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”Good Luck, Babe!”: Examining Belonging and Identity for Queer Undergraduate Women in Engineering

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Examining Belonging and Identity for Queer Undergraduate Women in Engineering

Introduction

The goal of this work is to examine the experiences of LGBTQIA+ women in STEM domains. Specifically, the present work examines the differences in feelings of belonging and identity in a chemical engineering program for students of various genders and sexualities based on cultural factors such as peer inclusion and hegemonic masculinity. This paper presents exploratory results from Spring 2024 of the author's undergraduate Honors thesis, which will be completed as of Spring 2025.

Women who are marginalized based on gender, race, sexual orientation, and/or class, have unique experiences with discrimination and sexism (Beal, 2008). They may experience more discrimination and prejudice (e.g., based on both race and gender) or they may experience different forms of prejudice given how their marginalized identities combine. This "double jeopardy" characterization of gender and other forms of discrimination allows for an intersectional examination of the experiences of marginalized women. For example, the discriminative experiences of queer women have the potential to be additive—based on both gender and sexual orientation—or interactive—a unique experience specific to women who are queer. However, this intersection of identities has not been studied in STEM fields despite the documentation of both gender and sexual orientation-based discrimination.

Women and queer—or lesbian, gay, bisexual, transgender (LGBTQ)—people are underrepresented and face persistent biases in the physical sciences, technology, engineering, and mathematics (STEM). For instance, women in STEM have been found to face microaggressions, have lower social capital, and receive lower wages than men (Committee on Increasing the Number of Women in Science, Technology, Engineering, Mathematics, and Medicine (STEMM) et al., 2020). Likewise, LGBTQ professionals in STEM were more likely to face interpersonal marginalization and devaluation in project teams than in traditional work structures without project-based teams (Cech & Waidzunas, 2022). Compared to their heterosexual and cis-gender colleagues, LGBTQ people also experienced more career limitations and harassment (Cech & Waidzunas, 2021). These findings are consistent with prior conclusions that gender and sexual orientation-based disparities cannot convincingly be explained by a difference in qualifications, preparations, or skills (Cundiff & Vescio, 2016).

Background

Masculinity & STEM Domains

STEM fields are stereotypically masculine domains, or fields where the attributes predictive of success are stereotypically associated with men but not women, and fields in which most employees and people in positions of power are men (Vescio, Snyder, & Butz, 2003). While the percentages vary between fields, women represent only 29% of the professionals on average in engineering and technology jobs (Eagly, 2021). Moreover, women leave STEM fields at each milestone at higher rates than their male counterparts (Corbett and Hill, 2015).

The absence of women in leadership positions contributes to women being seen as less favorable occupants and holding traits less suitable for those positions (Eagly, 2002). A similar argument exists for women in engineering. The traits that make a good engineer are stereotypical to those embodied by the traditional, white cis-heterosexual men but conflict with the stereotypes of

women. People who are queer and/or transgender are also seen as less likely to be good engineers because they are stereotyped as non-traditional regardless of their identity. In these contexts, women and queer people are more at risk of stereotype threat, or fear of confirming a negative stereotype about their group membership (Steele & Aronson, 1995). Importantly, stereotype threat undermines performance and connection to domains (i.e., domain disidentification, Steele & Aronson, 1995).

Belonging

Belonging is a fundamental human motivation, and a lack of belonging can affect mental, emotional, and cognitive processes (Baumeister & Leary, 1995). The quality, frequency, and stability of interactions define belongingness (Baumeister & Leary 1995). However, members of socially stigmatized groups are more uncertain of the quality of their interactions, which can adversely impact achievement motivation (Walton & Cohen, 2007). The academic consequences of belonging uncertainty include anxiety around facing rejection and even decrements in performance (Mendoza-Denton et al., 2002).

A consequence of stereotype threat and belonging uncertainty is domain disidentification—students who are in threatening fields may disidentify with a previously valued domain to maintain their sense of value and self-worth, pushing some to leave threatening domains (Hohne & Zander, 2019). In engineering, queer women may experience belonging uncertainty and stereotype threat both as women and as queer people, placing them at risk of domain disidentification.

Prior work in this area has found that a sense of belonging is lowest in the engineering classroom compared to an engineering conference or retreat (Wilson et al., 2010). Moreover, minoritized students, such as women and queer students, are more likely to experience a lack of belonging in the classroom because other students who hold the same identities are underrepresented or absent (Bahnson et al., 2024). Consequently, students who do not feel that they belong are more likely to leave engineering.

