The Influence of Gender & Race on Women in Engineering

A Research Paper submitted to the Department of Engineering and Society

Presented to the Faculty of the School of Engineering and Applied Science University of Virginia • Charlottesville, Virginia

In Partial Fulfillment of the Requirements for the Degree

Bachelor of Science, School of Engineering

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Spring 2024

On my honor as a University Student, I have neither given nor received unauthorized aid on this assignment as defined by the Honor Guidelines for Thesis-Related Assignments

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INTRODUCTION

I have encountered numerous challenges as an engineering student in a male-dominated field. While I've often found myself assigned to tasks traditionally viewed as "secretarial" roles that have historically been assigned to women, I've also recognized that I, at times, placed myself in these positions due to their importance. Engineering is a highly competitive field, and standing out is crucial, especially when seeking internships or full-time positions. The pressure to secure employment has led me to reflect on my role within engineering teams. While I've contributed to technical work, many of the tasks I've been assigned or willingly accepted were stereotypically 'feminine' and often invisible, forgotten, or erased from historical records. My female peers shared similar experiences, shouldering comparable responsibilities in academic or internship environments. We were often praised for skills like communication and writing, qualities that were seen as uncommon in engineers. This led me to ask, "What engineers are we referring to?" After all, the women in question are engineers.

It wasn't until a conversation with a peer that I fully grasped the broader implications of my position as a white, straight-passing, cisgender woman. I realized that while I face barriers due to my gender, my proximity to whiteness placed me in a more privileged position than many of my peers. My experiences were shaped by a system that allowed me to benefit from a certain level of visibility and access, while women of color in similar positions faced compounded challenges. Through deeper conversations with friends and colleagues, it became increasingly clear to how my privileges, derived from race and societal perception, had a negative impact on the opportunities and recognition available to women of color in STEM. My role in engineering, though limited by my gender, was still supported by a structure that gave me advantages not afforded to my peers from racially marginalized backgrounds.

This realization raises critical questions regarding how white women in engineering can leverage their privilege to foster an increasingly inclusive and welcoming environment where the value of an engineer is determined by skills and contributions rather than proximity to white men. Specifically, how does the racial privilege of white women in engineering influence the experiences and career progression of women of color, and how can an intersectional approach to gender and racial equity be developed to address these disparities? While discussions on diversity in engineering often group white women and women of color together in relation to white men, the power dynamics between the two groups remain largely unexamined. As a result, the inclusion of white women in DEI initiatives can inadvertently harm women of color, as white women often fail to recognize their place within the hierarchy. For instance, affirmative action policies, frequently associated with diversity efforts, have disproportionately benefited white women (African American Policy Forum, 2011), reinforcing racial disparities even within gender-based initiatives.

As white women continue to be classified as "diversity hires" under Diversity, Equity, and Inclusion (DEI) initiatives, it is essential to analyze how their racial privilege impacts the experiences of women of color in STEM. This study explores the intersectionality of race and gender through the lenses of tokenism, systemic barriers within academia, majorism, and challenges in fostering a female engineering community that prioritizes belonging and persistence. Tokenism/spotlighting highlights differences, which often isolates those who are one of the few who fall into such 'token' categories. For example, highlighting a white woman because she's a woman and a Black woman because she is Black gives women in engineering this one-dimensional persona that sets them apart from the majority. Furthermore, the systemic barriers are impacted through diversity programs meant to bridge the gaps but ultimately continue to reward 'whiteness' above other demographics/skills, as white women are continually the largest beneficiaries of diversity programs. These two contribute greatly to the feeling of belonging that is lacking within the female engineering community, which divides the community into many different portions, rewarding whiteness while highlighting people's differences in an inclusive way. Ultimately, this project examines how white women's privilege can reinforce structural inequities, as although they are disregarded due to gender, they continue to be rewarded for their race, and how dismantling these foundations which 'reward whiteness' could lead to the collapse of existing hierarchies, bridging the gap between the different communities, and creating a more cohesive engineering team that can create a greater technological future for everyone.

To investigate these issues, the research applies a framework that accounts for the overlapping influences of race and gender, drawing from feminist theory, critical race theory, and the social construction of technology. This study further examines how structural advantages shape career trajectories and workplace experiences for women in STEM. By understanding these dynamics, this research contributes to the broader discourse on inequality within STEM and proposes strategies to mitigate the impacts of white privilege within engineering.

