Exploration of Relationships between Conformity to Masculine Social Norms and Demographic Characteristics

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***Abstract*—In this full research paper, we bring into focus the interplay of conformity to masculine social norms and demographic characteristics (i.e., gender, race/ethnicity, institutional settings) among undergraduate engineering students in the United States. We approached this study with an exploratory, non-experimental design that involved examining patterns of relationship between the conformity to masculine social norms and demographic characteristics of respondents. Our data were obtained from of survey responses by engineering students (n = 128) in first-year general engineering courses at three universities in the Southeastern United States. We operationalized conformity to masculine social norms using the Conformity to Masculinity Social Norms Inventory (CMNI-22). Our results revealed moderate to low conformity to masculine social norms among engineering students in first-year general engineering courses. Overall, student demographic characteristics appeared to have weak to limited influence on levels of conformity. However, the institutional setting interacted significantly with both gender and race/ethnicity such that male students at the public research university setting and white students in the same setting reported significantly higher levels of conformity to masculine social norms than students in other demographic categories. We discuss these findings as they enrich understanding about how institutional contexts might affect gendered social norms related to engineering professional formation.**

Keywords- masculinity; social norms; inclusion

I. Introduction

In this full research paper, we seek to understand how undergraduate engineering students in the United States conform or not to documented masculine social norms. Engineering has long been considered a "man's job" [1], or as Tabassum [2] noted, it has been thought of as a field more congruent to men. Frehill [3] aptly described it as a space for proving manhood, and Campbell [4] labeled engineering as being "densely masculine." While there is ample evidence that the engineering workforce and preparatory programs have been marked by a notable majority of white male students, recent trends in both enrollment and program completion show a modest yet increasing pattern of women and Hispanic/Latinx in the field. For instance, female enrollment in engineering programs between 2007 and 2015 has increased by an average of approximately 2% across all degree levels. Enrollment of candidates from Hispanic/Latinx background also increased by an average of nearly 4% during the same period [5]

These modest trends provide important justification for investigating the institutional context of engineering particularly as it relates to the inclusion of individuals who do not fit the white and masculine norms of engineering. Despite considerable efforts to support and promote the inclusion of women in engineering, one might ask why we have seen little increase in enrollment. Significant efforts in engineering have been focused on increasing diversity [6-8]; however, simply adding more individuals who have been traditionally underrepresented to a culture that is not inclusive can exacerbate the underlying issues of a lack of inclusion and equity in engineering. Rather than examining how women might feel marginalized in engineering programs, as has often been examined, in this study, we turn our attention to examine how men might particularly feel included within engineering programs. We work to understand how masculinity is constructed as a social norm in engineering in order to better understand how to change engineering culture to be more inclusive and equitable. In other words, how does being an engineering student relate to conformity of masculine social norms for male engineering students? And how does enacting such masculine social norms affect the overall institutional cultures of engineering programs?

II. Literature Review

Prior research characterizes *social norms* as representing collectively constructed expectations regarding the role and conduct of various social groups. These norms are typically communicated by dominant groups in society. Social norm theory was initially developed by Perkins and Berkowitz [9] and has been often cited in psychology, behavioral health, and counseling to explain the efficacy of perceptions or misperceptions about the behavior of others in social settings to influence individual behavior. Within the overall theoretical framework of social norms, *masculine* social norms

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particularly serve influence individual behavior that is socially constructed as appropriate for those occupying the male space.

Prominent in this literature is the work of Connell [10], where hegemonic masculinity was framed as the ideal way of being a man to which all men are compelled by cultural and institutional persuasions to position themselves in relation to. Subscription to these ideal-male roles and the scripts associated with it is rewarded with prestige, recognition and dominance over others; particularly power over women. Despite the seeming benefits of conformity to masculine social norms, pressures to conform to these ideals have been shown to negatively affect help-seeking, sexual health and the self-esteem of men [11]

However, masculinity is a very complex phenomenon that can be enacted in various forms, including in the traditional hegemonic ways [12-13]. In essence, being masculine may not only be interpreted solely through the lens of traditional hegemony, although this is certainly one of the more common ways through which masculinity is enacted. We have argued that the more traditional views of masculinity were dominant in the selection of candidates and the training of engineers and that these norms may privilege students who conform to these norms [14].

