engineer," and that it was a "family thing" to be an engineer. Participants used these similar explanations as to why they were interested in engineering and how they came to major in it. Being from the Huntsville/Madison area was a salient experience and reason to why they were engineers. I still pressed the participants to explain what they meant when they used these phrases but because I also grew up in the area I was familiar with them and how it impacted my friends as well as myself. It also helped me better understand the underlying assumptions of

these phrases. In a way it does seem that "everyone is an engineer," but it is only one part of the population that represents this "everyone." Said differently, it's everyone who is white in the middle to upper class is an engineer or has some connection to the government work. It is a perspective and narrative of privilege, that it also representative of their schooling experiences.

The two high schools the participants from the Huntsville/Madison area attended are mostly white middle to upper class. These schools also encourage STEM pursuits and offer many A.P. science and math courses. One of the high schools has an engineering academy that helps you get internship experiences once you graduate and teaches engineering specific coursework. A lot of their classmates would also have had parents and siblings who worked as engineers. In these more privileged areas of the community, it would seem that everything and everyone is about engineering. Because of this, it makes sense that they would refer to it as a "family thing" to be an engineer when so many people are engineers in their community.

The large community and family connection to engineering also comes with the assumption that engineering is the best career option. It's common to hear phrases that "you can always find a job." For some students that might translate as a safety net for other pursuits or it can seem like it is "engineering or bust." Often, as some of the participants noted, parents in the area encourage you to go into engineering because of this job security and the assumption that it is a better career option than alternatives. These common ideas in the community set up engineering to be perceived as one of the best and valued career options.

Huntsville was a large part of my identity I brought to the participants stories and my analyses. My background could have influenced my conclusions. I also have a lot of pride in my hometown, and how it breaks the stereotypes of what we think about Alabama. So I tried to be reflective and make sure I was not painting a too positive picture or overstated the influence of

the area. However, I do believe it made a difference in what narratives they felt were available. I recognize that there is a unique privilege for those from Huntsville and have family connections to engineering that can help them more easily develop identities with the field because of these deep-rooted connections to engineering.

Chapter IV: Findings

This study examined how women constructed identities as engineers and how ideas and expectations of traditional gender roles and conceptualizations of "engineer" were integrated into those identities. The overarching research questions were:

1. What narratives do women engineering majors use to construct and make sense of their identity with engineering? Which dimensions of students' identity are most salient in this construction?
2. What role do gendered narratives play in the construction of their engineering identities?
3. How were their experiences influenced by the aspects of their identities that became salient in different contexts?

I thematically analyzed the participants' identity narratives to create a collection of the repeated themes from the participants' stories. In order to do this, I first analyzed each participant's interview and identity models separately. I identified the themes and repeated narratives, focusing on what their story was telling. Then I created a mini-narrative for each participant about how they came to engineering, how they identified with the field, how their identity influenced their experiences, and the role of gender in their narrative. Once this was completed, I went back through the mini-narratives and identified the repeated themes across the participants then situated them in the larger sociocultural ideas of engineering and gender. From this, I drafted the collection of themes that follows. In a similar fashion, it is drafted around how they came to engineering, how they identify with the field, how their identities influence their experiences, and then the role of gender in their identities and experiences as engineering students. Table 2 summarizes the findings.

Table 2.
Summary of Findings

How did they come to major in engineering?	Identity with the field	How did their identity influence their experiences?	Role of Gender
Family Connections: All of the participants had at least one family member that was an engineer and listed this as one of the reasons they majored it. In it was a "family thing"	*Student Engineers:* Participants viewed an engineering identity as grounded in content knowledge and experience. They viewed themselves as student engineers because they felt they had not learned all the necessary information to claim the title.	*Co-op:* For Lee and Anna, their co-op experience became salient in the classroom because their engineering experiences caused their classmates to view them as real engineers.	*Social Engineers:* They narrated themselves as social engineers against the masculine stereotype of the nerdy engineer who cannot communicate. The social traits have traditionally been feminized, but in their narratives these traits were seen as a positive and made positions them better engineers
Community Connections: Three of the participants were from the Huntsville/Madison area. They discussed how "everyone was an engineer" and it encouraged them to enter the field.	*Co-op Experience and Identity:* For Lee and Anna, their co-op experience gave them times were they felt like real engineers and they integrated co-op as part of their identity.	*Social Settings: Saliency of Engineer:* In social situations "engineer" became salient and others defined them by engineering stereotypes. This led them to stress how engineering did not define them and to discuss how they found better fit within engineering.	*Gendered Experiences in the Classroom and Co-op:* Their gender became salient in the classroom and workforce when others placed expectations on what work was appropriate for them based on their gender. These experiences reinforced gendered binaries.
Aptitude: They participants discussed that they had the knowledge and skills to be potential engineers. They always liked math, science, and problem solving.	*Social Engineers:* They presented themselves against the narrative that engineers were nerdy and could not communicate and that the field was purely technical. They viewed their social attributes as essential to their identity as engineers and for their success in the classroom.	*Gendered Experiences in the Classroom and Co-op:* Their gender became salient in the classroom and workforce when others placed expectations on what work was appropriate for them based on their gender.	*Essentialized Skills:* They used narratives of essentialized skills to discuss the different characteristics men and women brought to engineering outside of the engineering content. They felt there were overall differences just from being men and women in things such as organization and physical strength.

Narratives of Coming to Engineering- Grounding of Initial Fit

To understand how the participants saw themselves with engineering and the opinions of the field overall, I began the interviews by asking them how they came to major in engineering. The participants told similar stories of deciding to major in mechanical engineering because of their family connection to the field and that they had aptitude for engineering. The participants felt that to be an engineer you needed to have a certain set of knowledge and skills. Throughout their narratives they repeated the idea that an engineering identity was tied to content knowledge and skills. This led the participants to identify as student engineers. The participants also articulated a similar view of the field. They saw engineering as creative problem solving that could make a difference. Engineers could make things more efficient or help to keep people safe. Overall, engineers contributed to helping society.

Familial Connection

When I asked how they came to engineering one of the first things participants mentioned was a family connection to engineering. For many of the participants they described it as "family thing" to major in engineering. In fact, all of the participants had at least one family member who was engineer. In particular for Mary, everyone did seem to be an engineer, from her family to the surrounding community:

> Both of my parents are mechanical engineers. My older brother is a mechanical engineer and where I'm from pretty much everyone is an engineer or doctor, like everyone is an engineer. So at my high school we actually had an engineering academy so I was in the engineering academy. I liked it and I always liked math so coming to school that's what I decided…I haven't changed my major… I don't know it was like a family thing I guess to be a mechanical engineer (Lines 12-17)

Mary, as well as Lee and Olivia, are from the Huntsville/Madison area of Alabama. Huntsville is known as the Rocket City because of its connection and importance to the Space Race. The area is overall known for being an engineering and STEM hub. Between Redstone Arsenal, NASA, Boeing, and other similar contractors there is huge population of engineers and individuals who work for the government in a technical capacity. So for Lee, Mary, and Olivia the family connection extended to their community, so it also became a "community thing" to major in engineering, speaking to an overall expectation to enter the field from family and community alike.

Another common narrative was that their parents encouraged them to get a degree in engineering. Olivia's story provides an example of this while reiterating the themes of familial and community connection:

> So I'm from Huntsville and it is very engineering industry. I'm from Madison technically but the Research Park area. The STEM community is really big in Madison and it is just my family influences. All of my family is engineers…if they got a degree it's engineering and my parents really pushed me in that direction because I wasn't born here. We immigrated when I was 7 years old. My parents they got college degrees back in Vietnam that's where I was from, but we own a restaurant now, so they want me to get a degree in engineering for the job security (Lines 47-53).

Her narrative reiterates the role of family and community connections in choosing engineering, but it also adds another perspective that her parents encouraged her to be an engineer for the job security. Interestingly, all the other participants mentioned the job security and economic return of getting an engineering degree, in particular mechanical. They all mentioned that they chose mechanical because it was the most broad and therefore provided more job opportunities when they graduated.

Anna had a similar narrative that her mother, who is an engineer, encouraged her to enter the field. Anna also felt that engineering was the best career return on her academic investment. She describes being initially unsure if she wanted to become an engineer. However, she found fit through finding her passion for nuclear power and further building a connection with her family, and in particular her mother through engineering. Anna chose her minor, nuclear power generation systems, when she was interviewing for a job as a peer advisor. Anna explains, "when I interviewed for my job as a peer advisor for the college of engineering they had the nuclear power pamphlet on the desk, it's about hyperbolic cooling towers and my Mom worked [as an engineer] at a plant with hyperbolic cooling towers so it was like yeah that's kind of what I

pictured" (Lines 14-19). So she then signed up for the intro class and followed through with the minor, and a cop-op at a nuclear power plant for the company both her parents work for. The family connection encouraged her to pursue that minor, and through her co-op, and course work she found a passion for nuclear strengthening her identity and commitment to the field. It became more than just the family connection; it became a shared passion, a shared career, and made engineering a larger part of her identity. Anna explained that having the engineering connection with her mother, "tied engineering to be closer to my identity as far as family goes just because its something we both do." For Anna, a family connection was the foundation for her continued identity with engineering.

All of the participants saw family as a particularly salient part of their identity and how they saw themselves as individuals. It is important to note that all of the participants placed their family, or a collective family, friends, and faith, as the closest or next to the closest thing to their core in their original identity model. Anna put it inside her core as the most important thing to her. Lee said it was the closest thing to her core, and her most salient overarching identity. Mary said it had been the most defining thing to her life overall and along with Sara and Olivia, placed it as the second closest thing to her core. For the participants, family was incredibly important to their identity. Therefore, it makes sense that a family connection and encouragement influenced them to major in engineering and this connection became an important start in building their identity with engineering. Additionally, their family and community connections to engineering were unique and provided them access to information and opportunities that most people do not have, such as the ability to visit engineers at work and have exposure to engineering coursework before college. Therefore it is important to recognize that they were in a privileged position to have access to this information and narrative of fit with engineering.

Aptitude

The next most prevalent narrative was that they had the needed aptitudes that lead them to the field and made them fit with engineering. This overarching narrative of aptitude sets up the idea that engineering is characterized by a set of knowledge and skills, and to identify as an engineer you must have those abilities. The participants overall defined engineering as creative problem solving, but to be considered an engineer you needed to not only have those problems solving skills, you needed to have the specific content knowledge you gain through engineering coursework to back it up. The participants matched this expectation in their narratives of why they were engineers by saying they had those skills, the innate abilities or interests in math, science, and problem solving that enabled them to have a potential engineering identity. Their cognitive abilities became salient in why they majored in engineering and how they identified someone as an engineer.

For some of the participants it was a simple, they had always liked math and science and further related it back to their family. For Mary, Sara, and Lee they pushed it further to bring back the family narratives, saying they were from a science and math minded family. Sara expanded more and described how she felt she always had the engineering mindset, and that through engineering coursework she saw it was an engineering type of thinking, that it was systematic creative problem solving. For Anna, she framed her initial trepidation about majoring in engineering because math and science were not her favorite subjects. It is a different take on the narrative, but it still presents the idea that to be an engineer you need to be good at math and science. It suggests that they view it as an innate ability or mindset that gives you the potential to be an engineer. In particular for Lee, she most clearly articulated a fit with engineering and her aptitude.

Lee's narrated a fit with engineering through the strong connection of how she viewed herself and the characteristics of engineering. The attributes that she put in her identity model as describing her also described characteristics that she believed were needed to be an engineer. They were: resourceful, innovative, detail orientated, precise, outgoing, teamwork, and likes to know how things work. Importantly she discussed how those attributes described her and was also necessary to be a successful engineer. She reflected that, "because it kind of with all the other things I like to do it makes sense why I'm in the field … it's just the way my mind works and you know looking at it all on paper it makes sense why I'm in engineering" (Lines 312-316). Lee's narrative was the most specific, but similarly mirrors that to be an engineer you need to have a certain set of cognitive abilities. The participants related their decision to major in engineering based off of the idea that they were good at math and science. They constructed this initial fit based off of their expected academic performance and what they felt was necessary to be successful. They overall, narrate a strong tie between knowledge and an engineering identity. This focus on engineering as a set of skills and knowledge lead them to identify as student engineers.

Engineering Identities

Student Engineers

In terms of identity, they collectively identified as student engineers, or not yet full engineers. They saw engineering as an identity that you earn, a title grounded in knowledge and skills. The participants expressed that their goal was to be able to claim an identity as an engineer. They saw it as something they could claim after finishing their coursework, reinforcing that engineering is about a specialized set of content knowledge and skills. It is not enough to just have the mindset of an engineer, you must be able to show you passed the necessary

coursework and are able to apply that knowledge. Further, this means that the participants see an engineering identity as a sign that you are able to do engineering work out in the "real" world outside of the classroom. They saw a disconnect with the problems you solved in the classroom and the problems you solved in the workforce. This set up an engineering identity as an identity you literally worked towards through your educational experiences.

All the participants expressed that they would consider themselves an engineer, and no longer a student in training, once they graduated and could apply their coursework. They do not feel they have earned the title yet. Lee expresses this perspective in great detail,

> I guess like an engineering pupil like just someone who has the skillset, the potential skillset. I still need to be trained. I feel like engineer is such a respected title I don't want to say I'm an engineer yet before I have crossed all the lines and have my degree. But as a person I do think I think like an engineer. I work like an engineer. I have the work ethic of an engineer, but I haven't finished yet so I'm not technically an engineer. I would say engineer in training like you know kind of cuz I do think like an engineer, I'm very logical, and I've worked in the field as an engineer, but I didn't have the engineering title. So its kind of hard to say and walk around and say I'm an engineer because it doesn't feel like its right yet. I feel like I'm kind of jumping the gun a little bit I want that piece of paper in my hand to be like I'm in engineer and I graduated from [university]. But right now sitting here since it's so close I could say I'm an engineer but I don't want to yet (Lines 425-435).

For Lee, it was not only that she had not finished all the coursework she felt she did not deserve the title. She saw the title of "engineer" as highly respected and something you needed to earn

through your coursework. Similarly, Marry narrates how she sees herself as an engineering student, but it's her ultimate goal to be able to claim an engineering identity. Mary explains,

> Yeah I think so I think I view my engineering identity as more of a goal I'm going towards then how I necessarily feel. I guess a lot of the things when I'm talking to my engineering identity I relate that more to a student identity kind of thing. So yeah I guess I don't know, I guess they could be grouped together but my vision is engineer once I graduate. I'm training to be an engineer now (Lines 427-430).

For Mary, the engineering title was the end goal of getting her degree. She saw herself as a student and someone who was working toward claiming that title. She more clearly articulates how an engineering title is something you more literally work towards.

Olivia was the only participant to see a more current identity as an engineer, but she felt it was on a smaller scale. Again, she grounded this perspective in content knowledge and the engineering problems she was able to solve. She explained when I asked her if she identified as an engineer:

> Yes, I do. In training maybe. But I mean with all the internships I've been doing I kind of have like a sense of what the workforce is all about and I mean I would consider myself to be an engineer because solving book problems are the same as you know finding or working on a system in the real world so maybe its like a smaller scale of engineering, but yes I do (Lines 104-107).

Although she sees more of a current identity with engineering, she still takes a similar perspective that to be an engineer is about the knowledge you have and if you can solve engineering problems outside of the classroom.

Anna too, expresses a similar opinion and reiterates Lee's sentiment that it's a big deal to be labeled an engineer, that it is a title you earn. Anna explains the disconnect she felt in her co-op experience when her co-workers would consider her to be an engineer, because they felt she had the content knowledge. She explains,

> At [university] you know we are all study engineering it's the mindset, but if I go to work where I co-op…they are like, 'Anna you should know how to do this you are an engineer'. I look at them like not yet. I'm the one that reminds them that I don't have that box checked. I'm not quite an engineer. The expectation there is that I've taken the classes and I should know the stuff. And so in that sense there are engineers that tell me I am an engineer, which I always think is weird because I'm not yet. I feel like if you've earned it you shouldn't just throw it around lightly (Lines 363-368).

Anna's experience again reinforces the perspective that an engineering identity is grounded in content knowledge and shows that this perspective is also consistent in the workplace. They expected her to have the knowledge to be an engineer and be able to solve the problems that came up in her co-op. Additionally, Anna expressed that it's a big deal to consider yourself an engineer and "shouldn't be thrown around lightly." This was the second reason many of the participants mentioned as to why they did not consider themselves to be engineers.

Related to the knowledge of engineers, many of the participants did not identify as engineers because of the responsibility and expectations that comes with the title. They saw the content knowledge expertise of engineers as incredibly important and heavily relied upon by society. They felt that to claiming an engineering identity came with expectations that you would

build things that worked, but also that your work could have serious consequences if you had not mastered that knowledge. Olivia explains this perspective,

> Engineers they are like everywhere so you are expected to know your thing or else it could mean life or death. For example if you build a bridge and it collapses that's human lives in your hands. You want to make things better, people rely on you more in this occupation (Lines 291-297).

Because the participants associated an engineering identity with content knowledge, their experiences in the engineering workforce became salient to their identity and their experiences as an engineering student. In particular, for Anna and Lee their experience in the engineering work force through co-ops helped them build their identity with the field.

Co-op: An experience and an identity

Engineering students have the opportunity to apply for co-ops and internships so they can gain experience working in the engineering workforce. Anna and Lee chose to co-op whereas Olivia and Mary had internships. Sara went straight through the coursework. Co-op experiences are different in that the students work for a total of 12 months with a company. Internships typically last over the summer only. So by choosing to co-op students spend more time in the field and over the course of their 12 months with the company gain more opportunities to do hands-on engineering work. In both Anna and Lee's narratives of their identity with engineering their co-op experience was extremely salient. It validated that they could be an engineer, made engineer a more tangible career goal, and it showed them that through engineering they could do work that they valued. Co-op also became an identifying characteristic of who they were in the classroom. They were no longer just an engineering student; they became a co-op with "real" world engineering experience.

The participants viewed that an engineering identity was based on knowledge and skills, and because of this it made co-oping an experience where they were able to gain the hands on work experience to be seen as engineers by those they worked with and some of their classmates. Both Lee and Anna described how the transition from co-op to the classroom changed how they saw their identity with engineering and how they approached their coursework. Instead of focusing on academic achievement and making the highest grades, they transitioned to viewing their coursework as content they needed for the workforce, things they needed to understand for their future careers. They transitioned to see a future identity as an engineering professional, instead of just seeing themselves as someone with a future degree in engineering. This focus set them apart from the other participants, who focused more on the "now" and the student aspects of being an engineering major and not a future engineering professional.