ANALYSIS

To understand the barriers that women, particularly women of color, face in STEM, it is essential to examine three interconnected factors: sense of belonging, tokenism, and systemic barriers. These challenges not only affect women's academic and professional experiences but also shape their opportunities for success and advancement. Research on these issues highlights how gender and racial biases are deeply embedded in STEM environments, in both the academic and professional environments women encounter throughout their careers. While studies on sense of belonging focus on the emotional and social aspects of inclusion, tokenism examines how women are often singled out, and systemic barriers reveal how institutional structures maintain disparities. Together, these factors illuminate the complexities that women, particularly women of color, navigate as they pursue careers in STEM fields. Lewis et al. (2017) surveyed approximately 3,000 undergraduate students in STEM fields to assess their sense of belonging, gender, and persistence. The findings revealed that women generally felt less included than men, with these gender-based disparities linked to lower persistence rates in STEM disciplines. From an intersectional perspective, these findings suggest that while white women may experience exclusion based on gender, women of color face compounded challenges, including racial biases, which further hinder their sense of belonging. In predominantly white spaces, white women may experience gender-based bias, while women of color must contend with additional pressures to 'fit in,' carrying heavier burdens in these environments.

McLoughlin's (2005) longitudinal interviews with 28 female engineering students further support these findings. Her study, which focuses on "spotlighting", the practice of singling out women for their gender, highlights how gender bias affects both the academic and social experiences of women in engineering. From a Culture & Gender Studies perspective, this phenomenon illustrates how Eurocentric, American cultural norms often elevate white men within the social hierarchy, and those who fall outside such are highlighted as a rare phenomenon. By spotlighting women based on gender or race, their accomplishments are diminished in favor of promoting diversity, which inadvertently harms the very group it intends to support. This practice reinforces power dynamics, where white women are placed in a higher status than women of color, and both groups are seen not for their skills but for characteristics beyond their control.

Chow's (2024) qualitative study examines how tokenism, including individuals from marginalized groups to appear diverse, impacts women of color in the workplace. Chow's (2024) findings, through the lens of intersectionality, reveal how women of color are often recognized for their gender but overlooked for their racial identity, or vice versa, limiting their professional opportunities. For example, an African American woman may be included in a leadership initiative aimed at supporting women but her specific experiences with racism are ignored or dismissed due to the place she is filling as a 'token'. Additionally if an Asian American woman might be seen to contribute to a company's racial diversity yet the challenges related to gender bias go unaddressed. This results in many being labelled 'diversity hires' rather than qualified colleagues, which diminish their accomplishments and hard work. Spotlighting and tokenism are interchangeable in these circumstances, and it ties back to how the social 'norm' is that of eurocentric stereotypes, which white women fall into and women of color completely do not. Chow (2024) and McLoughlin's (2005) studies examine how such initiatives aiming to highlight the accomplishments of women in STEM, though intended to bridge the gap, unintentionally create division in the community. When these efforts fail to consider the full complexity of an engineer's racial and gender identity, they risk reinforcing a sense of 'otherness' rather than inclusion. Being singled out as a symbol of diversity can make individuals feel like outliers or

'exceptions' to the rule, rather than fully integrated members of the engineering community. This type of visibility, without genuine inclusion, deepens feelings of isolation that are already prominent in minority STEM students who already struggle with feeling as though they belong in the ocean of white men. As Lewis et. al. (2017) demonstrated, the lack of belonging, is not just about seeing representation, it's about the experiences of the individual and their ability to feel supported, valued and recognized as an engineer within the community.

Ohland et al. (2011) conducted a large-scale data analysis using the Multiple-Institution Database for Investigating Engineering Longitudinal Development (MIDFIELD) to examine academic success and degree completion rates in engineering. Their findings revealed systemic barriers that disproportionately affect underrepresented groups, particularly women of color, who experienced significantly higher dropout rates compared to their white peers. The study highlights how institutional policies and professional dynamics in engineering perpetuate racial privilege, making it more challenging for women of color to persist and succeed in the field. Drawing on Critical Race Theory, Ohland et al. (2011) explain that higher education institutions, with their historically discriminatory foundations, continue to marginalize students of color, as these institutions were not designed with their needs in mind.

Carrigan and Bardini's (2021) study examines how neoliberal values (e.g., individualism, competition, and meritocracy) shape students' identities in academic settings, highlighting how capitalist principles create structural inequities for marginalized students. The analysis, framed through Critical Race Theory, illustrates how neoliberalism exacerbates barriers for women of color in STEM, as it prioritizes individual success over collective support. This framework inherently puts those who rely on communal support, mentorship, and inclusive networks to thrive in historically exclusionary fields like higher education at a disadvantage. When success is framed as an individual pursuit, this reinforces isolation and forces marginalized students to compete against each other. Furthermore, this system strengthens majorism, the idea that institutions give preferential treatment to STEM over the liberal arts due to the economic profit such professions display in society. With this in mind, academic institutions, driven by capitalist ideals, devalue fields rooted in social justice and equity and widen the gaps between the different female communities in STEM based on their economic return rather than their potential or contributions. As a result, the pursuit of diversity becomes performative, lacking the structural change needed to cultivate environments where students support one another and succeed as a community.

