Double Standard: How Women of Color Must Navigate in the Engineering Environment

Kaitlyn Anne Thomas, University of Nevada, Reno

Ms. Thomas is a doctoral student and research assistant at University of Nevada, Reno in Engineering Education. Her background is in structural engineering. She received her bachelor's and master's degrees in civil engineering from Southern Methodist University.

Dr. Whitney Gaskins, University of Cincinnati

Dr. Gaskins is the Assistant Dean of Inclusive Excellence and Community Engagement in the University of Cincinnati College of Engineering and Applied Science, the only African-American female currently teaching in the faculty of the College of Engineering. Whitney earned her Bachelor of Science in Biomedical Engineering, her Masters of Business Administration in Quantitative Analysis and her Doctorate of Philosophy in Biomedical Engineering/Engineering Education. In her role as Assistant Dean, Dr. Gaskins has revamped the summer bridge program to increase student support and retention as well as developed and strengthened partnerships in with local area school districts to aid in the high school to college pathway. In 2009, she founded The Gaskins Foundation, a non-profit organization, whose mission is to educate and empower the African American community. Her foundation recently launched the Cincinnati STEM-ulates year round K-12 program, which is a free of charge program that will introduce more students to Math and Science. She was named the 2017 K12 Champion by the National Association of Multicultural Engineering Program Advocates (NAMEPA).

Dr. Kelly J. Cross, University of Nevada, Reno

Dr. Cross is currently an Assistant Professor in the Chemical and Materials Engineering Department at the University Nevada Reno. After completing her PhD in Engineering Education at Virginia Tech in 2015, Dr. Cross worked as a post-doctoral researcher with the Illinois Foundry for Innovation in Engineering Education and in the Department of Bioengineering with the Revolutionizing Engineering Departments (RED) grant at the University of Illinois at Urbana-Champaign. Dr. Cross' scholarship investigated student teams in engineering, faculty communities of practice, and the intersectionality of multiple identity dimensions. Her research interests include diversity and inclusion in STEM, intersectionality, teamwork and communication skills, assessment, and identity construction. Her teaching philosophy focuses on student centered approaches such as culturally relevant pedagogy. Dr. Cross' complimentary professional activities promote inclusive excellence through collaboration.

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Introduction

Engineering is in need of new ideas and innovations to keep up with the growing demands of infrastructure and technology of today's world. Diversity of thought and experience is necessary for this need in engineering to be met. Women of color (WOC) offer a source of underutilized intellectual capital in engineering. However, despite efforts in engineering education, WOC remain underrepresented and underserved (Green, 2006) in engineering and the student body of most engineering programs in universities in the United States (Cross et al., 2017). Research has shown that a possible reason for WOC leaving the engineering field may be from experiences of hostility within the environment that is associated with intersectional identities (Cross et al., 2017; Cross & Paretti, 2012; Mendenhall et al., 2018). The intersectionality of race and gender for WOC, also known as the "double bind," play a large role in their engineering education experiences (Malcolm, 1976; Malcom & Malcom, 2011). This intersectionality of multiple marginalized identities has a multiplicative (i.e., not additive) effect on the struggles to participate in STEM, which can increase the impact of the hostile chilly climate of engineering (Mendenhall et al., 2018; Ong et al., 2011; Ong, Jaumot-Pascual, & Ko, 2020). WOC must operate differently than their white, male and female counterparts because of their unwelcoming experiences during their engineering education. So, how does the double bind lead to a double standard in engineering?

In this study, we seek to explore how the interrelated system of oppression previous scholars named the *double standard* (Foschi, Lai, & Sigerson, 1994; Foschi, 1996, 2000) operate within engineering education and how the double bind WOC experience impacts this system of oppression. Foschi (2000) defines the double standard as "the use of different requirements for the inference of possession of an attribute, depending on the individuals being assessed" (p. 21). That is to say, inconsistent and unspoken performance criteria exist within engineering and WOC may be held to different standards based on negative stereotypes or bias beyond what their white male or female counterparts are held. In this work, this definition served to examine the double standards in educational and professional settings with "competence in task groups" (p. 21). We operationalize the double standard in this study to be a set of principles produced by the false notion of meritocracy and unacknowledged bias in engineering that serve to benefit the majority student population while simultaneously excluding or ignoring traditionally underserved minority (TUM) populations.