Recent findings by Seron, Silbey, Cech, and Rubineau [15] clarified earlier claims about the fragile nature of women's identities as engineers [16,2]. They argued women engineers, although aware of their status as outsiders in the field were not necessarily critical of the norms in the field as they found them to be indicative of meritocratic norms to which they subscribed. The authors posited that the cultural contextual norms in engineering may amount to more than a situation where an environment of masculinity is created such that it excludes women, but that women in engineering become part of the system which they then redefine as one of meritocracy despite the hegemonic masculinity which they recognize themselves as having to endure.

According to Mahalik and colleagues [17], traditional social norms regarding masculinity are associated with gendered expectations by society about masculine behavior, such as: risk-taking, emotional regulation, self-reliance and dominance. It is important to note that these authors do not characterize these norms as traits that are inevitably enacted by individual males. Rather, they describe these norms as messages of what it means to be a normal male in U.S. society that individuals come to understand as a cultural template for being masculine. Mahalik [17] described conformity to masculine social norms as "meeting societal expectations for what constitutes masculinity in one's public or private life" (p. 3) and nonconformity to these norms as not meeting such societal expectations. In order to assess how individuals conform, or do not conform to culturally-constructed masculine social norms, Mahalik et al. [17] developed the Conformity to Masculine Norms Inventory (CMNI), which we use in the present investigation.

III. Research Questions

The purpose of this study was exploratory. Our aim was to gain insights about the relationships between demographic characteristics among engineering students and their conformity to masculine social norms. Our hope is that these insights will provide clarity about the phenomenon that will serve as the foundation for more in-depth investigations into masculinity in engineering education. To address this purpose, the following research questions were developed

RQ1: In what dimensions of masculine social norms is conformity most evident among engineering students?

RQ2: How do demographic characteristic (gender, race/ethnicity, and institutional setting) impact engineering students' conformity to masculine social norms?

RQ3: Are there important interactions between demographic factors (gender, race/ethnicity, and institutional setting) in their influence of engineering students' conformity to masculine social norms?

IV. Methods

A. Sample

We obtained data from a sample of 128 engineering students who responded to a larger national survey of thirty-two ABET accredited institutions. [18] The present study focuses on three of these institutions to understand demographic and institutional differences within the same geographic region, the Southeast of the United States. The paper-and-pencil survey was deployed in the fall semester of 2017 to students in first-year engineering or general engineering courses. A total of 3,855 students responded to the survey with 3,711 valid student responses as determined by attention checks included in the survey. These courses were chosen to obtain a representative sample of all engineering disciplines as well as students' incoming attitudes in engineering degree programs.

Of the students at the three institutions in this study, approximately 69% of the respondents were in their first year of college, 14% were in their second year of college, and 11% indicated they were in their third year of college. Only 4% of respondents reported being in their fourth year of college or higher, while approximately 2% of the sample did not provide information about their length of stay in college. The data were digitized and audited for accuracy. In this study, we sampled respondents from a private liberal arts university (PrLA), a public liberal arts (PuLA) university, or a public research university (PuR); all located in the Southeastern United States.

B. Instrument

This study focuses on a subset of the questions included in the entire survey. For this exploratory study we used a scale comprising 21 of the 22 items on the Conformity to Masculine Norms Inventory [CMNI-22] developed by Mahalik and others [17, 19] as a measure of conformity to masculine social

norms. Although other forms of the CMNI are also commonly used to assess conformity to masculine social norms [CMNI-94, CMNI-55, CMNI-46] [17, 19] we did not consider these lengthier versions of the instrument the appropriate fit for our exploratory investigation. We omitted one item related to the "playboy" dimension of the CMNI-22 in our survey on the precaution guided by our institutional review board on the basis that it may negatively affect respondents in our sample and therefore compromise the larger national investigation. Accordingly, in our analysis of RQ1, we gathered results for only 10 of the 11 dimensions of conformity to masculine social norms. However, the composite conformity score comprised items from all 21 items across the 11 dimensions (with the playboy dimension contributing just one item).