Solidifying Identity and Future Career Goals

For both Anna and Lee their co-op became a salient experience that helped them form a deeper connection to the field. Their co-op experiences made an engineering career more of a tangible end goal. It helped them build confidence that they could do engineering work and would enjoy their future career. They found that through engineering they could make a difference in areas they valued. For Anna it was the environment and clean energy, whereas Lee wanted to contribute to the medical field. This also made engineering more central to their identity. Their co-op helped them to find a passion for the field, and as Anna called it, they found "their reason why." Having this reason why helped them push through the difficult coursework knowing that in the end they would have a career they enjoyed.

Anna listed her minor and co-op experience in nuclear power as very important to developing an identity with engineering and finding her passion for her future career. Anna's co-

op experience helped her validate that she could do engineering, and it became a significant experience in building an identity with engineering and her future career. It helped her to set up the end goal that she was going to be an engineer and this was the field she was going to work in. Throughout her narrative she talked about how passionate she was about nuclear and how excited she was to work in the field when she graduates. She explains that this also brings her a sense of assurance that she is going into the right profession, "I've minored in something I really like and worked in it and verified I really like it. And so there is a sense of assurance that I'm doing what I'm supposed to be doing" (Lines 430-431). She continues that this experience was also important because she was originally unsure about majoring in engineering. She explained, "I think since I came in undergrad not knowing what I wanted to do I think it helped validate that I could do engineering just because you know I'm not a straight A student. I struggle you know with the math and science kind of thing" (436-438). So for Anna, co-oping was instrumental in showing her that she could be an engineer and have a career she truly enjoyed.

The connection to nuclear became as she called it her "reason why." Knowing that she was going to have a career she was passionate about helped her push through the challenging coursework and reassure her it would all be worth it. She explained that she became so passionate about nuclear as she learned that it was the largest supplier of carbon free energy. She stressed that she truly "believes in green energy and the future of our planet" (Line 487), and she now tries to takes this focus outside of work and the classroom and to educate others about how safe and valuable nuclear power is. Through engineering she found a career where she can make a difference in the environment and it helped her move to a future orientated identity with engineering. She found a fit based on the things she values and cares about. Lee told a similar story about her co-op experience.

For Lee her co-op experience helped ground her identity with engineering and showed her that she could do it, setting forth a path to a more future orientated identity with engineering. She described how her co-op experience made her hungry for more. Lee expressed how she was nervous on her first day of work reflecting, "what if I hate this?" but she found she loved it and put engineering in more perspective for her. She saw that engineers could work in the medical field and not just aerospace as she experienced growing up. Lee explained:

> Because my father is [company] all I've seen my whole life is rockets and space stuff, which is cool, and kind of got me excited when I committed to engineering. But seeing the medical side, what I want to do, [co-op company] just a little background, makes the dialysis filters for kidney transplants. So they are making kidney filters and we got updates 'you helped x amount of patients today.' Yeah so it put it in perspective…that's what made me feel accomplished. Like at the end of the day I loved that. I was like wow we made x amount of filters today that is going to help x amount of people. That's really cool. It made me and I think it did help me in classes just for the gong ho for sticking it out. I had an end goal. Not specifically to work at [co-op company] but just the end goal of having the feeling of being able to help people and making something that matters (Lines 724-732).

Most importantly for Lee, her co-op experience showed her that there was a connection between engineering and the medical field. As seen in the above excerpt, it was very important for Lee to know she was making a difference and her work was having some kind of impact. She ultimately wanted to contribute to the medical field, but before her co-op she did not know it was possible to have that connection. So her co-op became an important experience to show her how engineer

could contribute to the medical field and it helped her be more motivated and "gong ho" about her major. She found that connection to what she valued and this helped her see the end goal of getting her degree. This helped her develop a stronger commitment and perception of fit with the field. Like Anna it helped her gain a tangible end goal and vision of what her future career as an engineer could be.

Through their co-op experiences both participants solidified an engineering identity and set a career as an engineer as their ultimate goal. They viewed themselves as student engineers, but expressed that they would soon shift to being an engineering professional. However, their co-op experience also set up situations where they would move in between a "real" engineer identity and then back to a student engineer identity.

Shifting Identity

Anna and Lee explained how they felt that her identity with engineering changed from space to space. They felt their engineering identity shifted as others labeled them based off of their expectations of Anna and Lee's knowledge and experiences as engineers. At school they felt they were engineering students and the focus was more theoretical about being able to solve specific derivations or model certain things. However, in their co-op they were seen as engineers and were supposed to be able to solve whatever the problem was. It was expected that they had taken the necessary classes and had the tools to solve the problem. They were also given opportunities to do "real" engineering work at their co-op. These experiences made Anna and Lee feel like engineers and these experiences also lead some of their classmates to view them as engineers. This reinforces that to the participants, claiming an engineering identity is based on your knowledge, skills, and experiences. For example, Lee described a time she felt like an engineer at her co-op:

> I did. Because you know production workers thought I was. Um cuz my title was engineer co-op kind of like intern but you know getting to work so closely with engineers…I actually helped to commission a machine and validate a machine in my name… Doing that was like the first real engineering thing I did. Validate a machine and submit papers with my name on it. Doing things like that I was like, 'Wow this is real,' which I love. I love doing things that matter because sometimes in the classroom it's hard working four days on a problem that you know isn't going to make a difference, but I love production cuz everyday I knew I went home and things went out the door. I felt accomplished. …With school sometimes it's hard when you turn in a problem. It's hard to feel as accomplished (Lines 663-672).

She felt like an engineer because she was given the opportunity to do real engineering work that she saw made a difference. This also contributed to the disconnect both her and Anna felt moving between the classroom to the co-op. In the classroom they were working on problems to learn and not to produce something. This made them feel like engineering students whereas in their co-op they could feel like real engineers. This reiterates that an engineering identity is heavily tied to content knowledge, skills, and here the purpose of the problems you solve. Because of their experiences, some of their classmates viewed them as engineers. This was very prevalent in Anna's narrative.

Anna placed "4th year co-op" in the core of her classroom identity model. She explained that she did this because being a co-op influenced her classroom experiences, especially how her classmates viewed her. She described that because she co-oped she came back with 9.5 months of engineering experience and it also put her in a weird position of splitting the curriculum. This

meant she would have classes with seniors and juniors and they viewed her very differently. She explained that to the upper classman since she was not in senior design "she's not quite there yet" (Line 678), but it is the opposite in her junior level classes and in particular in her minor. For her classmates in the nuclear minor she's made it. She explained:

> For the people in my nuclear class I've made it. I've worked at a nuclear power plant I've done what they want to do kind of thing. So I think both of those kind of tie to how I'm identified across the board in my classes. I'm a fourth year student but I also have work experience so all of those theoretical…pump valve things we talk about I've seen them I've used them I've done design changes on them I've done eddy current testing on the heat exchangers. I've done all that work and so it definitely effects how I'm seen in a classroom setting (Line 675-683).

To her classmates in nuclear she's an engineer, and she's in the unique role of being one of the only people, including professors, who have worked for a commercial power plant. The things they talk about in her classes she's seen first hand and has had experience with them. She further explains that because of her work experience and working for the minor she felt her classmates look at her differently, that it sets her apart. She has done the job they all want to do and they see her as an engineer and a content expert in a way. She also works for the minor, which sets her up to have specialized knowledge about the curriculum and labs. Her knowledge of the minor and nuclear power overall became very salient and influenced her experiences in the classroom.

Due to Anna's knowledge of the minor and the field, she found herself answering a lot of questions about the curriculum and about nuclear power. Her knowledge became a salient identifier for others. This was amplified by some of the professors' lack of experience in nuclear

power. She explained how one of her professor admitted that he did not know a lot about commercial nuclear power and overall she is in the unique position of having done for an employer what they are studying. She explains her unique position in the following anecdote:

> Everything we talk about in that class I've done for an employer and so that's kind of uncommon. Also like the only other person whose has worked in nuclear, she worked at corporate. So like any plant based stuff she knows because she's a chemical engineer. She studied piping and plants and stuff like that, but she's never actually done it. So it is kind of weird being that one person who's been there. Even the professor didn't work at commercial nuclear power plants so it's really weird to be that one person (Lines 699-704).

She is in the unique position as being one of the only people with work experience that directly relates to the coursework in the minor. Her knowledge of the field and the minor makes her a go to person for questions. She expressed that she did not mind helping and making herself available, but it puts her in a weird position and makes her stand out.

The Social Engineers: Against the Narrative

When I asked the participants how they saw themselves as engineers they framed it through the stereotypical representation of "engineer." They described the prevailing narrative of an engineer as someone who is nerdy, not very social, just likes to study, and can fix anything. They further described them as someone who is super smart but struggles to communicate with others. The participants situated themselves against this narrative to construct who they were as engineers. They described themselves as social engineers. This set them apart from some of the peers and ultimately made them better engineers. They felt that their social attributes were some of the most salient aspects to their identity and within the engineering classroom. Accordingly,

the participants placed social characteristics in their overall and classroom identity models. These included traits such as outgoing, funny, personable, charismatic, and friendly. They also included traits associated with working with others such as leader and mentor, because overall they expressed that working with and being around others was very central to who they were. They repeated and continued to reinforce that the social aspects of themselves were important to who they were as individuals and it was how they situated themselves within the prevailing narrative of "engineer."

It is also significant that they referred to the prevailing idea of an antisocial engineer as a stereotype or misconception; it shows that the participants do not fully agree with this representation. It sets them up to frame their identity on their own terms and allows them to narrate their differences as positive and beneficial while highlighting their fit within the engineering space. This creates a different narrative that sets them up to have a better fit and in their opinion, speak to who engineers really are, against the prevailing narrative. They continuously narrated themselves against this stereotype in both engineering and social spaces while emphasizing their membership in the engineering field. In the classroom, they narrated against the stereotype to show how they are different from their classmates and how their social skills were beneficial. In social settings, surrounded by non-engineers, they found others tried to define them by the engineering stereotype. They pushed back against this representation and worked to articulate that they were more than their engineering identity, that the stereotype was wrong, and again emphasized the social aspects of themselves.

Engineering/Classroom Spaces

The participants described how being social was beneficial and set them apart as engineering students. Although they see it as a stereotype that engineers are super smart but

cannot communicate, they use these narratives to describe how they are different from their classmates. They articulated that their social attributes make them more successful because engineering is grounded in group work and collaboration. They narrate an identity with engineering framing that they have the skills outside of the cognitive abilities that are necessary to be successful. They emphasize the importance of social skills in being a successful engineering student and future engineering professional. Many of the examples they provided came from their experiences with group work.

The participants repeated the narrative that their social skills were essential to successful group projects. For example, Lee, Sara, and Olivia spoke to how their social skills enabled them to help group members who were the stereotypical "smart kids who couldn't communicate" work with the group and express their ideas to others. The participants were the people who could be the "mixers" connecting everyone to benefit the group project overall. Sara presents this idea when she described how she saw herself in engineering:

> In engineering specifically, I kind of see myself more as like not necessarily the smartest one in the room, but the one who is able to talk to everyone, be the leader, and allow people to work together. So like a lot of times in engineering you will have people who are super antisocial are just like really really smart and don't want to talk to other people but I'm kind of like a good mixer between that (Lines 238-241).

Sara narrates her role as the leader, and the social member of the group who can come in and help the stereotypical engineers and other group members. It sets up the social aspects of her identity as beneficial and essential to helping group work go well. Importantly, we also see how

she more directly positions herself against the narrative of the antisocial engineer. Lee reiterated a similar perspective:

> My outgoing personality helps out a ton when I'm in group projects and group work because sometimes you know people are so brilliant that I work with but it's hard for them to communicate. So sometimes my social skills can help them out and I learn something from them too. It's like we balance each other (Lines 238-241).

Lee, too, positions herself as the opposite of the antisocial engineer. She presents herself as the one who can help those that fit the stereotype be more successful. Olivia adds to this explaining in her experience that engineering students also gravitate to social people for group projects, and not the "weird smart kids". She explains that this is largely because "you are more approachable and communication is the biggest thing in a group project". So not only do they help others in their group, but people gravitate and want to work with the social people because of their skills and approachability. This narrative not only positions them against the stereotype, it also suggests that those individuals who fit the stereotype are at a disadvantage and need them to be successful. It presents the participants as having better than average skills to be successful engineers.

Collaboration and communication are also very important for the engineering professional. It is part of the larger expectation and reality of working in engineering. Both Anna and Lee, who co-oped spoke to this. Lee explained the importance of collaboration and the misconception that engineers can't communicate:

> Engineering is all about group work so it's you know some people are like 'oh engineers are nerdy and like can't talk' but its not like that, because what's the

> point of making something if you can't present it and communicate it to others? You could make the greatest thing ever and if you can't communicate how it works, what you did, and why it should do this, it doesn't really mean anything (Lines 618-623).

Lee extends the importance of social skills to the workforce framing that you need the social skills to be able to communicate to others the engineering work you did. She puts the skills to communicate as almost as important as the engineering work itself, that it is an essential piece. Similarly she explained that in the workforce you work as a team with multiple types of engineers, so the expectation is that you are able to communicate what you have done to others. Anna expanded on this perspective explaining that the biggest misconception she sees with first year engineering majors is that as a co-op or future engineer you work alone at a desk and do not interact with others. She emphasized that if she "finds herself doing a job and she doesn't at least interact with three other people I'm doing my job wrong. That means that my opinion is the only one that matters and that's not true. That's not safe. That's not what you want in any engineering job. 100% of the time you will work with at least one other person" (member check). Here Anna extends this perspective that it is important and essential to good engineering practice to be able to work with others.

Social Spaces

When I asked participants where they felt their identity shifted one of the first places they mentioned were social settings. They felt that people outside of engineering defined them by engineering and largely associated them with misconceptions about what it means to be an engineer. It created the largest disconnect with how they saw themselves and how others viewed their identity. In social settings they found themselves having to push back against those

expectations and define who they were, that they were more than an engineer. Their overarching identity as an engineering major become salient in those situations because people tried to identify them solely on the narrative of engineer, the nerdy shy individual who just studied. The participants felt this happened because people outside of engineering did not understand what engineers actually did and the different personality characteristics engineers have, they solely relied on the stereotypes. The participants also explained that this happened because outside of engineering they were oftentimes the only one of their friends who was an engineer. Since they were the only one, it made their friends label them as "the engineer friend." It put them in a role to be the go to person for any "nerdy" or math and science related questions. They were also the person you called if you needed something fixed. Although they did not always mind, it put them in a set role that overshadowed other aspects of themselves they felt were more important than just being an engineer.

In these social situations their friends and people they met associated them with the stereotypical narrative of what it means to be an engineer. This caused many of their social interactions to be littered with misconceptions about what it means to be an engineer and makes salient the idea of "engineering student" as a socially awkward person. Anna explained how this happened with some of her friends:

> In social as much as you try to just be a college kid or whatever it's always blatantly apparent to my friends that aren't engineers that I study engineering. That I'm considered an engineer or whatever and I guess because in my friend group I am the only one that studies engineering so all of the misconceptions you could have are there. Kind of like 'Engineer Anna can do anything, she can fix my car' or whatever and there's no like second back up. So like if I say no I'm not

> an engineer, I'm just an engineering student every single of them is gonna agree that I'm an engineer (Lines 756-764)

As Anna explains, being the only engineering friend puts them in a situation where there is not another engineer to support her perspective on engineering and show that the misconceptions are not true. By being the only one, they can be an anomaly to the stereotype instead of showing to their peers that the stereotype is a misrepresentation. As the participants explain, this places characteristics on them, such as nerdy and shy, that do not match with how they see themselves. Sara described this experience from being the only engineer in her sorority:

> In my sorority I'm like the only engineering girl so I'm like instantly pinned as like 'oh if you need any nerdy smart questions go to Sara.' When it's not like that at all. I try to like it's really hard to separate school and like outside of school just cuz like no matter what my friends always see me as the smart engineering girl. They introduce me as 'she's an engineer' (Lines 747-750).

Similar to Anna's narrative, Sara too just wants to be a regular college student, but the title of engineer becomes salient and places characteristics on her that do not fit, and she is not always in a situation to argue against them. Especially when her friends introduce her as "the engineer" it automatically places those misconceptions on her before other aspects of her can come through.

Instead of narrating who they were as engineers like they do in the classroom, they had to narrate who they were not based on the narrative. These experiences place the participants in a situation where others are defining them by "engineer" and making it central to who they are. Additionally, the participants felt that in these social situations people associated engineer as being central to who they were and that it defined them. They described how the title of engineer would stick to them or it would be pinned to them by others. It not only placed assumptions on

who they were, they described that oftentimes they felt being pinned an engineer would stop conversations. Overall, the participants' felt that many of their experiences in social settings were characterized by people labeling them an engineer and not giving them the opportunity to be more than the stereotype.

This created a disconnect between who they felt they were and how others saw them in social settings. It made engineering define them, but with categories that did not represent them. This encouraged them to discuss how "engineer" did not define them. The participants explained that "engineer" was not what they wanted people to take away from them even though it was their goal to identify as an engineer. Mary explained this perspective:

> That's the big thing I don't like. I think they assume it defines me. It's like I would like to be thought more of as a friend, family more than like an engineering student. Its like I love my classes and the things it's brought me like my friends and stuff. I don't want to feel like my career I don't know I want to think its more of something I do and not who I am (Lines 532-535).

Even though the participants enjoyed their major, they do not want to be defined by it or their future career. As seen in Mary's statement, the participants wanted to be seen by what the valued most. This interestingly led them to express a better fit within engineering.

Although they did not want to be defined by their engineering major they did however narrate that they found better fit within engineering. They described that engineers in general were not what people expected. It was not all nerdy people who did math all day. They had friends who like them, were outgoing, friendly engineers. They spoke highly of the faculty, and many listed that their favorite part of engineering was the community and friends they made. In engineering they found peers who shared similar interests, sense of humor, and personalities.

Within engineering, what they were interested in was "cool and normal." But importantly, they could be more than the just the engineer friend. Engineer was no longer their defining characteristic. Sara explains this:

> I prefer more how my engineering friends see me as smart, hard working, funny, friendly, and outgoing rather than like some of my friends would be like, 'oh Sara is just in engineering and really busy but sometimes she's really fun and friendly when she's not doing engineering things' so that's the main disconnect there (Lines 440-443).

