Exploration of Conformity to Masculine Norms among Male Engineering Undergraduates

By

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Exploration of Conformity to Masculine Norms among Male Engineering Undergraduates

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Abstract

This study quantitatively examines the level to which college men studying engineering conform to masculine norms and the relationship between their conformity to masculine norms and sense of belonging in their major. Study participants were undergraduate, male-identifying students at a large, public research university in the Midwest. Masculine norm conformity was measured through the Conformity to Masculine Norms Inventory-46 (CMNI-46) and analyzed based on scores from each of the inventory's nine subscales that align with nine popular masculine norms identified in Western culture. A comparison between engineering males' masculine norm conformity scores and conformity scores from males enrolled in female-dominated majors at the same institution was also conducted.

Results of the study indicate that engineering males in the study's sample generally do not endorse the masculine norms measured by the CMNI-46. While the engineering males did indicate greater levels of conformity to the masculine norms compared to males in female-dominated majors, the differences were either statistically insignificant or very small. Masculine norm conformity scores were also found to predict only a small amount of the variance in scores measuring sense of belonging in major, indicating other variables not accounted for in the study are responsible for the majority of variance in belonging scores. This sample's lack of endorsement of the masculine norms identified in the CMNI-46 align with other recent studies of similar populations and suggest that the norms measured by the instrument do not align with modern college males' views of masculinity, suggesting that new approaches to masculinity research should be utilized for this population. Similarly, these findings suggest campus professionals should highlight positive expressions of masculinity when engaging in conversations about masculinity with men on campus.

Table of Contents

List of Tables vi
Chapter 1: Introduction 1
Purpose of the Study 2
Research Questions 4
Conceptual Framework 5
Hypotheses of the Study 7
Significance of the Study 7
Chapter 2: Literature Review 11
Sex, Gender, and Masculinity 11
Hegemonic Masculinity 12
Masculine Gender Role Norms 15
The Gender Binary 17
Masculinity in America 19
History of Engineering & Masculinity 20
History of Masculinity on the College Campus 23
Masculinity in Engineering Education 28
Relevant Literature Regarding Study Variables 31
Race/Ethnicity 31
Fraternity Life 32
Sexual Orientation 33
Men in Female-Dominated Majors 34
Sense of Belonging 35
Conclusion 37
Chapter 3: Methods 38
Sample 38
Data Collection 39
Conformity to Masculine Norms Inventory (CMNI) 40
Sense of Belonging in College Major 44
Independent Variables 45
Female-Dominated Majors 46
Greek Letter Fraternity and All-Male Organization Participation 48
Gender Salience 48
Data Analysis 48
Limitations of the Study 50
Conclusion 51
Chapter 4: Results 53
Research Question 1 54
Research Question 2 60
Research Question 3 65
Conclusion 70
Chapter 5: Discussion 72
Findings Related to Masculine Norms 72
Findings Related to Belonging 76
Implications for Practice 78

Suggestions for Future Research 81
Conclusion 84
References 86
Appendix A: Human Subjects Approval 115
Appendix B: Informed Consent Statement 116

List of Tables

Table 1: CMNI-46 Subscales and Example Items 44
Table 2: Demographic Variables and Codings 46
Table 3: Cronbach's Alpha Scores for Scales 49
Table 4: Coding for Nominal Independent Variables Used in Research Question 3 50
Table 5: Demographic Statistics for Study Sample and Campus Population 56
Table 6: Mean Scores of CMNI Subscales for Engineering Male Respondents 60
Table 7: Results of T-Test of CMNI-46 Subscale Scores by Group 64
Table 8: Major Group as Independent Variable in Regression: Coefficient Results by Subscale 65
Table 9: Regression Coefficient Results for Major Groups 67
Table 10: Pearson Correlations between CMNI-46 Subscale Average Scores of Engineering Men 68
Table 11: Pearson Correlations between CMNI-46 Subscale Average Scores of Men in Female-Dominated Majors 69

Chapter 1: Introduction

The engineer is perhaps one of our society's most stereotyped professionals. Popular media almost always portrays today's engineer as socially inept, nerdy, precise, literal, and male. While most stereotyped traits such as these may be unfounded or exaggerated, it is completely accurate to claim that engineering is dominated by males. In 2021, about 82% of the engineering workforce were males (U.S. Bureau of Labor Statistics, 2021). This is a result—at least in part—of the longstanding gender disparity in engineering education at the college level. As is widely known, women make up the majority of the college student population—59% in 2021 (National Student Clearinghouse Research Center, 2021), but they are greatly underrepresented in engineering programs, making up a little over 23% of all engineering undergraduate students (Roy, 2019). Improvement in the percent of women employed in science, technology, engineering, and math (STEM) fields has been a key priority over the last several decades, and the percentage of women in those fields has increased from 8% in 1970 to 27% in 2019 (Martinez & Christnacht, 2021). However, that same increase has not been seen in computing and engineering fields, which make up 80% of the STEM workforce; women in engineering professions rose from 3% in 1970 to 15% in 2019.

Explanations as to why engineering continues to remain a male-domain abound and many are hotly contested. Historians have proposed that engineering's foundations in the male-dominated fields of math and science helped create the gap and also shape the masculine environment that exists today (Barnett & Sabattini, 2009; Noble, 1992; Oldenziel, 1999; Shepherd, 1993). Modern scholars have explored—and largely debunked—the suggestion of a male ability advantage in math and science (Barres, 2006; Hyde, Lindberg, Linn, Ellis, & Williams, 2008; Riegle-Crumb, King, Grodsky, & Muller, 2012; Spelke & Ellison, 2009; Wai,

Cacchio, Putallaz, & Makel, 2010). Others have sought to examine how interest in engineering concepts and careers differs between men and women (Ceci, Ginther, Kahn, & Williams, 2014; Du, 2006; Eccles, 2007; Eccles & Wang, 2016; Su, Rounds, & Armstrong, 2009). Finally, the effect of the climate that engineering students experience—and specifically how welcoming and supportive it is of women—has been considered as the reason why progress toward gender parity remains stalled (Glass, Sassler, Levitte, & Michelmore, 2013; Hunt, 2016; Kahn & Ginther, 2015; Lordan & Pischke, 2022).

While the gender disparity among engineering students is widely researched, most explorations of the gendered environment that exist in engineering programs on college campuses focus on the negative experiences of women. Further, most of that research is of a qualitative nature. A lack of information exists on how the gendered environment of engineering is perceived by males, some of whom may not subscribe to the traditional masculine norms that are common throughout the field. This study seeks to address this gap by quantitively exploring masculinity among undergraduate engineering men with the intent of better understanding the impact this environment has on male students.

Purpose of the Study

The purpose of this study is to quantitatively examine the extent to which men studying engineering conform to masculine norms, which are behaviors traditionally associated with being a man. Additionally, the study seeks to determine whether differences exist in levels of conformity to masculine norms between engineering men and men studying majors that are majority-female. Finally, the study explores the relationship between conformity to masculine norms and sense of belonging in academic environment among male college students. This purpose of this final research question is to better understand if males who conform less to

traditional masculine norms feel as welcome in the masculine engineering environment and if that differs from males in majors that are not male dominated.

This study uses data collected from undergraduate men attending a large, public university in the Midwest. Conformity to masculine norms is measured by the CMNI-46 instrument (Parent & Moradi, 2009), which assesses masculine gender role conformity on nine subscales: Winning, Emotional Control, Risk-Taking, Violence, Power Over Women, Playboy, Self-Reliance, Primacy of Work, and Heterosexual Self-Presentation. Respondents are asked to review 46 statements and respond with one of four options: strongly disagree, disagree, agree, or strongly agree. Each of the 46 items is uniquely connected to one of the nine subscales. Winning subscale items ask for a response to prompts such as "It is important for me to win" and "I don't mind losing." The Emotional Control subscale measures the individual's endorsement of control of emotion of expression through response to prompts like "I hate it when people ask me to talk about my feelings" and "I never share my feelings." Risk-Taking prompts include "I enjoy taking risks" and "I frequently put myself in risky situations." Violence items ask individuals to respond to "Sometimes violent action is necessary" and "I am willing to get into a physical fight if necessary." The Power Over Women subscale assesses attitudes toward control over women through statements including "Things tend to be better when men are in charge" and "Women should be subservient to men." The Playboy norm evaluates the individual's attitudes toward sexual activity through prompts such as "I would only have sex if I was in a committed relationship" and "I would feel good if I had many sexual partners." Self-Reliance focuses on help-seeking attitudes with statements like "I hate asking for help" and "I never ask for help." The Primacy of Work subscale measures the individual's endorsement of work as a primary focus of life and prompts include "Work comes first" and "I feel good when work is my first

priority.” The final subscale—Heterosexual Self-Presentation—was originally labeled “Disdain for Homosexuals” and renamed in this revision of the CMNI. Its prompts include “Being thought of as gay is not a bad thing” and “I would feel uncomfortable if someone thought I was gay.” Results from all subscales are used for this study, and rationale for this decision is provided in Chapter 3, along with additional detail on the CMNI-46’s construction, reliability and validity.

In addition to the CMNI-46, participants in the study responded to six statements adapted from The College Belongingness Questionnaire about their sense of belonging in their academic major (Weeks, Asher, & McDonald, 2012). These responses are used to help understand how welcome the participants feel in their academic major environment. In addition to demographic information (age, year in college, race, sexual orientation, academic major), participants were asked if they participate in Greek-letter fraternities or any other all-male organization and also about the importance of gender to their identity, which will be referred to as gender salience. Bittner and Goodyear-Grant (2017) outlined the importance of examining the strength of study participants’ attachment to gender identity since gender is typically a critical factor in one’s social identity, in addition to being central to this study’s purpose. This is described as “gender salience” when used as a variable in this study.

Research Questions

The research questions for this study are:

1. What are the characteristics of male engineering college students at a midwestern research university and how do they score on measures of conformity to masculine norms?
2. How do characteristics of male engineering college students at a midwestern research university and their scores on measures of conformity to masculine norms differ from

male college students in female dominated majors (i.e., psychology, journalism, biology, education)?

3. Controlling for relevant background characteristics and gender salience, what is the relationship between conformity to masculine norms and sense of belonging in academic major among college males?

Conceptual Framework

Three concepts are central to this study: masculine norms, engineering as a masculine domain, and sense of belonging. Each of these are described briefly here and are presented in more depth in Chapter 2.

First, it is critical to acknowledge the existence of a common set of social practices and behaviors that have been determined to be acceptable for men to perform. Current literature generally refers to this concept as "hegemonic masculinity," which Carrigan, Connell, and Lee (1985) called a "culturally exalted form of masculinity" (p. 592). While the values associated with this definition can and do vary over time and by location and setting, generally these norms center around controlling one's emotions, exerting power over others, and rejecting all things associated with femininity (Hartley, 1959; Kimmel, 2005; Mahalik et al., 2003; O'Neil, 1981; O'Neil, Helms, Gable, David, & Wrightsman, 1986). The present study relies upon these established norms as the basis for the instrument that is used to measure conformity to masculine norms: the CMNI-46. Authors of the original CMNI instrument—of which the CMNI-46 is an abbreviated revision—utilized literature on dominant masculine norms to construct the measure (Mahalik et al., 2003).

Additionally, critical to this study is the construction of engineering as a masculine domain. Though now viewed as its own field, engineering is heavily rooted in mathematics and

science: fields that have historically excluded women (Barnett & Sabattini, 2009; Noble, 1992; Shepherd, 1993). The industrial and machinery workforce that arose from the technological advancements of the Industrial Revolution continued this practice of excluding women (Cockburn, 1985; Frehill, 1997; Rotundo, 1993). As engineering became a professionalized field in the late 19th century, institutions offering engineering training either severely restricted women from attending or barred them entirely (Bix, 2000, 2004; Frehill, 2004; Layne, 2009). Throughout the 20th century, as women gained access to higher education and eventually became the majority of college students, engineering schools continued to promote masculine norms—intentionally or not (De Pillis & de Pillis, 2008; Faulkner, 2000; McLoughlin, 2005; Stonyer, 2002). This study quantitatively explores the prevalence of those masculine norms in a current engineering school by assessing conformity to masculine norms among males studying engineering. It also provides a sense of comparison by also looking at masculine norms in academic units outside of engineering that are predominantly female.

Influenced by Maslow (1943) and his well-known hierarchy of human needs, the concept of belonging is the final key concept of this study. Defined by Asher and Weeks (2013) as "a feeling derived from the perception that one is an integral part of a community, place, organization, or institution" (p.287), this concept has been closely researched in education settings and shown to be positively associated with student success, persistence and mental health (Freeman, Anderman, & Jensen, 2007; Gopalan & Brady, 2020; Zumbrunn, McKim, Buhs, & Hawley, 2014). Strayhorn (2019) defined sense of belonging specific to the college context as "students' perceived social support on campus, a feeling or sensation of connectedness, and the experience of mattering or feeling cared about, accepted, respected, valued by, and important to the campus community or others on campus such as faculty, staff,

and peers" (p.4). Sense of belonging serves as the outcome measure for the third research question of this study and assesses the individual's sense of belonging within his academic major.

Hypotheses of the Study

The hypotheses of this study are:

1. Compared to their non-engineering male peers, male engineering college students at a midwestern research university will score lower on measures of gender salience, lower on sense of belonging in college major, and be less likely to identify as non-heterosexual or be involved in a Greek-letter fraternity or other all-male organization. Also, the engineering males will generally agree with the masculine norm subscales presented.
2. Male engineering college students at a midwestern research university will score higher on measures of conformity to masculine norms than male college students in female dominated majors at a midwestern research university.
3. A positive relationship will exist between conformity to masculine norms and sense of belonging in academic major among males studying engineering at a midwestern research university.

Significance of the Study

Mahalik, Talmadge, Locke, and Scott (2005) proposed the "benefits and costs" to men for conforming and not conforming to masculine norms. They suggested benefits to conforming include social acceptance, development of male identity, and social and financial rewards, while a benefit to not conforming could be the relief of pressure to maintain strict gender roles. However, the costs of adherence as well as non-adherence present many concerns. Many decades

of research have shown a link between the practice of dominant masculine norms and unfavorable physical and mental health outcomes, such as poor diet (Forth, 2009; Levi, Chan, & Pence, 2006; Rothgerber, 2013), drug and alcohol use (Darcy, 2018; Iwamoto, Cheng, Lee, Takamatsu, & Gordon, 2011; Iwamoto & Smiler, 2013), and unwillingness to seek psychological help (Johnson, Oliffe, Kelly, Galdas, & Ogrodniczuk, 2012; Seidler, Dawes, Rice, Oliffe, & Dhillon, 2016; Wong, Ho, Wang, & Miller, 2017). Alternatively, nonconformity to masculine norms among males has also been linked to negative outcomes (Aubé & Koestner, 1992; Harry, 1983; Rieger & Savin-Williams, 2012). These negative outcomes resulting from nonconformity include being victims of bullying (Wallien, Veenstra, Kreukels, & Cohen-Kettenis, 2010; Young & Sweeting, 2004), rejection from peers (Cohen-Kettenis, Owen, Kaijser, Bradley, & Zucker, 2003; Steensma et al., 2014), and long-term psychological distress (Landolt, Bartholomew, Saffrey, Oram, & Perlman, 2004; Lippa, 2008; Skidmore, Linsenmeier, & Bailey, 2006).