Identity

The self has been conceptualized as having two aspects—personal identity and social identity. One's social identity refers to the part of one's self-concept that derives from the social groups to which one belongs (Crocker & Luhtanen, 1990). Importantly, when belonging to a group that provides a social identity, people categorize themselves as group members and self-stereotype, meaning they want to be prototypical group members that embody the defining attributes of the group (Crocker & Luhtanen, 1990). Findings indicate that the extent to which someone will categorize and identify themselves as a group member is related to their sense of esteem within the group (Crocker & Luhtanen, 1990). Therefore, someone with high self-esteem will categorize and stereotype themselves in line with the attributes of a prototypical group member (cite). However, the predictions of social identity theory apply differently to those with low versus high self-esteem, which shaped the motivation to include collective self-esteem with engineering identity as measures (Crocker & Luhtanen, 1990).

Engineering identity describes an individual's sense of their performance as an engineer rather than their feelings of engineers as a group. Engineering identity is theorized as a role identity comprised of the intersection of a student's performance/competence, recognition, and interest in engineering (Godwin, 2016). However, as with the differences in the applicability of social

identity theory predictions, we anticipate that this scale may be a better predictor for dominant group members. Engineering identity goes beyond feeling like you are an engineer—it aligns with feeling like you can adopt the role of an engineer. Therefore, the instrument primarily addresses those who already consider themselves to be a prototypical group member. Through the measurement of collective self-esteem, we hope to examine identity for the widest range of students in both dominant and non-dominant groups, especially considering that the interactions between peer groups can predict engineering identity.

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Hegemonic Masculinity

Hegemonic masculinity refers to the form of masculinity that, within a given culture, is idealized and valued above other forms of masculinity and above femininity (Vescio & Schermerhorn, 2021). Hegemonic masculinity is a cultural ideology, or a set of characteristics, beliefs, and values that connects men and masculinity (but not women and femininity) to power, status, and success. This cultural ideology is endorsed by most people, regardless of gender, and is status-quo reinforcing. In other words, the endorsement of hegemonic masculinity reinforces men's dominance over women. As a result, women's endorsement of hegemonic masculinity reinforces men's dominance over women and marginalized men's endorsement of hegemonic masculinity reinforces White men's dominance over people of color.

In the United States, there are three core dimensions to the conceptualization of hegemonic masculinity (Thompson & Pleck, 1986; Vescio et al., 2010). First, hegemonic masculinity prescribes that men should be high in power, status, and dominance. Power describes the legitimization of men to hold high-status positions in society. Second, hegemonic masculinity also prescribes that men should be physically, emotionally, and mentally tough. Third, hegemonic masculinity upholds values of anti-femininity, which describes the notion that men should be nothing like women and refute all aspects of femininity.

Given its conceptualization and broad endorsement, hegemonic masculinity can be studied in two ways: as an identity that is internalized by individual men and as a cultural ideology that is endorsed by people of all genders. Both are relevant to understanding the context of chemical engineering and its effects on women and queer people.

As a cultural ideology, hegemonic masculinity has defined the attributes of success that underline many professional fields, such as STEM fields, and prior work has shown that endorsement of hegemonic masculinity leads to status-quo-maintaining attitudes and preferences. For example, prior work has found that the endorsement of hegemonic masculinity predicts voting patterns of status-quo-maintaining politicians and politicians accused of sexual assault (Vescio &

Schermerhorn, 2021; Schermerhorn et al., 2021). People of all genders may try to embody the masculine traits prescribed by hegemonic masculinity to be successful. However, even as most men strive to embody hegemonic masculine ideals, few achieve this embodiment. Therefore, hegemonic masculinity exists as an ideology that isn't necessarily tangible yet defines the form of masculinity that should yield success in STEM fields. For queer women in engineering, the masculinity they may embody is likely not infused with hegemonic masculine ideals, creating a conflict with the success and acceptance their masculinity may lend them.