Research Question

The purpose of this study is to explore the double standard for WOC in engineering education. We sought to answer the following overarching research question: **How do WOC navigate the engineering culture that promotes a double standard that marginalizes and oppresses them?** To answer our research question, we collected data from six WOC in engineering at a large, public, research-focused institution or also known as a predominantly white institution (PWI). We used a qualitative approach to capture nuanced details and information that was not captured in a survey or other quantitative methodology. Based on the data from this study, we deconstructed the overarching research question into three guiding questions:

- What experiences do WOC characterize as fundamentally marginalizing and oppressive in the engineering environment?
- In what ways did this group of WOC choose to respond to the marginalizing and oppressive experiences?
- How does the engineering environment promote a double standard for these women based on their reactions to these negative experiences?

Answering these questions can help us understand the process of these WOC for operating within the normative white male culture of engineering education and identify the pieces of the double standard that this environment creates for TUM populations who experience the double bind.

Background

WOC are a largely underrepresented demographic in engineering education. Because predominantly white males inhabit the engineering education environment, the dominance of whiteness and masculinity serves as a default in engineering in PWIs. This can be perceived as unwelcoming to TUM populations like WOC. Attrition rates for WOC remain high (Chang, Sharkness, Hurtado, & Newman, 2014), which suggests that these students may experience oppression or marginalization in the engineering education environment due to the normative engineering culture based on centered identities (Kirn et al., 2016). These experiences in the engineering education environment produce a chilly climate for women (Collins, Bayer, & Hirschfeld, 1996; Jorstad et al., 2017; Morris & Daniel, 2008; Malicky, 2003) and students of color (Cross & Paretti, 2020; McGee, 2016; McGee & Martin, 2011; Palmer, Maramba, & Dancy, 2011). Walton et al. (2015) examined two interventions to quell the effects of the chilly climate in engineering education for women students. This study showed that interventions relating to the students' "self-identity" becoming salient in their daily lives helped women to develop "external resources" like mentors to deepen their gender identities (p. 468). Further research shows that WOC face barriers to success in engineering, evidenced by the low demographic statistics of WOC in engineering fields, which reveals systemic issues of equity in the engineering education environment (Mendenhall et al., 2018; Ong et al., 2011; Ong, Jaumot-Pascual, & Ko, 2020).

Among these equity issues lies the double standard for women and TUM students produced in the environments within PWIs. The double standard for women in science, technology, engineering, and mathematics (STEM) has been studied (Hunt, 2016; Hill, Corbett, &St. Rose, 2010). Outside of engineering, the sexual standard for women (Milhausen & Herold, 2002) and specifically Black women (Fasula, Carry, & Miller, 2014) has been studied, but little to no research has been conducted to examine the double standard produced by the double bind in engineering education. With this study, we aim to fill this gap by examining how WOC navigate the double standard produced in the engineering education environment.

Theoretical Framework

This study employs the theoretical framework of intersectionality to investigate the themes of microaggressions, engineering socialization, and isolation. Intersectionality is defined as the space where two or more identities meet and influence certain consequences of the systems that undermine those identities, such as oppression (Crenshaw, 1990). In this study, we use the intersectionality framework as a lens to understand how multiple identities (race and gender) intersect to form the double bind for WOC, which becomes salient in the chilly climate of