Upon entering college, males bring an existing understanding of gender norms expected of them as men, but they also enter into a time and space—college—that plays a formative role in the development of their understanding of masculinity (Harris III & Struve, 2009; Kimmel, 2008; Laker & Davis, 2011; Tillapaugh & McGowan, 2019). Most of the literature on college men's development focuses on problematic behaviors—substance abuse, sexual assault, violence, poor academic performance—resulting from men adhering to masculine norms (Capraro, 2000; Locke & Mahalik, 2005; Mullen, Watson, Swift, & Black, 2007; Wimer & Levant, 2011). College men studying engineering are placed into an additional developmental environment where they begin to shape their own identity as an engineer: in the classroom, through co-curricular activities and employment (Hughes & Hurtado, 2013; Pierrakos, Beam, Constantz, Johri, & Anderson, 2009). Aside from well-documented engineering classroom

climate issues that are often hostile toward female students, the engineering student experience has been described as one of high stress and anxiety, often connected to a variety of mental health issues among students (Danowitz & Beddoes, 2020; Jensen & Cross, 2018).

College males studying engineering find themselves in an incubator of masculinity. Messages about the ways they should and should not behave as men come from all directions, and as described above, the way they respond to those messages has consequences. This study makes a unique contribution by researching the attitudes and feelings of males currently immersed in this space where two formative settings overlap: college life and engineering education. By quantitatively examining college engineering males' conformity to masculine norms and the relationship that conformity has to a sense of belonging in the engineering environment, this study provides practitioners—from professors to advisors to counselors—with a deeper understanding of the common issues and attitudes that could be affecting the mental health, academic performance, and persistence of those students. A positive relationship between masculine norm conformity and belonging could suggest that males who are less conforming find themselves feeling unwelcome, this signaling another problematic outcome of masculine norm conformity in addition to those detailed above. Additionally, the prevalence of at least one of the norms measured in this study—Power Over Women—has clear implications for female students studying engineering. Assessment of this norm provides one measure of the environment that females face in engineering programs and could lead to actionable items that ultimately result in improved representation. Finally, this study takes place nearly two decades after the initial CMNI was published (Mahalik et al., 2003) and at a time when traditional masculine norms are being revived in politically conservative spheres and rejected in liberal circles (Kimmel, 2017; McElroy, 2022). The data produced from this survey serve as a current

snapshot of the attitudes held by college males regarding their own perspectives on masculinity today.

Chapter 2: Literature Review

This study focuses on the intersection of three spheres: masculinity, engineering, and higher education. The first section of this literature review introduces the concept of masculinity through explanation of relevant terms and concepts surrounding gender, as well as addressing the use of gender binary language in this study. The following sections examine the relationship between masculinity and the other two spheres: engineering and higher education. Following that, the final section of this review summarizes literature relating specifically to the variables used in this study. Relevant information is provided on some of the demographic variables used in the study: race, sexual orientation, Greek life participation, and female-dominated majors. Then the chapter concludes with a review of literature on the remaining variables important to this study: masculine norms and belonging.

Sex, Gender, and Masculinity

Foundational to the framework of masculinity is the understanding of the difference between sex and gender. This study focuses on gender and engineering because this provides for a richer exploration, looking beyond the simple numbers of males versus females and instead to an examination of the attitudes and beliefs that are associated with being male. In the 1950s, psychologist John Money and his colleagues began conceptually differentiating sex and gender (Money, Hampson, & Hampson, 1955a, 1955b, 1957; Muehlenhard & Peterson, 2011). They saw sex as a biological construct and gender as a psychological and behavioral construct. Around this same time, Beauvoir (1953) also wrote about the differences between biological sex and gender. This distinction was adopted by the American Psychological Association (2015), which states “sex usually refers to the biological aspects of maleness or femaleness, whereas gender implies the psychological, behavioral, social, and cultural aspects of being male or female (i.e.,

masculinity or femininity)" (p. 450). Perez (2019) defined gender simply as "the social meanings we have imposed on male and female bodies" (p.313). The concept of gender as a social construct dominated the feminist scholarship and women's liberation movements that emerged in the decades following Money and colleagues' distinction (Deaux, 1984; Unger, 1979). Pleck (1981) expanded upon that scholarship and applied it to men in his Gender Role Strain Paradigm, which argued that gender roles are not a result of biology but instead psychological and social influences. The Role Strain Paradigm was in contrast to the Gender Role Identity Paradigm (GRIP) that had dominated masculinity research for decades and argued that individuals had a psychological need to develop a gender identity that was consistent with their biological sex (Levant, 2011).

Hegemonic Masculinity

The work of Carrigan, Connell, and Lee (1985) further detailed the increasing focus on masculinity and gender resulting from feminist critiques of patriarchy and introduced the idea of a "culturally exalted form of masculinity" (p. 592), which they called "hegemonic masculinity." Their focus was on past scholarship surrounding sex roles, which primarily prescribed that men should be in dominant roles over women. This term—hegemonic masculinity—is essential to this study as it represents the social norms that are expected of males; these norms informed the development of the quantitative instrument used in this study. In *Gender and Power*—the most-cited work regarding hegemonic masculinity—Connell (1987) noted several key points about hegemonic masculinity. First and foundationally, that the macro level relationship between masculinity and femininity is centered on global dominance of men over women. Second, Connell wrote that hegemonic masculinity is "always constructed in relation to various subordinated masculinities as well as in relation to women" (p. 183). This "social ascendency"

over other forms and displays of masculinity does not mean that others were eliminated, but instead that they were subordinated. A third important point Connell noted about the concept was that this ideal did not have to actually be displayed by the majority of men. Instead, the ideals embodied by hegemonic masculinity are "models of masculinity which are quite specifically fantasy figures" (p. 184). Expanding on that point, Connell wrote, "The public face of hegemonic masculinity is not necessarily what powerful men are, but what sustains their power and what large numbers of men are motivated to support" (p. 185). Men are motivated to support it—even though they may not display it—because of the benefit of cultural ascendancy it provides. Finally, Connell noted "the most important feature of contemporary hegemonic masculinity is that it is heterosexual" (p. 186). This feature ties hegemonic masculinity closely to heteronormativity: a term introduced by Warner (1991) and defined as "a hegemonic system of norms, discourses, and practices that constructs heterosexuality as natural and superior to all other expressions of sexuality" (as cited in Robinson, 2016, p. 1). Heteronormativity is highlighted later in this chapter and also is quite similar to one of the norms used by the quantitative instrument used in this study.

In an article published 20 years after the original concept was introduced, Connell and Messerschmidt (2005) summarized applications and criticisms of hegemonic masculinity and responded to many of the critiques with suggestions on what they believed should be retained from the original concept and what should be revised. They affirmed the essentials of hegemonic masculinity: that it "presumes the subordination of nonhegemonic masculinities" and "works in part through the production of exemplars of masculinity…that have authority despite the fact that most men and boys do not fully live up to them" (p. 846). By this, they meant that men hold these standards up as the ideal, even though they are often unattainable and far from the actual

norm attained among common men. For example, hegemonic masculinity allows and encourages men to cite the physique of a professional athlete as what a man should be, even though most men's physiques do not meet these standards. The suggestions of revisions and reformulations put forth by Connell and Messerschmidt addressed more nuanced components of the concept, leaving the foundations in place. One topic of their revision relates especially to this study. The authors proposed that analysis of hegemonic masculinities should occur on three levels: local, regional, and global. They cautioned readers not to assume a hierarchical structure (moving down from global) and emphasized the links between each level (Messerschmidt, 2018). The application of this point is important to the current study as masculinity is measured by an instrument constructed from national masculine norms (regional) with a focus on males in the masculine engineering environment at a particular institution of higher education (local).

Kimmel (2005) articulated the importance of the ongoing study of masculinity by proposing the concept of men as the "invisible gender," explaining that, while history is full of stories about men, these stories have not—until recently—explained "how the experience of being a man structured the men's lives, or the organizations and institutions they created, the events in which they participated" (p. 3). He credited the work of feminist scholars with adding gender to the list—along with race and class—of how we understand social life. It is from this development that social scientists and historians have been prompted to reexamine how gender influenced the actions of prominent figures and movements throughout history. In the decades since hegemonic masculinity was introduced, an expanding field of masculinities research has emerged. The plural—masculinities—is commonly used to acknowledge "the wide variety of ways in which masculinity is expressed" (Spector Person, 2006, p. 1166). The literature has focused on a variety of intersections between masculinity and another held identity, such as race,

disability, and sexuality, among many others, which in turn has allowed for the development of a richer and more expansive understanding of masculinities throughout society (Christensen & Jensen, 2014; Shuttleworth, Wedgwood, & Wilson, 2012; Wong, Liu, & Klann, 2017; Wright, 2005). Some of those intersections are discussed in more detail later in this chapter as they are represented in the research literature and as they pertain to the present study.

Masculine Gender Role Norms

The expression and performance of masculinity—as opposed to a theoretical conceptions of gender roles—is critical in this research because masculinities are active; they are "behaviors, languages and practices, existing in specific cultural and organizational locations, which are commonly associated with males" (Whitehead & Barrett, 2001, p. 15). This is rooted in the work of West and Zimmerman (1987) and Butler (1989) who introduced the ideas of "doing gender" and "gender performativity," respectively. These theorists emphasized the collective nature of gender and that it is replicated and reinforced through recurring social interactions among others (as cited in Sallee & Harris III, 2011). In this study, the key variable quantitively measures an individual's conformity to masculine gender role norms, which are the socially accepted ways that masculinity is expressed and performed. The existence of gender role norms therefore is critical to understanding the present study.

Gender role norms are an extension of the construct of social norms, which are understood to be standards that guide acceptable behavior and have been academically explored in psychology and sociology for over a century (Cialdini & Trost, 1999). When the expectation for acceptable behavior in a social situation differs based on an individual's gender, these are understood to be gender role norms, and these guidelines are communicated to individuals as descriptive norms (observations of the way men behave), injunctive norms (observations of the

way men should behave), and cohesive norms (observations of the characteristics of popular or successful men and their behavior) (Addis & Mahalik, 2003). This study uses a revision of an instrument that is often used to measure conformity to masculine gender norms: the Conformity to Masculine Norms Inventory (CMNI)-94 (Mahalik et al., 2003). The masculine gender role norms identified in the CMNI-94 closely mirrored the norms identified in other masculine norm conformity measures established prior to its construction (Levant, Hirsch, Celentano, & Cozza, 1992; Thompson & Pleck, 1986). In its initial form, there were 11 norms identified: winning, emotional control, risk-taking, violence, dominance, playboy, self-reliance, primacy of work, power over women, disdain for homosexuals, physical toughness, and pursuit of status. Parent and Moradi (2009) removed dominance and pursuit of status in their revision of the original CMNI-94, and that revised instrument—the CMNI-46—is used in this study. Further details on the items used to construct each subscale are provided in the next chapter.

Since the publication of CMNI-94, other measures of masculine norm conformity have been revised and proposed (Levant, Hall, Weigold, & McCurdy, 2015). Two such measures—the Gender Role Conflict Scale Short Form (GRCS-SF) by Wester, Vogel, O'Neil, and Danforth (2012) and the Male Role Norms Inventory-Revised (MRNI-R) by Levant et al. (2007)—identified masculine norms that closely align with the CMNI-46. The seven subscales identified by the MRNI-R: avoidance of femininity, negativity toward sexual minorities, self-reliance, aggression, dominance, non-relational sexuality, and restrictive emotionality. While fewer, the constructs measured by the GRCS-SF—success, power, and competition; restricted emotionality; restricted affectionate behavior between men; and conflicts between work and family relations—also are closely aligned with those used in the CMNI-46. In a recent study, Wong et al. (2020) investigated subjective masculine norms among a sample of U.S. men. Their study identified the

10 most prevalent masculine norms, in order of prevalence as: emotional toughness; providing for family; avoidance of femininity; being a gentleman (polite, charming); work (earning money, being employed); nonaggression (refraining from violence toward others); character (good moral character); avoidance of homemaking (not doing home tasks stereotypically done by women); physicality (not being physically weak, working out); and heterosexism. Most of these norms closely align with the subscales identified in the CMNI-46 with the exception of nonaggression, which the authors noted was especially surprising. Moving beyond the existence of these masculine norms, researchers have sought to examine the relationship between conformity to these norms and other attitudes and behaviors. As mentioned in the previous chapter, adherence to masculine norms has been consistently linked to negative outcomes including depression, alcohol and drug use, anxiety, and avoidance of intimacy (Burn & Ward, 2005; Iwamoto & Smiler, 2013; Kaya, Iwamoto, Brady, Clinton, & Grivel, 2019; Seidler et al., 2016). The present study contributes to the literature on the relationship between masculine norm conformity and sense of belonging in engineering among college men.

The Gender Binary

Before moving further, it is important to acknowledge and affirm that gender does not exist solely as a binary (male/female) and that individuals—regardless of sex at birth—may identify as a combination of male and female or as neither (Schudson, Dibble, & van Anders, 2017; Tate, 2014). In the last decade, discussion surrounding this topic has increased, certainly at least in part due to the increase in the number of adults identifying as transgender and the related rise in awareness of transgender issues (Meerwijk & Sevelius, 2017). Additionally, scholars from a variety of fields have produced challenges to the idea of a gender binary (Hyde, Bigler, Joel, Tate, & van Anders, 2019). Hyde's (2005) "gender similarities hypothesis" is often cited in

these challenges regarding psychological differences between males and females. The hypothesis—formulated from a review of 46 meta-analyses of research on psychological gender differences—argued that males and females are alike on most psychological variables and that differences are greatly exaggerated.

The present study does not seek to minimize or erase the experiences of those who identify as other than male or female. However, the language used in this study does often align with the male/female binary in discussion of the norms that are being discussed. There are four reasons that the use of this language remains acceptable in this study. First, all participants in this study self-identified as male. Second, one of the recurring and central components of traditional masculine norms is anti-femininity or the avoidance of feminine behaviors (Bosson & Michniewicz, 2013; Kimmel, 2012; Thompson, Grisanti, & Pleck, 1985). This places masculine norms in opposition to feminine norms, or put another way: masculinity is anything not feminine. Third, the engineering academic environment has been linked to heteronormativity, which is rooted in the endorsement of the male/female binary (Bilimoria & Stewart, 2009; Cech & Waidzunas, 2011; Kitzinger, 2005). Therefore, the environment in which this study takes place is familiar with and permeated by this binary. Fourth and finally, dichotomous and gendered language regarding hard versus soft skills appears in discussion about engineering education (R. Hong, 2016; Kumar & Hsiao, 2007). For example, Hacker (1981) found male engineering faculty members "described social sciences in womanly terms: soft, inaccurate, lacking in rigor, unpredictable, amorphous" (p. 345). This view reflects the culture of engineering that values rational, formal knowledge (masculine) over emotional, humanistic (feminine) knowledge. Further explanation of the gendered climate of engineering follows later in this chapter.