When hegemonic masculinity is a central identity for men, they are at risk of that masculinity being threatened. Relating to the core dimensions, masculinity can be threatened when men are outperformed by women, likened to women, or have failed in being a stereotypically "good" man (Vescio et al., 2021). Other consequences of masculinity threats include violence and discrimination against minoritized and non-normative groups. For example, when men are outperformed by a woman, men experience threats to masculinity that lead to an increase in sexism and the sexualization of women (Dahl et al., 2015). When men learn that they are like women in their emotional response to masculinity threats, they are more likely to perpetrate sexual violence against women (Vescio et al., 2023). Moreover, straight men are more likely to express anti-gay attitudes and engage in compensatory violence when their masculinity is threatened through a same-sex advance (Schermerhorn & Vescio, 2021). Because masculinity threats are likely to lead to attitudes and behaviors that reify men's dominance, engineering has the potential to be a microcosm of hegemonic masculinity because of high-achieving women and queer students. Therefore, the feelings of peer inclusion and acceptance for women and queer students are likely impacted by both cultural and individual endorsements of hegemonic masculinity in engineering.

Peer Inclusion

Peers are a salient aspect of education, particularly in engineering considering the extent of group work completed within the curriculum. However, in the engineering classroom, one barrier to positive peer interactions is the sense of a more welcoming climate for those of dominant identities (Davis et al., 2023). Specifically, people of color, like White women, have reported the climate of engineering feeling more inclusive for White men (Davis et al., 2023). This disconnection in understanding inclusion between dominant and marginalized group members in engineering implies a difference in how these group members experience belonging and develop an engineering identity.

Research on peer inclusion for sexual orientation is less extensive than that of race or gender, and research on the intersection of any of these identities is even less so. Existing research in engineering education on queer engineers and peer relations focuses on gay men in engineering or transgender and gender non-conforming individuals. Prior work found that peers are more likely to be silent rather than openly support their gay peers (Hughes, 2017). Other research addresses the challenges experienced by trans women in engineering, specifically their struggle to be accepted as both women and engineers (Haverkamp, 2019).

The role of hegemonic masculinity as both a cultural ideology and/or an identity internalized by men is lacking in the conceptualization of peer inclusion in engineering education. STEM domains are stereotypically masculine domains in which the attributes predictive of success are stereotypically associated with men and not women. Men are the majority population in most engineering fields, and masculinity theorists have suggested that masculinity is performed by

men for men (Kimmel, 2008, 2012). In addition, prior work shows that competent women in masculine domains can result in individual men experiencing threats to masculinity (Dahl et al., 2015; Vescio & Dahl, 2012). Therefore, not only are men in engineering predominantly performing their masculinity for other men, but they are also being threatened by the mere presence of competent women and other minoritized groups such as queer people, and people of color. If students embody more than one identity that may threaten the masculinity of men in engineering, then the risks of sexual violence, sexism, homophobia, and racism for existing in a male-dominated field may increase, calling for an intersectional examination of their experiences.

Intersectionality

Intersectionality demands an examination of how individuals are affected by different forms of power and oppression and is predominantly rooted in the work of Black Lesbian Feminists during the second wave of feminism. In "A Black Feminist Statement, The Combahee River Collective, an influential group of Black Lesbian Feminists during the 1970s, acknowledged the inseparability of race, gender, sexuality, and class in the dynamics experienced individually and collectively within the group (The Combahee River Collective, 1977). In her work, Audre Lorde, a member of the collective, proclaims the danger of ignoring differences of race, gender, sexuality, or class. In her work "Age, Race, Class, and Sex: Women Redefining Difference," she claims, "It is rather our refusal to acknowledge those differences, and to examine the distortions which result from our misnaming them and their effects upon human behavior and expectation" (Lorde, 2007). Ultimately, the work of the Black Lesbian Feminists from the second wave of feminism created the foundation for us to study this work from an intersectional lens.

Differences in race gender, sexuality, and/or class impact how women experience sexism and discrimination. Moreover, being marginalized beyond gender has been suggested to result in more prejudice and discrimination—a "double jeopardy" situation (Beal, 2008). Beal ultimately argues that different forms of discrimination for women are not only inseparable but also entwined. The "double jeopardy" characterization demands the exploration of entwined, unique experiences for queer women in engineering that are distinct from the normative experience of women in engineering.

The acknowledgment of these differences connects not only to intersectionality but also to identity politics, which is an idea contributed by another member of the Combahee River Collective, Barbara Smith. She argued that "the most radical politics" can come from an individual and their identity (The Combahee River Collective, 1977). Kimberlé Crenshaw used this work to develop intersectionality theory, which emerged as a framework that explained the compounding (i.e., interacting and/or cumulative) effects of gender, race, and other forms of discrimination for Black women in the legal system (Crenshaw, 1991). Examining marginalization from an intersectional lens reveals how unprotected marginalized women, particularly women of color, can be both in their existence and in more isolated moments, such as court cases. In this work, intersectionality is essential to examine the lived experiences of queer women in engineering more wholistically rather than individual moments and identities.