engineering. Dr. Susan Jones and colleagues used a conceptual model of multiple dimensions to illustrate how identity salience forms in a situative perspective (Duran & Jones, 2019; Jones, 2009; Jones & McEwen, 2000). Whatever identities become salient to an individual in a situation will intersect in some way to cause specific consequences. For WOC in engineering education, the intersectional identity, or double bind, of race and gender can lead to marginalized social interactions, cultural norms, and representation (Cross et al., 2017; Mendenhall et al., 2018; Ross, Capobianco, & Godwin, 2017). Specifically, Tate and Linn (2005) examine intersectional identities of WOC in STEM to discover how these students tended to separate academic and social activities due to the salience of different identities in each setting. However, WOC experienced "feelings of difference and a sense of not belonging" in academic contexts (p. 491), which signifies possible issues of equity and inclusion in engineering education. Settles (2004) reveals how negative outcomes result from the salience of multiple conflicting identities. Specifically, Settles showed how women in science face difficulties that have lasting "psychological and performance consequences" because of their conflicting woman and scientist identities (p. 496). Similarly, Carlone and Johnson (2007) highlighted the lack of recognition for WOC scientists who succeeded despite a disruption to the science identity development. Therefore, the intersectionality framework allows us to consider how WOC make meaning of their experiences that may promote or hinder the integration of their racial and engineering identity dimensions.

Furthermore, not all TUM populations have equivalent experiences in engineering education. Intersectionality is necessary to understand the uniqueness and nuances of students with intersecting marginalized identities. McCall (2005) discusses an anti-categorical approach to identity research, stating that "a wide range of different experiences, identities, and social locations fail to fit neatly into any single 'master' category" (McCall, 2005, p. 1777). This speaks to intersectionality as a theoretical framework to understand this "wide range" of identities that are present in engineering education students even though engineering education caters to a single understanding of engineering identity. The nuances of the experiences of WOC in engineering are explored in this qualitative study.

Methods

Positionality Statements

Kaitlyn Thomas: I am a heterosexual, white woman raised by two working-class parents in a double-income household. Both parents were first-generation college graduates from the Midwest, and they raised me and my two siblings in California. I graduated from a private, teaching-focused university in Texas with a bachelor's and master's degree in civil engineering with an emphasis on structural engineering. I worked for three years as a civil engineer before going back to school and pursuing engineering education. My education and career in engineering took place in predominantly white, male settings. Since this research captures the experiences of WOC, my race, gender, and experiences in engineering education are salient as a researcher in this study. Many of these women's experiences I did not relate to firsthand because of my identification as a white female. This research opened my eyes to the barriers to entry and success in engineering education for WOC and other TUM populations.

Whitney Gaskins, PhD: I am a Black, cisgender heterosexual female who identifies as a Christian who is an empowerment enthusiast for marginalized populations. I started my career as an engineer in industry working for foreign-based automobile manufacturer. I transitioned to

academia and currently work as an engineering assistant professor and assistant dean for inclusive excellence and community engagement. I also oversee a K-12 community foundation that encourages underrepresented minority students to pursue careers in STEM. I was raised in a predominantly white, rural Midwestern area by parents who both hold college degrees. My passion for my work comes from my desire to create opportunities for marginalized individuals who have traditionally been underserved in our society. My work generally focuses on increasing access to spaces and ensuring that individuals have positive experiences within those spaces.

Kelly Cross, PhD: My interest and concern about this research topic is relevant to me both personally and professionally. I am Black, female, same-sex loving, engineering professor with strong beliefs around spirituality. I am a first-generation PhD in my family and raised in a racially and economically segregated large city in the Midwest. My research agenda is to broaden participation in engineering. My previous research investigated the experiences of multiple marginalized groups including women of color and members of the LGBTQ spectrum. I typically take an intersectional approach to identity in research and I am passionate about giving voice to those often overlooked in the business of educating engineers in the U.S.

Recruitment

The interviews used for this study stem from a larger, sequential mixed-methods study. The six WOC opted in to be interviewed after a recruitment process that included emailing all female undergraduate engineering students and solicitation to student organizations (National Society of Black Engineers (NSBE), Society of Hispanic Professional Engineers (SHPE), and Society of Women in Engineering (SWE)).

Participants

Six WOC students from the College of Engineering at a large, research-focused Midwestern university self-selected to be interviewed for this study. All participants were at least eighteen years old at the time of the interviews. Table 1 shows the racial identification information of each participant. To protect the participants' anonymity, pseudonyms replaced their names, and some demographic information was excluded to avoid inadvertently identifying information in this manuscript.