Masculinity in America

The present study is also informed by research of masculinities, particularly research focusing on how, historically, males have performed and practiced masculinity over time and in certain environments. As this study is conducted in America and uses an instrument centered on American masculine norms, a historical examination of masculinity in America is important. Kimmel's (2012) history of American men relied heavily on the idea of the Self-Made Man, which he traces to the beginning of the country. This model of manhood is rooted in independence, achievement, responsibility, and wealth—attributes also related to the pursuit of higher education, which will be discussed later. Three themes were identified by Kimmel as foundational to the development of the Self-Made Man and American masculinity: self-control, escape, and exclusion. American men—now free from the rule of the British monarchy—could no longer look to a king or queen for control, so they had to exhibit their own self-control over their bodies, passions, and temptations. Similarly, the new country of America—though it espoused virtues of equality—provided an opportunity to for white men to exclude others from positions of power or authority in the formation of a new government and society. The true practice of equal opportunity for all those living in the new country would threaten the dominance white men held over politics, business, education, and other institutions, and therefore, men seeking to obtain or retain power had to utilize methods of exclusion against those they wished to remain in power over. This theme of exerting power through exclusion appears in discussions of masculinity throughout a variety of cultures and time periods and appears to be "as much about the power of certain men over other men as it is about the power of men over women" (Bourke, 1996, p. 14). In particular, the themes of control and exclusion will reoccur in discussions about masculine norms later in this chapter.

History of Engineering & Masculinity

Additionally important to this study is the construction of engineering as a masculine field. These gendered themes existing throughout the foundations of engineering work alongside—and sometimes duplicate—the themes discussed above in the explanation of American masculinity. This study seeks to connect immersion in the engineering environment to conformity to masculine norms; therefore, it is essential to examine how the engineering environment might produce and endorse the masculine norms being examined.

Engineering—though now viewed as its own field—relies heavily on mathematics and science. To understand the history of engineering, therefore, the development of science and mathematics should be examined. Noble (1992) thoroughly investigated the history of Western science's masculine development, from ancient Greece to modern times. He argued that the male domination of science did not evolve naturally from an ancient patriarchy, but instead was intentionally rooted in the consistent and continued exclusion of women. Much of this occurred in the Middle Ages, as Christian clerics studied the natural world in hopes of understanding the divine. Shepherd (1993) argued that the culture of scientific pursuits was shaped by existing monastic culture—already homosocial and misogynistic—where science was being developed. At the same time, religious life was also affecting the women of Europe and their access to scientific knowledge. Due to the fear of dying during childbirth, as well as the high cost of dowries, many women of the time entered convents, which cost about a fourth as much as a dowry (Barnett & Sabattini, 2009). Behind the walls of the convent, the women were shielded from science, instead taught literature, music, poetry, and skills for managing a household. Science was not part of instruction because participation in scientific life was not an option for

them. They were cut off from access to the academic discoveries being made at the time, and this continued to influence how females were educated for many centuries.

As modern technologies continued to advance in the 19th century, the labor economy was also changing. Division and specialization of labor were quickly becoming widespread, and the gendering of occupations began to increase (Lorber & Farrell, 1991). With these changes came a separation of men and women's work, and men had to fight to define their own roles in the labor force and sought a clear demarcation between the jobs of men and women. Benjamin (1991) observed that because scientific practice began as almost exclusively male, it is perceived as "male in the dual sense that the natural sciences have been associated with men's work, and, moreover, with manly work" (p. 4). This perception helped to shape modern views of technological fields. Kimmel (2012) noted that this phenomenon is common throughout the Western world but developed most quickly and was most recognizable in America.

During the Industrial Revolution and subsequent changes in the American economy, which also was occurring not long after the Civil War, Rotundo (1993) noted that "the exclusion of women linked the bitterest of rivals in the solidarity of a male profession" (p. 199). Masculine work was attractive because it carried status and value, and when women attempted to engage in masculine work, it threatened men's sense of superiority (Henwood, 1996). Reskin (1991) argued that sex segregation of occupation was enforced by men to preserve their advantaged position over women. Men were able to accomplish this by promoting wage differences between males and females, segregating females in the workplace, prohibiting female entry into a profession or industry, and openly harassing women in public and private (Wyer, Barbercheck, Geisman, Öztürk, & Wayne, 2001). Others labeled women as too frail or delicate to participate in the more industrial side of engineering (Trescott, 1984).

While math and science principles can be concretely found in the basics of engineering, there is also an unmistakable connection to the more nebulous—possibly even more masculine—concept of technology. Engineering culture labels engineers as creators of technology, which is placed at the very core of engineering (McLean, Lewis, Copeland, Lintern, & O'Neill, 1997). The competent engineer is measured by "how well one presents an image of an aggressive, competitive, and technically oriented person…In most workplaces, this means looking, talking, and acting male" (McIlwee & Robinson, 1992, p. 20-21). Engineers—past and present—take pride in their technical prowess because it distinguishes them from non-engineers and because it creates a power differential, which is used to exclude those without this knowledge (Faulkner, 2000). Faulkner (2001) provided seven reasons that help explain the masculine gendering of technology: key actors are male, strong divisions of labor within technology exist, technological artifacts are gendered, cultural images of technology are strongly tied to hegemonic masculinity, technical knowledge and practice is gendered, styles of technical work are gendered, and technology plays an important role in the gender identities of men who interact with technologies. The link between modern technology and hegemonic masculinity is explained by their common themes of control, domination, and valuing rationality over emotion (Faulkner, 2000; Hatmaker, 2013). Cockburn (1985) put it another way: "Engineering represents everything that is defined as manly—the propensity to control and manipulate nature; the celebration of muscle and machine in action upon raw materials; the tolerance of, even pleasure in, dirt…and metal shavings" (p. 57). These themes are closely related to the masculine norms measured in this study.

History of Masculinity on the College Campus

This study particularly examines the engineering climate within higher education, and therefore it is important to understand the links between American higher education and masculinity, which is at times connected to the literature reviewed in the previous section regarding American masculinity. As was the case in nearly all other prominent institutions of the time, higher education in early America was off limits to women. Solomon (1985) explained, "Nothing could have been farther from the goals of the patriot (male) generation than the promotion of women's rights and learned women. The leaders did not want their wives and daughters to be intellectuals; they, like other less educated Americans, feared the result of too much learning for women" (p. 11). Additionally, each of the nine colleges founded prior to the American Revolution shared the same purpose—to train and educate leaders and clergy—a goal which could only be fulfilled through the education of men (Lucas, 2006).

Women were not just to be kept out of these places of learning, but it was also important for young men attending colleges to intentionally escape the women in their lives. Leaders of American colleges in the 18th century called for students to be removed from their families in order to be under the complete authority of their male instructors and away from the potential feminizing influence of mothers (Vine, 1997). As more men gained the right to participate in this new democracy, the need for education became more apparent. Solomon (1985) wrote, "Because the effectiveness of male suffrage required an informed citizenry, some education for everyone became a necessity. The promotion of literacy for the male majority and of liberal education for future leaders gave new importance to education in the whole society" (p. 12). Also, as the economy continued to advance, the need for educational distinction and differentiation became

more apparent, though it was not until after the Civil War and into the turn of the century when a college education became more foundational to the American man.

Outside of teacher-training or "normal" schools where females outnumbered males, the rest of college attendees in the decades following the Civil War experienced a highly gendered environment (Ogren, 1997). The pursuit of "intellectual manhood" was the chief goal of young men attending college in the Antebellum South (Williams, 2015). This was one facet of male maturity among others, including moral manhood, physical manhood, and social manhood. Though intellectual manhood was likely the foundation of all of these, since it provided men with the ability to think and reason, which were critical in the pursuit of morality and social prowess. Veysey (1965) wrote of a similar philosophy espoused by educators of the time: "Educators who believed in mental discipline often linked the word 'manly' to their notion of character. Manliness did not mean softness…Manliness meant power: the kind of power that one gained by a diligent wrestling with Greek grammar" (p. 28).

The social structure of educational institutions also continued to play a key role in these efforts of cultivating manhood. Though colleges of the late 19th century differed in many regards, all shared a common purpose: creating the college man (Handlin & Handlin, 1970). One frequently included component of the university experience and perhaps the most obvious example of collegiate masculinity was the fraternity. In his book, Syrett (2009) traced the progression of American fraternities and argued that since their beginnings in 1825, fraternities have been "regarded by most college students as the preeminent or hegemonic form of masculinity on college campuses, the standard by which all other college men were measured" (p. 3). He noted that their masculinity has been defined through the exclusion of others from their ranks and often from their broader sphere of influence on college life. Excluded groups included

not only women, but those men who did not adhere to the standards that were set by fraternity men. These standards shifted over time and included aspects of class, race, sexuality, athleticism, religion, and recklessness. Participation in a Greek letter organization along with participation in any other all-male organization on campus will be used as a variable in the present study.

As the turn of 20th century approached and economic changes shifted the roles of American men, the idea that men should be college educated became more prevalent (Clark, 2010). He argued that the force behind the growth of college-going behaviors was the college experiences way of fulfilling the new and varied desires of American men:

> The college man could be the vigorous athlete and the civilized scholar, the genteel leader and the modern professional. He could find fraternal bonding and 'instant' tradition, while indulging in a raucous sporting culture. He could simultaneously prove his self-made worth through athletics and work (as a student or after graduation). (p. 9)

Popular media of the day assisted in promoting the move toward college attendance (Clark, 2005). Many college leaders advocate for liberal education in popular magazines of the time. They described their curriculum and outcomes in masculine and elite terms, while arguing that college was the proper training grounds for business. Other magazines of the time also began writing extensively about the college life and curriculum. They focused on culture, fraternities, and athletics; all focused on idealized images of the college man.

As detailed previously, the increase in research around masculinity occurred around the same time that women became the majority gender on American college campuses: the 1970s (Archer, Pratt, & Phillips, 2001; Snyder, de Brey, & Dillow, 2016). In the time since, much attention has been paid to the intersection of education and masculinity, particularly with regard to how young boys navigate and engage with educational systems in their childhood and

adolescence (Lesko, 1999). Masculinity in higher education has also become a popular topic, especially as policy makers and administrators seek to better understand current issues of campus violence, sexual assault, and degree completion rates (Harper & Harris III, 2010; Laker & Davis, 2011). This has led to the call for a better understanding of men's development as men, making sure to focus on the role gender plays in that development. Men's development had previously been studied in the 1960s and 1970s, but without a specific consideration to the role gender played in their development (Edwards & Jones, 2009; Laker, 2003). In response to this need, Davis and Laker (2004) were among the first to offer recommendations for improving men's engagement on college campuses. Based on existing conceptual and theoretical framework around masculinity and gender role conflict, Davis and Laker suggested that men on campus would be better served by campus academic and student services if those programs considered men's development, intersections of identities, and practiced a balance of challenge and support. Because men arrive on campus already having been well-socialized into gender norms, much of the literature surrounding best practices to engage college men focus on creating safe and supportive environments for men to explore and challenge those existing norms (Berkowitz, 2011; Edwards & Jones, 2009; Harris III, 2010).

Kimmel (2008) provided an understanding of the rules that college-aged males have been socialized to follow in his book *Guyland*. Building on and further confirming the work of prior scholars (Brannon, 1976; Pollack, 1999), Kimmel formulated the rules of "Guy Code" from interviews he conducted with nearly 400 young men. The rules that emerged focused heavily on suppression of emotions ("Boys don't cry" and "Take it like a man"), negative views toward help-seeking ("I don't stop to ask for directions") and winning ("He who has the most toys when he dies, wins). The rules of Guy Code, Kimmel wrote, are maintained by three cultures that

pervade masculinity: a culture of entitlement, a culture of silence, and a culture of protection. These cultures are often discussed in research on rape culture and sexual assault among college fraternities (Seabrook & Ward, 2019).

Additional research on college masculinities has focused on the intersection of masculinity and race and ethnicity. In particular, scholars have produced significant research on Black masculinity and Latino masculinity in the college environment. Research regarding the Black male experience on campus cautions against any monolithic description of Black college men but does acknowledge the common beliefs that manhood is associated with sexual promiscuity and violence (Allen, 2020; Ford, 2011; Harris, Palmer, & Struve, 2011; Travers, 2019). Literature has also addressed the conflict between Black men who view academic excellence as not masculine and those who are seeking to redefine Black masculine norms to highlight academic excellence and campus involvement (Pelzer, 2016). In literature regarding Latino men on campus, the concept of *machismo* (hypermasculine pride) is often invoked and the negative role it plays in Latino men's perspectives of the college environment has been explored (Rodriguez, Blaney, Vasquez, & Salinas Jr, 2021; Rodriguez, Lu, & Bukoski, 2016; Sáenz, Mayo, Miller, & Rodriguez, 2015). Like the phenomenon discussed regarding Black men seeking to reframe success on campus as a masculine norm, the concept of *caballerismo* (family-centered, socially connected, and honorable) has been promoted as an alternative (to *machismo*) masculine norm that promotes connecting to the institution and seeking support when needed (Arciniega, Anderson, Tovar-Blank, & Tracey, 2008; Estrada & Jimenez, 2018). These intersections of other identities and masculinity are only two examples of many, but they do reiterate common masculine norms throughout literature, particularly violence, sexual promiscuity, and negativity toward help-seeking behaviors. The present study seeks to contribute

further to research on the intersection of race, ethnicity, and masculinity by including race and ethnicity as a variable.

Masculinity in Engineering Education

Masculine themes of exclusion were even further pronounced in the engineering subset of American higher education. From its beginning in the 19th century, non-Caucasian males were almost always excluded from engineering education in the U.S. (Frehill, 2004). This issue was clearly not unique to the area of engineering in higher education, but it further established the beginning of the engineering profession in America as a place only for white males.

Massachusetts Institute of Technology (MIT)—consistently ranked America's most premier engineering school—began admitting women in the late 19th century, though the institution still enrolled less than 100 female students in the 1940s, 80 years after the first female was admitted (Bix, 2000). During that same decade, MIT's president told students that enrolling at MIT was a "man-size job, and it will take max-size effort to get it done" (Bix, 2000, p. 25). Another essay emphasized the masculine traits of another profession: the engineer. Welcome traditions for students at MIT included baseball games and other male-bonding rituals, including an event at which students and their fathers could smoke cigars. Well into the 1960s, freshmen men were informed that the women at MIT were not of the feminine quality found at other area institutions; women at their institution were described as "five feet tall and equally wide" (Bix, 2000, p. 34). Historical accounts from the decades preceding World War II use the term "invade" to describe the admission and enrollment of small numbers of women in certain engineering schools (Bix, 2004). Campus humor magazines published cartoons of women with their hair stuck in equipment and using heavy-duty machinery to perform kitchen tasks.

Faulkner (2000) described engineering colleges as a “fraternity” where all participants survive the same “hazing experience” and build a community and culture from this (p. 107). She also called the environment a “technical locker room” where the “jocks” display their power through demonstrating their own technical competence and superiority (p. 108). From interviews with women in a New Zealand engineering program, Stonyer (2002) found that the women positioned themselves as masculine as possible by never crying or discussing life issues. This helped them become “almost guys,” never reaching exact parity with the males in the program and therefore confirming the dominant masculinity. To better understand engineering identity, Tonso (2006) conducted a three-year embedded ethnographic study among American engineering students. The study noted that engineering identity was ultimately decided by external verification of engineering identity by peers, not through personal identification or performance. Students in the study spoke about how engineers were characterized on campus, and those identities seldom referred to women and if they did, were often in a pejorative way. When the author asked men in the study what it was like to be a man on campus, they acknowledged they were in a place that privileged men and placed extra burdens on women. However, in subsequent questions about equality on campus, the men also noted that men and women were treated equally on campus. The author responded to this conflict:

> through a complicated cultural process of taking for granted the way their campus world was supposed to be – that is by demonstrating campus cultural knowledge about gender – instead of noticing the way their campus actually worked, student engineers actively learned to not notice a campus gender-status ideology with its roots in wider U.S. society (p.304).