Conformity scores were determined by summing up responses to anchored numeric scale (0 - "Strongly Disagree" to 6 - "Strongly Agree") on each of 21 items on the scale. The CMNI -22 has very high concurrent validity with the original 94-item CMNI [20] and a Cronbach's alpha reliability index of .67 (.65 for women and .72 for men) [19], although other measures of reliability such as theta [21] are considered most appropriate for multidimensional scales such as the CMNI [19, 22].

C. Data Analysis

Once we obtained the survey responses, we organized the data for analysis using IBM Statistical Package for the Social Science (SPSS) version 21 software [23]. Our analyses involved preliminary screen of data, descriptive summaries, testing assumptions of tests of significance, and inferential analyses using independent samples t-tests and factorial analysis of variance (ANOVA). All inferential tests were conducted at an alpha level of 0.05.

To facilitate data analysis, categories for two of the demographic variables were combined. We recoded gender into a binary variable (men/women) excluding the few cases that did not fit these categories. Similarly, because of the low frequency count on several of the race/ethnicity categories, this variable was dichotomized with categories of "white" and "Non-white race/ethnicity." These categorizations were chosen to examine how students who fit the dominant group in engineering, white men, may conform to masculine social norms within an engineering context. While this approach is limited to comparisons to the dominant group, it does begin to highlight how students who do not fit the majority attitudes may experience engineering culture differently than their peers.

V. Results

To address RQ1, descriptive analyses were conducted. [17] notes that CMNI -22 comprised the top two items for each of the 11 dimensions of conformity to masculine social norms. Following these guidelines, each set of items were combined to create a score for each dimension. A summary of scores on each of the dimensions is presented in Table 1.

These results reveal that engineering students in our sample reported the greatest degree of conformity to the pursuit of status, primacy of work, heterosexual self-presentation, and violence dimensions of masculine social norms. On the other hand, the lowest degrees of conformity were associated with the power over women, self-reliance, dominance, and emotional control dimensions

To examine RQ2, we conducted independent samples t-tests and a one-way ANOVA on conformity to masculine social norms by the demographic characteristics of gender (men/women), race/ethnicity (white/non-white), and institutional setting(PrLA/PuLA/PuR).

Gender: Results of the test $t(118) = 1.98$, $p = .50$, $d = 0.45$. indicated a statistically significant difference in conformity to masculine social norms between male and female engineering students. Men had significantly higher conformity scores compared to women (see Table 2)

Race/Ethnicity: Our analyses revealed that differences in conformity to masculine social norms $t(113) = 1.44$, $p = .154$, d = 0.36 between white engineering students and non-white students was not statistically significant (Table 2).

Institutional Setting: Similarly, analysis of data for institutional setting $F(2, 125) = 2.56$, $p = .082$, $\eta^2 = .04$, revealed no statistically significant differences in conformity to masculine social norms between engineering students at PrLA, PuLA, or PuR institutions (Table 2).

Interactions: To address RQ3 we conducted Factorial ANOVA to explore interactions between demographic factors on conformity to masculine social norms among engineering students. The results of these analyses showed that the interaction between gender and race/ethnicity was not statistically significant $F(1,110)=.94$, $p = .335$, $\eta^2 = .008$. These results suggest that ethnicity does not interact with gender to potentially moderate its influence on engineering students' conformity to masculine social norms (Table 3)

However, when the interaction between gender and institutional setting on conformity to masculine social norms was modeled, it was found to be statistically significant $F(2,114) = 3.17$, $p = .046$, $\eta 2 = .053$. Although neither the main effects of gender or institutional setting were significant, simple effects contrasts revealed that differences in conformity to masculine social norms between male and female engineering students were significantly different for the Pubic Research institutional setting $F(1,114) = 6.99$, $p = .009$, $\eta^2 = .060$, but not for the Public Liberal Arts setting $F(1,114) = 2.45$, $p = .118$, $\eta^2 = .021$, nor the Private Liberal Arts setting $F(1,114)= 1.06$, $p = .307$, $\eta^2 = .009$. Table 4 provides a summary of descriptive statistics for this analysis The interaction between race/ethnicity and institutional setting on conformity to masculine social norms was also statistically significant $F(2,109) = 3.96$, $p = .022$, $\eta^2 = .068$. The main effects for institutional setting and race/ethnicity on their own were not statistically significant.