The participants narrated a better fit in engineering compared to other social settings, because being an engineer was no longer the most salient part of their identity or a defining aspect of who they were. Sara's example illustrates that how in engineering the aspects of themselves that they valued and placed more central to their core, came through. They could be seen as more than an engineer. Within engineering their identities were more representative of how they see themselves, how they drew themselves in the model, and how they wanted others to view them.

Role of Gender

The contrast of their social skills against the narrative of the antisocial engineer also aligns with essentialized ideas of gender that participants brought into their narratives. The participants mainly used gendered narratives to position themselves as the social engineer. Previous work has shown how traditionally the social side of engineering has been labeled as "feminine" and not "real" engineering (Cech, 2015, Faulkner, 2007). However, the participants framed their social traits as positive attributes and positioned themselves as better engineers. As much of the participants tried to form their identities against gendered expectations, essentialized ideas of gender came through when they talked about their experiences.

Their gender became salient in the classroom and workforce when others placed expectations on what work was appropriate for them. Some of the participants felt that they had to prove that they were smart enough to be in the engineering classroom, and that all of their actions were on display. They felt it was harder to blend in and just be a student. However, some of the participants did not feel this same pressure. They discussed how they were part of the engineering community and that their gender did not influence their classroom experiences, but it did influence their time in the workforce. Lee and Anna found that some of the tasks they were asked to do in their co-op related to essentialized ideas of gender and that when they went against these expectations it brought a lot of attention. They participants also repeated in their narratives essentialized ideas of skills. When they discussed what men and woman brought to engineering they focused on more traditional ideas of women's innate organization skills and men's physical strength. As much as the participants pushed away from the stereotypical representation of engineer, they struggled to see past the limits and contradictions of essentialized ideas of gender present in their experiences.

Gendered Engineering Identities

The participants mainly used gendered narratives to articulate how they were the social engineers against the stereotype of engineer. As mentioned previously, this stereotype suggests that engineers are nerdy people who cannot communicate with others. Previous work has shown how traditionally the social side of engineering has been labeled as "feminine" and not "real" engineering (Cech, 2015, Faulkner, 2007). However, the participants saw their identity as the social engineers as beneficial, something that made them better engineers against the stereotype. The stereotype also comes with the assumption that engineers are men. In the participants narratives they oftentimes alluded to men classmates as the engineers who fit this stereotype. It

also comes through in more specific examples when they talked about the stereotype. For example, Olivia referenced the "weird nerdy guys" and Lee provided the example of helping her man classmate communicate better with their peers in a group project.

This interestingly switches the narrative and highlights the importance of the previously feminized and devalued social aspects of engineering practice. It places those who fit the stereotype, who are most likely men, as lacking in important skills that are needed to be an engineer. This is not completely unfounded. Research has shown that although the technical side of engineering has traditionally been privileged, engineering is not just technical. Social skills are incredibly important in the engineering curriculum and the workforce (Brunhaver et al., 2018; Huff, 2014). The participants are positioning their narrative against the idea that the social side of engineering is less valued or is not "real" engineering. They narrate that these characteristics that have been labeled "feminine" make them better engineers and set them apart from their peers. They position the social side of engineering as an essential component of "real" engineering work. As the participants discussed, it was not enough to be able to understand the content you needed to be able to communicate and work with others. They emphasized that engineering was all about collaboration and group work and framed social skills as a central component to this process. In their view, you needed to be technical and social.

Outside of narrating themselves against this stereotype, they did not see a mismatch with being a woman and being an engineer. As mentioned previously, the constructed their identity and fit with engineering based on knowledge, skills, and familial influence. They reinforce that an engineering identity was based on skills and what engineers did, not stereotypical expectations of who an engineer was. In particular, Lee emphasized how engineering work needed to be genderless. She described that a mechanical engineer was someone who was

interested in how things worked and that a man or a woman could be interested in that. Many of the participants felt that more women were getting involved with engineering and that soon it would not seem like such a "rarity" or "big deal" to be a woman engineer. Although the participants stressed that engineering was tied to your interests, they discussed that were aware of the stereotypes that women were not engineers or were not smart enough to be engineers. They importantly refer to them as stereotypes, and they were able to see past these misconceptions due to their familial and hometown connections to engineering. These connections, albeit part of their privileged position, helped make an engineering identity seem like a viable option for them, and also presented a narrative through which it made sense for them to be engineers.

When asked how they came to engineering one of the first things participants mentioned was their family connection to engineering. For many of the participants they described it as "family thing" to major in engineering. In fact, all of the participants had at least one family member who was engineer. This was particularly salient for Anna, whose mother was an engineer. She described how seeing her mother as an engineer made it where she never felt like she could not be an engineer or that women were not engineers. Many of her life experiences showed that women belonged in engineering, that the stereotype was a misconception. Anna explained these experiences in the following anecdote:

> With my mom being the degreed professional in my household I never grew up with conception I feel like a lot of girls get that just because you are a girl you are supposed to study elementary education or nursing or whatever. Those identifiers were never really a problem for me. A lot of people think 'wow you are a girl an engineering that must be hard' and I'm like "It's just like everything else'. That

> being said of 6 co-ops I was the only girl, was the only girl in my thermo class. I've been the only girl a lot of times but I mean I'm part of WIN, Women in Nuclear. I help with 'I can' girls in engineering camps. I'd say [gender] is not the biggest part of my identity as an engineer…but you know I would say I do make an effort to encourage more girls to not to have that stereotype. Just because it was never a thing for me but I do realize that it is a misconception a lot of people have (Lines 478-489)

For Anna, she felt that gender did not play a large role in her narrative or how she identified with engineering. She explained that she never felt the pressure to enter a more stereotypically feminine career because her mom was an engineer. From her experiences, Anna saw an available narrative for women to be engineers. The other participants had a similar experience, that with family and community connections to engineering they focused on the actual work of engineers. This moved the focus to what engineers actually did instead of more stereotypical representations of who belonged in the field.

Essentialized Characteristics

Although they did not fully integrate essentialized ideas of gender into their identity, they used these narratives to discuss the different skills and characteristics men and women brought to engineering. The participants emphasized that women and men were equal in their ability to be engineers and to understand the content of engineering, but that there were overall differences just from being men and women. So even though they did not believe gender influenced their engineering identity, they still framed their understanding of appropriate roles through a gendered lens. This focus on separate roles is in line with gender complementarian viewpoint that women and men have distinct roles, a "created order" (Colaner 2008; Bryant). The

complementarian perspective is seen as truth, and views essential gender differences as an ideal and divinely created. (Bryant, 2009; Colaner 2008). Four of the five participants placed faith or Christianity close to their core or even central to their identity in their models. This likely encouraged them to interpret their experiences in the gender complementarian view where they use similar language to discuss how women and men are naturally different. They accepted and internalized these distinctions by discussing how gender mattered when you needed someone to be organized and take charge and when you needed someone to lift something heavy. They largely spoke about these differences in terms of working on group projects and how the different tasks were divided up. Therefore, they do not problematize this separation in group project roles even though they emphasized that men and women were equal in their abilities to be engineers.

The main characteristic the participants mentioned was that women were more organized than men. From their perspective, being organized was a fairly universal characteristic for women and it was essential for group projects. All the participants mentioned how women tended to be more organized, but Olivia elaborated the most on how she saw essentialized characteristics play out in group projects. She explained women's roles and her preferred roles as the following:

> Female and male we both have our own kind of like weaknesses and strengths for me like being a girl in engineering my strength would be you know being able to socialize better and like being the leader of the group project and getting all the boys organized and like keeping everyone on task. That's like really hard with boys I feel like just from experience and trends with group projects and just knowing my friends in engineering that are guys (Lines 444-447).

We see here that Olivia focuses on her organization and social skills, that these enable her to be the leader and keep the men and her projects in line. Here again, she narrates herself with the social engineering identity and presents this narrative that their woman characteristics are necessary and important to keeping the group together and working. It is also important to recognize that she identifies the social as the feminine in accordance with essentialized beliefs. Although she narrates the benefit of these skills, she stills articulates this gendered conception. She continues to describe the roles of men in group projects:

> But guys on the other hand are more like active with projects they are the ones doing all the labor like putting together a robot or like a piece of ply wood or like the constructions of the things the coding. I know I'm really slow on like all the nerdy stuff like coding, matlab, and modeling and sometimes even construction. So I let all the boys do that then I'm the one that's like putting together the presentation and organizations and like giant charts and like putting together the report and being the leader in like if we have a presentation or something (Lines 448-453).

Olivia described men's roles around doing the heavy lifting and the more physical aspects of the projects. In her experience she would let them do more of the coding and "nerdy" stuff. This goes along with the expectations that men's roles are tied to physical strength and the more "nerdy" or technical aspects of engineering. This ties in with the expectation that women may do more of the secretarial aspects of the projects and less of the technical engineering work. But Olivia expressed that she was fully capable of doing the coding and modeling, it was just that she preferred to take on the more leadership and secretarial roles. She referred to these as the more PR type roles and she wanted to be the communicator of the group. However, Olivia later

emphasized in her narrative that men and women are equally capable of doing the mental work of engineering such as working systems and data analyses, that outside of things related to physical strength, that men and women were the same. This is similar to the experiences of Anna and Lee, that gender felt salient outside of the mental work of engineering.

Sara felt that her traditional woman characteristics, and where she broke from those stereotypes, were amplified in the engineering space. Overall she narrated a disconnect and conflict between how she saw herself and the essentialized expectations of woman and engineer. She felt that her more traditionally woman characteristics such as being friendly, and caring stood out along with being outgoing because they were unexpected of an engineer. Then she felt that being athletic, smart, and a leader were unexpected because she was a woman. She felt that defying expectations of woman and engineer was central to who she was and caused her to stand out more in the engineering classroom. Because of this, she felt that being a woman in engineering defined her in the engineering classroom.

When I asked her to explain further why she felt being a woman engineer defined her in the classroom she spoke to other gendered expectations of being a woman and being an engineer and how they conflicted. She explained:

> Being a girl in engineering…like it's a very different lifestyle especially like you are expected to go to work and make a lot of money but you're also expected to like I want to be a mom kind of thing. Find that balance. So a lot of times people are like 'oh you can't do both.' So it's important to still be caring, friendly, and have that like girl side to you. But also being in engineering being able to be smart and leader and kind of like not let like petty things get to you. Which is something you don't see a lot in girl characteristics (Lines 623-629).

Here Sara articulates a disconnect she sees with the expectations of being a woman and engineer in the workforce. She feels she is supposed to balance being an engineer and a mom. This belief likely comes from the gender complementarian view that a woman's role is to be a mother and located in the home sphere. Therefore, Sara feels the narrative is that she cannot do both, and she wants to find a balance of what she defines as her woman and engineering characteristics. She narrates herself as being unexpected and against the stereotypes, instead of seeing the overall problems and limits of those perspectives. She can see in her own experience and identity that there are limitations to essetialized ideas and stereotypical representations of woman and engineer, but she does not push it further to critique the system.

Although, Olivia and Sara spoke the most about essentialized characteristics they also contradict themselves in these narratives. After Olivia described the different skills men and women have in engineering she said gender did not inform her choices, "so I feel like gender doesn't really define who I chose to be and how I act with engineering and like in life" (Lines 453-454). However, she articulates a strict divide in what roles women and men take in group projects, and she discussed how she prefers those feminized roles conforming to those ideals. Similarly, when she described how men in engineering would prefer jobs that were more hands on, where you got your hands dirty, and required more physical strength. However, when I asked her what she hoped to do with her degree she contradicted this expectation:

> I really want to go into the government contractor sector like working in the Army, or the missile defense, or even NASA if I chose to go back, or like the Navy. Working on like different aircrafts, and ballistic missiles, or like weaponry, those are really interesting to me. I think those would be interesting to be in. (Lines 374-377).

She also expressed that she wanted to make the world a better place by working with the military. But from her own definition, interests in missiles and weaponry would be more of the realm of men and she described it later that these were her "tomboy" interests.

Similarly, Sara sees herself as unexpected and against the stereotypes instead of seeing the limits of the stereotypical representations of woman and engineer. This was present in the other participants' narratives when they used gender complementarian discourse to discuss how women were naturally more organized and that men were better suited for things requiring strength. They did not articulate as strong as a connection to essentialist ideals as Sara and Olivia, but they were still present in their narratives and how they made sense of the labor division in group work. They still used these gendered narratives to describe skills that women and men brought to engineering even though they expressed that men and women were equal in their ability to be engineers. This speaks to how socialized woman are to believe and integrate these gendered narratives into their experiences. Women are not socialized to think in ways that question these gendered conceptions, and research has shown that many undergraduate students are not aware of how gender distinctions characterize their experiences in higher education (Francis, Burke, & Reed, 2014). Importantly, the participants were able to recognize the limits of the dominant narratives of engineer. From their experiences and their strong fit with the field, it was easier for the participants to see the limits of the conceptions of engineering and not gender, even though many of their actions and identities with the field went against those gendered expectations. However, it is still promising that they narrated themselves against the limiting stereotypes of engineering.

Gendered Experiences

On the surface there was less of a gendered connection to how they saw themselves with the field, and in particular, the participants did not discuss gender unless I prompted them to. However, the participants more clearly saw times where gendered impacted their experiences as an engineer. They described times they felt gender mattered in the classroom and workforce. Largely, these experiences came from their gender becoming salient and carrying with it an awareness of being the minority and expectations of what they were supposed to excel at. They discussed "being the only one" in classes. It made them stand out and sometimes feel less like just an engineering student. Whereas, others felt that they were simply part of the engineering community and did not feel like they were treated differently in the classroom. However, they drew connections to gendered experiences in their co-op. In the following sections I describe some of their gendered experiences as engineering students.

Standing Out

When I asked the participants if there were ever times they felt like a woman engineer and not just an engineer their responses focused on feeling like the only one, or when their was a spotlight on them being a woman and an engineer. They discussed how they ultimately got used to being one of the few girls as they progressed through the major and they got to know their classmates better, but in the beginning it felt much more prominent. Mary described her experience of standing out in the classroom in great detail in the following anecdote:

> I really never felt tons of different expectation for me being a girl it's more of just when you are the only girl you stand out in a class. Usually when I'm in a class I'm there to learn. I'm not trying to be the center of attention. So at the time it would kind of bother me, but it doesn't really bother me anymore. I think it has to

> do with, I'm friends with so many people now it's not a big deal. But yeah I'd say in the beginning it kind of bothered me now it doesn't really. Never in a sense where it was terribly negative, it was just kind of like there's three of us it's very obvious when we are here and not here, when we are paying attention that kind of thing (Lines 461-471).

Mary, like the other participants discussed how she got used to being one of the few women and it came from becoming friends with her classmates, and just overall getting used to it. Mary explained later that this was just the biggest change for her when in high school her classes were split more evenly between men and women. What is also prevalent in her narrative is her frustration at being in the spotlight by being one of the few women. It was harder to blend in and just be a student, especially when her actions felt more noticeable. As much as she was there to learn and just wanted to be a student, her gender became salient and made her stand out because there were so few women.

Similarly, Sara found that standing out in the classroom placed extra pressure on her when she spoke up in class. She explained, "whenever you answer a question out loud I always feel like the pressure is on you because you're a girl so if you get it wrong it's like 'Oh you are the dumb girl' kind of thing… it's also like if you do talk in the classroom it's like 'Oh there is a girl talking, I didn't know they talked' kind of thing (Lines 688-691). Her experiences hints to this expectation that women are not in the engineering classroom, and that it is even more unusual if they participate in class. It goes back to what Mary talked about in being more visible in classes. By being one of the few women your actions in the classroom become more noticeable and are potentially judged more harshly. Accordingly, Mary and Sara also discussed that they felt they had to prove that they were smart enough to be in the engineering classroom.

Both Mary and Sara felt that women engineering students had to prove themselves to some of their peers. Largely, they had to prove that they did not represent the stereotype that women were not as smart at math and science. They had to show they belonged in engineering and they could compete with the men. Mary described that early in her experiences as an engineering student some of her classmates would assume women were not as smart. Similar to her experience with standing out, she found that this happened less as she progressed in the major and made more friends. She describes her experiences of proving herself accordingly:

> That's another big varying one. I've found that at least as a girl there are definitely people that assume you're not as smart… I think it really does bother some people but it doesn't super bother me. I just kind of treat it as a way to prove myself because I don't think I'm dumb… It's a lot different now because I've become friends with some people in my classes, but in the beginning I'd say I think girls tend to be assumed that you aren't as smart (Lines 245-253).

Sara described a similar perspective. She explained that women ultimately had to work harder and that you had to "prove yourself right off the bat just because instantly right off the bat people don't think you're smart" (Lines 252-253). They felt that in those initial interactions with their peers they had to disprove the misconception that they were not smart enough to be in engineering. Even though they explained that as you progressed in the major you did not have to prove yourself anymore, they still had to work to maintain that accepted status. Sara felt that women had to be more hardworking in engineering because men could "slack off and still be considered an engineer kind of thing but if a girl slacks off it is like 'Oh she doesn't care, she doesn't want to be an engineer' (673-674). So in Sara's experience it does not end with proving yourself. You have to continue to show that you have the ability to compete. She presents this

narrative that once a woman slips up in engineering; gender becomes salient again and it causes people to jump to the idea that women do not belong in engineering. Their actions are judged more harshly. Sara felt that women had to be tough, persistent, and go the extra mile in those situations to make sure you were taken seriously. She overall presents the story that is harder for women in engineering to maintain a status of belonging in engineering.

In order to have her classmates take her seriously as an engineer and see past the stereotypes of gender Sara felt she needed to try to be one of the guys. She did this by showing her athleticism. She explained how being athletic and sporty was important to her identity, but she also used this as a way to distance herself from the stereotypically representations of "girl" that would signal she did not fit in engineering. She did not want her gender to influence how her classmates thought of her. When I asked her about a time she tried to be one of the guys she gave the following example of throwing a football:

> I can throw a football pretty far. So that'll always be my go to like 'Hey I can throw a football that means I can compete with you in engineering.' Yeah I'm really sporty when it comes to those kinds of things. Like I'd rather go play sports and be running around than sitting around talking kind of thing. So that's kind of helped me fit well and adapt in kind of those engineering social environments (Lines 362- 365).

For Sara, by showing she could physically compete with them she hoped it would cross over into the classroom and show she was capable of competing with the men in engineering. She emphasized the more masculine aspects of herself. She placed athletic in her identity model, and here she highlighted that aspect of herself to try and find better fit and prove she belonged in engineering.