In addition to these historical and cultural examples of engineering programs perpetuating masculinity, institutional messages and actors have been found to promote the idea of engineering as a masculine domain. De Pillis and de Pillis (2008) asked students to review mission statements of both liberal arts colleges and engineering schools and characterize their impressions of a hypothetical successful student at each institution. Based only on the review of mission statements, the hypothetical successful student at schools of engineering was determined to be more masculine, dominant, and forceful than the hypothetical liberal arts student. In 2005, Harvard president Lawrence Summers advocated the hypothesis that males are intrinsically advantaged in aptitude and motivation for math and science: dubbed the "Larry Summers Hypothesis" (Barres, 2006; Summers, 2005). This prompted researchers to publish many articles and even entire books in response to his claims, which were largely debunked (Hyde et al., 2008; Spelke & Ellison, 2009). More recently, another university president—Mitch Daniels of Purdue—held up the engineering-heavy (and simultaneously male-dominated) student population on his campus as a solution to the ongoing underrepresentation of men on college campuses, which was met with immediate criticism that he missed the real issues surrounding the gender gap, especially with regard to the underrepresentation of women in engineering (Daniels, 2022; Flaherty, 2022).

While today's engineering student population on college campuses is around 77% male (Roy, 2019), males currently lag behind females in student persistence rate to the second year and the six-year graduation rate (American Society for Engineering Education [ASEE], 2017). The most recently published data from 2015 showed that females had a retention rate of 82.7%, while the overall population of engineering students had a retention rate of 81.5%. In 2011 (the most recently available data), the six-year graduation rate for women was 63.9%, while the rate

for all engineering students was 59.9%. Though participants in the present study are all men, these retention data points are important to consider because they show that men in engineering—while overrepresented—are being outperformed by their female colleagues in these critical academic performance benchmarks. The next section reviews other relevant literature regarding what is known about the intersection of engineering and other variables used to describe participants in the study.

Relevant Literature Regarding Study Variables

This final section reviews literature relating specifically to the variables used in this study. Relevant literature is provided on the intersection of engineering education and the demographic variables used in the study—race, sexual orientation, and Greek life participation—and then the chapter concludes with a review of literature on men in female-dominated majors and belonging (two key independent variables).

Race/Ethnicity

Much of the literature regarding underrepresented demographics in engineering focuses on women and students from racial and ethnic minorities. The National Science Foundation (NSF, 2019) promotes use of the term "underrepresented minority (URM) students" to define engineering students who identify as African American, Latinx, or American Indian or Alaska Natives. In 2018, male URM students made up 19.5% of undergraduate engineering enrollment, while they represented 30.4% of the overall undergraduate enrollment (National Center for Science and Engineering Statistics [NCSES], 2021). Graduation rates for URM males in engineering are not readily available; however, the most recent data available shows the six-year graduation rates for URM groups are lower than White and Asian students (ASEE, 2017). In 2011, six-year graduation rates for all White and Asian students were 60.3% and 68.7%,

respectively, while rates for all African American, Latinx, and American Indian or Alaska Native students were 41.2%, 49.6%, and 49.5%, respectively. These students have also been shown to perceive the engineering curriculum as more challenging and feel less of a sense of belonging than Caucasian students (Marra, Rodgers, Shen, & Bogue, 2012). This finding is particularly of interest for the present study as belonging is a key variable being analyzed. Based on this literature, it is to be expected that participants in the present study who are from an underrepresented racial or ethnic group will report lower sense of belonging scores in engineering. The literature presented earlier in this chapter regarding Black and Hispanic masculinity suggests that conformity to masculine norms among those populations will be similar to or above that of White and Asian men in the study.

Fraternity Life

While fraternity life is a heavy focus of research on masculinity in college (DeSantis, 2007; Sanday, 1992; Syrett, 2009), there is little published on the overlap of engineering education and Greek life relevant to this study's goals. Tonso's (1999) ethnography on engineering student culture did identify "Greeks" as one of three main student cultures among engineers; "Academic-achievers" and "Nerds" being the others. That study elaborated on some of the differences between engineers who participate in Greek Life and those who do not but included a very limited sample and does not include relevant application for this study. Research on engineering student success does often cite the positive effect of engagement in campus organizations on student persistence, which aligns with existing research on engagement among college students broadly (Lee, Godwin, & Nave, 2018; Simmons & Chau, 2020; Tinto, 1993; Veenstra, Dey, & Herrin, 2009). Including fraternity participation as a variable in the present study provides the opportunity to analyze the relationship between conformity to masculine

norms and participation in an environment outside of engineering that is also deeply connected to masculine norms. Given the prevalence of masculine norms in both environments—engineering and fraternity life—it is reasonable to assume that students in either group will report higher conformity scores than those who are in neither group.

Sexual Orientation

Only in this current century has literature began to include research on LGBTQ engineers (Cech & Waidzunas, 2011). While research on this specific population is scarce, scholars have called for LGBTQ students to be included in the discussion of populations that are underrepresented and marginalized in engineering education (Cech & Rothwell, 2018). As mentioned earlier in this chapter, the engineering environment has often been found to endorse heteronormativity, which would certainly impact the environment LGBTQ students experience (Bilimoria & Stewart, 2009; Cech & Waidzunas, 2011; Kitzinger, 2005). Cech and Waidzunas (2011) reported that gay male engineering students felt they were often stereotyped as feminine and therefore less technically skilled. This was closely related to the heteronormative climate of engineering, which they noted as maintaining a "sharp distinction between two sexes" (p.2). In one of the few studies of its type, Hughes (2018) found that LGBTQ students were 7% less likely to be retained in STEM programs compared to non-STEM, after controlling for known factors that impact retention. The inclusion of sexual orientation as a variable in this study assists in addressing the lack of research on the LGBTQ engineering student population and will also provide further examination of the previously mentioned connection between heteronormativity and engineering culture, which would suggest that non-heterosexual students will report a lesser sense of belonging in engineering programs. It is expected that men in the study who do not

identify as heterosexual will report lower conformity to masculine norms than the heterosexual study participants.

Men in Female-Dominated Majors

This study uses men in female-dominated majors as a comparison group to engineering students. Literature regarding this population is less prevalent than the literature concerning women in male-dominated majors, which often focuses on the climate women experience in academic environments where they are in the gender minority (Dresden, Dresden, Ridge, & Yamawaki, 2018; Lawson, 2020; Steele, James, & Barnett, 2002). Though few, some researchers have focused on characteristics of and gender conformity among men in gender atypical fields. Chusmir (1990) proposed a model of men's nontraditional career choice and suggested that these choices were produced from an interaction of personal, family, and societal influences moderating. Lease (2003) used data from college students to test Chusmir's model and found that men with more "ideologically liberal social attitudes" (p. 253) were more likely to choose occupations that were gender balanced or female-dominated. In a study of male undergraduate and graduate students, Jome and Tokar (1998) found that men in female-dominated majors were less likely to endorse traditional masculine values and behaviors, such as antifemininity, toughness, and homophobia. A recent study by Beutel, Burge, and Borden (2019) used the original version of the instrument used in this study (CMNI-94) to explore the relationship between conformity to masculine norms and choice of major among U.S. college men. After controlling for race/ethnicity, academic year, and parental education attainment, they found the most significant relationships between choice of major and the subscales measuring emotional control and primacy of work norms. Their study included engineering students in a broader category of "STEM and Medicine" and found that men in that category scored higher on the

emotional control norm than students in health sciences, arts and humanities, and communication and media. Additionally, their study used STEM and medicine students as a comparison group and found few or no significant associations between masculine norm subscale scores and choosing a major in business and social and behavioral sciences students. They concluded that business, social and behavioral sciences, and STEM and medicine fields "may attract similar groups of men in terms of their adherence to masculinity and may be perceived as similarly masculine fields of study" (p. 385). This research suggests that men in female-dominated majors should report lower conformity to masculine norms than those of their engineering peers in the present study. The present study expands on these studies by comparing masculine norm conformity among engineering students to men in majors where women are the majority.

Sense of Belonging

This study uses belonging in academic major as a key variable in its third research questions. Therefore, it is important to briefly explain this concept and how it has been applied to the study of college students. The concept of belonging is rooted in Maslow's (1943) hierarchy of human needs, which placed "love and affection and belongingness needs" (p.380) in the middle of the pyramid of needs. This basic need was placed above physiological and safety and below esteem and self-actualization. Theorists since have adopted this concept and identified the need to belong as a driver for the human desire to form relationships, deemed crucial for survival (Ainsworth, 1989; Axelrod & Hamilton, 1981; Buss, 1990; MacDonald & Leary, 2005). Hagerty, Lynch-Sauer, Patusky, Bouwsema, and Collier (1992) proposed two key components of belonging: feeling valued, needed, and accepted and feeling that one's characteristics fit within a system or environment. Additionally, they argued that belonging is context-dependent, meaning that the individual contextualizes the feeling based on settings, like a social club or a workplace.

Baumeister and Leary (1995) further expanded on belonging research by introducing the idea of a "need to belong" in a widely cited study that summarized previous findings of the negative effects of failure to form relationships with others. They argued that the need to belong served as a fundamental motivation among humans. Lambert et al. (2013) sought to explore the meaning of belonging further by examining whether individuals felt as though they fit in a specific setting or context, instead of merely just recognizing that they have positive social relationships. In their research, they chose to label this as "sense of belonging," and their distinction of the concept connects closely to how the belonging is used in this study.

Higher education researchers have long explored the importance of a student's connection to the campus community. Similar to belonging, Schlossberg's (1989) concept of mattering addressed college students particularly and detailed four characteristics that can make individuals and groups feel as though they matter to a community: attention, importance, ego extension, dependence, and appreciation. Another related explanation was offered in Tinto's (1993) seminal work that focused on a student's sense of belonging as a key factor in determining college student success. His framework of academic and social integration offered a variety of campus connection points—academic and social—that could aid in a student's integration to and persistence through college. Strayhorn (2019) defined sense of belonging specific to the college context as "students' perceived social support on campus, a feeling or sensation of connectedness, and the experience of mattering or feeling cared about, accepted, respected, valued by, and important to the campus community or others on campus such as faculty, staff, and peers" (p.4). Research on belonging, in particular, has been conducted throughout a variety of higher education segments and has been positively associated with student success, persistence and mental health (Freeman et al., 2007; Gopalan & Brady, 2020;

Zumbrunn et al., 2014). This study uses an adaptation of a short instrument designed by Weeks, Asher, and McDonald (2012) that was specifically designed to assess feelings of belonging within an educational environment. The use of belonging in this study is important because of the proven connection between belonging and student persistence (Hausmann, Schofield, & Woods, 2007; Strayhorn, 2008; Yi, 2008). Strayhorn (2019) detailed his research on STEM college students and sense of belonging, summarizing that belonging in STEM is positively associated with satisfaction with college, earning better grades, and intention to stay at their institution. These critical outcomes provide an important link between this study's goals and student success, which help inform the study's implications for practice.

Conclusion

The chapter has provided the reader with a background on the key terms and concepts used in this study. An explanation of the difference between sex and gender and how the performance of gender is influenced and shaped began the chapter. Following that, a description of the evolution of the study of masculinity was given, along with a summary of hegemonic masculinity, explanation of the term "masculinities," and a rationale for the use of gender binary language in the study. The gendered history of engineering was then provided along with a history of American masculinity and the masculine themes in American higher education. Finally, literature regarding key concepts of this study were introduced, including an overview of variables and their relationship to engineering education, as well as a detailed summary of masculine norm literature and an explanation of the concept of belonging.

Chapter 3: Methods

This chapter presents the research methodology used to quantitatively examine conformity to masculine norms among male engineering students at a midwestern research university. The study answers the following research questions:

1. What are the characteristics of male engineering college students at a midwestern research university and how do they score on measures of conformity to masculine norms?
2. How do characteristics of male engineering college students at a midwestern research university and their scores on measures of conformity to masculine norms differ from male college students in female dominated majors (i.e., psychology, journalism, biology, education)?
3. Controlling for relevant background characteristics and gender salience, what is the relationship between conformity to masculine norms and sense of belonging in academic major among college males?

A description of the sample and data collection process begins the chapter, which is then followed by an explanation of the main dependent variable used: the Conformity to Masculine Norms Inventory (CMNI-46). Next, the instrument used to measure belonging is described, along with measures of other independent variables. The chapter concludes with a summary of the data analysis process used and limitations of the study.

Sample

This survey was administered at a four-year, public, majority undergraduate university with a Carnegie Classification of Doctoral University: Very High Research Activity and a student population of around 27,000. The population surveyed for this study identified as male,

American undergraduate students attending the university in the 2019-2020 academic year. Because the study instrument being used was developed based on gender norms in the United States, it is therefore appropriate to include only those who are U.S. citizens. The survey was administered to the total population of American male undergraduate students at the research site. Email addresses of all male-identifying, undergraduate domestic students were provided for this population by the institution's research office. The Institutional Research office receives gender data from the student's initial admissions application, which asks students to self-report gender. Additionally, the first question posed to respondents was "Do you identify as a male/man?" Only respondents who answered "yes" were advanced to the rest of the survey. This ensured that gender identification was not assumed from the data provided by the Institutional Research office and was actually confirmed by the survey participant.

Data Collection

Prior to survey administration, human subjects approval was received from the University of Kansas' Human Research Protection Program in October 2019 (see attached in Appendix A). In December 2019, the survey was distributed by email via Qualtrics to 8,397 potential participants. Participants were first emailed a request to participate and then sent a reminder email four weeks after the original email request. Informed consent was provided to the participant online before the survey began (see attached in Appendix B). Participation was incentivized with the chance to be entered into a drawing to win one of four $25 Amazon gift cards. Responses were anonymous, as no personal identifying information was collected. The survey received 1,647 participant responses, which represented an 19.6% response rate. Data were then downloaded from the Qualtrics website and analyzed for missing items. Responses from participants who did not confirm they identify as a male/man, who did not complete all

items of the survey, or did not report their major were eliminated. This left 1,429 responses to be used in the study.

Conformity to Masculine Norms Inventory (CMNI)

Many measures of gender role performance exist, however the instrument chosen for this study was developed and validated using theoretical foundations like those detailed in the previous chapter. The original Conformity to Masculine Norms Inventory (CMNI) was designed by Mahalik et al. (2003) to measure attitudes, behaviors, and cognitions reflecting both conformity and non-conformity to 11 masculine normative messages. The 11 messages—Winning, Emotional Control, Risk-Taking, Violence, Power Over Women, Dominance, Playboy, Self-Reliance, Primacy of Work, Disdain for Homosexuals, and Pursuit of Status—form subscales on which results are reported, and then an overall score can be reported based on the sum of all items. To begin the process of constructing the measure, Mahalik et al. reviewed literature on traditional masculine norms in the United States, conducted focus groups with several hundred college-aged students on the topic of masculinity, and consulted many other assessments designed to assess gender role conflict and conformity to masculine norms. Originally, the instrument was comprised of 144 items and was narrowed to 94 items after a factor analysis was conducted. Items are all answered on a 4-point Likert scale (1 = strongly disagree to 4 = strongly agree), and authors estimate an administration time of 10-15 minutes (Mahalik et al., 2005).