We followed this analysis with simple effects contrasts which revealed that differences in conformity between white engineering students and engineering students of other racial/ethnic groups were statistically significant in the Public Research institutional setting $F(1,109) = 6.03$, $p =. 016$, $\eta^2 = .05$, but not in the Private Liberal Arts setting $F(1,109) = 1.90$, $p =. 171$, $\eta^2 = .02$, nor the Public Liberal Arts setting $F(1,109) = 1.27$, $p =. 262$, $\eta^2 = .01$. A summary of descriptive statistics for this analysis is presented in Table 5.

TABLE 1: CONFORMITY TO MASCULINE SOCIAL NORMS AMONG ENGINEERING STUDENTS

Dimension of Masculine Social Norms	N	Min	Max	Mean	SD
Pursuit of Status	128	0	12	7.61	2.63
Primacy of Work	128	0	12	6.87	2.51
Heterosexual Self Presentation	127	0	12	6.80	3.81
Violence	128	0	12	6.75	2.84
Risk Taking	128	1	12	6.34	2.63
Winning	127	0	12	6.34	2.57
Emotional Control	128	0	12	5.88	3.16
Dominance	128	0	12	5.84	2.51
Self-Reliance	126	0	12	4.90	2.97
Power Over Women*	127	0	8	2.62	2.31

*One item on the survey was associated with this dimension. Scores for all other dimensions were associated with two items.

VI. FINDINGS

Our results show that the engineering students in our sample varied in their self-reported conformity to the different dimensions of conforming to masculine social norms. While the self-reported conformity to the norms of pursuit of status, primacy of work, heterosexual self-presentation, and violence dimensions were relatively high; the self-reported conformity to the norms of power over women, self-reliance, dominance, and emotional control dimensions were lower. Furthermore, our results suggest that although there are tangible differences in overall conformity to masculine social norms between male and female engineering students when the moderating effect of institutional setting is considered, this difference is most evident at the public research university setting. Similarly, although differences in conformity to masculine social norms were not statistically significant across race/ethnic groups, or institutional settings; institutional setting appeared to moderate the effect of race/ethnic group on conformity to masculine social norms in a way that made a difference only at the public research university setting.

VII. DISCUSSION

The findings depict a nuanced picture of how individual conform or not to masculine social norms in the context of engineering degree programs. First, on the surface, there was little difference among various social groups in relation to their conformity to social norms. For example, we found no significant difference between students who identified as white and those who identified as other races or ethnicities or among students who were enrolled in the three institutions that were sampled. And although the findings showed that students who identified as male conformed to masculine social norms significantly more than students who identified as female, the magnitude of these differences was notably small when considering that we probed how one enacts norms related to one's identified gender.

TABLE 2: MEANS AND STANDARD DEVIATIONS FOR CONFORMITY BY DEMOGRAPHIC CHARACTERISTICS

	Conformity to Masculine Social Norms		
	N	M	SD
Gender			
Female	29	58.10	7.70
Male	91	62.29	10.46
Race/Ethnicity			
White	95	58.25	9.71
Non-White	20	61.82	10.18
Institutional Setting			
Private Liberal Arts	40	58.80	10.57
Public Liberal Arts	18	59.17	10.45
Public Research	70	62.93	9.59

In general, the entire sample of engineering students scored mid-range on the CMNI measures. Although this trend did not suggest an unusually high group mean for conformity to masculine social norms, this general trend indicates that all engineering students, regardless of race or gender, were likely to indicate the same degree of conformity to these norms. These results are consistent with other work that has shown that engineering is a "prototypical masculine profession" [24, p. 351].

Indeed, work in industrial and organizational psychology investigating the U.S. perceptions of masculinity and femininity associated with particular occupations, found that engineering is widely perceived as masculine in society. Descriptions that accompany this perception include personality traits (i.e., competitive, daring, dominant, adventurous, aggressive, courageous, stands up under pressure) and cognitive traits (i.e., analytical, mathematical, exact, quantitatively skilled, and good at reasoning,

abstractions and problem solving) [25]. These authors showed that gender disparities in particular professions may be linked

TABLE 3: DESCRIPTIVE STATISTICS FOR CONFORMITY AS A FUNCTION OF GENDER AND RACE/ETHNICITY

	Male			Female			Total	
Race/Ethnicity	*N*	*M*	*SD*	*N*	*M*	*SD*	*M*	*SD*
White	73	63.04	10.43	22	57.77	8.30	61.82	10.18
Non-White	14	58.50	11.16	5	58.80	5.68	58.58	9.86
Total	87	62.31	10.62	27	57.96	7.79	61.28	10.16