Table 1: Participant Self-Reported Racial Identification Information

Participant Pseudonym	Self-Reported Race
Aalyah	African American
Kelly	Hispanic American (half Norwegian)
Lisa	Asian American (Filipino)
Monica	African American (biracial)
Sandra	African American
Tracy	African American

Study Limitations

The limitations of this study include the scope of the study's design and the generalizability of the results. The study uses a small sample of six WOC, all from the same university. As a result, the stories of these women reveal the systemic issues from one singular PWI. However, this small sample size indicates the need for more research on WOC since the representation of WOC in engineering remains low. Though the generalizability of the results was not the aim of the study, further research will be useful to fill in this gap and allow for these results to influence other PWIs across the United States.

Data Analysis

The data were collected through semi-structured interviews that were audio-recorded and transcribed. We employed an a priori coding method through a codebook produced from the larger study as well as a thematic analysis method (Fereday & Muir-Cochrane, 2006). Each transcript was read through completely before any coding was performed. After the first read-through, we assigned one or more codes to specific lines of text in the transcripts and supplemented the codes with comments. The comments included further detail explaining why the codes were used, the feelings of the coder at the time of coding, or possible links to previous literature or concepts. This thematic analysis led to the four emergent themes based on the data from the six interviews. These four themes reflected trends in the experiences of these women. The codes "Confidence/Pride and Empowerment" and "Moment of Pride" were present in the original codebook, but their definitions leaned toward circumstances that did not match these new code definitions. Instead, lack of confidence or valuing one's own achievement/skills learned were highlighted. These new code definitions offered nuanced information, which were needed to characterize the six interviews in the current study. During the analysis process, the code definitions and final code designation was negotiated among research group members to produce intercoder reliability. The full codebook for the overall project can be found in an upcoming manuscript (Cross et al., 2021).

Results

The results of this study are consistent with previous research suggesting that a system of oppression called the double standard exists in engineering education. The double standard in engineering education is defined in this study as a set of principles produced by the chilly climate of engineering that serve to benefit the majority student population while simultaneously excluding or ignoring TUM populations. WOC experience a double standard because they must react in different ways to protect themselves and survive in this chilly climate. To be recognized as an engineer, WOC must adapt to social norms that are not their own to stay engaged with the engineering community while maintaining their own agency and sense of racial identity. The engineering community needs to continue developing inclusive spaces where WOC can thrive and establish safe spaces filled with individuals they can confide in within their engineering education. Concurrently, WOC can seek to establish community with supplementary clubs or organizations that they sometimes have to form themselves on campus and identify mentors to help them navigate volatile environments exacerbated by recent social justice awareness. This is an extra burden of time, energy, and other resources for WOC on top of their rigorous engineering curriculum.

The three main themes that revealed the double standard in these six participants' experiences were microaggressions, engineering socialization, and isolation. Table 3 defines these themes

and identifies the subcodes associated with them. These themes emerged across the experiences of these WOC to reveal a double standard in engineering education. Within this engineering education environment, the systems needed to succeed (like support from community members and environments that foster an engineering identity in line with one's personal identities) are provided easily for white males, but WOC must go seek these out, often at the cost of their own time and resources.

The double standard in engineering education encompasses how the women in this study felt like in engineering, they were being socialized toward the White male culture through their interactions with classmates and faculty as well as in the workplace. The normalized, white male culture produced situations that were damaging to WOC because engineering peers and faculty were insensitive to the double bind and its effects on WOC, creating environments that perpetuate racist and sexist behaviors and interactions. In this study, the WOC talked about these negative experiences, which took the forms of microaggressions, engineering socialization, and isolation. The following sections break down text from the six interviews to expose these themes and how they contribute to the double standard in engineering education.