In the initial publication of the CMNI, the authors detailed five studies the authors conducted to assess the reliability and validity of the CMNI prior to its publication (Mahalik et al., 2003). Two of these studies, in particular, addressed issues of reliability. The first examined internal consistency and indicated a coefficient alpha of .94 for the CMNI score. Eleven

subscales are used to make up the CMNI, and those alphas ranged from .72 to .91. The other study within the article used to establish reliability used a test-retest study. From this study, the overall CMNI test-retest coefficient was .95. However, the subscales produced a range from .51 to .96. Most subscales (9 of 11) produced alphas over .70. The test-retest period was relatively short—two to three weeks—and also had 40 participants. Mahalik et al. (2003) used three other measures to validate the CMNI. These were the Brannon Masculinity Scale—Short Form (Brannon & Juni, 1984), the Gender Role Conflict Scale (O'Neil et al., 1986), and the Masculine Gender Role Stress Scale (Eisler & Skidmore, 1987). Positive and significant relationships were found between the CMNI and each of the three concurrent measures.

A companion measure to the CMNI was created and published by Parent and Moradi (2009), who conducted the first factor analysis on the CMNI since its initial publication, and this is the instrument used in the present study. After conducting the factor analysis, Parent and Moradi affirmed the use of the CMNI as a worthy instrument to examine male gender performance but questioned the inclusion of two subscales: Dominance and Pursuit of Status. In their suggested revision of the instrument, the authors eliminated 44 items that produced factor loadings of less than .60 and four other lowest scoring items in subscales where all items were above .60. This was done to achieve optimal subscale length. Ultimately Parent and Moradi's revisions resulted in a 46-item test, appropriately named the CMNI-46. In addition to a shorter administration time, the authors proposed their revisions further refined the conceptual and empirical framework of the measure. Another adaptation to the original instrument that was made in this revision reflected changing cultural norms regarding attitudes toward homosexuality. Since the creation of the CMNI, a significant change in the acceptance of homosexuality occurred among the American public (Brewer, 2014). Though not in direct

response to shift in public opinion, Parent and Moradi (2009) noted the problematic title of the subscale "Disdain for Homosexuals," stating APA recommendations against using "homosexuals" as a noun and also noting that none of the items in that subscale address attitudes toward gay or lesbian people, but instead the desire to present oneself as a heterosexual. Subsequently, in the CMNI-46, Parent and Moradi renamed the subscale "Heterosexual Self-Presentation."

Some concerns with the sample Parent and Moradi (2009) used to produce their revision should be noted. Primarily, the sample size used (n=229) appeared small. This was addressed by the authors, however, who stated their sample exceeded Kline's (2005) recommendations for confirmatory factor analysis sample size as well as the recommendations of MacCallum, Browne, and Sugawara (1996). Another potential cause for concern with the sample used was the nationality of the participants in the revision. While Mahalik's participants were American, Parent and Moradi's sample was made up of Canadian males. The authors responded to this, however, and stated that the Canadian sample means were similar to the means found in the original CMNI study. Parent and Moradi (2011) conducted further examination of the reliability, validity, and factor structure of the CMNI-46 with another sample of American college males. Their overall findings in that study supported the original CMNI-46 data and further confirmed its applicability in this area.

Though the evolving and fluid nature of gender norms in a single culture can prompt concern about the use of quantitative methods to measure gender performance or conformity, the careful construction of the CMNI—including its strong conceptual framework and the thorough quantitative and qualitative methods used to create it—provides researchers with a strong tool to use in research on masculinity. Additionally, the revisions put forth by Parent and Moradi (2009)

appear to at least maintain the level of integrity of the initial measure, if not increase it; all while reducing the administration time for participants. Measuring masculinity produces significant challenges related to construct validity, and quantitative measures must be firmly rooted in relevant literature and theory to ensure they remain relevant and valid.

Since the publication of the CMNI-46, the instrument has continued to be critiqued and additional abbreviations of the original CMNI-94 have been proposed (Hsu & Iwamoto, 2014; Levant et al., 2020; Owen, 2011). Recent research using the CMNI and its abbreviated versions have suggested using the instruments' subscales only in research, in favor of reporting the total score as a single measure of masculine norm conformity. After conducting a factor analysis on three measures of masculinity, Levant et al. (2015) promoted the use of CMNI-46 subscale scores while cautioning against the use of a total score. Hammer, Heath, and Vogel (2018) also found a lack of support for using the CMNI-46 to measure overall conformity to masculine norms and suggested the CMNI-46 be used to measure specific norms. Gerdes and Levant (2018) found that use of the total score obscures the complexity of subscales' relationships to each other and other variables, thus also advocating for the reporting of subscale scores.

In response to these recommendations, the present study reports the scores from the nine CMNI-46 subscales and not a total score of all items. Items for each subscale were totaled, with some reverse scored. Reverse scored items are italicized below. This study presents the mean score for each respondent on each individual subscale. The nine subscales and examples of some survey questions for each subscale are as follows:

Table 1

CMNI-46 Subscales and Example Items

Subscale	Example Survey Items
Winning (6 items)	• In general, I will do anything to win • It is important for me to win
Emotional Control (6 items)	• I never share my feelings • I hate it when people ask me to talk about my feelings
Risk-Taking (5 items)	• *In general, I do not like risky situations* • I frequently put myself in risky situations
Violence (6 items)	• *I am disgusted by any kind of violence* • Sometimes violent action is necessary
Power Over Women (4 items)	• In general, I control the women in my life • I love it when men are in charge of women
Playboy (4 items)	• If I could, I would frequently change sexual partners • *I would only have sex if I was in a committed relationship*
Self-Reliance (5 items)	• *I am not ashamed to ask for help* • It bothers me when I have to ask for help
Primacy of Work (4 items)	• My work is the most important part of my life • Work comes first
Heterosexual Self-Presentation (6 items)	• *It would not bother me at all if someone thought I was gay* • I try to avoid being perceived as gay

Note. Reverse scored items are italicized.

Sense of Belonging in College Major

In response to criticism that existing measures of feelings of belonging include presumed causes of belonging, Weeks et al. (2012) produced a short instrument that focused on feelings of belonging and did not hypothesize on causes of those feelings. Their instrument—The College

Belongingness Questionnaire—was designed for use with students and asked respondents about their feelings of belonging at a "school." Participants in the present study were provided with the six statements adapted from the instrument. In this study, the word "school" was replaced with "major" to focus responses on feelings on belonging within academic major. These statements asked participants to respond on a 5-point scale where 1 represented "strongly disagree" and 5 represented "strongly agree" to these items:

1. I feel like I belong in my major.
2. It's hard for me to fit in my major.
3. I feel connected to my major.
4. I feel welcome in my major.
5. This is definitely the right major for me.
6. I'm glad I chose this major.

All items were found to load onto a single factor and produce high internal reliability (α=.91) with a college sample (Asher & Weeks, 2013). To produce the belonging score, responses are scored (with item 2 reverse scored) and totaled. In this study, the results of this score are presented as a mean score of the six items.

Independent Variables

Participants in the present study were asked to respond to demographic data questions including age, year in college, race, and sexual orientation. Due to limited sample size of respondents identifying as gay or bisexual, those two responses have been combined. Also due to small sample sizes, any respondent who identified with at least one underrepresented minority race (Black/African American, American Indian/Native American, or Hispanic/Latino) was coded as an underrepresented minority. This follows the guidance from the National Science

Foundation (2019), as was detailed in the prior chapter. The coding of these variables is shown in Table 2. In addition to demographic information, the following independent variables used in this study were selected due to their relevance to gender and the college environment.

Table 2

Demographic Variables and Codings

Category	Coding
Year in college	• 1st = 1 • 2nd = 2 • 3rd = 3 • 4th = 4 • 5th or more = 5
Race	• If the individual selected White/European American and/or Asian/Pacific Islander = 0 • If the individual selected Black/African American, American Indian/Native American, or Hispanic/Latino = 1
Sexual orientation	• Heterosexual/Straight = 0 • Gay = 1 • Bisexual = 1

Female-Dominated Majors

Research question 2 includes a variable identifying participants who are males in majors that are majority-female by population. Majors determined to be majority-female had to be above 60% female by undergraduate population at the research site during the academic year the study was conducted, as well as also be shown to have at least 60% female population in two national data samples collected within five years of this study (National Center for Education Statistics, 2016, 2018). This decision was made to ensure that these majors were also female dominated in national data and not only at the institution where the data was collected. There were 286 responses from men in these majors, which included the following:

- American Studies
- Anthropology
- Applied Behavioral Science
- Biological Sciences
- Communication Disorders
- Community Health
- East Asian Languages and Cultures
- Elementary Teacher Education
- English
- Environmental Studies
- French, Francophone and Italian Studies
- Human Biology
- Journalism
- Law and Society
- Linguistics
- Molecular Biosciences
- Music Therapy
- Psychology
- Secondary Teacher Education
- Social Welfare
- Sociology
- Women, Gender and Sexuality Studies

This variable was coded as “engineering major = 0” or "female-dominated major = 1"

Greek Letter Fraternity and All-Male Organization Participation

Participants were asked if they were currently affiliated with a Greek letter fraternity and also were asked if they were currently a member of any all-male organization or team. Responses were "Yes" or "No." Each question was separately coded: 0 = no and 1 = yes.

Gender Salience

The final survey question asked each participant to rate how important gender is to his identity by asking "When considering your identity, how important is gender as part of your identity?" Four choices were provided and coded as indicated: not very important (1), somewhat unimportant (2), somewhat important (3), very important (4). Bittner and Goodyear-Grant (2017) outlined the importance of examining the strength of study participants' attachment to gender identity since gender is typically a critical factor in one's social identity. This measure of salience is even more important in this study since gender identity is a critical concept being explored.

Data Analysis

After downloading responses from the Qualtrics server, responses from individuals who did not identify as a male or man were removed, along with those who did not complete all CMNI-46 items and provide an academic major. Those responses were imported into SPSS to begin recoding. CMNI-46 item responses and Belonging scale items were then coded based on the instructions detailed above, and the CMNI-46 subscales were then created. All CMNI-46 subscales and the Belonging scale were tested for reliability. Those results are reported in Table 3. Following that, means for each of them were created. Then the demographic variables were coded as detailed above, along with gender salience score, Greek letter fraternity participation

and all-male organization participation. Next a variable was created to indicate if a respondent was from a major in engineering or a female-dominated major.

Table 3

Cronbach's Alpha Scores for Scales

Scale	Number of Items	α
Winning	6	0.847
Emotional Control	6	0.910
Risk-Taking	5	0.811
Violence	6	0.858
Power Over Women	4	0.810
Playboy	4	0.791
Self-Reliance	5	0.866
Primacy of Work	4	0.827
Heterosexual Self-Presentation	6	0.913
Belonging	6	0.870

Research question 1 is answered through reporting of descriptive statistics (frequencies, percentage of samples, means, standard deviations, etc.) on all of the study's independent variables for the male engineering college students and the other male college students in the study. Descriptive statistics are presented for the nine CMNI-46 subscales and the Belonging scale. Additionally, bivariate t-tests were conducted using the demographic variables, gender salience, Greek letter participation, all-male organization participation, and belonging score as

dependent variables to determine whether there are statistical differences between the engineering males and their peers.

Research question 2 is answered through t-tests conducted for each of the nine CMNI-46 subscales comparing the male engineering students with the male college students in female dominated majors.

Research question 3 is answered by analyzing responses of males studying engineering via multiple regression analysis. Control variables included the demographic variables, gender salience, and Greek letter fraternity and all-male organization participation. The nominal independent variables were coded as outlined in Table 4. Independent variables were tested for multicollinearity using variance inflation factor (VIF). The dependent variable was the sense of belonging score, and key independent variables were the nine CMNI-46 subscales. The nine CMNI-46 subscales were tested for correlation with each other by running a bivariate Pearson Correlation. This analysis was used to analyze the relationship between the nine subscales and belonging among the engineering males in the study.

Table 4

Codings for Nominal Independent Variables Used in Research Question 3

Category	Coding
Race	• If the individual selected White/European American and/or Asian/Pacific Islander = 0 • If the individual selected Black/African American, American Indian/Native American, or Hispanic/Latino = 1
Participates in a Greek letter fraternity	• No = 0 • Yes = 1
Participates in an all-male organization	• No = 0 • Yes = 1

Limitations of the Study

This study used one single measure of masculine norm conformity published nearly two decades ago. Though it is currently the most widely used measure of masculine norm conformity (Wong et al., 2020) and has been revised, it may not reflect the most current environment of masculinities in America. Additionally, the measure used in this study asked participants to provide their own reactions and adherence to a particular masculine norm as opposed to their perspective on the prevalence of a norm in a particular environment or setting. Therefore, this study is only able to provide insight into the individual's self-perceptions of masculine norm adherence and not the prevalence of masculine norm adherence within an academic major culture. Also, because this study is cross-sectional, it does not allow for analysis of change in conformity to masculine norms over time in an academic environment, so the effect of time in an engineering environment on an individual's masculine norm conformity cannot be explored. Another limitation is the study's inability to determine the level to which each respondent feels immersed in the culture and environment of his academic major. While the belonging variable is used to help determine one's level of connection to and comfort with an academic major, it does not and cannot attempt to measure the impact that environment has on an individual's attitudes.

Finally, this study is limited by the single site from which participants were recruited, as well as the limited ethnic and racial diversity among the sample. Because of the limited representation of underrepresented students, this study combines males who identify with one of those groups (Black/African American, American Indian/Native American, or Hispanic/Latino) into the same category. This limits the study's ability to assess the nuances particularly of Black and Latino masculinity that are documented and were presented in the literature review.

Conclusion

This chapter described the process conducted to answer the study's research questions. An explanation of the primary instrument used in the study—the CMNI-46—was provided, along with details on its reliability and validity. Additionally, an explanation of the decision to use the instrument's subscale scores was provided. Other variables were summarized, and the data analysis process was described, along with study limitations.

Chapter 4: Results

The purpose of this study was to quantitatively examine the extent to which undergraduate men studying engineering at a Research University conform to masculine norms. This chapter reports the quantitative results of the study's research questions, which are:

1. What are the characteristics of male engineering college students at a midwestern research university and how do they score on measures of conformity to masculine norms?
2. How do characteristics of male engineering college students at a midwestern research university and their scores on measures of conformity to masculine norms differ from male college students in female dominated majors (i.e., psychology, journalism, biology, education)?
3. Controlling for relevant background characteristics and gender salience, what is the relationship between conformity to masculine norms and sense of belonging in academic major among college males?

All the respondents to this study's survey identified as male and were undergraduate, domestic students at a four-year, public, majority undergraduate university with a Carnegie Classification of Doctoral University: Very High Research Activity during the Fall 2019 semester. Of the 1,429 complete responses received for this study, 338 were from engineering students and 291 were from male college students in one of the majors identified as female-dominated, which were defined as majors over 60% female by undergraduate population at the research site during the academic year the study was conducted, as well as also be shown to have at least 60% female population in two national data samples collected within five years of this

study. Only the data from participants belonging to one of these two groups were used in the analysis presented in this study.

Research Question 1- What are the characteristics of male engineering college students at a midwestern research university and how do they score on measures of conformity to masculine norms?

This research question was answered by reporting the descriptive statistics on the independent variables collected in the study, as well as those of the nine CMNI-46 subscales and the Belonging scale, from the engineering male students who submitted complete responses. The entire sample for this study was compared to the available known data available for the campus population to determine if the sample gathered was like the campus population. Campus population data was received from the campus's institutional research office. Campus population data on sexual orientation was not available. In place of that figure, data from the Fall 2019 National College Health Assessment was used (American College Health Association, 2020).