Previous work utilizing intersectionality in engineering education has explored the connection between race and gender. One study has found that the majority women (i.e., white, Asian, and Middle Eastern women) were less likely to experience belonging in engineering while minority women were not less likely (Godwin et al., 2018). However, this finding was explained as a

result of the number of minority women in chemical engineering being significantly less than that of other engineering fields, so the students who are in the field have an established degree of persistence (Godwin et al., 2018). Moreover, another study has suggested that engineering identity alone does not explain the retention of Black women in the engineering workplace (Ross, Huff, & Godwin, 2021).

However, to the best of my knowledge, there has been no work explicitly examining the intersectional effects of identity for queer women in engineering. Rather, prior work focuses on queer men, Transgender and Gender Non-conforming individuals, or the queer community as a whole. In this work, intersectionality will be used to frame the experiences of queer women as the interacting and cumulative impact of their queer and women identities. We anticipate these effects negatively impacting their sense of belonging, engineering identity, collective self-esteem, and sense of peer inclusion.

Research Questions

This work examines the belonging and identity experiences of queer women in engineering and the role of hegemonic masculinity in shaping these experiences through the following research questions:

> RQ1: How do gender, sexual orientation, and their interaction impact the feelings of identity, belonging, and inclusion for undergraduate chemical engineering students?
>
> RQ2: How does the endorsement of hegemonic masculinity differ between undergraduate chemical engineering students of various genders and sexual orientations?

Methods

Participants

Participants were 271 students enrolled in 200, 300, and 400-level chemical engineering courses during the last week of the Fall 2023 semester. The participants received extra credit in exchange for their participation, and an alternate assignment was provided for students who did not want to complete the survey. 102 second-year students, 88 third-year students, and 67 fourth-year students completed the survey. The gender distribution across participants was 147 men, 110 women, and 4 genderqueer/gender non-conforming (GNC) students, who were not included in this analysis. The experiences of GNC students are significant to the examination of queer experiences in engineering, and gender is more complex than the binarized system that is required for statistical significance. The remainder of the participants did not select a gender. 36 participants identified as a member of the LGBTQIA+ community, and 198 identified as straight. Among those who identified their gender as “Woman”, there were 2 students who identified themselves as lesbians, 15 who identified themselves as bisexual, and 4 who identified themselves as queer.

Procedure

Students completed a survey that was approved by the Institutional Review Board of the Pennsylvania State University. After reading a consent statement (see Appendix A), students completed measures of belonging, identity, peer inclusion, hegemonic masculinity, and faculty inclusion (see Appendix B for full measures used). Each measure used a seven-point Likert scale

from (1) strongly agree to (7) strongly disagree. Questions throughout the scales were appropriately reversed. Demographic information was collected.

Positionality

Katharine Getz is a white lesbian who believes in the expansiveness of self, gender, and sexuality. Her motivation to research the experiences of belonging and identity for LGBTQ+ undergraduate engineering students comes from her own experiences and observations of her peers. Her academic background is in chemical engineering, sexuality and gender studies, and engineering education, and her mentor for this project comes from an experienced Psychology background, which guided the construction and methodology of the work. Moreover, as a fourth-year chemical engineering student at Penn State, the participants are her peers. This "insider" position impacted her understanding of the participants and ability to connect with the participants who were also queer women in the chemical engineering program.

Results

Each variable (engineering identity, collective self-esteem, sense of social and academic fit, peer relations, hegemonic masculinity) was submitted to a gender (man, woman) by sexual orientation (straight, queer) between-participants analysis of variance (ANOVA). Significant interactions were interpreted through simple effects tests. The first compared the magnitude of difference with gender within the level of sexual orientation. The second compared straight to queer students within their gender identities.

A significant main effect of gender emerged on each variable. As seen in Table 1, women reported lower senses of belonging and identity, less feelings of inclusion from peer interactions, and a decreased endorsement of hegemonic masculinity.

Table 1. Significant Main Effects of Variables for Gender.