Table 2: Three Main Themes and Their Operationalized Definitions

Theme	Subtheme	Definition	Operationalization
Microaggressions	Microinsult	Stereotypical notions about WOC such as personality traits, appearance, or negative assumptions of intelligence or ability	Statements regarding unspoken insults that communicate negative stereotypes, hostility, or insults to a group
	Microinvalidations	Statements that undermine the abilities or intelligence of WOC because of race or gender	Statements that characterize minorities as foreigners, profess color blindness, assert that bias does not play a role in minorities' experiences, or deny personal bias
Engineering Socialization	Internalized oppression	Process of adopting engineering social practices and unacknowledged epistemologies that sustain inequity	Statements regarding social norms in engineering that prevent equity and full participation of WOC in engineering
Isolation	Lack of representation	Statements that acknowledge participant as the only WOC in their engineering environment	Statements describing loneliness, lack of belonging, lack of representation, or descriptions of being the only woman or person of color in their environment

Microaggressions

Microaggressions are defined as insinuations that promote stereotypical ideas of WOC without overtly insulting (Sue et al., 2007). In this study, microaggressions fell into one of two subthemes: microinsults and microinvalidations. Microinsults occur when individuals communicate negative stereotypes, hostility, or insults to a group, and microinvalidations occur when individuals make statements that undermine the abilities or intelligence of WOC because of their race or gender (Lewis et al., 2013, 2016, 2019; Harwood et al., 2015, 2018; Lee et al., 2020). All participants reported experiencing microaggressions toward themselves or witnessed microaggressions toward others. Most of these microaggressions took the form of inappropriate banter among classmates or faculty that left the participants feeling excluded or hurt in some way. The following are two examples of these microaggressions and how they contributed to the double standard that marginalized these women.

Sandra experienced multiple microaggressions in her engineering education that ultimately led her to leave the field altogether. One such instance was in her first year interacting with male classmates. Sandra reflects on how she felt unladylike in the following:

> "Some of the banter and conversation in my first year in [name], all the other engineers, the guys, it wasn't too abrasive or vulgar, but it was just unnecessary, so that felt unladylike to me because I don't necessarily sexualize certain things."

This interaction invalidated Sandra's identity as a female and led her to be excluded from the conversation. As such, we classified this experience as a microinvalidation. From Sandra's perspective, this language was uncomfortable and inappropriate because she admits she doesn't "necessarily sexualize certain things." Therefore, Sandra reacted by staying silent and leaving this language unacknowledged, allowing it to perpetuate because she is not in an authority role to necessarily change the cultural norms that allowed the language in the first place. Sandra must continue to operate within the double standard without the representation necessary to address the situation. Another participant experienced inappropriate behavior that was racially driven and equally as inappropriate.

Monica spoke about her experience with microaggressions in engineering education when she recalls an event called the First-Year Engineering (FYE) Fest, which is a student work fair for new students. A photographer walks over to Monica and her group to ask for a picture. Monica continues in the following:

> "And we're like, "Yeah, sure, okay." And he's like, "No, no, no. The black people." And we're like, scrrrt! Like, "What?" And he's like, "Yeah, the college wants me to take pictures of women and pictures of people of color." Now, the photographer was black; he was a black man. He was just doing his job of what the college told him to do. But that didn't make it better for me. I feel like, in his mind, why would he also think that doctoring photos is the way to promote diversity?"

In this interaction, the photographer acknowledged Monica and included her only because of her race and gender. This invalidated Monica's value in engineering because her accomplishments in the field did not matter. As such, we coded this experience as an invalidation. Though the photographer wanted to take her picture because of the double bind, the purpose of the picture was to spotlight Black women in engineering. Monica's experience with this photographer exposed a problem in engineering education culture, which is attempting to promote diversity or advertise it without genuinely making efforts to diversify the engineering education population from students to faculty. As a result, initiatives may be overlooked to increase opportunities and engagement for minority populations like WOC because they may seem unnecessary given the facade of progress.

This unwarranted attention can lead WOC to feel like the token (Stichman, Hassell, & Archbold, 2010), which may feel like being paraded around by the school to promote diversity. Spotlighting, whether it is with neutral or mal intent, promotes an environment that is uncomfortable and therefore perceived negatively by the population called out (McLoughlin, 2005). Research has shown that WOC are exposed to systemic racism as a result of tokenism (Robinson, 2013). In Monica's experience, the extra expectation for her to be the school's banner for diversity is an unfair burden on her and an example of systemic oppression in the large public institutions. Adding on this expectation of representation for all WOC to a small group of students is an unfair and inequitable practice in educational institutions. Conversely, white males would not experience this microinvalidation in engineering because they are the

majority population. Thus, Monica's microaggression experience exposed another facet of the double standard in engineering education that WOC are subjected to.