Following guidance from the National Science Foundation (2019) regarding underrepresented minority students, any respondent who identified with at least one underrepresented minority race/ethnicity (Black/African American, American Indian/Native American, or Hispanic/Latino) was counted as an underrepresented minority. The engineering sample contained a slightly lower portion of underrepresented minority students (13.3%) than the total study sample (14.6%) and the campus figure (14.1%). Due to limited sample size of respondents identifying as gay or bisexual, those two responses were combined. Males who identified as gay or bisexual made up 8.6% of the engineering sample, which was considerably lower than the total sample rate of 14.3%. While a comparable campuswide figure was not available, this number came in slightly lower than the figure found in a nationwide survey of

undergraduate students during that same time period, which was 9.4%. Due to the lower figure and also because this variable is of interest to gender norms, a chi-square test for association was conducted to determine if gay and bisexual males were significantly less represented in the engineering sample, compared to the rest of the sample of non-engineers. The result indicated a statistically significant difference between the two groups, $\chi 2(1, N=1411) = 11.923$, $p < .001$, though the association between group (engineer or non-engineer) and sexual orientation was negligible, $\varphi = -0.092$, $p = <0.001$.

Respondents were asked if they participated in a Greek-letter fraternity and if they participated in any other organization that was exclusively male. Engineers reported a 15.4% participation rate in fraternities, lower than the overall sample and campus rates of 20% and 18%, respectively. Additionally, respondents were asked if they were members of any other all-male organization on campus, aside from a Greek-letter fraternities. The participation rate in all-male organizations for engineers was 18.7%, lower than the study sample rate of 20.4%. As this question was unique to this study, a campuswide figure was not available. Year in college was also collected in the survey, and the distribution of responses is roughly similar across all options, with first year producing the most responses (25.2%) followed by third year (23.4%), fourth year (21.0%), second year (20.4%), and fifth or more (9.2%). Comparison figures for the study and campus are presented in Table 5. Research question two will elaborate on the demographic differences between engineering and female-dominated major students. Detailed results of these comparison are presented in Table 5.

Table 5

Demographic Statistics for Study Sample and Campus Population

Table 5: Demographic Statistics for Study Sample and Campus Population

Variable	Study sample (n=1,429)	Campus population	Engineering students in sample (n=338)	Female-dominated major students in sample (n=291)
Major group				
Engineering men	23.9% (338)	24.4%		
Men in female-dominated majors	20.6% (291)	17.0%		
Men in other majors	55.5% (800)	58.6%		
Race				
White/European American and/or Asian/Pacific Islander	83.9% (1,199)	80.3%	85.5% (289)	82.5% (240)
Black/African American, American Indian/Native American, or Hispanic/Latino	14.6% (209)	14.1%	13.3% (45)	16.2% (47)
Did not report	1.5% (21)	0.5%	1.2% (4)	1.4% (4)
Sexual orientation				
Heterosexual/ Straight	85.7% (1,225)	88.2%	91.4% (309)	77.0% (224)
Gay or Bisexual	14.3% (204)	9.4%	8.6% (29)	23.0% (67)
Participates in a Greek letter fraternity	20.0% (286)	18.0%	15.4% (52)	19.2% (56)
Participates in an all-male organization	20.4% (292)		18.7% (63)	18.6% (54)
1st year in college	22.4% (320)	22.1%	25.2% (85)	23.0% (67)

Variable	Study sample (n=1,429)	Campus population	Engineering students in sample (n=338)	Female-dominated major students in sample (n=291)
2nd	21.5% (307)		20.4% (69)	23.4% (68)
3rd	22.9% (327)		23.4% (79)	24.4% (71)
4th	22.8% (326)		21.0% (71)	18.6% (54)
5th or more	9.2% (131)		9.2% (31)	9.6% (28)
Did not report	1.3% (19)		0.9% (3)	0.9% (3)
18	15.2% (217)	17.2% (1,477)	15.7% (53)	13.7% (40)
19	19.2% (274)	19.6% (1,684)	21.3% (72)	20.6% (60)
20	17.6% (252)	18.1% (1,559)	20.1% (68)	19.6% (57)
21	21.2% (303)	18.9% (1623)	18.0% (61)	19.6% (57)
22	11.1% (159)	10.0% (858)	8.9% (30)	8.9% (26)
23 or older	15.3% (219)	14.6% (1,252)	16.0% (54)	17.5% (51)

Note. Institutional level data did not list races selected when a student identified as two or more races; therefore, those numbers were excluded from the total count above.

Because of the importance of gender identity as a concept in this study, all respondents were asked to rate how important gender is to his identity on the following scale: not very important (1), somewhat unimportant (2), somewhat important (3), very important (4). The average gender salience response of engineering men was 2.30, which was lower than the total sample average of 2.46. This put respondents' average feelings about gender salience around the middle of the scale, somewhere between somewhat unimportant and somewhat important.

Another important concept in this study is belonging. Participants in this study were provided with the six statements adapted from The College Belongingness Questionnaire (Weeks

et al., 2012) that focused on belonging within academic major. The statements were scored on a 5-point scale where 1 represented “strongly disagree” and 5 represented “strongly agree,” where a higher score indicates a higher sense of belonging. In this study, the results of this score were calculated as a mean score of the six items. Engineering males reported an average score of 4.14, while the total sample produced a near identical 4.15. This indicated a strong sense of belonging in academic major for both groups.

As this study’s key dependent variable, conformity to masculine norms was measured using Parent and Moradi’s (2009) Conformity to Masculine Norms Inventory (CMNI-46). This 46-item instrument measured participants’ attitudes, behaviors, and cognitions reflecting both conformity and non-conformity to nine masculine normative messages: Winning, Emotional Control, Risk-Taking, Violence, Power Over Women, Playboy, Self-Reliance, Primacy of Work, and Heterosexual Self-Presentation. Winning subscale items asked the respondent about views on the importance of winning. The Emotional Control subscale measured the individual’s endorsement of control of emotion of expression. Risk-Taking assessed how much the respondent enjoys taking risks. Violence items asked individuals to respond to the need for violence at times. The Power Over Women subscale assessed attitudes toward control over women. The Playboy norm evaluated the individual’s attitudes toward sexual activity with multiple partners. Self-Reliance focused on the respondent’s likelihood to ask for help. The Primacy of Work subscale measured the endorsement of work as a primary focus of life. Heterosexual Self-Presentation asked respondents to react to the importance of being identified by others as heterosexual. Each item was answered on a 4-point Likert scale (1 = strongly disagree to 4 = strongly agree), and the items all aligned with one of the nine messages to form nine subscales. This study calculated a mean score for each respondent on each individual

subscale. A higher score indicated stronger conformity to the masculine norm message identified in that subscale.

Engineering men's mean scores on the subscales in order from highest to lowest were:

1. Violence
2. Winning
3. Emotional Control
4. Primacy of Work
5. Risk-Taking
6. Self-Reliance
7. Heterosexual Self-Presentation
8. Playboy
9. Power Over Women.

Engineering males averaged a score of 2.85 on the Violence subscale, which indicates an average position close to "agree" for all the statements related to that norm. The only other subscale average score that fell closer to "agree" than "disagree" was the Winning norm. Mean scores for six norms fell closer to "disagree" in the range between "disagree" and "agree." In order from closer to "agree" to closer to "disagree," those six norms were: Emotional Control, Primacy of Work, Risk-Taking, Self-Reliance, Heterosexual Self-Presentation, and Playboy. The lowest scoring norm was Power Over Women, and its mean score of 1.61 placed it near the midpoint of "strongly disagree" and "disagree." Table 6 provides further detail on subscale scores from the engineering male respondents. Overall, these results indicate that the engineering males disagreed with the majority of these norms, and when they did agree, on average, the level of agreement was weak.

Table 6

Mean Scores of CMNI Subscales for Engineering Male Respondents

Scale	N	Minimum	Maximum	Mean	Std. Deviation
CMNI: Winning	338	1.00	4.00	2.61	0.55
CMNI: Emotional Control	338	1.00	4.00	2.48	0.66
CMNI: Risk-Taking	338	1.00	4.00	2.40	0.49
CMNI: Violence	338	1.00	4.00	2.85	0.59
CMNI: Power Over Women	338	1.00	4.00	1.61	0.54
CMNI: Playboy	338	1.00	4.00	2.02	0.67
CMNI: Self-Reliance	338	1.00	4.00	2.21	0.59
CMNI: Primacy of Work	338	1.00	4.00	2.42	0.64
CMNI: Heterosexual Self-Presentation	338	1.00	4.00	2.20	0.75

Research Question 2- How do characteristics of male engineering college students at a midwestern research university and their scores on measures of conformity to masculine norms differ from male college students in female dominated majors (i.e., psychology, journalism, biology, education)?

To answer this question, descriptive statistics from the two groups—engineering males and males in female-dominated majors—along with scores on the CMNI-46 subscales were compared. As shown in Table 5, the portion of engineering males identifying as White or Asian was 85.5%, which was higher than the percent of males in female-dominated majors identifying with those races: 82.5%. The percentage of males identifying with an underrepresented minority race was higher among female-dominated majors (16.2%) than engineering (13.3%). In order to compare the difference in this variable through a statistical test, a chi-square test for association

was conducted and did not indicate a statistically significant difference between the two groups, $\chi^2(1, N=621) = 1.031$, $p = .310$. Men in engineering were not significantly less likely to be from diverse backgrounds than were men in female dominated majors.

Regarding sexual orientation, 91.4% of engineering males identified as heterosexual, compared to 77% of males in female-dominated majors; 8.6% of engineering males identified as gay or bisexual, compared to 23% of males in female-dominated majors. A chi-square test for association was conducted and showed a statistically significant association between sexual orientation and the major groups, $\chi^2(1, N=629) = 25.226$, $p = <0.001$. This indicated that males in female-dominated majors are more likely to identify as gay or bisexual than males in engineering. However, the association between major groups and sexual orientation was small, $\varphi = 0.200$, $p = <0.001$.

The fraternity participation rate for engineering men and men in female-dominated majors was 15.4% and 19.2%, respectively. A chi-square test for association was conducted and showed there was not a statistically significant association between the two groups with regard to participation in a Greek letter fraternity, $\chi^2(1, N=628) = 1.638$, $p = .201$. Participation in an all-male organization was nearly identical between the two groups: 18.7% of engineering males and 18.6% of female-dominated major males. This result was also not statistically significant, $\chi^2(1, N=629) = 0.002$, $p = .965$. In other words, the men in engineering were similar to the men in female dominated majors in terms of their participation in Greek letter organizations and other all-male organizations.

Gender salience scores were reported on a scale of 1 to 4, with 4 indicating that gender is very important to the respondent's identity. The mean score reported by engineering males was 2.30, while males in female-dominated majors reported a mean score of 2.50. Both mean scores

indicate an average response between “somewhat unimportant” and “somewhat important” to the question “When considering your identity, how important is gender as part of your identity?” There was a statistically significant difference in gender salience scores between the two groups, though the effect size was low, t(623.384) = -2.306, p = .021, d = -.183. Specifically, men in female-dominated majors were more likely to identify gender as a salient part of their identity than men in engineering. However, both groups fell between “unimportant” and “important” in their average scores, indicating that gender was generally not important to their identity.

The mean sense of belonging in major question—scored from 1 to 5, where 5 indicates the highest sense of belonging—score of engineering males was 4.14. Males in female-dominated majors averaged a score of 4.13. The difference in sense of belonging scores between engineering (M = 4.14, SD = 0.754) and female-dominated majors (M = 4.13, SD = 0.778) was not statistically significant, t(627) = .321, p = .285, d = .026. In other words, belonging scores between the two groups were not different. These scores indicate a strong sense of belonging in the major for both groups.

To determine if the males in engineering and males in female-dominated majors scored differently on the each of the nine CMNI-46 subscales, bivariate t-tests were conducted. Each respondent’s mean score was calculated as an average of the items for each subscale. Items were scored on a 1 to 4, with 4 indicating the highest level of conformity to that norm. The two groups’ mean score difference was not statistically significant on three of the nine subscales: Risk-Taking, Violence, and Self-Reliance. This indicates that there are no differences between the level of conformity to those three norms between the two groups. Mean scores for Risk-Taking and Self-Reliance were in the range of 2.2 to 2.4 for both groups, which is closer to

"disagree" than "agree." However, both groups scored closer to "agree" on the Violence subscale, with engineers scoring 2.85 and males in female-dominated majors scoring 2.78.

Engineering males reported a statistically significant, higher conformity to five of the subscales as compared to males in the female dominated majors: Winning, Emotional Control, Power Over Women, Primacy of Work, and Heterosexual Self-Presentation. While all were significantly higher, the effect sizes for Emotional Control, Power Over Women, Primacy of Work, and Heterosexual Self-Presentation were small. The effect size for Winning was lower than the threshold for a small effect size. In other words, while engineering men scored significantly higher on those five norms than the other men, the effect size did not reach a medium or high level. The only subscale that showed engineering males scoring a statistically significant lower score than males in female-dominated majors was Playboy. While the mean score was significantly lower, the effect size did not reach the threshold for a small effect size. Both groups fell near the "disagree" mark for the Playboy norm. The average scores for both groups on all subscales except Power Over Women fell between 2.0 and 2.9, indicating an average response somewhere between "disagree" and "agree" to the items in the CMNI-46. The average score for both groups for the Power Over Women subscale fell between 1.48 and 1.61, which is between "strongly disagree" and "disagree." A detailed analysis of mean scores is displayed in Table 7.

Table 7

Results of T-Test of CMNI-46 Subscale Scores by Group

Scale	Engineering		Female-Dominated					
	M	SD	M	SD	*df*	*t*	*p*	*D*
Winning	2.611	0.549	2.512	0.517	627	2.314	0.021*	.185
Emotional Control	2.485	0.661	2.294	0.647	627	3.634	<.001***	.291
Risk-Taking	2.396	0.492	2.397	0.489	627	-0.036	0.972	-.003
Violence	2.853	0.590	2.780	0.577	627	1.564	0.118	.125
Power Over Women	1.605	0.544	1.480	0.465	626.976	3.1	0.002**	.245
Playboy	2.017	0.670	2.124	0.653	627	-2.016	0.044*	-.161
Self-Reliance	2.213	0.590	2.244	0.577	627	-0.663	0.507	-.053
Primacy of Work	2.420	0.640	2.277	0.649	627	2.768	0.006**	.221
Heterosexual Self-Presentation	2.200	0.746	2.007	0.723	627	3.287	.001**	.263

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

An additional analysis was conducted to identify any group differences on conformity to the nine masculine norms, after controlling for the study's other variables. A linear regression was run for each of the nine subscales, with each subscale average score as the dependent variable. Independent variables entered were age, race, academic year, sexual orientation, Greek life participation, all-male organization participation, gender salience score, and major group (engineering or female-dominated). The results of these regressions indicated that, after controlling for the study's other independent variables, major group was a significant predictor of mean score for five of the subscales: Winning, Emotional Control, Power Over Women, Primacy of Work, and Heterosexual Self Presentation. All five statistically significant analyses indicated that membership in a female-dominated major predicted a lower score on the

masculine norm. These results mostly align with the t-test results, except that Playboy mean differences were statistically significant in the t-test but not in the regression model that controlled for the other independent variables. The coefficient results for major groups as an independent variable from each regression model are reported in Table 8.