Mary and Sara's stories show that there was a transition of sorts where they had to prove that they could compete and were smart enough to be engineering. From their experiences you can see how the masculine expectation of who should be in the engineering classroom comes through, especially in those early courses. They feel that their actions in the classroom were being watched and that they have to show they belong. In particular, this can be more of a continuous process where you have to work harder to maintain that you belong. As Sara explained, she felt that women were not able to mess up and say something wrong. That in some ways their status as being accepted in engineering hinged on their ability to show they could still compete. From standing out to proving themselves, Mary and Sara just wanted to be seen as engineering students like everyone else. However, not all the participants shared a similar experience in the classroom.

Positive Classroom Experiences

In a different narrative, Anna, Lee, and Olivia expressed more positive feelings towards being one of the few women. They discussed how it did not bother them. Lee and Olivia emphasized how they never felt out of place or felt their peers discriminated against them. Olivia explained how she felt people outside of engineering viewed it was a bigger deal to be a woman in engineering:

> I feel like people outside of engineering would make a bigger deal than people in engineering because all the guys in engineering look at you the same. There's never a time where like someone would discriminate against me doing something that we are assigned…There's not a time where I feel out of place or like making a big issue about why I have to do this or that, but then like other people that

> don't have that perspective or experience would think that girls are being put down more in the field because there's not a lot of us (Lines 558-563).

Lee reiterates a similar sentiment:

> I feel like some people just still see engineering and think man, but the people within engineering haven't made me feel like that. I think it's the world um rumor or stereotype I guess that it's a man's field and that's just because numbers wise. I mean its more men (Lines 573-582).

They both discussed how when you were in engineering it did not feel like you were treated differently because you were a woman. They framed it more as a misconception, or disconnect based on what people customarily think about being a woman in engineering and their personal experiences. Both Lee and Olivia understood why people would think they would have a difficult time being one of the few women, but they explained that they never felt less than. They both emphasized that being a woman engineer was not what people expected, that just because they were underrepresented did not mean that they were treated differently in their experiences. Having fewer women did not mean it was a man's field or that they were being put down. Like Olivia, Lee emphasized how she never felt less than, or felt she was given less important tasks because she was a woman. She continued, that she had not heard from her friends that they felt less than:

> And I haven't heard from other girls them feeling less than either. And I feel like you know my girlfriends are strong willed and if they felt belittled, I mean if I felt belittled you'd hear about it. I wouldn't just sit there and take it. But luckily I haven't had a situation where I even needed to go there (Lines 609-612).

Here Lee emphasized that she and her friends would say something if they felt they were being belittled. By doing this, Lee speaks to the narrative that women face a chilly climate in engineering and that if it had been her experience she would have spoken up.

Anna, Lee, and Olivia also presented their engineering experience as a more of a collective or community. They felt that they were part of a group struggling together to work through the coursework towards a common goal. Anna did not see it as a big deal to be the only woman in the classroom because everyone was struggling with the same content. They were in it together. She said, "It's not a big deal that I'm the only girl [in the classroom] because we are all equals you know? We are all struggling and studying engineering" (Lines 531-532). Lee had a similar view. She described how engineering was all about group work that you spent countless hours studying and working on projects with your classmates. She felt this naturally created a community of people working towards a common goal. She further explained that sometimes it felt like it was them against the curriculum that, "honestly sometimes it feels like a battle and a war. You come out… [from] studying for so long together and finally succeeding. Everyone looks so beaten and worn, but its like we did it we learned" (Lines 261-263). Similarly, Olivia described how you would not be able to learn all the information for classes and truly keep up if you did not work with your peers. She described how this created an environment where people were willing to help each other and form more of collaborative community to get through the course work.

Although, Mary and Sara felt they had to prove themselves to some of their classmates, they also saw engineering as a community of students. Both Mary and Sara discussed how some of their favorite parts of engineering were the friends they made and the community. Mary explained how her friends encouraged her to work harder and be more "gung ho" about

engineering, because the people she surrounded herself with did not make her feel like she did not belong. She could just be a student. She explained feeling more "gung ho" around her friends in the following way:

> It's mainly more when I'm with my close friends… I kind of study with the same people, I'm like usually in the same projects with the same people. So I'd say usually when [I'm with them] there's no I have to prove myself. There's no I feel less than, that I have to prove that I'm a worthy group member kind of thing. So I'd say in those situations like when I'm with people that don't look their nose down at me (Lines 282- 286).

Although, Mary described how some people in engineering made her feel less than and that she had to prove herself, she still found a supportive community that did not make her feel this way. They encouraged her to be more excited about engineering, to feel more like an engineer, and work harder. These stories present a more positive perspective on the experiences of women engineers and signal that the climate of the field could potentially be changing.

Gendered Co-Op Experiences

Although Anna and Lee spoke highly of their experiences in the engineering classroom, they felt gender mattered more in their co-op experiences. They felt that the work you did or were asked to do set you apart from your peers. Anna went it to detail about this difference. She explained that she did not see it as a big deal to be the only girl in the classroom because everyone was struggling with the same content, whereas in the work environment it's a bigger deal to be a woman because it is more likely that you will be the only woman and the focus is on the work you do. In the classroom you are all asked to do the same assignments. She also

explained that at work she's the "20 year old girl trying to be one of the, you know just one of the employees, but really one of the guys" (Lines 732-735). Anna explains further:

> It's not a big deal that I'm the only girl [in the classroom] because we are all equals you know we are all struggling and studying engineering, whereas in the workspace your ability to complete a task sets you apart from your peers. So I feel like it is became a bigger deal because I was able to be more efficient or I was I don't know just treated differently I guess. Not always treated differently just sometimes kind of like 'oh you know he will treat you different kind of thing' just like older people with different biases (Line 527-538).

So she sees gender mattering more in the work environment due to older employees who have personal biases and through the work you are able to do. Overall, being a woman could become salient based on the work you did and how others responded.

This happened to Anna when she did the "dirty work" of eddy testing in muddy water while two man engineers ran the data. She explained that, "it made it funnier that I was a girl and the two guys I was with weren't doing the dirty work. It was more noticeable that a little girl was doing all this work" (Lines 745-750). But it also drew a lot of attention to her, and made it seem more noticeable. She further explained that there were people at work she had never met before who came up to here and were like "you're the girl who got there shoes dirty the other day." She felt like it traveled like gossip in high school, because it caught a lot of people off guard that not only did you have an engineer getting their hands dirty, but it was the woman co-op when there were five man co-ops who could have also done that work. She also explained that she felt it was unexpected and funny because there is a stereotype that engineers do not get there hands dirty, so if a man co-op had done it the joke would have been "oh they make him do the dirty work

because he's a co-op," and it would have been less of a big deal if a man came back covered in mud. But because she was the girl, it was more unexpected. She felt when she did something unexpected it was given an exponential term because she was a woman, it added more attention to the behavior.

For Lee, she found that she was asked to do certain tasks that could have been classified as more expected for women. She was adamant that she never felt gender influenced the engineering work she was asked to do. However, she provided examples of other tasks unrelated to engineering work that she may have been asked to do because they were more characteristic of women. She explained how she was asked to organize something at work. She said she did not take it as an insult because women do tend to be more organized and she had wanted to organize it anyway. She also gave an example of when she had to talk to a production worker and be gentler, because he was very shy. She explained she did not now if it was a woman's touch to be gentler because the worker was so sensitive, or if it was because she had been working around him more. So for Lee, gender came up in the day-to-day activities of being an engineer that did not directly relate to doing engineering work. Her gender became salient when they needed some to organize something or be gentler with giving orders, highlighting gendered expectations. Even though Lee and Anna felt that their gender did not influence the work they did as engineers, it still impacted how others interpreted their work and what tasks they were asked to do. Their gender became salient when their actions or tasks that needed to be done related to essentialized characteristics of gender. Similarly, the participants had a tendency to use gender complementarian discourses to describe their experiences and the differences between men and women in engineering.

Summary of Chapter

In this chapter I explained how the participants saw themselves with the field and how their identities influenced their experiences. The participants told similar stories of deciding to major in mechanical engineering because of their family connection to the field and that they had the needed aptitude for the engineering. I found that the participants viewed an engineering identity as grounded in content knowledge and experience. Therefore, they presented an engineering identity as an overall goal and a title they wanted to achieve. This encouraged them to view themselves as student engineers because they felt they had not learned all the necessary information to claim the title. For Lee and Anna, their co-op experience became salient because it gave them times they felt like real engineers and these experiences set them apart from their peers. They had additional engineering experiences that led their classmates to see them as engineers. They articulated characteristics of an engineer based on what they knew and more of what an engineer was and not who they were. When I pressed them further to talk about how they saw themselves with the field, and who engineers were, they largely constructed themselves against the stereotypical representation of engineer.

When the participants discussed who they were as engineers they focused on how they did not fit the stereotype and expectations of engineer. They positioned themselves as the social engineers in the classroom and socially. They discussed how the social aspects of themselves were salient to their identity with engineering and influential to their classroom experiences. In fact, they discussed how their social skills made them better engineers, and provided them the necessary skills to be successful in the collaborative environment of engineering. But the stereotypical idea of engineer followed them into social situations and caused others to define them by the stereotypes. They pushed back against this, and stressed how engineering did not

define them, that they were more than just engineers. This also led them to find a better fit in engineering where they could be more than just the engineer friend.

Then I discussed how the participants used gendered narratives to construct their identity as engineers and how gender became salient in their experiences. Largely, gender came into to play when they narrated themselves as social engineers against the masculine stereotype of the nerdy engineer who cannot communicate. These social traits have traditionally been feminized and devalued, but in their narratives these traits were valued and positioned them as better engineers. As much of the participants tried to form their identities against gendered expectations, they participants used gender complementarian discourses to discuss their experiences.

Their gender became salient in the classroom and workforce when others placed expectations on what work was appropriate for them. Some of the participants felt that they had to prove that they were smart enough to be in the engineering classroom, and that all of their actions were on display. They felt it was harder to blend in and just be a student. However, some of the participants did not feel this same pressure. They discussed how they were part of the engineering community and that their gender did not influence their classroom experiences, but it did influence their time in the workforce. As much as the participants pushed away from the stereotypical representations of engineer, they struggled to see past the limits and contradictions of the essentialized ideas of gender present in their experiences.

Chapter V: Discussion

In this chapter, I aim to situate the findings more directly with my research questions and summarize how my findings relate to and extend the current literature. Then I address the implications for this work for research on women in engineering with conclusions and recommendations for future work. The purpose of the study was to examine how women engineering students constructed identities with their major and how ideas and expectations of traditional gender roles were integrated into those identities. I examined the repeated narratives they used to construct and make sense of their identity and how their experiences and identities shifted as different aspects of their identity became salient. My main research questions were:

1. What narratives do women engineering majors use to construct and make sense of their identity with engineering? Which dimensions of students' identity are most salient in this construction?
2. What role do gendered narratives play in the construction of their engineering identities?
3. How were their experiences influenced by the aspects of their identities that became salient in different contexts?

I summarize the findings with these questions and the current literature in the following sections.

Question 1

What narratives do women engineering majors use to construct and make sense of their identity with engineering? Which dimensions of students' identity are most salient in this construction?

The participants first constructed their identity with engineering based off of their familial connections and aptitude. They saw an engineering identity as grounded in content knowledge and skills, so they highlighted these aspects about themselves to show they had fit and the potential to be engineers. They also narrated themselves as social engineers, and situated

themselves against the prevalent stereotype that engineers were nerdy people who could not communicate. They highlighted their social attributes as being central to their identity as an engineer and important for their experiences in the classroom. They narrated themselves according to the 21st century definition of engineering that is more representative of the field (Villanueva and Nadelson, 2016). They viewed engineering as creative problem solving, grounded in collaboration, and that benefits society.

Engineering as Content Knowledge and Skills

The participants first repeated narratives of their familial connections and aptitudes to present why they were engineers. The participants defined engineering as creative problem solving, but felt that to identify as an engineer you needed to have the necessary knowledge and skills. They equated an engineering identity with what engineers did and could do. Due to this, the participants focused on how they had the necessary skills and potential to be engineers they just needed the engineering specific coursework. This led them to collectively identify as student engineers, or not yet full engineers. They saw engineering as an identity that you earned, a title grounded in knowledge and skills. The participants expressed that their goal was to be able to claim an identity as an engineer.

Since the participants defined an engineering identity by knowledge and skills, the participants first situated their identity with engineering by repeating similar narratives that they had the necessary cognitive skills to be an engineer. They discussed how they always liked math, science, and problem solving, and put characteristics like innovative, and smart on their identity models. They addressed how these cognitive attributes were salient to why they majored in engineering and gave them the potential to claim an engineering identity. This reinforced that knowledge was central to how they saw an engineering identity. For some of the participants

they extended this to their family and community. They repeated narratives that it was a "family thing" to be an engineer, or they came from a math and science family. All of the participants had at least one family member who was an engineer and they referenced how this influenced their decision to be an engineer and their knowledge of the field. For three of the participants, they extended it to express that it was an overall "community thing" to be an engineer. The overarching narrative was that they were student engineers, but they came to engineering because they had the needed cognitive skills and familial connection to the field.

This connection with content knowledge is present in the current literature. Students' competency and performance beliefs are seen as one of the main factors that lead students to identify as engineers (Carlone & Johnson, 2007; Godwin et al., 2016; Hazari et al., 2010; Patrick et al., 2018) and choose to enter the field (Eccles, 1987,1994, 2009; Wigfield & Eccles, 2000). It is important for students to perceive they are capable of doing engineering work and expect to perform well to build an engineering identity (Godwin et a., 2016; Patrick et al., 2018). Similar to this research, the participants began their narratives of fit with engineering based on their performance and competency beliefs. The participants emphasized how they felt they had the necessary skills to be successful and work towards an engineering identity. They first explained how they always liked math and science and were good at it. Past research has shown that competency and performance beliefs about math and science were a precursor to students identifying as an engineer and choosing to major in engineering (Goodwin et al., 2016). Additionally, the participants placed the skills they felt were needed to be successful in the field directly on their model and as a salient part of who they were. This further situated that the participants believed they were competent in engineering and would perform well. They expected to be successful and integrated these skills directly into their narrative of who they were

and why they fit with the field. These findings reinforce the importance of students' competency and performance beliefs for seeing a potential identity with the field and choosing to enter the field.

The current findings also expands the work of past researchers who found that when you ask students what constitutes an engineering identity, they focus on specific content knowledge and skills that are needed in engineering practice. Similar to the findings in the current study, Meyers et al. (2012) and Stevens et al (2008) found that students focused on specific disciplinary knowledge and milestones such as completing the engineering degree, to define what counted as engineering work and contributed to an engineering identity. The participants expressed similar reasons as to why they identified as student engineers. They wanted to finish the coursework so they knew they had the skills and content knowledge necessary to complete real engineering work. In another study of Auburn engineering students, we found that some students similarly identified as engineers in training for the same reason (Lakin & Hill, 2017). Therefore, this study extends the findings that engineering students focus heavily on specific disciplinary knowledge as the grounds for an engineering identity. In this way, an engineering identity is seen as something you work towards and earn throughout your coursework.

This study also reinforces the importance of knowledge and exposure to engineering for building an engineering identity. Pierrakos et al. (2009) found that students' knowledge and exposure to the field as well as contact with actual engineers was important to building an identity and persisting with engineering. Similarly, the participants expressed how their familial and community connection to engineering influenced their decision to major in engineering and it provided them social capital. All of the participants had at least one family member who was an engineer. This provided them unique opportunities to visit engineers at work and be able to

talk with their family about the work of engineers, and what area of engineering they should go into. Lee, Mary, and Olivia had the additional community connection to engineering. They felt that being from the Huntsville/Madison area was central to why they were engineers, and it provided them opportunities to be a part of engineering academies at their schools and it provided the narrative that "everyone is an engineer." The familial and community connections helped the participants to see engineering as a viable career for them and gave them the opportunity to have a better understanding of what engineers did. The Huntsville/Madison area is also unique in its connection to engineering and the opportunities it provides. Therefore the participants had access to information and opportunities that most people do not, and this placed them in a privileged position. Unlike most individuals, opportunities for them to build a connection with engineering were readily available through family members, their schooling, and surrounding community. Although women are underrepresented in engineering, these women had access to social capital, alongside their whiteness, that helped them be successful and build an identity with the field. In this way, I studied up and further research should examine the experiences of women students who do not come from privileged backgrounds.

Social Engineers

The participants also constructed themselves as social engineers. They situated this narrative in direct opposition to the stereotypical representation of engineers as nerdy people who struggled to communicate. They felt that the social attributes of themselves were some of the most salient aspects to their identity and within the engineering classroom. Accordingly, the participants placed social characteristics in their overall and classroom identity models. These included traits such as outgoing, funny, personable, charismatic, and friendly. They also included

traits associated with working with others such as leader and mentor, because overall they expressed that working with and being around others was very central to who they were.

They believed these attributes set them apart from their peers and ultimately made them better engineers, because collaboration and group work were essential in the engineering classroom and workforce. They discussed how their social skills were integral for group work and overall collaboration. They saw their role as helping those who did not have these social skills succeed in the group project settings. The social engineer was an engineer who had the technical abilities, but was also able to communicate and help the group work together. This narrative not only positions them against the stereotype, it also suggests that those individuals who fit the stereotype are at a potential disadvantage and need them to be successful. They talked through the stereotype of the anti-social engineer showing it is still the most prevalent narrative, but importantly situated it as a misconception and a disadvantage in practice. It sets them up to frame their identity on their own terms and in a positive way against the stereotype.

The participants presented a more modern view of engineering that valued the social side of engineering practice. They saw engineering as more than just content knowledge and applying math and science. They viewed engineering as creative problem solving, grounded in collaboration, and that benefits society. This perspective is inline with Villanueva and Nadelson (2016) 21st century definition of engineering. They found that the more modern view was that engineers were 21st century interdisciplinary problem solvers with a social impact. This view also emphasized the use of teamwork to solve complex problems. Villanueva and Nadelson (2016) argued that this view of engineering was the most representative for the current engineering field and the actual work of engineers.

Engineers do not solely exist in the technical realm; engineering work is embedded deeply in the social world (Huff, 2014). Although technical skills are important, social interactions are how technical work expertise is distributed (Trevelyan, 2007) and social skills are needed for project coordination and management (Brunhaver et al., 2018). In practice, engineering is sociotechnical problem solving (Huff, 2014). This also works to suggest how engineering stereotypes and representations of STEM as individualized, competitive, and deeply technical is a misrepresentation for the practice of engineering, as well as the goals of the field.