Instrument	Women	Men	F	p	η_p^2
Engineering Identity**	5.30 (.78)	5.70 (.64)	27.72	<.001	.12
Collective Self-Esteem**	5.07 (.67)	5.36 (.65)	15.39	<.001	.06
Belonging**	4.72 (.79)	5.14 (.73)	20.81	<.001	.08
Peer Inclusion**	5.26 (.79)	5.60 (.68)	6.99	.009	.03
Hegemonic Masculinity**	3.09 (.93)	3.77 (.93)	18.40	<.001	.08

Note: * indicates $p < 0.05$, ** indicates $p < 0.01$

For sexual orientation, a significant main effect emerged for Engineering Identity and collective-self-esteem, as shown in Table 2. Therefore, queer students have a decreased sense of identity as an engineer by both scales compared to their straight peers.

Table 2. Significant Main Effects of Variables for Sexual Orientation.

Instrument	Queer	Straight	F	p	η_p^2
Engineering Identity**	5.18 (.99)	5.60 (.65)	5.72	.018	.02
Collective Self-Esteem**	4.96 (.71)	5.29 (.65)	4.57	.034	.02
Belonging	4.73 (1.00)	5.01 (.72)	5.77	.205	.01
Peer Inclusion	5.35 (.71)	5.48 (.75)	.237	.627	.00
Hegemonic Masculinity	3.17 (1.24)	3.55 (.92)	1.91	.169	.01

Note: * indicates $p < 0.05$, ** indicates $p < 0.01$

Consistent with intersectionality predictions, the gender X sexual orientation interaction was significant on engineering identity, $F(1, 230) = 12.27$, $p < .001$, $\eta_p^2 = .051$, collective self-esteem, $F(1, 230) = 6.19$, $p = .014$, $\eta_p^2 = .03$, and belonging, $F(1, 230) = 3.18$, $p = .017$, $\eta_p^2 = .02$. As shown in Figures 1, 2, and 3, the interactions on each variable were driven by the same pattern of mean difference. Compared to their peers who were men, both straight and queer women reported lower levels of engineering identity, collective self-esteem, and belonging. Importantly, however, the magnitude of the gender difference was consistently larger among queer students than straight students: engineering identity, [$F(1,230)_{queer} = 22.81$, $p < .001$, $\eta_p^2 = .090$ versus $F(1,230)_{straight} = 4.93$, $p = .027$, $\eta_p^2 = .021$], collective self-esteem, [$F(1,230)_{queer} = 12.20$, $p < .001$, $\eta_p^2 = .050$ versus $F(1,230)_{straight} = 3.27$, $p = .072$, $\eta_p^2 = .014$], and belonging, [$F(1,230)_{queer} = 15.49$, $p < .001$, $\eta_p^2 = .059$ versus $F(1,230)_{straight} = 7.41$, $p = .007$, $\eta_p^2 = .031$]. We also estimated the magnitude of the sexual orientation effects separately for men and women. Queer (vs. Straight) women reported lower levels of engineering identity, [$F(1,230) = 19.39$, $p < .001$, $\eta_p^2 = .078$], collective self-esteem, [$F(1,230) = 11.94$, $p < .001$, $\eta_p^2 = .049$], and belonging, [$F(1,230) = 7.52$, $p = .007$, $\eta_p^2 = .032$]. By contrast, sexual orientation did not influence men's engineering identity, [$F(1,230) = .56$, $p = .455$, $\eta_p^2 = .002$], collective self-esteem, [$F(1,230) = .056$, $p = .814$, $\eta_p^2 = .000$], or belonging, [$F(1,230) = .58$, $p = .447$, $\eta_p^2 = .003$].

Discussion

We expected to find a significant main effect for each variable with gender and sexual orientation, which was true for gender. These findings indicate that women feel a lower sense of belonging in engineering, identify less as engineers by each scale tested, feel included less by their peers, and are less likely to endorse hegemonic masculinity compared to their male peers.

However, for sexual orientation, a significant main effect emerged for only engineering identity and collective self-esteem, which indicates that queer students identify less as engineers than their straight peers but experience no significant differences in feelings of belonging, peer inclusion, or endorsement of hegemonic masculinity.

We also found that queer women had lower feelings of belonging and a lesser sense of identity (engineering identity, collective self-esteem) than queer men and straight women. While we found that women (vs. men) were consistently lower on identity (engineering identity, collective self-esteem), belonging, peer inclusion, and hegemonic masculinity, the magnitude of this gender difference was larger when students were queer than when they were straight. Moreover, there was no significant difference between the scores of queer and straight men for belonging or identity (engineering identity, collective self-esteem), but there was a significant difference between queer and straight women on those variables. These findings suggest that queer women in engineering face compounding intersectional experiences faced by women. These findings also suggest the existence of particular environmental and cultural factors in engineering, such as hegemonic masculinity, that affect the belonging and identity of queer women, but not queer men nor straight women.