Table 8

Major Group as Independent Variable in Regression: Coefficient Results by Subscale

Scale	β	*p*
Winning	-.105	.009**
Emotional Control	-.132	.001**
Risk-Taking	-.014	.773
Violence	-.041	.317
Power Over Women	-.119	.003**
Playboy	.044	.285
Self-Reliance	.023	.582
Primacy of Work	-.126	.002**
Heterosexual Self-Presentation	-.093	.009**

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

Research Question 3- Controlling for relevant background characteristics and gender salience, what is the relationship between conformity to masculine norms and sense of belonging in academic major among college males?

Separate multiple regression analyses were conducted to determine the relationship between conformity to masculine norms and sense of belonging while controlling for background variables. One analysis was conducted on data from engineering males only, and another was conducted on the data from males in female-dominated majors. Demographic variables included as independent variables included race, sexual orientation, year in college, age, gender salience, and Greek letter fraternity and all-male organization participation. Key

independent variables were the nine CMNI-46 subscale scores, and the dependent variable was the sense of belonging score. All independent variables were tested for multicollinearity using variance inflation factor (VIF). These tests indicated that multicollinearity was not a concern. Additionally, the nine CMNI-46 subscales were tested for correlation with each other by running a bivariate Pearson Correlation. Results of those tests are presented in Tables 10 and 11. While many of the correlations were statistically significant, none produced coefficients above 0.6 and most were < 0.3, which indicates small or medium correlation according to Cohen (1988).

The regression run on the engineering male's dataset showed several of the independent variables were significant predictors of sense of belonging. All significant predictors were CMNI-46 subscale scores. None of the demographic variables were significant predictors. Winning, Playboy, Self-Reliance, and Primacy of Work subscale scores were all significant in this model. Scores on Winning, Playboy, and Self-Reliance were negatively associated with Belonging scores, while a positive association was found between Primacy of Work scores and Belonging. Coefficient results for the model are presented in Table 9. Overall, the entire model was statistically significant, $R^2 = .131$, $F(16, 316) = 2.984$, $p < .001$, adjusted $R^2 = .087$. This means that knowing the CMNI-46 subscales can predict belongingness with 9% accuracy.

In comparison, results of the regression run on the males in female-dominated majors produced only two statistically significant predictors of sense of belonging. Both were CMNI-46 subscale scores. Like the engineering group, none of the demographic variables were significant predictors of belongingness. The two significant subscales were Emotional Control and Playboy, and these scores were negatively associated with Belonging scores. Overall, the entire model was statistically significant, $R^2 = .111$, $F(16, 270) = 2.117$, $p = .008$, adjusted $R^2 = .059$. Coefficient

results for the model are presented in Table 9. This model predicted 6% of the variance in belongingness.

Table 9

Regression Coefficient Results for Major Groups

Variable	Engineering		Female-Dominated	
	β	*p*	β	*p*
Age	0.064	0.503	0.015	0.888
Gender salience	0.078	0.172	0.079	0.199
Greek letter fraternity participation	-0.005	0.930	0.076	0.216
All-male organization participation	0.005	0.924	0.055	0.359
Year in college	0.087	0.350	0.079	0.452
Race	-0.013	0.810	-0.010	0.865
Sexual orientation	-0.101	0.082	0.058	0.396
Winning	-0.141	0.026*	-0.022	0.748
Emotional Control	0.104	0.077	-0.186	0.007**
Risk-Taking	-0.004	0.951	0.041	0.530
Violence	-0.008	0.892	-0.083	0.191
Power Over Women	0.000	0.994	0.046	0.525
Playboy	-0.116	0.042*	-0.160	0.009**
Self-Reliance	-0.160	0.006**	0.030	0.643
Primacy of Work	0.161	0.005**	0.073	0.240
Heterosexual Self-Presentation	0.037	0.588	-0.120	0.142

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

Table 10

Pearson Correlations between CMNI-46 Subscale Average Scores of Engineering Men

	Winning	Emotional Control	Risk-Taking	Violence	Power Over Women	Playboy	Self-Reliance	Primacy of Work	Heterosexual Self-Presentation
Winning	1	.258**	.302**	.273**	.309**	.185**	.145**	.280**	.275**
Emotional Control	.258**	1	.133*	0.103	.136*	0.004	.333**	.158**	.200**
Risk-Taking	.302**	.133*	1	.281**	.231**	.122*	0.036	.137*	.263**
Violence	.273**	0.103	.281**	1	.271**	.130*	-0.079	0.014	.296**
Power Over Women	.309**	.136*	.231**	.271**	1	.286**	0.074	.170**	.455**
Playboy	.185**	0.004	.122*	.130*	.286**	1	0.027	-0.024	0.047
Self-Reliance	.145**	.333**	0.036	-0.079	0.074	0.027	1	-0.033	0.085
Primacy of Work	.280**	.158**	.137*	0.014	.170**	-0.024	-0.033	1	.151**
Heterosexual Self-Presentation	.275**	.200**	.263**	.296**	.455**	0.047	0.085	.151**	1

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

Table 11

Pearson Correlations between CMNI-46 Subscale Average Scores of Men in Female-Dominated Majors

	Winning	Emotional Control	Risk-Taking	Violence	Power Over Women	Playboy	Self-Reliance	Primacy of Work	Heterosexual Self-Presentation
Winning	1	.210**	.294**	.224**	.374**	.130*	0.087	.264**	.369**
Emotional Control	.210**	1	0.015	0.076	.202**	0.075	.415**	0.089	.271**
Risk-Taking	.294**	0.015	1	.286**	.245**	.201**	0.004	.163**	.148*
Violence	.224**	0.076	.286**	1	.302**	0.085	-0.028	0.033	.187**
Power Over Women	.374**	.202**	.245**	.302**	1	0.030	0.005	.117*	.555**
Playboy	.130*	0.075	.201**	0.085	0.030	1	0.011	.141*	-0.048
Self-Reliance	0.087	.415**	0.004	-0.028	0.005	0.011	1	-0.092	0.006
Primacy of Work	.264**	0.089	.163**	0.033	.117*	.141*	-0.092	1	.164**
Heterosexual Self-Presentation	.369**	.271**	.148*	.187**	.555**	-0.048	0.006	.164**	1

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed)

Conclusion

This chapter presented the results from the quantitative analysis conducted to answer the study's three research questions. Descriptive statistics on the study participants were presented, along with a comparison of the study sample to the broader campus population. These descriptives indicated that both groups—engineers and males in female-dominated majors—on average did not agree with the masculine norms presented. Almost all average scores—except Power Over Women—fell in the range between "disagree" and "agree," indicating, at best, a very weak endorsement of these norms. Both groups also reported gender was not very important to their identity, as well as both reporting a strong sense of belonging in academic major.

Differences in scores on the CMNI-46 subscales between engineering males and males in female-dominated majors were tested to determine significant differences. Of the nine subscales, statistically significant differences between the two groups were discovered in six of the subscales. Engineering males scored significantly higher in Winning, Emotional Control, Power Over Women, Primacy of Work, and Heterosexual Self-Presentation and scored lower in only one: Playboy. Regression analysis produced the same findings of major group difference, except for the Playboy subscale. This further confirmed that all mean subscale scores reporting significant differences were scales on which engineering males scored higher than males in female-dominated majors. Finally, the impact of CMNI-46 subscale scores on sense of belonging was analyzed via regression. Analysis found that, of all variables, the only significant predictors of belonging were masculine norm subscale scores. None of the demographic variables nor gender salience were significant predictors of belonging in either group. Winning, Playboy, Self-Reliance, and Primacy of Work subscale scores were significant predictors of Belonging scores

for engineering males, and Emotional Control and Playboy subscale scores were significant predictors of scores from males in female-dominated majors.

Chapter 5: Discussion

This study sought to quantitatively examine the level to which male traditional aged undergraduate engineering students conform to masculine norms. Study participants from a large, public university in the Midwest were surveyed in the Fall of 2019 and asked to respond to the Conformity to Masculine Norms Inventory (CMNI-46) (Parent & Moradi, 2009) as well as demographic questions and other questions about their college experiences, gender salience, and sense of belonging in their major. The following research questions were answered by exploring their responses and also comparing these responses to those from college males enrolled in majors that were majority-female:

1. What are the characteristics of male engineering college students at a midwestern research university and how do they score on measures of conformity to masculine norms?
2. How do characteristics of male engineering college students at a midwestern research university and their scores on measures of conformity to masculine norms differ from male college students in female dominated majors (i.e., psychology, journalism, biology, education)?
3. Controlling for relevant background characteristics and gender salience, what is the relationship between conformity to masculine norms and sense of belonging in academic major among college males?

Findings Related to Masculine Norms

Analysis of engineering males' responses to the CMNI-46 subscales showed the group did not conform to most norms indicated by the nine subscales and for the two norms that did show some conformity, the level was quite low. The responses choices for the CMNI-46 items

lie on a four-point Likert scale ranging from “strongly disagree” to “strongly agree.” Mean scores on only two of the nine subscales—Violence and Winning—were above the midpoint of the scale. The Violence subscale asked respondents to respond to statements about their views on violence being justified at times and the need to act violently. Items in the Winning subscale included prompts about the need to win and aversion to losing. All remaining seven subscales measured by the CMNI-46—Emotional Control, Primacy of Work, Risk-Taking, Self-Reliance, Heterosexual Self-Presentation, Playboy, and Power Over Women—produced mean scores below the midpoint, with Power Over Women scoring the lowest and being the only norm to produce an average response between “strongly disagree” and “disagree.” This indicated that the engineering males did not identify with the majority of the masculine norms measured by the instrument.

Norm conformity among males in female-dominated majors was similar to engineering males in this sample. Like engineering undergraduates, males in female-dominated majors produced only two mean subscale scores above the midpoint of the scale: Violence and Winning. The remaining subscales averaged closer to the “disagree” mark of the scale. For the female-dominated majors’ group, the only average subscale score below the “disagree” mark was Power Over Women—like the engineering males. Engineering students, on average, scored higher on all masculine norms, except for the Playboy subscale than male students in female identified majors. Testing to determine which subscale score differences were statistically significant indicated that, after controlling for other variables, the two groups’ scores were significantly different on five of the subscales: Winning, Emotional Control, Power Over Women, Primacy of Work, and Heterosexual Self-Presentation. This study’s hypothesis was that engineering males would score higher on masculine norm conformity than males in female-dominated majors.

While engineers did score higher on all norms, effect sizes were small. Therefore, the answer to the research question regarding difference in masculine norm conformity between the two groups is that men in engineering do score higher on masculine norm conformity, but the difference is minimal.

No normative scoring guide for the CMNI-46 exists and published descriptive data on subscale scores from samples are scarce. Most studies instead report results on between-group differences and correlations between CMNI scores and other relevant variables. The engineering college student sample surveyed by Akpanudo, Huff, and Godwin (2018)—which was about one-quarter women—used a variation of the CMNI and, like this study's sample, found Power Over Women to be the lowest scoring subscale and the only norm to score below the "disagree" threshold. The rest of the subscale average scores, like this study, fell between "disagree" and "agree," though the ordering differed. The college student sample surveyed by Hsu and Iwamoto (2014) reported near identical conformity levels as this study's results. In their study, the college men's subscale mean scores all fell between "disagree" and "agree," except for Power Over Women, which was the lowest subscale mean score and fell between "strongly disagree" and "disagree." The top scoring norm for their sample was Violence and the second-highest scoring norm was Winning, reflecting the same result as this study. This indicates that the results from the present study align with samples from other studies. Specifically, and notably, this study also found that samples of college males do not endorse the masculine norms identified in the CMNI. The original instrument was normalized using a sample similar to this one: white, heterosexual college males (Mahalik et al., 2005). Continued demonstrations of low conformity or nonconformity to the masculine norms used in this instrument appear to indicate a shifting in attitudes about masculinity among college males. A rise in public and open conversations about

toxic masculinity and rejection of the gender binary could be the reason that younger populations of males seem to not align themselves with the hegemonic masculine norms of the past.

Rejection of the Power Over Women norm in this study's sample—though clearly not an anomaly considering the findings of other studies—is notable due to the clear history of womens' underrepresentation in engineering (Cockburn, 1985; Faulkner, 2001; McIlwee & Robinson, 1992; Trescott, 1984; Wyer et al., 2001). This history combined with the persistent underrepresentation of women in engineering majors appears to create an environment where negative attitudes toward women would exist, if not be prevalent. However, these findings do not support that assumption. The stern rejection of the Power Over Women norm by this study's respondents offers two potential readings. The first reading of this result—an optimistic one—indicates that men in the study do not feel superior over women and firmly reject any suggestion that women are inferior to men. This would be a very welcome development and a key shift in the history of engineering education, signaling that male students see their female colleagues as just as qualified to be engineers as they are. A more skeptical reading of these results is that these results failed to uncover more implicit biases against women that actually do exist among male engineering students. Examples of these biases could include favoring project contributions from males over females, instances of gendered microaggressions like being labeled as too independent or assertive, and the phenomenon of "spotlighting," which refers to the act of singling out women because of their gender in ways that makes them feel uncomfortable (McLoughlin, 2005; Terrell et al., 2017; Yang & Carroll, 2018). Statements used by the CMNI-46 to assess this norm include "In general, I control the women in my life" and "Women should be subservient to men." Perhaps these statements incite too strong of a response among male respondents or response bias exists. Regardless, it appears that it is more appropriate to explore

college men's attitudes toward women with revised items or other research methods and approaches.

While this study sample's highest scoring norms—Violence—did not reach a strong level of conformity, it is worth discussion that this norm was the highest scoring for both engineering males and males in female-dominated majors. Firstly, the connection between masculinity and violence is heavily documented (Amato, 2012; Bowker, 1998; Raewyn W Connell, 2017; L. Hong, 2000; Miedzian, 2002). Therefore, it may not be a surprise that this is the norm with which a sample of men identify the most, from the given nine norms measured. However this finding does differ from a finding by Wong et al. (2020) that identified nonaggression to be a prevalent masculine norm. In that study, the authors emphasized the surprising nature of this finding, given that Violence is such a key component of masculine norm measures. The authors noted, however, that this same finding about nonaggression as a masculine norm occurred in a prior study conducted by the same lead author (Wong, Ho, Wang, & Fisher, 2016). Wong et al. (2020) suggested that this could be part of the emergence of more norms related to "positive masculinity," which is being explored with more frequency (Kiselica, Benton-Wright, & Englar-Carlson, 2016; Levant, 2011; McDermott et al., 2019; Roberts-Douglass & Curtis-Boles, 2013). This is another example of potentially evolving masculine norms that should be explored in more detail.

Findings Related to Belonging

Belonging was included as a variable in this study to explore how connected participants felt to their academic major. The initial hypothesis for this study was that a positive relationship would exist between conformity to masculine norms and sense of belonging among engineering males. This study found that, of all the study's variables, the only significant predictors of sense

of belonging in major for engineering males were four of the CMNI-46 subscale scores, though the regression model including CMNI-46 subscale scores predicted only a small amount (9%) of the variance in belonging scores for the engineers in the sample. Three of the significant subscales were negatively associated with sense of belonging: Winning, Playboy, and Self-Reliance. The fourth and final significant subscale—Primacy of Work—was positively associated with sense of belonging.

