”We just get stereotyped:” A Comparative Analysis of the Experiences of Undergraduate Women of Color and White Women in Engineering (Work in Progress)

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Women, and particularly women of Color, are underrepresented in engineering, often leading to disciplinary experiences that are characterized by hostility, isolation, and low sense of belonging (McGee, 2018; Miller et al., 2021; Rodriguez & Blaney, 2021). Research has highlighted how the experiences of undergraduate women of Color within engineering contexts are often characterized by increased negative outcomes (Dancy et al., 2020; Dortch & Patel, 2017; McGee, 2016; Mensah & Jackson, 2018; Rodriguez & Blaney, 2021). Yet, scholarship examining gender in engineering that claims to broadly study women (or STEM, as there is little research centered on the engineering context specifically) often conflates the experiences of white women and women of Color (Amelink & Creamer, 2010; Malcom & Feder, 2016; Park et al., 2020; Powell et al., 2009).

The extant scholarship on women's experiences in STEM broadly and that of women of Color in engineering demonstrates that the intersection of race and gender creates nuanced and differential experiences for white women and women of Color. However, there remains limited research that explores how the experiences of white women and women of Color compare within STEM and engineering in particular (for an exception, see Salazar et al., 2020). Further, it is unknown how the women themselves consider and negotiate their salient social identities of race and gender in the engineering context. This is notable as engineering is a disciplinary environment that centers whiteness and masculinity (Milam & Nye, 2015; Parson & Ozaki, 2018; Rohde et al., 2020; Secules, 2019).

The purpose of this study is to explore how undergraduate women experience and understand their gender and race and ethnicity as they progress through their first year in engineering. Using longitudinal, qualitative data, we employ critical race feminism to explore the differences in the first-year experiences of 33 women in engineering by race and ethnicity, with a focus on understanding how racial and ethnic identity either mitigates or exacerbates gender-related issues within engineering.

Theoretical Framework

Critical race feminism (CRF) focuses on the experiences of women of Color and is employed to examine the intersection of race, class, and gender and the manner in which these interlocking systems of oppression create unique experiences for them. Similar to critical race theory (CRT), CRF's roots are in critical legal studies (Childers-McKee & Hytten, 2015) as well as various feminisms (Wing, 2003). However, scholars have increasingly used and suggested the use of CRF in education contexts, broadening the scope of CRT (Childers-McKee & Hytten, 2015).

CRF is driven by the following core tenets (Carter, 2012; Evans-Winters & Esposito, 2010; Wing, 2003). It is multidisciplinary, drawing from various disciplines and theories and callings for the promotion of frameworks and practices that critique and combat both gender and racial oppression. The theory centers on a concern with the various forms of oppression and how these oppressions manifest in the lives of women of Color due to the intersection of race, class, and gender. As such, CRF focuses on anti-essentialism in that it suggests that women of Color have multiple political identities that should be considered. Further, the experiences of White women do not necessarily mimic those of women of Color, and the experiences of men of Color do not automatically speak to the experiences of women of Color. In short, the experiences that shape women of Color are unique to those of men of Color, white women, and white men.

Using CRF, which centers, race, class, and gender inequity, we critically examine the experiences of undergraduate women in engineering through a structural and systemic lens. In doing so, we infer if and how power and interlocking oppression uniquely shapes the experiences of women of Color differently than their white women counterparts in the undergraduate engineering context.

Methods

This WIP uses data from a larger study examining the experiences of undergraduate women engineering students at a selective research institution in the mid-Atlantic region. Women make up more than 30% of the institution's undergraduate population. Participants were recruited in the fall 2017 academic term through a recruitment email sent to all first-year women engineering students at the institution. The email invited prospective participants to engage in a study about their experiences as women engineering students during their college years. Thirty-three first-year women engineering students are included in the sample, with 17 women of Color – 5 Black, 5 Asian, 2 Latinx, 4 Bi/Multiracial and 1 Middle Eastern woman (who indicated based on how the census at the time classified her as white but shared that she experienced herself as a woman of Color and is included in our analysis thusly) – and 16 white students.

The data for this study comes from one semi-structured interview, which occurred during the fourth week of the participants' first semester of college. This interview aimed to understand how participants came to choose to major in engineering, their inside and outside of the classroom experiences during their first few weeks on campus, and their expectations for their first college year and future experiences in engineering. These interviews were conducted in-person and lasted for approximately one hour each. We utilize interpretative phenomenological analysis (IPA) to understand how the women in our study experience and make meaning of their gender and racial and ethnic identities in the engineering context. In delving into the distinct lived experiences of our participants, we see congruence with IPA (Creswell & Poth, 2016; Smith et al., 2009), particularly as we consider how their experiences relate to what is known beyond the disciplinary context (Merriam & Grenier, 2019; Smith et al., 2022). Primarily concerned with mean-making, IPA allows us to illuminate the voices and perspectives of those marginalized in education (Childers-McKee & Hytten, 2015) and understand the meaning participants attribute to their experiences. Interview transcripts were coded deductively, utilizing the existing literature and our research question as guides, enabling us to focus on how these women experience and understand their gender, race, and ethnic identities in the engineering context.