This change to value social skills is also seen in the ABET Criteria for Accrediting Engineering Programs. ABET Criteria 3 lists student outcomes and communication skills have been a part of those criteria since 2000 (Estes, Brady, & Laursen, 2018). Criteria 3 was recently revised and the student outcomes for 2018-2019 continue to reflect the emphasis on communication skills and the social and cultural influence engineering can have (ABET, 2017). For example, four of the seven criteria relate these concepts. These criteria are:

> 2. An ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors
>
> 3. An ability to communicate effectively with a range of audiences
>
> 4. An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts
>
> 5. An ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives

Criteria 2 and 5 represent the field's current focus on ensuring students have the communication skills and ability to work on collaborative teams. The participants emphasized this view of engineering in their framing of themselves as social engineers and stressing the importance of being able to work with others. Whereas criteria 3 and 4 emphasize the more recent efforts to show how engineering can have a social and cultural influence. For example, there has been a movement to rebrand engineering as collaborative problem solving working for the good of humanity with such projects as the "Grand Challenges" and "Messaging for Engineering" (National Academy of Engineering, 2008; 2013; 2015). These campaigns led by the National Academy of Engineering are working to try and change the stereotypical representations of engineering and show that engineering is also collaborative problem solving that can impact society (NAE, 2008; 2013; 2015). These criteria coupled with the current initiatives to rebrand engineering, illustrate that social skills and a potential social impact are valued in engineering.

Therefore, the participants' view of engineering is representative of the necessary skills for engineering practice as well as the current goals of the field. They align themselves with Villanueva and Nadelson (2016) 21st century definition of engineering and with the current standards of the field. Therefore, they may have a better understanding of the sociotechnical realities of engineering practice. They saw the value and importance of the social aspects in engineering, whereas some research has suggested that engineers devalue these attributes (Cech, 2015; Faulkner, 2006, 2007). The participants saw the opposite. In their view it was not enough to just have the engineering technical skills, an essential component was having the communication and social skills to express your knowledge and work with others. They presented themselves as being better suited to be successful in the engineering workforce.

Question 2

What role do gendered narratives play in the construction of their engineering identities?

The participants mainly used gendered narratives to articulate how they were the social engineers against the stereotype of engineer. As mentioned previously, this stereotype suggests that engineers are nerdy people who cannot communicate with others. Previous work has shown that traditionally the social side of engineering has been labeled as "feminine" and not "real" engineering since the technical and masculine side is the most valued (Cech, 2015, Faulkner, 2007). However, the participants saw their identity as social engineers as beneficial, something that made them better engineers. The stereotype also comes with the assumption that engineers are men. In the participants' narratives, they oftentimes alluded to men classmates as the engineers who fit this stereotype. In this way, the stereotype of engineer is also a distortion of the masculine ideals of STEM. STEM culture is competitive, individualistic, and in engineering values the technical. This can be seen as those classmates who are incredibly smart, but cannot communicate with others, or as some of the participants described, students who did not want to work with others. They potentially represent the stereotypes played out, showing the limits of these expectations.

This switches the narrative and places those who fit the stereotype, which are most likely men, as lacking in important skills that are needed to be an engineer. The participants are positioning their narrative against the idea that the social side of engineering is less valued or is not "real" engineering. They narrate that these characteristics that have been labeled "feminine" make them better engineers and set them apart from their peers. They position the social side of engineering as an essential component of engineering work. The participants' perspective contradicts past research that showed that the social, feminized roles in engineering were

devalued (Cech, 2015, Faulkner, 2007). Here the participants value and embraced the social side of engineering and saw it as a necessary component alongside the technical aspects of engineering. They also did not see an identity as a social engineer a disconnected from a "real" engineering identity. Past researchers have suggested that women oftentimes have to negotiate their identity with engineering because the technical side of engineering is the most valued, and most associated with masculine roles. This can produce a potential mismatch with what is valued in engineering and the roles most associated with women. Because of this, engineering majors can seem gender inauthentic for women (Faulkner, 2006; 2007), and they must negotiate their gender identity with their possible engineering identities (Goldman, 2012).

However, the participants did not see a mismatch with being a woman and being an engineer because they constructed their identity and fit with engineering based on knowledge and skills. Further they highlighted the importance of social roles and did not view them as disconnected from a "real" engineering identity. They reinforced that an engineering identity was based on skills and what engineers did, not stereotypical expectations of who an engineer was. In contrast the participants felt the social side of their identities made them more authentic engineers and subsequently integrated it as one of the most important parts of their identity. This is similar to the identity negotiation strategy Hatmaker (2013) referred to as gender ownership. Gender ownership is the identity negotiation tactic where women "emphasize and capitalize on the strengths that women bring to the engineering role"(Hatmaker, 2013, p. 394). Therefore, in their identity as social engineers they are highlighting how their social attributes that are usually deemed feminine and devalued were essential to being a successful engineer. Importantly, gender ownership can cause a disruption in the masculine ideals of the field. As Hatmaker (2013) explains, "this approach may serve to alter the dominant view of difference so that rather than

the view that being a woman is not detrimental to being a competent engineer; being a woman is instead considered a positive opportunity" (p. 394). Therefore, from this perspective the participants are taking the first step in this disruption by framing themselves as social engineers. However, the ideals of the field should be disrupted further to move away from reinforcing the gendered binaries of the technical and social.

Traditionally the culture of STEM has privileged characteristics that can be considered masculine, but this perspective is not representative of the work of engineering and the skills needed to be successful. Researchers have shown that engineering is not just technical, social skills are incredibly important in the engineering curriculum and the workforce (Brunhaver et al., 2018). In particular, social skills have been integrated into the ABET standards for student outcomes (Estes, Brady, & Laursen, 2018), and there are current efforts to rebrand engineering as collaborative problem solving for the good of humanity (National Academy of Engineering, 2008; 2013; 2015). In this way, engineering is a sociotechnical practice (Huff, 2014). Although the participants may not have recognized the gendered dynamics, the participants described engineering work in this way. They saw the limits of this presentation of engineering as being purely technical. It seems that engineering field is shifting in that the stereotype of "engineer" does not match what is needed to be successful. Those characteristics that have previously been seen as feminine and negative are precisely those characteristics that are needed in the modern definition and current goals of the field. This suggests that representing the stereotype is potentially a disadvantage. Those students who fit the expectation of the masculine stereotype of STEM may find easier fit initially based on their identity, but not in skills needed to be successful. There is oftentimes a disconnect in how engineers view their identity with the field

and the actual practice of engineering (Huff, 2014), disregarding the social aspects inline with the cultural expectations.

Although there has been a change to value the social in engineering, we must be cautious in positioning the social aspects as feminine and as the new most valued characteristics. Engineering is a sociotechnical practice (Huff, 2014) where the skills are intertwined and not dualistic in practice. By referring to engineering as masculine, and deeply technical served to reinforce and naturalize gendered assumptions of the field. This also served as a rationale to exclude women. Therefore, the solution is not to exchange the masculine ideals for feminine ideals. It is tempting to present the narrative that women are now better equipped to be engineers in the modern times because of their social characteristics, but this would be counterproductive and further serve to reinforce binaries and ideas of essentialized characteristics. The goal should be to reclaim "scientific inquiry as a non-hegemonic endeavor experienced by a spectrum of identities" (Heybach & Pickup, 2017, p. 624), not to tie science with expectations of being a woman or man. Therefore these sociotechnical characteristics should not be gendered. This would naturalize gender differences and creates a binary that does not represent engineering practice. To work towards greater equity and more accurate representations of the field, we need to view these traits as part of engineering practice and not tied to a specific gender.

Even though the participants narrated a promising identity and view of engineering away from the masculine ideals, they still used essentialized ideas of gender to discuss what roles women and men had in engineering. This was most evident when they discussed what roles men and women would take in group projects. They referenced essentialized ideas of women as being more emotional and better at organizing, while men were better at the more physical and hands on aspects of engineering. The participants however emphasized that women and men were

equal in their ability to be engineers and to understand the content of engineering, but still articulated a gendered division of labor for group projects. This focus on separate roles is in line with gender complementarian viewpoint where women and men have distinct roles, a "created order" (Colaner & Giles, 2008; Bryant, 2009). This gender complementarian perspective is seen as truth, and views essential gender differences as an ideal and divinely created. (Bryant, 2009; Colaner & Giles, 2008). It is not surprising that the participants used these discourses to explain their experiences because four of the five participants placed faith or Christianity close to their core.

Holding gender complementarian beliefs encourages women to interpret and reconcile their roles in distinctive ways, and oftentimes leads them to shape their behavior to those standards (Bryant, 2009). Therefore, they did not problematize this separation in roles even though they emphasized that men and women were equal in their abilities to be engineers. This created an interesting contradiction in their narratives. They expressed more egalitarian perspectives towards women being engineers and they did not believe that gender informed their identity. However, they still reinforced and used these gender complementarian narratives to explain and naturalize the different skills women and men brought to engineering and their expected roles. They understood their roles and experiences through this perspective so they did not see limitations of these gendered divisions and how it contradicted some of their beliefs that gender did not inform who they were as an engineer. By embracing the more traditional feminine roles they were reinforcing the gendered division of labor.

Olivia and Sara articulated the strongest connection to these essentialized ideas of gender. Olivia used these narratives describe the appropriate roles men and women would take in group projects and with what careers they were more likely to prefer. Her explanations fell along the

lines of the social and technical, where she felt women should take on the communication and more secretarial work in group projects where the men did more of the technical work. However, she contradicted these expectations when she described how she hoped to work with the military in ballistics or weaponry once she graduated. Sara narrated a disconnect and conflict between how she saw herself and the gender complementarianism expectations of woman and engineer. She felt that defying expectations of woman and engineer was central to who she was. She narrates herself as being unexpected and against the stereotypes, instead of seeing the limitations of those perspectives.

All of the participants saw the limits of the stereotypical representation of engineer, but accepted more essentialized ideas of women's roles. This was present in the participants' narratives when they discussed how women were naturally more organized and men were better suited for things requiring strength. This speaks to how socialized woman are to believe in and accept the gendered stereotypes as innate and natural. It is not surprising because essentialized ideas of gender are pervasive and highly socialized. Additionally, in the gender complementarian perspective, these differences are divinely created. Because the participants considered their faith as central to who they were it is likely that they had internalized these ideas of essential gender differences and used this perspective and associated discourses to understand their experiences. However, it is promising that the participants were able to recognize the limits of the dominant narrative of an engineer. From their experiences and their strong fit with the field, they were able to see the limits of this view of engineering and narrate a different identity. They did not feel they had to fit with the stereotype of the field. Even though they might not have been aware of it, many of their actions and identities with the field went against gendered expectations. It is still promising that they narrate against the stereotype of engineer and are potentially seeing a shift in

the field. It was most likely easier for them to understand and recognize the limits of "engineer" than it was for them to see the limits of "woman."

Question 3

How were their experiences influenced by the aspects of their identities that became salient in different contexts?

I had originally had two separate research questions to examine how their identities informed their experiences and changed in different contexts. I first asked:

How does the engineering identity they construct influence their experiences in their major?

Then my follow up question was:

How do these storied accounts of their identities change as different dimensions of their identity become more or less salient as they navigate the various contexts of their major? How does this influence their experiences?

However, I found throughout my interviews and analysis process that the better question was to combine the two questions and instead ask how their experiences were influenced based on what aspects of their identities became salient. I found that in different contexts aspects of themselves would become salient by their own doing or placed on them by others and this altered their experiences or how they viewed their identity. It was more of a joint, concurrent process. In their narratives what seemed salient for them was brought up by others or very situational. So I found the more interesting question was what identities became salient and how did this change how they felt about engineering and their experiences.

Co-Op

In both Anna and Lee's narratives of their identity with engineering their co-op experiences were extremely salient. It validated that they could be an engineer, made engineering

a more tangible career goal, and it showed them that through engineering they could do work that they valued. Co-op also became an identifying characteristic of who they were in the classroom. They were no longer just an engineering student; they became a co-op with "real" engineering experience and it changed how others viewed them. The emphasis of engineering as knowledge and skills led Anna and Lee's status as co-ops to be salient to their identity and experiences with engineering.

Their co-op experience gave them the opportunity to work in the field and gain hands on experience and knowledge. This caused their identities to shift. In the workforce they felt like real engineers because of the work they did, but felt like students in the classroom. However, some of their classmates considered them to be engineers because of their experiences and knowledge they gained from their co-op. So co-op became a salient environment for them to see themselves as engineers, and a salient identifier that signaled they had more engineering knowledge than their peers. Previous research has shown the importance of being recognized as a scientist in building an identity with the field (Carlone & Johnson, 2007) and here their classmates recognize them engineers because of their knowledge and experiences. Even though their classmates viewed them as engineers and "having made it" Lee and Anna still saw themselves as student engineers. This disconnect reinforces how an engineering identity is grounded in content knowledge and skills. Lee and Anna's co-op experiences showed them they had more to learn, but these experiences signaled to their classmates that they were closer to being "real" engineers.

Gendered Co-op Experiences. Anna and Lee felt they had more gendered experiences in their co-op compared to the classroom. Overall, being a woman became salient based on the work they were asked to do, the work they completed, and how others responded. In Anna's

experience, if she did unexpected work for a woman and an engineer, she felt it was more noticeable because she was a woman, and drew more attention to her. For Lee, she found that she was asked to do certain tasks that could have been classified as more expected for women. Even though Lee and Anna felt that their gender did not influence the work they did as engineers, it still impacted how others interpreted their work and what other tasks they were asked to do. Their gender became salient when their actions or tasks that needed to be done related to essentialized characteristics of gender.

These experiences are what Hatmaker (2013) referred to as marginalizing interactions. Marginalizing interactions are workplace interactions that validate women's gender identity and cause them to be seen as a woman first then an engineer. These interactions highlight and impose gendered expectations on women. Examples of these interactions are times when coworkers make requests based on gendered stereotypes or call attention to them being a woman by compartmentalizing them as mothers or wives (Hatmaker, 2013). These experiences can cause women to feel devalued and have less of sense of belonging to the profession. It can make their gender identity seem more salient than the engineering professional identity they hope to construct in the field. Male and colleagues (2018) expanded this framework to examine students' experiences in the engineering workforce. Similar to the findings from the current study, although workforce experiences were overall positive learning experiences for the students they faced the masculine culture of the field. Like Anna and Lee, Male and colleagues (2018) found that the women students experienced marginalizing interactions that drew attention to their gender such as imposed gendered expectations and requests based on their gendered. These interactions, similar to Anna and Lee's experiences in their co-ops serve to highlight that they are first women then engineers.

Gendered Classroom Experiences

The participants' gender became salient in the engineering classroom when others placed expectations on what work was appropriate for them based on their gender. Like Anna and Lee, May and Sara experienced marginalized interactions in the classroom that highlighted gendered expectations (Hatmaker, 2013). In accordance with past research (Carlone & Johnson, 2007; Madsen, Holmegaard, & Ulriksen, 2015) Mary and Sara felt that they had to prove that they were smart enough to be in the engineering classroom, and that all of their actions were on display because they were women. They felt it was harder to blend in and just be a student. These findings support the work of other researchers who found that students' gender became salient, making their physical presence in the engineering classroom seem illegitimate (Carlone &Johnson, 2007, Faulkner 2006; 2007, Gayles & Ampaw, 2016; Malone & Barabino, 2009). Additionally, inline with Hirshfield's (2017) findings, they felt women had to be more hardworking to be recognized as a valuable contributor through their work. Sara also explained how she felt women had to work harder to maintain their status as being able "to compete" in engineering, where men classmates had room to make mistakes. Their experiences support the findings of Carlone and Johnson (2007) that women students oftentimes have a harder time being seen as scientists by their classmates due to the cultural representation that STEM is for white men.

Even though they felt these experiences decreased once they progressed through the major and got to know more of their classmates, it still shows that women in engineering have to work harder in their early engineering experiences. They can gain acceptance and ultimately have positive experiences later on, but initially they still have to prove they belong and work against those initial misconceptions and stereotypes. Mary and Sara's stories show that there was

a transition of sorts where they had to prove that they could compete and were smart enough to be in engineering. From their experiences you can see how the masculine expectation of who should be in the engineering classroom comes through, especially in those early courses where students may be relying more heavily on stereotypes to categorize their classmates. It is positive that Mary and Sara expressed that not all of their classmates made them feel this way and these experiences decreased, but it shows that they still faced to some degree the chilly climate of engineering.

In contrast, Anna, Lee, and Olivia did not feel this same pressure in the classroom as Mary and Sara. They discussed how they were part of the engineering community and that their gender did not influence their classroom experiences. Lee and Olivia emphasized how they never felt out of place or that their peers discriminated against them. They both discussed how when you are in engineering it did not feel like you were treated differently because you were a woman. They framed it more as a misconception, or disconnect based on what people customarily think about being a woman in engineering and their personal experiences. They emphasized that being a woman engineer was not what people expected, that just because they were underrepresented did not mean that they were treated differently in their experiences. Anna, Lee, and Olivia also presented their engineering experience as a more of a collective. They saw that they were part of a group struggling together to work through the coursework towards a common goal.

Disconnect in Gendered Classroom Experiences. It is interesting that Anna, Lee, and Olivia did not feel the same gendered pressure that Mary and Sara did. I believe there are a few possible reasons for this. First, the participants used gender complementarian discourses to discuss the skills women and men brought to engineering. They understood the gender

differences in roles through this perspective, so it likely that they also interpreted their other classroom experiences through this lens. They may have had experiences that they did not identify as being gendered or discriminatory, because of their gender complementarian perspective. Certain comments or behaviors might not have met their threshold for what counted as discriminatory, or went against what they believed was to be expected or natural. Women after all are socialized to accept gendered experiences and it is normalized. They may have internalized these beliefs and may not have recognized the gendered aspects of their experiences because they framed their understanding of gender through this perspective**.**

Anna, Lee, and Olivia also may have had a more positive experience because the sense of community they felt with engineering and their friends in the major. Recent research has shown that peer relations help persistence in engineering (Pierrakos et al., 2009; Robnett & Thomas, 2017) and can help foster a sense of community that creates a greater sense of belonging to engineering for underrepresented students (Davis, Cheon, Moise, & Nolen, 2018). Importantly, these peer relations and sense of community can serve as a buffer to negative interpersonal experiences for underrepresented students (Davis, Cheon, Moise, & Nolen, 2018). Since Anna, Lee, and Olivia emphasized the engineering community, their sense of belonging likely served as a buffer to these negative experiences. Similarly, Mary and Sara discussed how they had less gendered experiences once they got to know their peers and found their friend group. So it may be that Anna, Lee, and Olivia felt that sense of community and belonging earlier in their engineering experiences and it buffered those gendered experiences.