For males in female-dominated majors, the only variables found to be significant predictors of sense of belonging in major were two of the CMNI-46 subscales: Emotional Control and Playboy. Both were negatively associated with sense of belonging, and the regression model for this group predicted 6% of variance in belonging scores. While these findings did indicate a relationship between conformity to masculine norms and sense of belonging in engineering, the relationship was small, indicating that other variables not measured in this study are to account for more of the variance in sense of belonging among engineering males. Presumably one of those important variables not gathered in this study is academic performance, as the challenging nature of engineering education requires acceptable grades to continue in the major.

Given the documented underrepresentation of African American, Latinx, and American Indian, Alaska Native and LGBTQ students in engineering enrollment (Cech & Rothwell, 2018; NCSES, 2021), it was intriguing that none of the demographic variables gathered in this study—including race and sexual orientation—had a significant impact on sense of belonging in engineering. Again, this points toward the impact of other variables not measured by this study.

Though conformity to masculine norms was not able to predict much of a student's sense of belonging, the relationships identified are supported by literature. It is understandable that

Primacy of Work was the only significant predictor to be positively associated with belonging major among men studying in a highly professionalized field. Engineering education works to socialize engineers into their profession, making their work as engineers central to who they are as a person (Hughes & Hurtado, 2013; Pierrakos et al., 2009). The survey prompts for the Primacy of Work norm echo this in statements like "My work is the most important part of my life." Therefore, it makes sense that students who place a high value on their career also feel they belong in an intensive setting that is training them for a profession tied closely to their own identity. The remaining four norms—Winning, Emotional Control, Playboy, Self-Reliance—that were significant and negatively associated with sense of belonging all promote individualistic behaviors. These subscale scores derived from norm statements like "It is important for me to win" (Winning), "I tend to keep my feelings to myself" (Emotional Control), "I would feel good if I had many sexual partners" (Playboy), and "It bothers me when I have to ask for help" (Self-Reliance). Individualistic attitudes and behaviors like this stand in direct contrast to the central themes of belonging, which focus on community and positive relationships with others (Ainsworth, 1989; Axelrod & Hamilton, 1981; Buss, 1990; Hagerty et al., 1992; MacDonald & Leary, 2005). These findings, therefore, reiterate the underlying assumptions of the concept of belonging: forming meaningful connections with others and feeling supported and upheld by a community.

Implications for Practice

Overall, this study's findings showing a rather low endorsement of traditional masculine norms among men on a college campus—even among men in heavily male-dominated academic programs—appear to be encouraging. A large body of research has demonstrated the problematic costs of men conforming to the traditional masculine norms mentioned in this study, including

poor physical health, substance abuse, mental and emotional problems (Mahalik et al., 2005). Therefore, these results do not necessarily raise alarm indicating the existence of these problematic norms among the study's sample. However, though the quantitative instrument used in this study may not appear to be best suited for gauging masculine norm conformity, this does not mean critical examinations into hegemonic masculinity on campus are unnecessary. Instances of problematic behaviors associated with these norms are still very much present on college campuses. Hazing, binge drinking, sexual assault, and drug abuse are all longtime issues associated with campus masculinities, and they still require attention from professionals. Results from this study might indicate the need for a different approach to conversations about masculinity with college men.

Laker (2003) introduced the term "bad dog approach" to describe attempts to punish and change bad behavior instead of helping the perpetrator of the behavior to understand why the behavior is problematic. This approach was presented by Laker in discussion about the wrong way to combat offensive acts committed by college men: instead of just telling them to stop, explore and explain why the behavior is hurtful. Campus professionals should be continually encouraged to avoid the bad dog approach, and instead be given the tools and space to critically examine why many masculine norms and behaviors lead to negative outcomes. For example, instead of a quick punishment for using homophobic language, a student should be given the opportunity to understand why that term is hurtful to someone. The results of this study appear to support the need for this type of advanced intervention. By generally rejecting the norms on a survey, this shows college males appear at least know they should not agree with these behaviors frequently associated with toxic masculinity. However, it is harder to determine whether these

are genuinely held beliefs or if they truly understand the widespread repercussions of behaviors like homophobia and misogyny. Moving beyond the bad dog approach can help with this.

The apparent rejection of problematic masculine norms that appears in this study could also be a chance to instead encourage more positive aspects of masculinity among college men. An increasingly popular segment of masculinities work—positive masculinities—has been suggested as a new way to engage men in examining their own expression of masculinity, ultimately leading to improved mental health outcomes (Kiselica et al., 2016; Seidler, Rice, River, Oliffe, & Dhillon, 2018). Campus staff and administrators could use this approach to create programming and opportunities for men that emphasize positive psychology and strengths-based approaches to development (Cole, Moffitt-Carney, Patterson, & Willard, 2021). Language and campaigns on campus promoting men engaging in these positive behaviors may resonate more with this population than messages combating negative aspects of more traditional masculine norms because they do not appear to connect with the norms identified and examined by this study. Additionally, campus officials should highlight individuals who represent alternative masculinities on campus. This could be accomplished by creating opportunities for students to engage with men from occupations and domains not typically associated with hegemonic masculine norms or men whose gender expressions do not align with traditional stereotypes.

Another population to feature in this work are advocates who use their own privilege—in this case, primarily male privilege—in order to advance others. This behavior in particular stands in stark contrast to the self-centered, individualistic norm of Winning. The increasingly hostile cultural and political actions toward trans and gender-nonconforming people present a unique opportunity to recruit men as allies for those who are particularly affected by nonconformity to

masculine norms. Specifically in the case of engineering, this could be accomplished by featuring male managers and executives who prioritize hiring and promotion of women and other underrepresented groups in their companies. This provides an example of a way men can replace behaviors associated with one problematic masculine norm with a positive expression of masculinity.

Finally, it is important to understand how masculinity intersects with other important identities held by an individual. For some segments of campus, it could be that certain norms are more prevalent, thereby requiring different interventions and unique approaches to addressing the associated behaviors. Masculinities research has focused on intersections between masculinity and race, disability, and sexuality, among many other identities. For example, as discussed in Chapter 2, there are distinct movements relating to redefined concepts of masculinity among Black and Latino men, specifically. Campus professionals should not ignore the varied norms that exist among those different intersections and ensure that specific efforts are dedicated to these populations.

Suggestions for Future Research

Methods to assess gender norms are incredibly complex. Changing attitudes and cultural shifts make it complicated to create and validate measures that can be reliably used to answer the types of questions that are asked in a study like this. As mentioned in Chapter 3, revisions of the original Conformity to Masculine Norms Inventory continue to be proposed, and while it remains one of the most popular measures to assess masculine norms (Wong, 2022), even the newest revisions may not properly assess the masculinities seen in dominant culture today. This is especially true due to the recent impact of politically extremist movements on modern views of masculinity among American men (Kimmel, 2017). A different approach to exploring the

masculine norms that exist in a particular environment—in this case, engineering education—might better answer research questions similar to those from this study. The present study relied on respondents to report their own views related to masculine norms, which raises concerns about response bias and social desirability. A mixed-methods approach using interviews or other qualitative methods may more accurately measure the true responses of this group. Bonilla-Silva and Forman's (2000) work on examining college students' attitudes toward race is an example of this type of approach that could be applied to this topic. Future research should also consider the perceptions of the prevalence of masculine norms in a given environment. Cheryan and Markus (2020) proposed how to identify and counteract "masculine defaults" that occur in male-majority environments. The concept of masculine defaults refers to a form of bias that occurs in a setting where behaviors generally associated with male gender roles are viewed as the norm and often rewarded. These defaults are cited quite often in explorations of engineering culture and even cited by Cheryan and Markus. They used the example of computer science putting forth the image of the male "computer geek," which in turn helped create a masculine default for the field. The authors advocate for examination of masculine defaults at several levels of a culture: the ideas valued by that culture, the policies that the culture upholds, the interactions that occur within the culture, and the individual beliefs and behaviors held my members of that culture. Future researchers should use this approach and framework of masculine defaults to better gauge the prevalent norms in an environment, without relying on the self-reporting of individual perspectives on given norms that may be outdated or irrelevant.

The rejection of the Power Over Women norm in this sample seems to call for updated items that can better quantitatively assess the themes of avoidance of femininity and exclusion of women that have always been critical hallmarks of hegemonic masculinity. Concepts like

Avoidance of Femininity and Benevolent Sexism may be better norm substitutes for Power Over Women. This is a concept that has long been included in other measures of male gender role norms (Levant, Hall, & Rankin, 2013; O'Neil et al., 1986). Items from other measures designed to assess attitudes toward women should be considered, such as ones included in Valentine's (2001) Multidimensional Aversion to Women Who Work Scale. Other scholars have explored this topic via embedded ethnography on campuses (Tonso, 2006) and also analysis of institutional messages (De Pillis & de Pillis, 2008). Another option would be to examine this norm via implicit bias testing regarding stereotypes about women in engineering (Charlesworth & Banaji, 2019; Greenwald, McGhee, & Schwartz, 1998; Smyth & Nosek, 2015).

A more longitudinal approach to exploring this research topic could focus on how attitudes regarding masculinity change as an individual progresses through engineering education. Upon entering an engineering program, students could be given an assessment related to gender norm conformity—probably not the one used in this study, given the results—and then be asked to complete the same assessment at the midpoint and end of their college careers. This would attempt to ascertain what, if any, impact engineering education has on conformity to gender norms. Also, it would attempt to answer whether certain levels of conformity or nonconformity drive a student to leave engineering. This type of study would provide a perspective of the impact of environment on gender role conformity, in contrast to the snapshot view provided by the current study.

Future research exploring the connection between gender norm conformity and sense of belonging in major should also look more deeply at the role of other variables in a student's profile and background. As mentioned previously, the intersection of masculinity and other held identities can certainly vary and may provide a stronger insight into this relationship. Also,

academic performance data may assist as a predictor of sense of belonging in major, especially for academically rigorous majors like engineering. This aligns with the longstanding connection in literature between retention and academic performance (DeBerard, Spelmans, & Julka, 2004; Pantages & Creedon, 1978). Another important variable to consider is a student's level of financial security, which has also been tied to retention (McGrath & Braunstein, 1997). This is closely related to two other variables that should be considered in future study of belonging: a student's socioeconomic status and level of parental support. Because this study was unable to produce a model that could reasonably predict sense of belonging, there are clearly other variables that were not measured in this study that impact this important measure.

Conclusion

This study sought to examine the link between masculinity and engineering education. Beyond relying on stereotypes about who engineers are and are not, data and historical evidence was presented to tie those two areas together. Building from an understanding of the roots of engineering and the masculine themes woven into that history, the study connected these concepts with those of gender, masculinities, and belonging to form the study's research questions. To answer those questions, the study explored how a sample of male undergraduate engineer students scored on measures of conformity to nine masculine norms. That sample was then compared to a sample of male students who were pursuing a major that is currently female dominated. Finally, the relationship between conformity to masculine norms and sense of belonging in major for both groups was examined for both groups. Results indicated that males in engineering generally did not strongly endorse or reject most of the masculine norms measured, aside from the one norm regarding asserting power over women (which they reject). The men in engineering did indicate higher levels of conformity on eight of the nine norms in

comparison to their peers in female-dominated majors, though the differences were small or insignificant. Of all the study's variables, scores on masculine norm conformity were the only significant predictors of sense of belonging in major for both groups, but again, the ability of those variables to predict sense of belonging was not notable. More of the scales were significant for engineering males than the other group, and the masculine norm scores were able to predict sense of belonging better for engineering males than males in female-dominated majors, though neither model was able to predict much of the variance in belonging. In summary, this study did not support the assumption that the college men studying engineering adhere to the masculine norms associated with the male-dominated and masculinized field of engineering. These findings provided a better understanding of how male engineering students respond to traditional themes of masculinity and also insights into how these themes can be better explored, ultimately with the goal of ensuring supportive, inclusive, and diverse education environments for engineers of the future.

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Appendix A: Human Subjects Approval

THE UNIVERSITY OF KANSAS
Research

Date: October 16, 2019

TO: Charles Neiss, (charles@ku.edu)

FROM: Alyssa Haase, IRB Administrator (785-864-7385, irb@ku.edu)

RE: **Approval of Initial Study**

The IRB reviewed the submission referenced below on 10/16/2019. The IRB approved the protocol, effective 10/16/2019.

IRB Action: APPROVED	**Effective date: 10/16/2019**	**Expiration Date : 10/15/2024**
STUDY DETAILS		
Investigator:	Charles Neiss	
IRB ID:	STUDY00144587	
Title of Study:	Conformity to Masculine Norms Among Undergraduate Men	
Funding ID:	None	
REVIEW INFORMATION		
Review Type:	Initial Study	
Review Date:	10/16/2019	
Documents Reviewed:	• emails with HRPP office regarding drawing, • information statement.pdf, • KU HRPP Human Research Protocol.pdf, • recruitment email.pdf, • Research topic background, • Survey to be used	
Exemption Determination:	• (2)(i) Tests, surveys, interviews, or observation (non-identifiable)	
Additional Information:		

KEY PROCEDURES AND GUIDELINES. Consult our website for additional information.

1. **Approved Consent Form:** You must use the final, watermarked version of the consent form, available under the "Documents" tab, "Final" column, in eCompliance. Participants must be given a copy of the form.
2. **Continuing Review and Study Closure:** You are required to provide a project update to HRPP before the above expiration date through the submission of a Continuing Review. Please close your study at completion.
3. **Modifications:** Modifications to the study may affect Exempt status and must be submitted for review and approval before implementing changes. For more information on the types of modifications that require IRB review and approval, visit our website.
4. **Add Study Team Member:** Complete a study team modification if you need to add investigators not named in original application. Note that new investigators must take the online tutorial prior to being approved to work on the project.
5. **Data Security**: University data security and handling requirements apply to your project.
6. **Submit a Report of New Information (RNI):** If a subject is injured in the course of the research procedure or there is a breach of participant information, an RNI must be submitted immediately. Potential non-compliance may also be reported through the RNI process.
7. **Consent Records:** When signed consent documents are required, the primary investigator must retain the signed consent documents for at least three years past completion of the research activity.
8. **Study Records** must be kept a minimum of three years after the completion of the research. Funding agencies may have retention requirements that exceed three years.

Appendix B: Informed Consent Statement

Information Statement

The Department of Educational Leadership & Policy Studies at the University of Kansas supports the practice of protection for human subjects participating in research. The following information is provided for you to decide whether you wish to participate in the present study. You should be aware that even if you agree to participate, you are free to withdraw at any time without penalty.

We are conducting this study to better understand college men and masculine norms. This will entail your completion of a survey. Your participation is expected to take approximately 15 minutes to complete. The content of the survey should cause no more discomfort than you would experience in your everyday life.

Although participation may not benefit you directly, we believe that the information obtained from this study will help us gain a better understanding of masculine norms among college men. Your participation is solicited, although strictly voluntary. You will be entered into a drawing for a gift card for your participation in this study. You do not have to complete the survey to be entered into the drawing. Your name will not be associated in any way with the research findings and no identifiable information will be collected. It is possible, however, with internet communications, that through intent or accident someone other than the intended recipient may see your response. You have the option to skip questions if you choose.

If you would like additional information concerning this study before or after it is completed, please feel free to contact us by phone or mail.

Completion of the survey indicates your willingness to take part in this study and that you are at least 18 years old. If you have any additional questions about your rights as a research participant, you may call (785) 864-7429 or write the Human Research Protection Program (HRPP), University of Kansas, 2385 Irving Hill Road, Lawrence, Kansas 66045-7563, email irb@ku.edu.

Sincerely,

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