Finally, Liska (2015) critiques mainstream feminism for centering the experiences of white, middle-to-upper-class women, often overlooking the compounded discrimination faced by women of color, often referred to as white feminism. This argument identifies how white women often victimize themselves in the wake of discrimination or attempt to step in as the hero. Liska's

(2015) study demonstrates the importance of focusing on a feminist framework that promotes equality for all people by acknowledging differences and bridging the gaps instead of denying that white women and women of color are marginalized in the same way and to the same extent.

To further explore the impact of these challenges, it is crucial to delve deeper into the specific ways that sense of belonging, tokenism, and systemic barriers manifest within STEM fields. By examining each factor more closely, we can gain a better understanding of how they interact to create a complex web of obstacles that disproportionately affect women of color. These factors not only shape the academic experiences of marginalized groups but also influence their long-term career prospects and overall success.

RESULTS

The intersection of race and gender within capitalist societies and its impact on the career experiences of women of color in engineering is important to acknowledge, as it influences the place women hold within the engineering community. Chow (2024) highlights how tokenism, while intended to support diversity, equity, and inclusion efforts, often isolates individuals by emphasizing their marginalization rather than their skills and contributions as engineers. This tokenization process inadvertently reinforces the very barriers DEI initiatives aim to dismantle, especially within a society where DEI is demonized as 'rewarding' less qualified people for being a minority. Carrigan's study on neoliberalism further complements this by showing how competitive ideals in capitalist structures exacerbate the isolation of women of color. By spotlighting their differences rather than fostering a sense of community, these systems create an environment where female engineers feel alienated and unsupported by their peers. This results in women of color being confined to stereotypical roles as the 'diversity hire' or 'token female,' undermining their professional and academic growth and reinforcing the compounded challenges of navigating both racial and gender biases in the field.

Systemic barriers within engineering academia contribute to inequitable outcomes for women of color. Ohland et al.'s (2011) research highlights how the academic system is structured to provide unequal access to resources, mentorship, and networking opportunities for minority students, leading to decreased academic performance for women of color. These barriers are deeply embedded within the institutional culture, reinforcing gender and racial inequalities within the American education system, which are further amplified by the neoliberal ideals Carrigan explores. Chow (2024) expands on these systemic issues by examining tokenism in the workplace, revealing how women of color continue to face discrimination and exclusion post-graduation, often under the guise of inclusion. Tokenism marginalizes their contributions, focusing on race or gender rather than individual skills and achievements. Together, these studies illustrate how overcoming systemic barriers is essential for retaining women of color in engineering, as these persistent issues contribute to the loss of promising talent before they even enter the workforce.

The sense of belonging is critical and plays into the retention and involvement of women in STEM fields. The studies revealed that women in engineering and technical disciplines often feel isolated compared to their male counterparts. This exclusion and lack of acceptance discourages women from continuing in these fields, and this effect is even more pronounced for women of color, as their support system is smaller than any other marginalized group, especially when looking at the subgroups within. Without a supportive, inclusive environment, underrepresented women face high attrition rates, reinforcing STEM as a male-dominated space. For women of color, the compounded discrimination within a male-dominated culture, where a sense of community could otherwise support increased belonging and persistence which further widens the gap. Ohland et al. (2011) support such a conclusion, demonstrating that women of color face additional barriers to academic success and degree completion due to race and gender disparities rooted in institutional foundations. These findings underscore the importance of diversity, equity, and inclusion initiatives, as individuals are unlikely to stay in environments where they feel unwelcome. Without change to the broken system, there will not be growth in the community. If these issues persist in academia, the demographic makeup of engineers will stay the same, and technological evolution will continue to benefit men, as it has done for centuries.

CONCLUSION

Ultimately, increasing the representation of women in STEM is crucial, as the absence of their sustained participation in the engineering community risks stalling technological advancements that could profoundly benefit women. In 2023, it was finally recognized that menstrual product absorbency needed testing with materials beyond colored water, and the 2000s marked the introduction of the first female crash test dummy for vehicle safety being examples of the ongoing misrepresentation of women in technological development spaces. Furthermore, medical devices, BMI scales, and facial recognition systems continue to rely on the "average" white male as the default, underscoring the persistent gap in innovation. Despite living in the twenty-first century, white women are still viewed as "diversity hires" within DEI initiatives, highlighting the stagnation of inclusive technological progress. While white women experience marginalization within the hierarchical system, they remain complicit in perpetuating its inequities by overlooking how their privileges disadvantage women of color. It is essential, as the studies of Chow (2024), Ohland et al. (2011), and Lewis et al. (2017) demonstrate, for women to foster supportive communities, as those who feel alienated are more likely to disengage. White women must critically examine their position within this biased framework, one that marginalizes women of color, or risk reinforcing the oppressive system identified by Carrigan and Liska (2015) as an unproductive system for all women. If the majority of the female

engineering community continues to dismiss these systemic issues, meaningful change will remain elusive. Therefore, by cultivating a community dedicated to dismantling entrenched inequalities, each successive generation can expect a shift where women are no longer seen as tokens, but as equal contributors to the field, recognized for their skills and achievements alongside their peers.

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