Preliminary Findings

Preliminary findings demonstrate a disparity between the perceptions of white women and women of Color in how social identities are a benefit or disadvantage in their engineering experiences. While white women largely perceive their gender as neutral or a disadvantage, women of Color noted that the intersection of their race or ethnicity and gender serves as an advantage in facilitating opportunities. For example, Brianna, who is Latina, stated "one of the reason[s] why I'm here is because I got a really big scholarship due to my ethnicity and my accomplishments. So I think, like, that definitely helps. Being a minority student, it gives you some advantages." In contrast, Jordan, a white woman, shared "since I've been [at institution] no, I don't think [my identity as a woman has] had any effect [on my experience]."

Additionally, women of Color highlight the importance of communities of peers with shared identities. For example, Nicole, a Black woman, stated:

> The whole idea [of the minorities in engineering program] was to say in this huge, huge school, this is all there is to represent minorities so you guys should stick together and have each other's backs. So that was a nice thing to start the semester 'cause even though none of us knew each other…you knew that you had a group of people that would have your back…It was a common understanding that you can't let the other minorities fail because then everything's just gonna be all white run. You have to help those of you that fall in the same boat kind of thing. I think that was helpful.

Lucy, a bi-racial woman, succinctly stated: "I know that I feel very lucky to be in that [minorities in engineering] program and to have those resources. I know I couldn't do without that program. I just couldn't." However, white women downplayed their gender minority status in engineering, articulating an ethos of meritocracy and egalitarianism with men peers. For example, when asked to consider how her gender identity was relevant to her success in engineering, Mia stated "as far as [if] being a woman is relevant to my actual success, I don't think so. I think that's more determined by my abilities and my kind of drive to work hard and do well in my classes."

Of particular importance in this novel comparative study, women of Color highlighted the ways that white women exacerbated racial or ethnic-related challenges that they experienced within the discipline. Brianna, a Latina woman, described how she felt that "Caucasian females and Caucasian males" perceived women of Color in her engineering classes, stating:

> I think people see us, Hispanic women in engineering as something they have not seen a lot. So they feel like, "Oh, maybe she won't know how to do this. Or maybe she doesn't know about that." Or sometimes people just assume you don't speak English as well as you do. Then, I feel like we just get stereotyped to what their culture is supposed to be like. So that diminishes our accomplishments and without people actually knowing us.

Genika, a Black woman, shared tangible examples of white women moving away from her in classes, rolling their eyes when she asked a question, or looking her up and down to size her up. She stated:

> I just feel like [white women], I don't know if they're trying to combat male superiority and they're just, I don't know, but I feel like they want to be better as well, but instead of working with [women of Color], they're kind of like working against us.

The examples that Brianna and Genika provide suggest that white women may be in need of education around the implications of minoritized identities, including race and gender. In particular, education efforts should help white women understand how they may implicitly or explicitly contribute to challenging environment women of Color face, specifically in the engineering context

Discussion

As these findings indicate that women of Color and white women can and do experience the engineering context differently, the need for identity-related spaces and asset-based approaches to providing support for women of Color is critical. In particular, the need for identity-related spaces for women of Color cannot be understated; engineering and university programs should continue to invest in these resources as they contribute to the overall success and belonging of women of Color engineering students through the development of community.

Furthermore, the intersection of women's social identities may be perceived as advantageous to them; therefore, programs and interventions targeted to women or women of

Color in engineering should utilize asset-based approaches to providing support, highlighting the myriad ways in which their identities are valuable in engineering spaces. While white women and women of Color engineering students share a gender identity, white women also contribute to the challenges women of Color experience, demonstrating a need for white students to learn about the way structures such as race, gender, and class uniquely oppress women of Color and opportunities to demonstrate allyship and care for their women of Color peers. This type of education might be integrated into orientation modules, first-year experience seminars, or experiential learning opportunities within engineering (i.e. women in engineering programs).

Conclusion

As noted in the introduction, research on gender in engineering and STEM often conflates the experiences of white women and women of Color. Our research demonstrates the criticality of examining these student populations separately as well as within conversation with one another. In doing so, peers, faculty, engineering program directors, and institutions can take care to provide the specific types of support that white women and women of Color may need.

Findings from this study have implications for how institutions engage with women in engineering, with results suggesting the need for more intentionality around the integration of discussions of race, gender, class, and other structures into engineering curricula while also approaching engineering pedagogy from a more community-centric perspective. By doing so, institutions can help women engineering students, and women of Color in particular, feel support and belonging throughout their engineering studies. Future work includes a narrower examination of the data by student major and the individual race and ethnicity of the women of Color in the sample. We also hope to explore the ways in which participants' social class may complicate or nuance these findings.