TABLE 4: DESCRIPTIVE STATISTICS FOR CONFORMITY AS A FUNCTION OF GENDER AND INSTITUTIONAL SETTING

	Male			Female			Total	
Institutional Setting	*N*	*M*	*SD*	*N*	*M*	*SD*	*M*	*SD*
Private Liberal Arts	31	59.77	11.20	8	55.88	8.00	58.97	10.65
Public Liberal Arts	7	55.29	8.85	4	64.75	4.79	58.73	8.75
Public Research	53	64.64	9.59	17	57.59	7.58	62.93	9.59
Total	91	62.26	10.46	29	58.10	7.70	61.26	9.99

TABLE 5: DESCRIPTIVE STATISTICS FOR CONFORMITY AS A FUNCTION OF RACE/ETHNICITY AND INSTITUTIONAL SETTING

	White			Non-white			Total	
Institutional Setting	*N*	*M*	*SD*	*N*	*M*	*SD*	*M*	*SD*
Private Liberal Arts	30	57.47	10.58	9	62.56	10.57	58.64	10.66
Public Liberal Arts	8	60.75	6.39	3	53.33	13.43	58.73	8.75
Public Research	57	65.26	9.73	8	55.25	5.65	63.15	9.76
Total	95	61.82	10.18	20	58.25	9.71	61.20	10.15

to public perceptions of appropriate gender performances. For students who enroll in engineering, they may already conform more strongly with masculine social norms that are associated with the field of engineering [26]. Application and enrollment in engineering fields may already be a filtering mechanism for students' attitudes about masculinity and its alignment with engineering culture and norms.

Each of the examined independent variables yielded little difference associated with how individuals conformed or not to masculine social norms. However, when we examined the institutions of enrollment as a moderating variable on gender or race/ethnicity, we found more pronounced differences within our sample. Students enrolled at Public Research Institutions were more likely to conform to masculine social norms than their peers. This finding is concerning as many engineering programs exist in this type of setting. Our results may point to why masculine norms in engineering continue to persist.

These findings align with other investigations that have highlighted the crucial importance of individual institutions in constructing engineering cultures. For example, Ohland and colleagues [27] found in their study of eight-semester persistence and six-year graduation rates that institutional differences were more pronounced in predicting these variables than gender differences. In their conclusion, they suggest that the institution in which a student belongs is a core factor in determining their overall experience as an engineering student. Furthermore, in her large-scale ethnographic study, Tonso [28] has highlighted the significance of "campus culture" (p. 25) as a noticeable consideration that colors engineering team (and individual) experiences. While the findings in this present study do not directly link to features of the participants' felt culture on their respective campuses, they do provide a link between conformity to masculine social norms within individuals of various gender, racial, and ethnic backgrounds.

A. Limitations

The data in this exploratory study are cross-sectional in nature. As such, we cannot determine causality from our results. Additionally, our sample size for the three institutions examined is small. This small sample size limited our ability to examine differences for students' conformity to social norms at the intersections of multiple race and gender identity categories.

Furthermore, as discussed earlier, we selected and adapted an instrument in a way that was not invasive to the larger study associated with the national survey. While certainly a strong indication of the degree to which student conform or not to masculine social norms, it is possible that the scores indicated from the CMNI-22 do not best capture this social reality. We are currently evaluating the expanded version of the CMNI as well as other instruments that capture individual relationships to masculine social norms.

B. Future Work

Our future work will examine students' conformity to masculine social norms with the entire sample from the national survey. This survey had responses from 3,855 across 32 ABET accredited institutions in the U.S. Further examination of a larger sample will allows disaggregating the data by more nuanced race and gender demographic categories as well as further exploring the interactions by institutional type revealed in this initial study.

Additionally, we are in the initial phases of a small-scale investigation that captures how white, male students experience norms that validate their gender identity. Through this qualitative investigation, we intend to identify features of engineering cultures that validate and encourage masculine social norms while capturing an in-depth and analytical viewpoint of how individual students experience this culture.

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