I also believe that Anna and Lee's status as co-op served as a buffer. Anna and Lee's peers saw them as engineers because their co-op experiences gave them more "real" engineering knowledge and experience. They had experience and knowledge that set them apart from their

peers, and put them in a position of knowing more. The findings suggest that students tie an engineering identity to knowledge, so this puts them in a position to be considered engineers above their peers. Because of this, there was probably less questioning of their knowledge and skills because they had done "real" engineering work when some of their classmates had not. Importantly, because of their experiences and knowledge their peers recognized them as engineers. Research has shown that recognition from others is important for building an identity with the field and sense of belonging (Carlone & Johnson, 2007; Godwin et al., 2016; Patrick et al., 2018). So even though Anna and Lee did not identify as engineers, their peers recognized them as such, which likely helped them to develop a greater sense of belonging with the field. Therefore, Anna and Lee potentially had more positive classroom experiences because of their greater sense of belonging with the field and their status as "real" engineers due to their co-op experiences.

Social Settings: Saliency of Engineer

When I asked participants where they felt their identity shifted one of the first places they mentioned were social settings. They felt that people outside of engineering defined them by engineering and largely associated them with misconceptions about what it means to be an engineer. It created the largest disconnect with how they saw themselves and how others viewed their identity. In social settings they found themselves having to push back against those expectations and define who they were, that they were more than an engineer. It is interesting to present these stories because the literature has mainly focused on their experiences as students within engineering and not how it influences their social experiences. Here we see how narratives and misconceptions of "engineer" follow them outside of the classroom showing what it means to be a woman engineer socially.

Their overarching identity as an engineering major become salient in the social situations because people tried to identify them solely on the narrative of engineer, the nerdy shy individual who just studied. The participants felt this happened because people outside of engineering did not understand what engineers actually did, and that oftentimes they were the only one of their friends who was an engineer. They would be labeled as the "engineer friend," and it became the most salient part of who they were instead of their other characteristics. Further, by being the only one, they could be an anomaly to the stereotype instead of showing their peers that the stereotype is a misrepresentation. As the participants explained, this placed characteristics on them, such as nerdy and shy, that did not match with how they saw themselves. They felt people pinned them as engineers and the misconceptions stuck to them. They also described how they felt the label of "engineer", stopped conversations. People were no longer interested in talking with them or jumped to conclusion about whom they were. The label of engineer constrained them in social settings.

This created a disconnect between who they felt they were and how others saw them in social settings. It made engineering define them, and caused the participants to push back against this. They stressed how engineering did not define them, that it was not the most important part of their identity. It could describe them, because many aspects of themselves made them an engineer but it did not define them. They wanted to be defined by what they valued, such as their family and faith. They wanted to be more than an engineer. Interestingly, the participants found that they could be more than an engineer in their engineering spaces and this led them to find better fit with engineering.

The participants' identities were constrained socially, but opened up in the engineering setting. They could be more than engineers. They described that engineers in general were not

what people expected. They had friends who like them, were outgoing, friendly engineers. Many of the participants discussed how their favorite part of engineering was the community and friends they made. It was people like them who shared similar interests, sense of humor, and personalities. Within engineering, what they were interested in was "cool and normal." But importantly, they could be more than the just the engineer friend. Despite some experiences of chilly climate, Sara and Mary still spoke highly of their engineering community and friends. Sara went as far as to explain how she preferred how her friends in engineering saw her. This is inline with recent research that shows that peer relations and a sense of community creates a greater sense of belonging to engineering for underrepresented students and contributes to their persistence and identification with the field (Davis, Cheon, Moise, & Nolen, 2018). In this way, positive peer relations and community building can serve as a buffer, or "disrupt existing power relations and negative interpersonal experiences of underrepresented students" (Davis, Cheon, Moise, & Nolen, 2018, p. 10). For the participants their positive peer relations in engineering served as a buffer to negative interpersonal experiences in engineering and outside of engineering. An important part of their sense of belonging was how in engineering spaces the aspects of themselves that they placed more central to their core, came through. Within engineering their identities were more representative of how they saw themselves and how they drew their models.

Conclusions

The findings from this study present a complex narrative of women's experiences in engineering and show a potential shift in the field (or an overlooked paradox). Although the participants did endorse and identify with some gender essentialized ideas, the participants did not see a mismatch with being a woman and being an engineer. Instead they narrated themselves

against the stereotypical representations of the field, and felt that their social characteristics made them better engineers. Their social skills situated them with the more modern view of engineering and primed them for leadership in the engineering field.

The participants narrated themselves with the modern definition of engineering, that engineers were 21st century interdisciplinary problem solvers with a social impact (Villanueva & Nadeslon, 2016). This view also emphasized the use of teamwork to solve complex problems. So the participants are presenting themselves with the most accurate representation of engineering while still recognizing that many others hold inaccurate stereotypical ideas about the field. In their perspective, engineering is a technical and social endeavor and the technical side is not the only one valued. This view of engineering as both technical and social is consistent with actual engineering practice (Huff, 2014). Potentially the participants have a better understanding of the sociotechnical realities of engineering practice and are more prepared to enter the workforce because they see past the limits of the stereotypical representation of the field as purely technically. It is important that they saw the value and importance of the social aspects in engineering, whereas some research has suggested that engineers devalue these attributes (Cech, 2015; Faulkner, 2006, 2007). But this perspective is not representative of the work of the engineering and the skills needed. This shows an important shift in the field and how some individuals view it.

It seems that engineering field is shifting in that the stereotype of "engineer" as lacking social skills does not match what is needed to be successful. Those characteristics that have previously been seen as feminine and detrimental are precisely those characteristics that are needed in the modern definition and current goals of the field. This suggests that representing the stereotype is potentially a disadvantage. Those students who fit the expectation of the masculine

side of STEM may find easier fit initially based on their identity, but not in skills needed. This is an important shift to available narratives of what it means to be an engineer and what skills are needed to be successful. It potentially creates more narratives where those individuals who traditionally found it harder to find fit can find their place.

This view of engineering shows the importance of both technical and social skills; therefore it is incredibly important that we do not continue to gender the technical and social. At its foundation engineering is both technical and social. To work towards greater equity and more accurate representations of the field we need to view these traits as part of engineering practice, and not tied to a specific gender. Although it is tempting to use the findings to support the idea that women are better equipped for the modern view of the field because of their social skills, this reinforces and reproduces essentialized binaries of man and woman. This is counterproductive to working towards equitable science. The goal should be a genderless science, and not to tie science with expectations of being a woman or man.

It is also an important and potentially a new finding that the participants found a better fit with engineering. They felt that there were constrained socially by the stereotypes of "engineer." However, their identities opened up in engineering for exactly their non-stereotypical social skills. Despite some experiences of chilly climate, the participants spoke highly of their engineering community and friends. In engineering, the aspects of themselves that they placed more central to their core came through and spaces with mostly engineers allowed them to feel more authentic than spaces where they were "the engineering person". Within engineering, their identities were more representative of how they saw themselves and wanted to be seen by others.

Implications

These findings illustrate how women in engineering do not always struggle to identify

with the field. The participants' narratives show how women in engineering can construct their identities with the field against the stereotype, but consistent with actual engineering practice. They showed how they belonged in engineering and could even be more successful than those who fit the stereotype. They actively positioned themselves against those stereotypes and called them misconceptions. Most importantly, the participants narrated how they were capable of being engineers, felt they belonged, and articulated how the social aspects of themselves made them better engineers. The participants did see a disconnect between the stereotype of engineer and how they saw themselves, but instead of interpreting that as a deficit, they saw the limits of the stereotype. They found a fit with engineering based on how they saw themselves, what they valued, and their personal perception of the field. Importantly, their perception of engineering aligned with the more modern definition and current goals of the field. Therefore it is important to highlight these narratives and continue efforts to rebrand engineering as collaborative problem solving working for the good of humanity (National Academy of Engineering, 2008; 2013; 2015).

This study is also unique in that I "studied up" by examining how women from privileged positions in engineering constructed their identities with the field. Although they persisted and did not struggle to see fit with the field, they also came from a more privileged position that helped them be successful. These findings still illustrate that students' knowledge of engineering, exposure to engineering, and contact with actual engineers is important to building an identity and persisting in the field (Pierrakos et al., 2008), but it is important to frame these findings through privilege. For these participants, those opportunities were readily available through family members, their schooling, and surrounding community. Although, women are underrepresented in engineering and STEM fields overall, these women had access to social

capital, alongside their whiteness, that helped them be successful in the field. This is not to discredit their experiences or identity with engineering, it is just important to highlight that they had access to opportunities that most individuals would not have. This is a potential limitation of the study and reinforces why it is important for future research to study women engineering students from less privileged backgrounds to provide a larger spectrum of women's experiences in engineering.

Even though this sample is from a more privileged population, there are still implications for the literature on women in engineering and engineering education. In particular, these findings highlight the importance of structured industry experiences for students' identity with engineering. In Lee and Anna's narratives their co-op experiences were important in solidifying their commitment with engineering as a future career. Their co-op experience increased their competency and performance beliefs and helped them see a value alignment with engineering. They were able to see firsthand that they were capable of doing engineering work and how engineering matched with their goals and values for a future career. Research has shown that it is important for students to have competency and performance beliefs (Godwin et a., 2016; Patrick et al., 2018) as well as value alignment (Diekman, et al., 2010; Diekman et al., 2017) to build an identity and persist with engineering. Therefore, co-op and other industry experiences are potentially important opportunities to help students build a stronger identity and connection with engineering.

These findings also highlight how women are resistant to talk about gender in engineering and how they do not always recognize the gendered aspects of their experiences. The participants held egalitarian beliefs about women's ability to be engineers, but reinforced gendered ideals in their narratives. They largely used gender complementarian discourses to

explain and interpret their experiences. This was most prevalent when they naturalized gender differences in group project roles. They explained that gender did not inform their identity with engineering, but they reinforced binary thinking when they explained that women and men were naturally different in the skills they brought to engineering. The findings illustrate how some women who express a strong fit with engineering still view their experiences through a gendered lens. This also likely influenced their discussion of discriminatory experiences. Because they understood their experiences through the gender complementarian lens, it is likely that those participants who did not report gendered experiences did not recognize them. Certain comments or behaviors might not have met their threshold for what counted as discriminatory, or went against what they believed was to be expected or natural.

This also related to methodological challenges. The women did not place gender on their identity models until I prompted them to do so. They also stressed that gender did not inform their identity or many of their experiences in engineering. However, when I asked them to explain a time when they felt like a woman engineer and not just an engineer they were able to provide examples. This highlights the importance of how researchers frame their questions about gender. The participants wanted to be seen as an engineer or a student like their man classmates. So it was likely easier for them to talk about gendered moments in this way and recognize those experiences. Moving forward, researchers need to be aware of the language they use in asking questions about gender to try and facilitate these discussions that might be tough or hard for participants to recognize.

Finally, the findings illustrate the importance of outside engineering experiences on students' identity and perceptions of the field. The majority of research on women in engineering has focused on their classroom experiences, but these findings suggest that what happens outside

of the classroom is also important. The participants discussed how they found better fit in engineering because they felt constrained by the stereotype of engineer in social settings. This suggests that women in engineering are potentially constrained by engineering stereotypes in the classroom and socially that put expectations on who they should be. However, they felt their identities opened up in engineering because they could be more than the engineering friend. These findings suggest that it is important to look at individuals' total schooling experiences and how they can influence their identity and perception of the field.

Suggestions for Future Research

First, future researchers need to examine the experiences of women from less privileged backgrounds to provide a larger spectrum of women's experiences in engineering. Future researchers also need to continue to examine this potential shift, or overlooked paradox in how students view the engineering field and the value of social skills. In particular, future research should include both women and men students to see if there are any differences in how they see the more modern definition of engineering and what is required to be successful and fit in with the field. It would be interesting to see if women students are more likely to identify with the modern definitions of engineering and emphasize the need for social skills in engineering practice. Similarly, future researchers should examine the experiences of women outside of the engineering classroom and how these non-engineering spaces influence their identity and sense of fit with engineering. It would be interesting and important to the field to see if this was something unique to these women, or if women engineers consistently feel that "engineer" carries expectations that make them feel more out of place or constrained in social settings. This would present a different narrative of how women see themselves with the field, increase the

importance of climate in general social settings, and highlight that engineering can be a place where they can be most like themselves.

Most importantly, researchers need to resist gendering the social and technical aspects of engineering practice from a dichotomous view that feminine traits are uniformly less valued. This abstract does not represent the realities of the engineering workforce and serves to reinforce gender binaries and the marginalization of women. To truly advocate for an equitable science, the terminology we use in research and the norms of the field should not serve to reinforce these gendered ideals.

Reflections on my Personal Transformation

Reflecting back on my dissertation process I can see how I have grown as a researcher and an individual. One of the lessons I learned was the importance of being open-minded and flexible. Things do not always go as planned during the research process, and as a researcher it is important that we are able to adjust and persevere through these moments. I found that the times when my conversations with participants went in unexpected directions or away from my original plan, they ended up leading to some of my more fascinating findings. This reinforced for me the importance of truly following participants' trails (Riessman, 2008) and not constraining the co-construction of an interview to my precise interview script.

The influence of my hometown was also unexpected. This reinforced that as a researcher I need to remain reflective and critical of things I have taken for granted in my personal life and how that can influence my research process. I knew Huntsville had a unique connection and position with engineering, but through this project I have come to see the privilege in that uniqueness and how it can create a different narrative about women in engineering. Moving

forward, I will remain reflective on how my upbringing in an engineering town influences how I position myself and interpret research on women in engineering.

Conclusion

These findings present an important and different narrative about women's experiences in engineering. Their stories show how women can find a positive community in engineering, and have a place where they can feel the most like themselves. Although they still had to face some gendered experiences, engineering was still the place where they could find friends with shared interests and personalities. It is important to include these stories and present a more positive narrative of women's experience. When looking over the current literature, it can be easy to think that women always face a chilly climate and struggle to belong. These experiences do happen, but it is also important to break up these narratives with narratives of fit and successful women in engineering. The participants were successful and built their identity with engineering against the prevalent stereotypes of who and what an engineer was. They created their own narratives that represent the more modern conceptualizations of the field. If we continue to only tell the negative stories it reinforces the idea that women do not belong, instead of showing the changes that are happening in the field. The intent is not to silence the other narratives, but to open up the discourse and include other stories. Stories can accomplish change, making us look at things differently (Riessman, 2008), and show us the previously silenced or taken-for-grantedness of women's lives (Woodiwiss, Smith, & Lockwood, 2017). These new stories are what the field needs to present a fuller narrative of women's experiences and identity with engineering.

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Appendix A

Interview Script

Interview 1:
What's your engineering major?

Can you tell me a little bit about how you came to major in engineering?

How do you define engineering?

Where do you see mechanical fits with that?

Do you consider yourself to be an engineer? Can you tell me a little about that?

When do you think you will consider yourself an engineer?

Start MMDI Script:
Here is an atom model of identity. The central part of this model is your core sense of self. The surrounding circles are other parts of your identity that make up who you are, and they become more (or less) salient, or important in different situations. Can you fill out this model with how you see yourself? Can you tell me a little about each identity you place on the surrounding circles?

Where does engineering fit?

Thinking of the core, in general how do you see your identity with engineering?

Do you feel there are any expectations on your identity as an engineer? If so, can you tell me about a time you felt this?

Do you feel there are different expectations with engineers and with non-engineers? If so, can you tell me about a time you felt this?

Do you feel your engineering identity is consistent across your experiences in the major? Can you tell me about a time you felt it changed?

Where does gender fit?

Can you tell me about a time you felt like a woman engineer and not just an engineer?

Can you tell me about a time gender mattered in engineering?

Second Interview:

Here is the identity model you made in our last meeting. Here is another blank copy of the worksheet. Can you fill it out showing how you see your identity in the classroom?
Can you tell me a little about each identity you place on the surrounding circles?

Thinking of the core, in general how do you see your identity in the engineering classroom?

Do you feel like there are specific expectations for you in the classroom? Can you tell me a little about them?

Can you tell me about a time you felt like a woman student and not just a student in the classroom?

Can you tell me about a time gender mattered?

Can you tell me about another place you feel your engineering identity shifts?

Final Interview:
Looking back through your identity worksheets, does one identity come across as being the most salient and influential for you?

How do you think your identity with engineering influences your experiences in the field?

Can you tell me about a time where it influenced how you acted in different situations?

Can you tell me about the climate of engineering?

What do you think is the cause of this?

Do you feel your engineering identity becomes salient at times outside of your major and related activities?