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References

Amelink, C.T. and Creamer, E.G. (2010). Gender differences in elements of the undergraduate experience that influence satisfaction with the engineering major and the intent to pursue engineering as a career. *Journal of Engineering Education, 99*(1), 81-92. https://doi.org/10.1002/j.2168-9830.2010.tb01044.x

Carter, N. (2012). Critical race feminism: An educational perspective. *PowerPlay: A Journal of Educational Justice*, *4*(1), 249–261.

Childers-McKee, C. D., & Hytten, K. (2015). Critical race feminism and the complex challenges of educational reform. The Urban Review, 47, 393-412.

Creswell, J. W., & Poth, C. N. (2016). Qualitative inquiry & research design: Choosing among five approaches. Sage Publications.

Dancy, M., Rainey, K., Stearns, E., Mickelson, R., & Moller, S. (2020). Undergraduates' awareness of White and male privilege in STEM. *International Journal of STEM Education, 7*(52), 1–17. https://doi.org/10.1186/s40594-020-00244-3

Dortch, D., & Patel, C. (2017). Black undergraduate women and their sense of belonging in STEM at predominantly White institutions. *NASPA Journal About Women in Higher Education, 10*(2), 202–215. https://doi.org/10.1080/19407882.2017.1331855

Evans-Winters, V. E., & Esposito, J. (2010). Other people's daughters: Critical race feminism and Black girls' education. *Educational Foundations, 24,* 11–24.

Malcom, S. M., & Feder, M. A. (2016). Barriers and opportunities for 2-year and 4-year STEM degrees: Systemic change to support diverse student pathways. The National Academies Press.

McGee, E. O. (2016). Devalued Black and Latino racial identities: A by-product of STEM college culture? *American Educational Research Journal, 53*(6), 1626–1662. https://doi.org/10.3102/0002831216676572

McGee, E. O. (2018). "Black genius, Asian fail": The detriment of stereotype lift and stereotype threat in high-achieving Asian and Black STEM students. *AERA Open, 4*(4), 2332858418816658. https://doi.org/10.1177/2332858418816658

Mensah, F. M., & Jackson, I. (2018). Whiteness as property in science teacher education. *Teachers College Record, 120*(1), 1-38.

Merriam, S. B., & Grenier, R. S. (Eds.) (2019). *Qualitative research in practice: Examples for discussion and analysis (2nd ed.)*. John Wiley & Sons.

Milam, E. L., & Nye, R. A. (2015). An introduction to scientific masculinities. *Osiris, 30*(1), 1–14.

Miller, R. A., Vaccaro, A., Kimball, E. W., & Forester, R. (2021). "It's dude culture": Students with minoritized identities of sexuality and/or gender navigating STEM majors. *Journal of Diversity in Higher Education, 14*(3), 340–353. https://doi.org/10.1037/dhe0000165

Park, J., Young, K., Salazar, C. & Hayes, S. (2020). Student–faculty interaction and discrimination from faculty in STEM: The link with retention. *Research in Higher Education. 61*(3), 1-27. 10.1007/s11162-019-09564-w.

Parson, L. & Ozaki, C. (2018). Gendered student ideals in STEM in higher education. *NASPA Journal About Women in Higher Education*. *11*(1), 1-20. 10.1080/19407882.2017.1392323.

Powell, A., Bagilhole, B., & Dainty, A. (2009). How women engineers do and undo gender: Consequences for gender equality. *Gender, work & organization, 16*(4), 411-428.

Rodriguez, S. L., & Blaney, J. M. (2021). "We're the unicorns in STEM": Understanding how academic and social experiences influence sense of belonging for Latina undergraduate students. *Journal of Diversity in Higher Education, 14*(3), 441–455. https://doi.org/10.1037/dhe0000176

Rohde, J., Satterfield, D. J., Rodriguez, M., Godwin, A., Benson, L., & Kirn, A. (2020). Anyone, but not everyone: Undergraduate engineering students' claims of who can do engineering. *Engineering Studies, 12*(2), 82–103. https://doi.org/10.1080/19378629.2020.1778036

Salazar, C., Park, J. J., & Parikh, R. M. (2020). STEM student-faculty relationships: The influence of race and gender on access to career-related opportunities. Journal of Women and Minorities in Science and Engineering, 26(5), 413-446. https://doi.org/10.1615/JWomenMinorScienEng.2020031959

Secules, S. (2019). Making the familiar strange: An ethnographic scholarship of integration contextualizing engineering educational culture as masculine and competitive. *Engineering Studies, 11*(3), 196–216. https://doi.org/10.1080/19378629.2019.1663206

Smith, J. A., Flowers, P., & Larkin, M. (2009). *Interpretative phenomenological analysis: Theory, method and research*. SAGE.

Wing, A. K. (Ed.). (2003). *Critical race feminism: A reader* (2nd ed.). New York University Press.