The findings of the present work address an understudied but useful student population in engineering education. Examining the experiences of queer women in engineering can provide vital groundwork for understanding how the hegemonic masculine culture of engineering impacts the experiences of all women in engineering, particularly those who deviate from the normative woman. Despite the novel contributions of the present work, this study included only a small sample of queer students, of whom most were queer women. Future iterations of this survey will be administered to a wider population to receive a larger sample size. Additionally, the sample population that this work draws from is a homogeneously white, upper-class sample, which is not inherently representative of the global population of engineers. Assumptions regarding the pervasiveness of hegemonic masculinity in an undergraduate engineering program and the compounding nature of the disparities that affect marginalized students may have affected the results of this work. While hegemonic masculinity has been accepted as an underlying factor of engineering culture, this work contributes a novel examination of the impact of the endorsement of hegemonic masculinity on individual students of diverse gender identities and sexual orientations.

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Appendix A. Consent Statement

You are being invited to volunteer to participate in a research study. This summary explains information about this research.

This study examines how engineering students feel about their classes and their major course of study. You will be asked to answer questions in which you indicate your perceptions of the importance of your major, your peers, and your engagement. We will also ask you to provide us with some simple demographic information. There will be no information that links your identity to your individual responses and all data will be kept by the Principal Investigator and Research Associates. Information collected in this project may be shared with other researchers, but we will not share any information that could identify you. You will earn course credit for participating. Alternative means are also available for earning course credit as specified. If you have questions, complaints, or concerns about the research, you should Dr. Theresa Vescio at vescio@psu.edu. If you have questions regarding your rights as a research subject or concerns regarding your privacy, you may contact the Office for Research Protections at 814-865-1775. Your participation is voluntary, and you may decide to stop at any time. You do not have to answer any questions that you do not want to answer.

Your participation implies your voluntary consent to participate in the research.

Appendix B. Complete Instruments Used in Survey

- Note: the scales appear in the same order they appeared to the participants.
- Note: (R) is used to indicate reverse scoring of an item.

Collective Self-Esteem Luhtanen, R., & Crocker, J. (1990). A Collective Self-Esteem Scale: Self-Evaluation of One's Social Identity. *Personality and Social Psychology Bulletin, 18(3), 302–318.*

Instructions: We are all members of different social groups or social categories. Some social groups or categories pertain to gender, race, religion, nationality, ethnicity, and socioeconomic class. We earn our membership into other social groups, like professions and achievement-based groups. We would like you to consider your memberships in those particular groups or categories and respond to the following statements on the basis of how you feel about those groups and your memberships in them.

There are no right or wrong answers to any of these statements; we are interested in your honest reactions and opinions. Please read each statement carefully, and respond by using the following scale from 1 to 7:

1. I am worthy of being a chemical engineer. (R)
2. I often regret that I chose chemical engineering.
3. Overall, chemical engineers are considered good by others. (R)
4. Overall, being a chemical engineer has very little to do with how I feel about myself.
5. I feel I don't have much to offer chemical engineering.
6. In general, I'm glad to be a chemical engineer. (R)

7. Most people consider chemical engineers, on the average, to be more ineffective than other groups.
8. Being a chemical engineer is an important reflection of who I am. (R)
9. I am a cooperative participant in groups of chemical engineers. (R)
10. Overall, I often feel that being a chemical engineer is not worthwhile.
11. In general, others respect chemical engineers. (R)
12. Being a chemical engineer is unimportant to my sense of what kind of a person I am.
13. I often feel I'm a useless member in groups of chemical engineers.
14. I feel good about being a chemical engineer. (R)
15. In general, others think that chemical engineers are unworthy.
16. In general, being a chemical engineer is an important part of my self-image. (R)

Engineering Identity Godwin, A. (2016). The Development of a Measure of Engineering Identity. *2016 ASEE Annual Conference & Exposition Proceedings*

Instructions: To what extent do you agree or disagree with the following statements:

1. My parents see me as an engineer. (R)
2. My instructors see me as an engineer. (R)
3. My peers see me as an engineer. (R)
4. I have had experiences in which I was recognized as an engineer. (R)
5. I am interested in learning more about engineering. (R)
6. I enjoy learning engineering. (R)
7. I find fulfillment in doing engineering. (R)
8. I am confident that I can understand engineering in class. (R)
9. I am confident that I can understand engineering outside of class. (R)
10. I can do well on exams in engineering. (R)
11. I understand concepts I have studied in engineering. (R)
12. Others ask me for help in this subject. (R)
13. I can overcome setbacks in engineering. (R)

Sense of Social and Academic Fit Walton, G. M., Logel, C., Peach, J. M., Spencer, S. J., & Zanna, M. P. (2015). Two brief interventions to mitigate a "chilly climate" transform women's experience, relationships, and achievement in engineering. *Journal of Educational Psychology*

Instructions: Answer the following questions about what **chemical engineering** is like for you. Indicate the extent to which you agree or disagree with each statement using the scales below.

1. I belong in chemical engineering at Penn State University. (R)
2. I feel comfortable in chemical engineering at Penn State University. (R)
3. Other people understand more than I do about what is going on in chemical engineering at Penn State.
4. I think in the same way as people who do well in chemical engineering at Penn Sate University. (R)
5. It is a mystery to me how chemical engineering at Penn State University works.
6. I feel alienated from chemical engineering at Penn State University.
7. I fit in well in chemical engineering at Penn State University. (R)
8. Compared with most other chemical engineering students at Penn State University, I am similar to the kind of people who succeed in chemical engineering. (R)
9. Compared with most other students at Penn Sate University, I know how to do well in chemical engineering. (R)
10. Compared with most other chemical engineering students at Penn State University, I get along well with people in chemical engineering. (R)

Peer Inclusivity: Connection to peer relations and engineering identity. Davis, S. C., Nolen, S. B., Cheon, N., Moise, E., & Hamilton, E. W. (2023). Engineering climate for marginalized groups: Connections to peer relations and engineering identity. *Journal of Engineering Education.*

Instructions: Please indicate how much you agree with each statement about interacting with **peers** in chemical engineering.

1. My chemical engineering peers respect my ideas. (R)
2. In chemical engineering, people tend to ignore me.
3. Most of my chemical engineering peers are comfortable working with me. (R)
4. It is too hard to work with people who do not share my home language.
5. I have friends in chemical engineering with whom I can really be myself. (R)
6. Some of my peers think people like me should not be in chemical engineering.
7. Working in groups, I am able to influence our decisions. (R)
8. I am not appreciated for the work I do in chemical engineering groups.
9. My chemical engineering peers often interact with me based on stereotypes.

10. I often socialize with chemical engineering peers outside of class. (R)

Hegemonic Masculinity Thompson Jr, Edward H., and Joseph H. Pleck. "The structure of male role norms." *American Behavioral Scientist* 29, no. 5 (1986): 531-543.

Instructions: Please indicate your agreement with each of the following statements.

1. Success in his work has to be man's central goal in this life. (R)
2. The best way for a young man to get the respect of other people is to get a job, take it seriously and do it well. (R)
3. A man owes it to his family to work at the best-paying job he can get. (R)
4. A man should generally work overtime to make more money whenever he has the chance. (R)
5. A man always deserves the respect of his wife and children. (R)
6. It is essential for a man to always have the respect and admiration of everyone who knows him. (R)
7. A man should never back down in the face of trouble. (R)
8. I always like a man who's totally sure of himself. (R)
9. A man should always think everything out coolly and logically, and have rational reasons for everything he does. (R)
10. A man should always try to project an air of confidence even if he really doesn't feel confident inside. (R)
11. A man must stand on his own two feet and never depend on other people to help him do things. (R)
12. It bothers me when a man does something that I consider "feminine." (R)
13. A man whose hobbies are cooking, sewing, and going to the ballet probably wouldn't be my kind of guy. (R)
14. It is a bit embarrassing for a man to have a job that is usually filled by a woman. (R)
15. Unless he was really desperate, I would probably advise a man to keep looking rather than accept a job as a secretary. (R)
16. If I heard about a man who was a hairdresser and a gourmet cook, I might wonder how masculine he was. (R)
17. I think it's extremely good for a boy to be taught how to cook, sew, clean the house, and take care of younger children. (R)
18. I might find it a little silly or embarrassing if a male friend of mine cried over a sad love scene in a movie. (R)