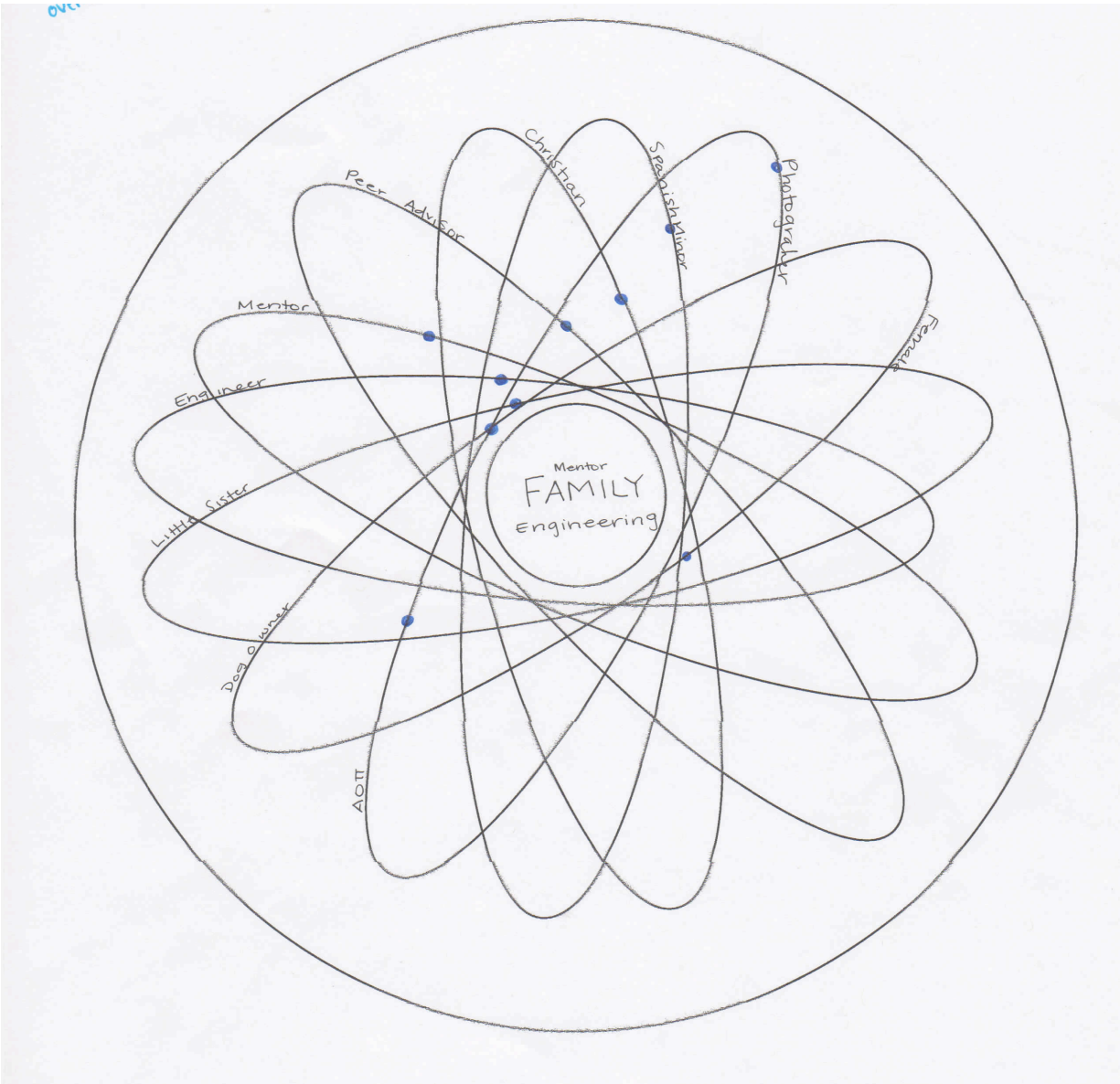
Can you tell me about a time this happened?

Can you tell me about where you see engineering in your overall identity?

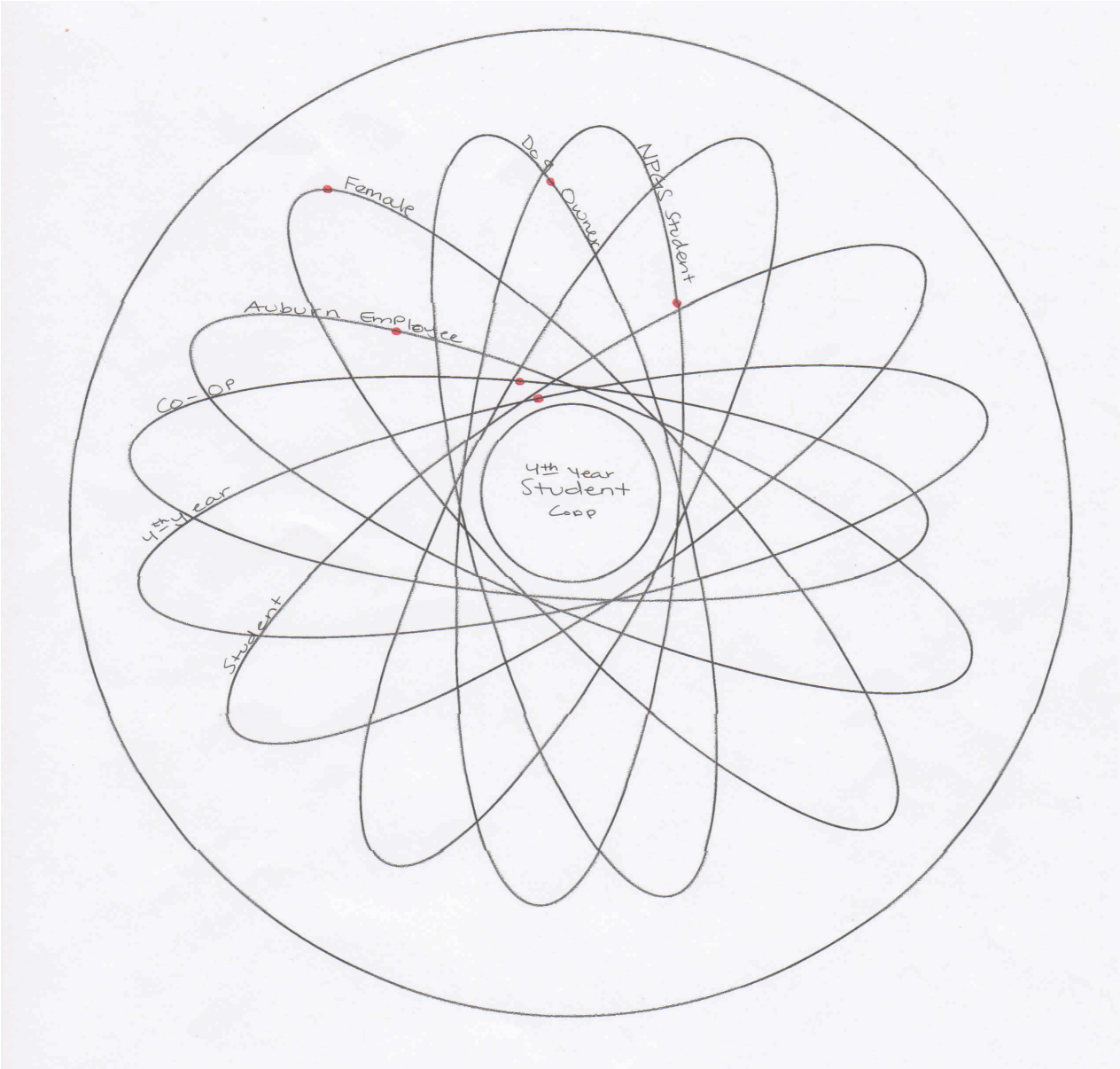
Is there an identity you feel is more salient for your overall identity?

Appendix B: Identity Models

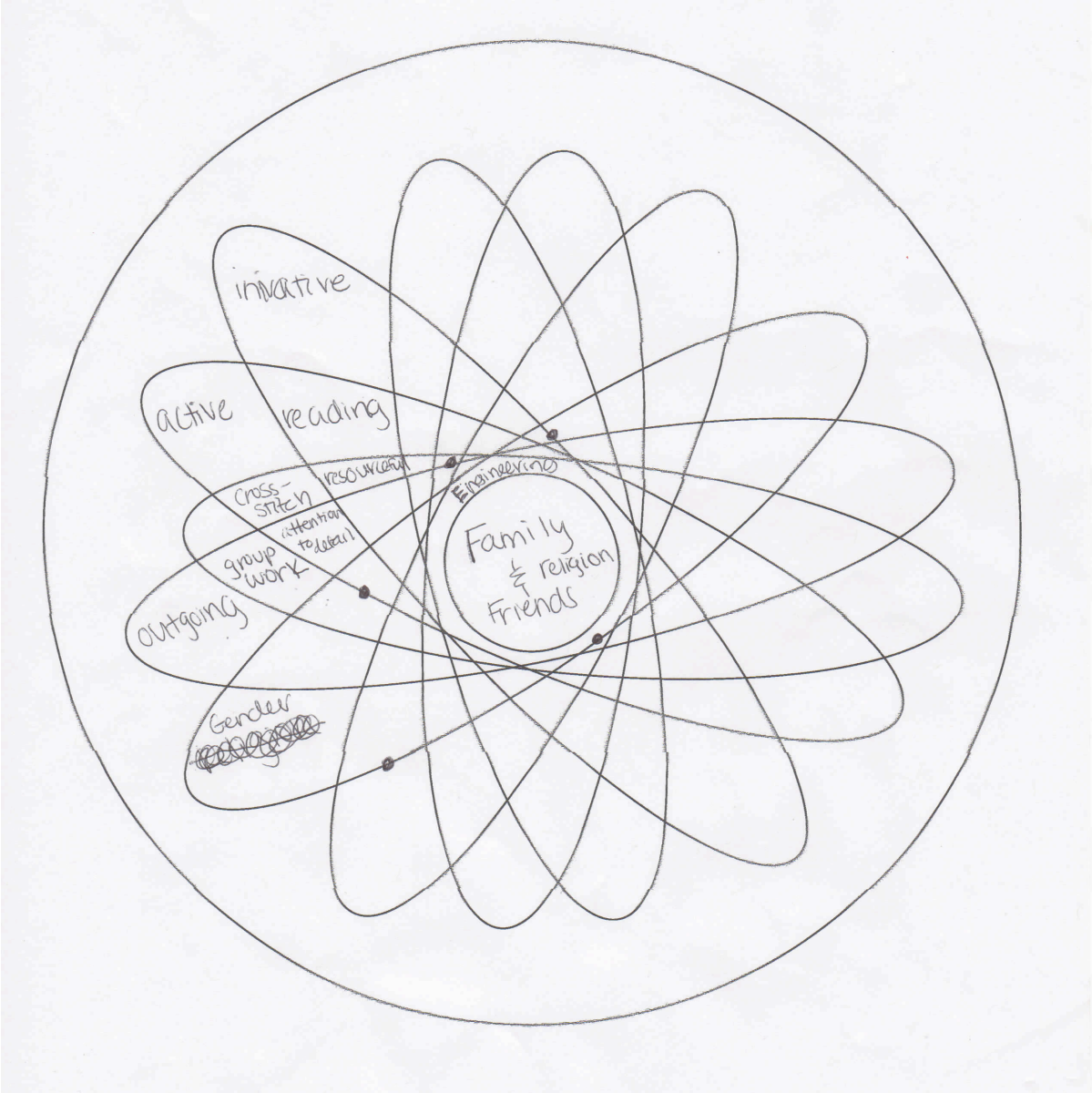
Anna
Overall Identity Model



Classroom Model



Lee
Overall Identity Model



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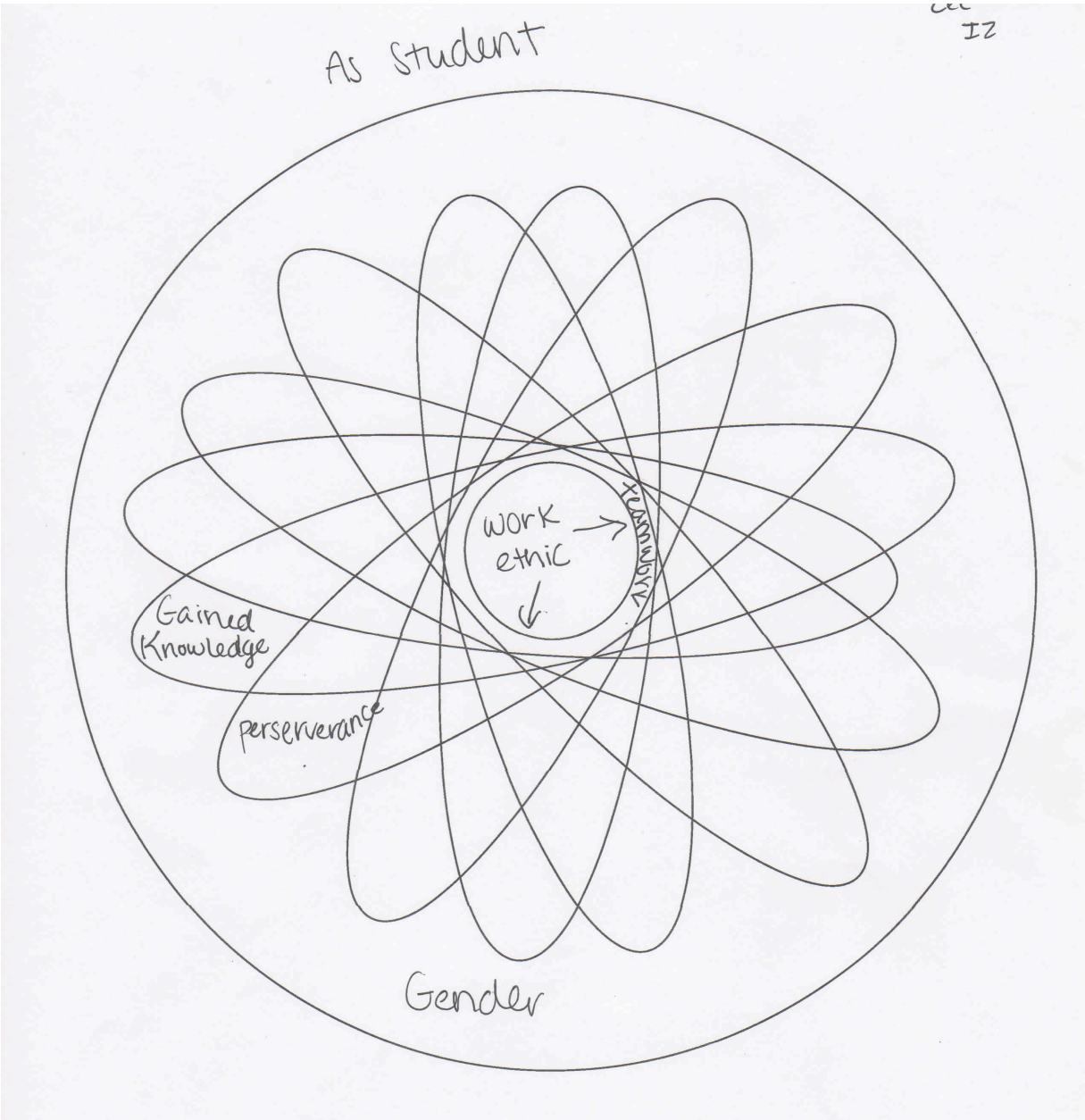
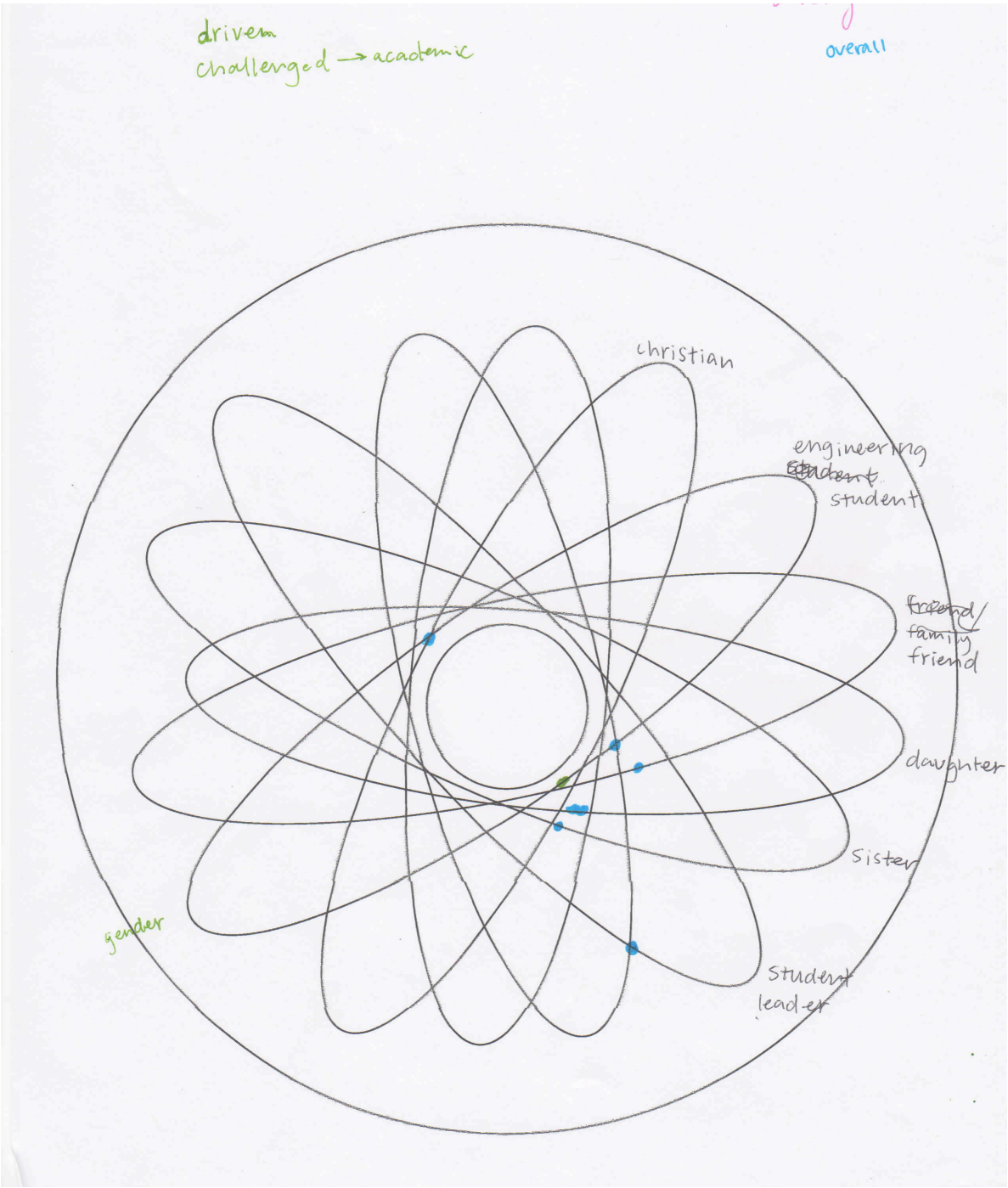


Mary
Overall Identity Model



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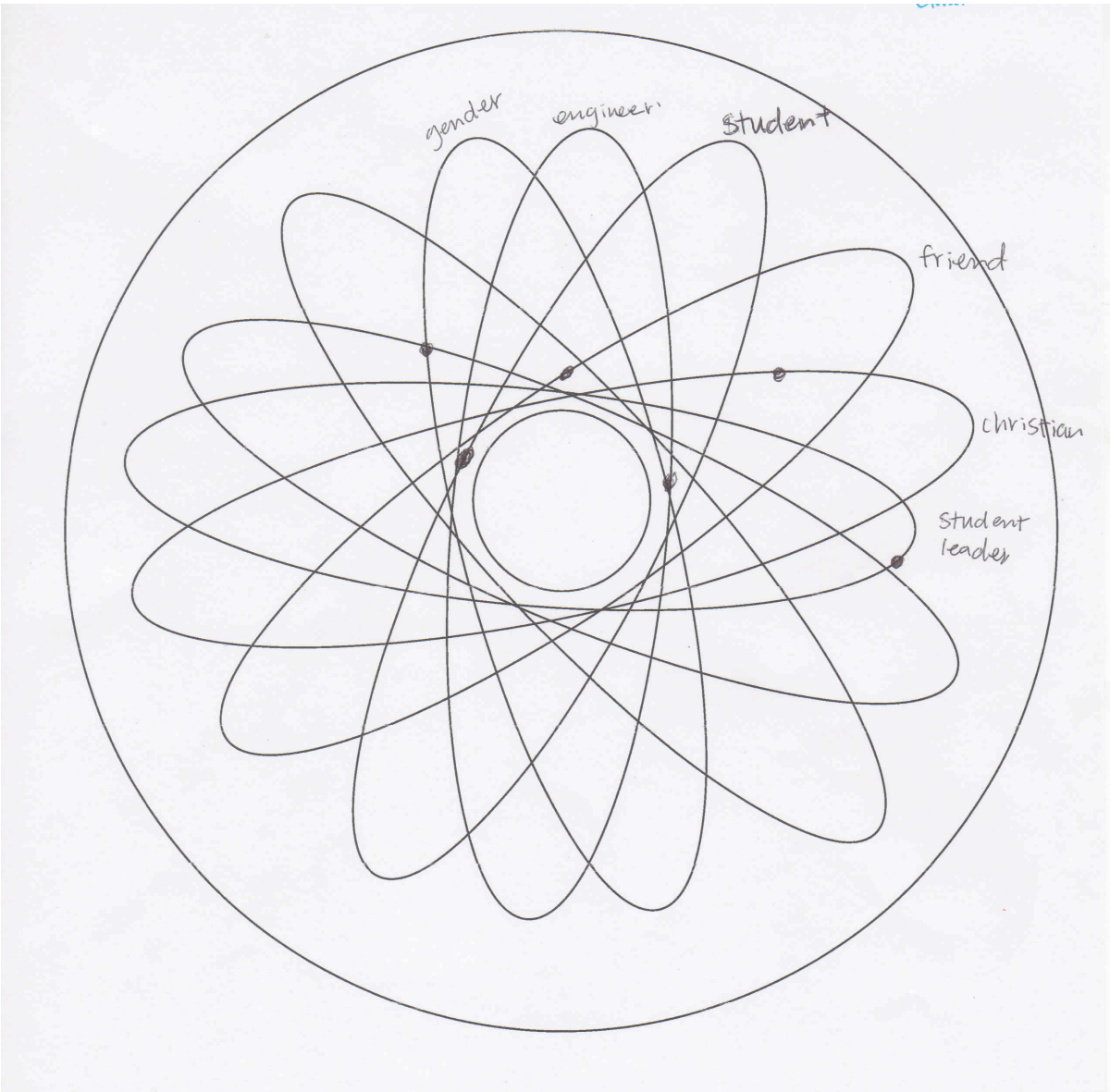
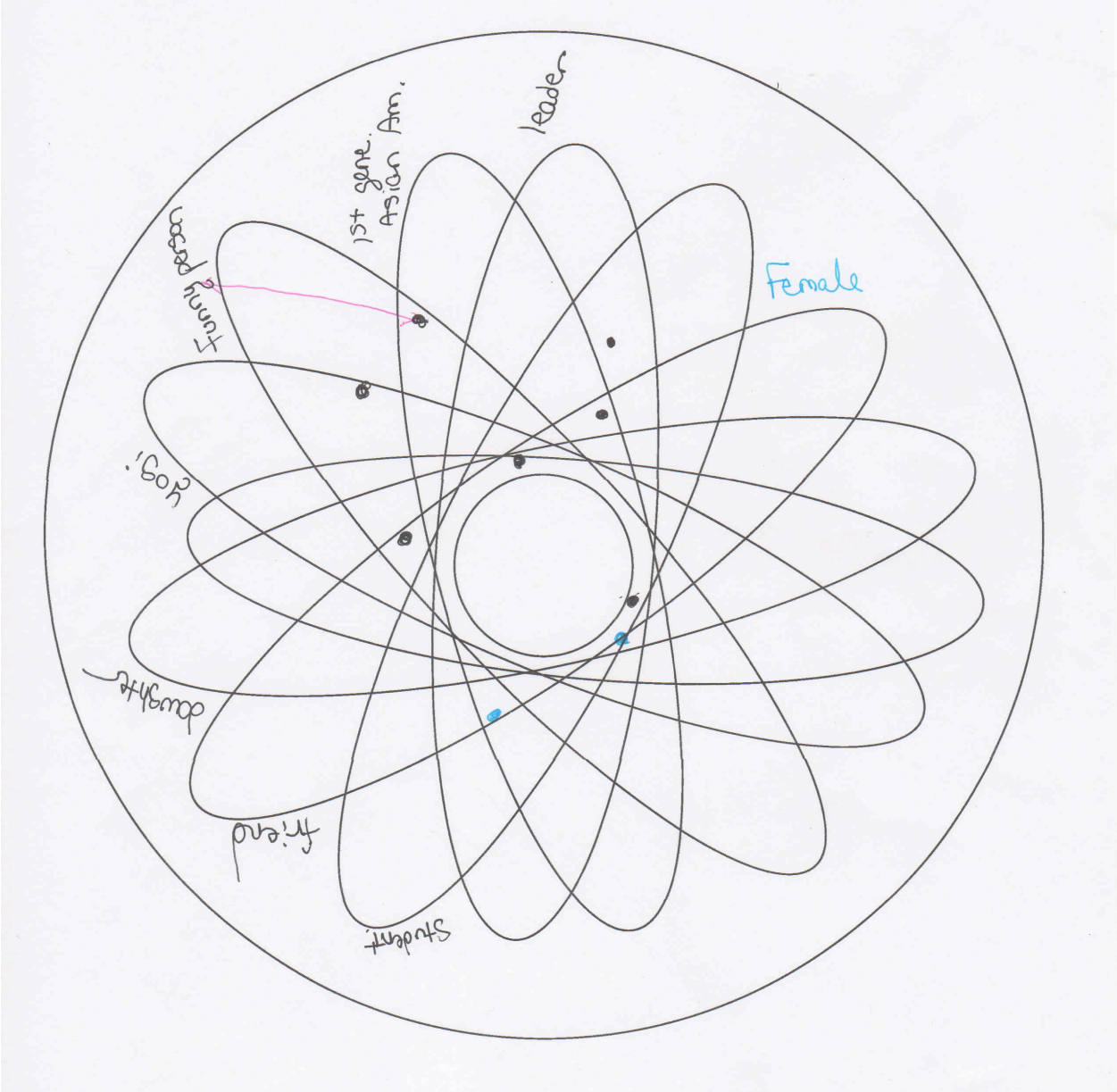
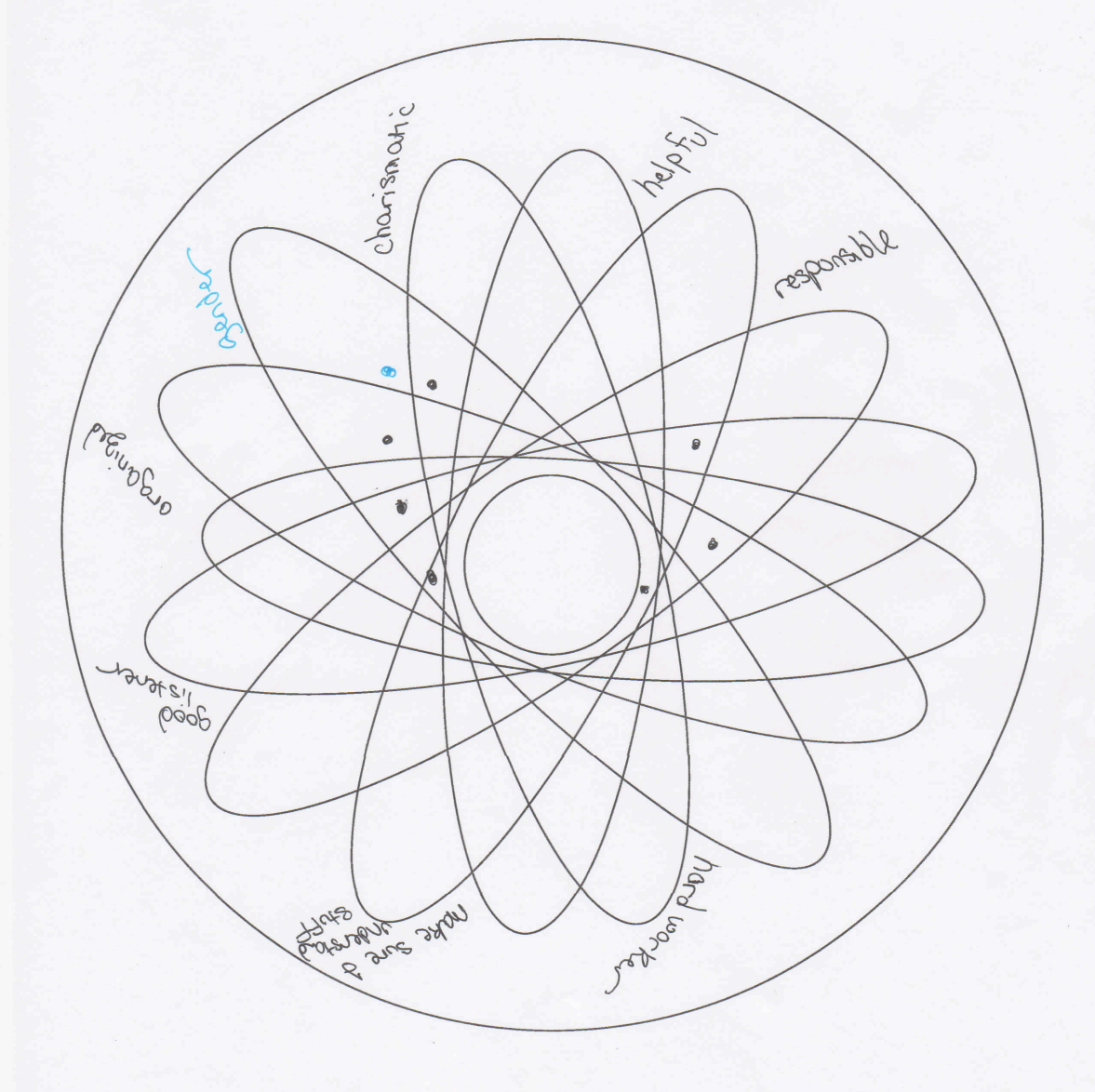


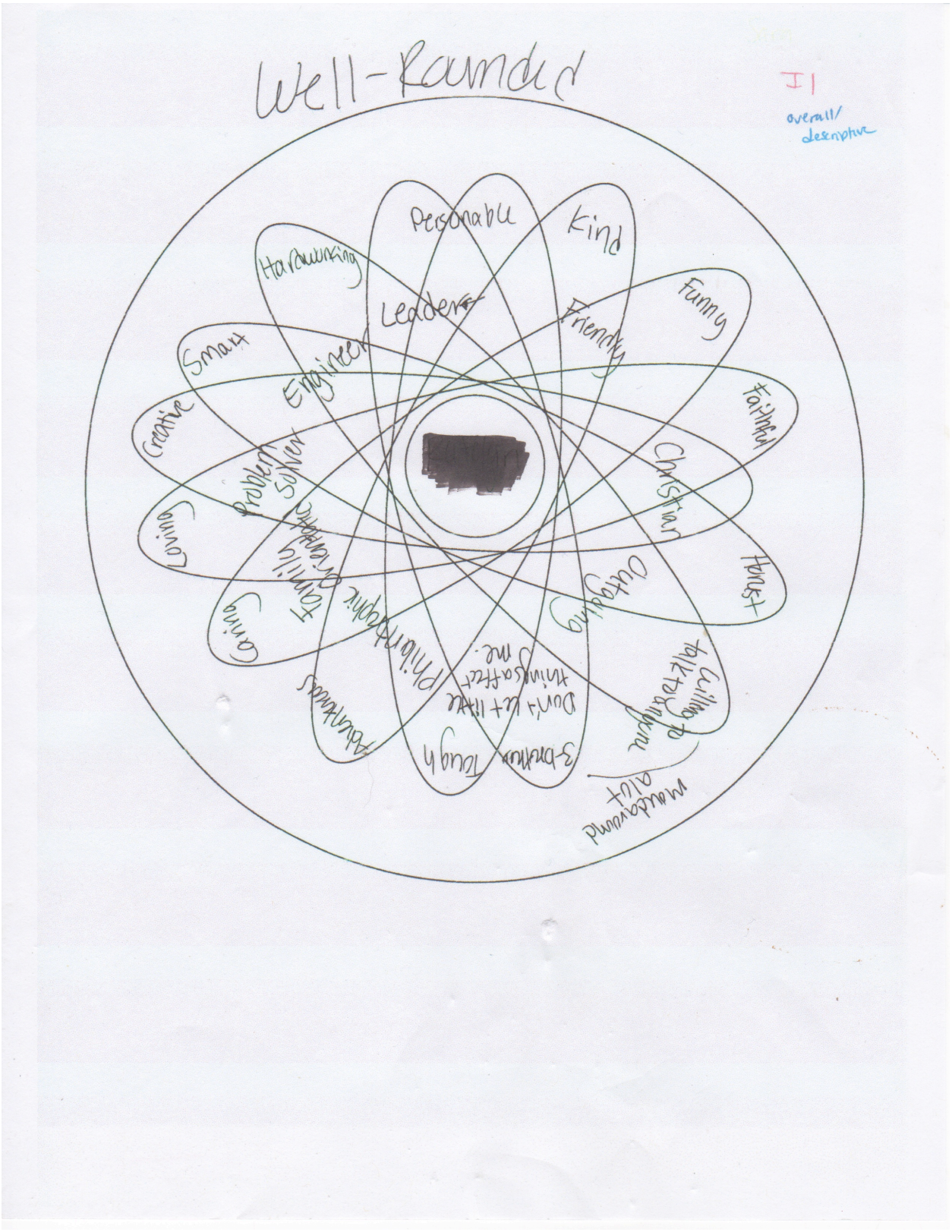
Olivia
Overall Identity Model



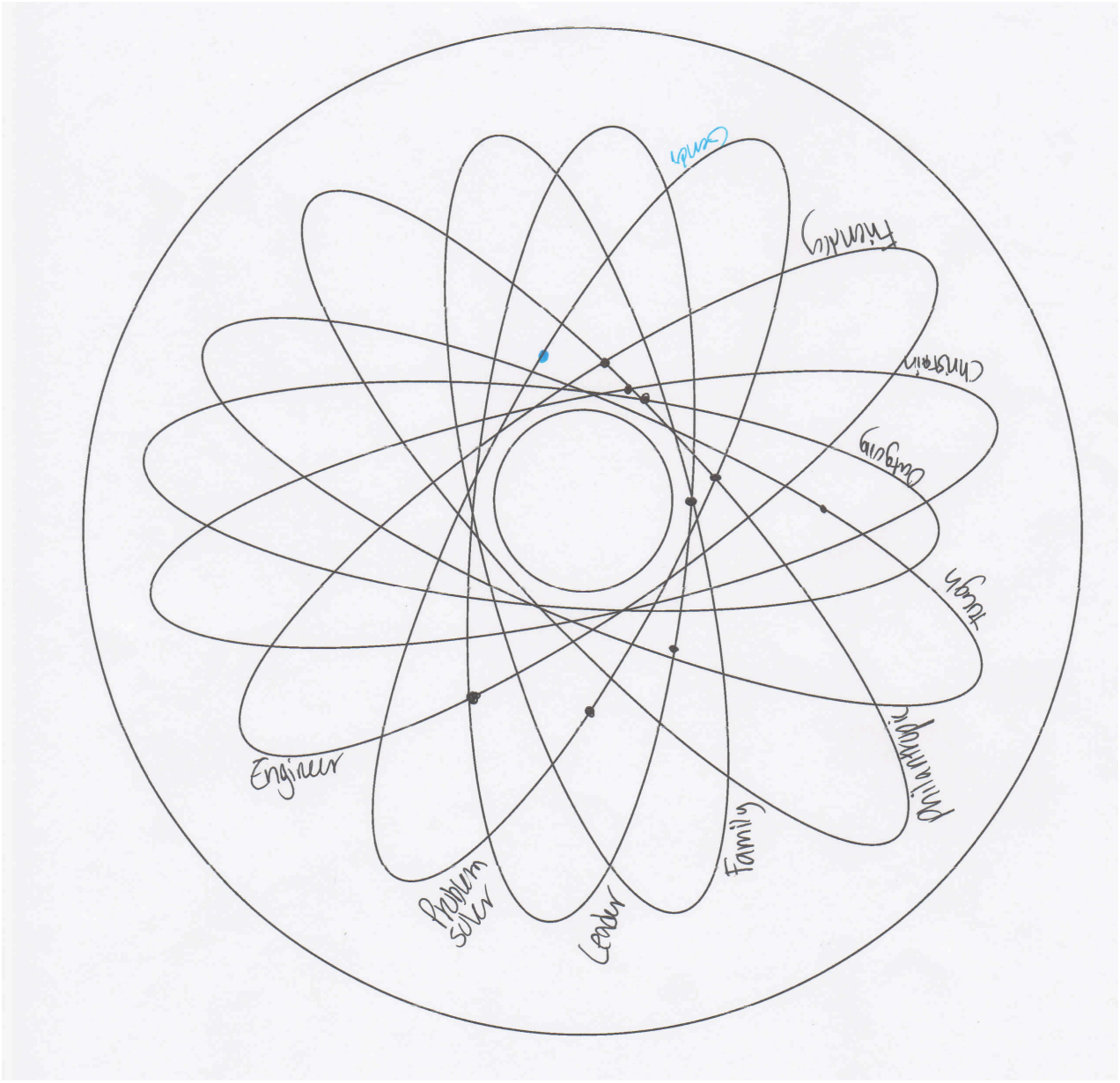
Classroom Model



Sara
Overall Model 1. Explanation of Characteristics



Overall Model 2. Saliency of Main Characteristics



Classroom Model