Both WOC in these examples experienced microinvalidations to their multiple identities in the engineering environment. Sandra's identity as a woman was invalidated through inappropriate conversations among her colleagues that excluded her. Monica's identity as an engineer was invalidated because she was spotlighted for her race and gender and not her accomplishments in engineering. All participants recalled similar experiences that marginalized them because of their race and gender in engineering. The double bind exposed the double standard in engineering in two other ways: engineering socialization and isolation.

Engineering Socialization

Similar to how the participants in this study reported microaggressions, all six women reported instances of engineering socialization during their engineering education. Engineering socialization is defined as the process of adopting engineering social practices and unacknowledged epistemologies that sustain inequity (Ong et al., 2011). The subcodes associated with engineering socialization is internalized oppression, defined as consequences of negative experiences that result in perceived inadequacy or incapability to succeed in engineering. Kelly and Tracy offer examples of the internalized oppression that manifested from the engineering norms they were socialized to.

Kelly expresses how this system of oppression manifested in the teaching styles of her engineering professors. This socialization forced her to adapt to norms that left her feeling inadequate or out of place. She explains in the following:

> "…when I got to college, it's kind of seemed like when professors would teach, they would – there's like, that base level and then, they'd cover the base level on like, the first day. And then, after that, it was just assumed you knew all these things and I was never learned any of those things."

Kelly admits she did not have the same educational background as other students coming into the same engineering program when she states, "I was never learned any of those things." She highlights her forced adaptation to engineering practices when she states that her professors "assumed [she] knew all these things," and that is how they taught. This indicates that engineering faculty favor a specific learning path or system of education. Different educational backgrounds were unacknowledged in Kelly's classes by her professors. Kelly's experience reveals the engineering education double standard based on the academic practices and expectations in the environment. The assumption that all students start from the same level of understanding can leave students who did not have the same educational background feeling inadequate or not smart enough to participate in engineering. Another participant in this study reveals a similar experience that highlights this double standard.

Tracy acknowledges the differences in her previous education compared to her classmates, which leave her feeling lacking in the skills necessary to succeed in engineering. She explains in the following:

> "…I would say sometimes I feel like I'm lacking abilities compared to some of my peers, or I'm lacking knowledge compared to some of my peers."

Tracy feels like she is "lacking abilities [and] knowledge" in her education because she started from a different educational position. No one (faculty or staff) addressed or resolved this difference in starting point in her engineering education. This may indicate that professors favor

a singular path to knowledge and conceptual understanding in engineering, and if any other path was taken, the student has the responsibility of filling in the educational holes. As a result of this extra burden placed on the student, Tracy feels unprepared and behind in her studies compared to her peers. Her lack of performance/competence beliefs could negatively affect her engineering identity development (Godwin et al., 2016; Hazari et al., 2010) as well as her engineering persistence (Marra et al., 2009; Mau, 2003). Therefore, Tracy perceived her differing ideas or unacknowledged educational background as her fault for being unprepared. This is a result of the double standard of engineering socialization in the classroom.

Kelly and Tracy both provided examples of how engineering socialization promotes a double standard in the classroom by promoting narrow pathways to understanding, leaving other ideas or ways of knowing unacknowledged. As a result, these participants felt unprepared for their studies. This is also connected to the theme of isolation since WOC are so underrepresented in engineering education. This isolation leads to negative perceptions about their knowledge, skills, and abilities, causing the students to feel at fault.

Isolation

The last theme that kept repeating in the six interviews of this study was isolation, which is defined as loneliness, lack of belonging, lack of representation, or the experience of being the only woman or person of color in their environment. We associated the subtheme of lack of representation with isolation because so few WOC are represented in the engineering environment that students can feel isolated as a result. Not only can isolation lead to lack of belonging in engineering, but it can also create instances of miscommunication or undermining of WOC (Seymour & Hewitt, 1997; Tate & Linn, 2005). Also, isolation can place undue burdens on TUM populations to seek out community because it is not provided by the school. Two participants explain these two facets of the engineering education double standard through the theme of isolation.

Aalyah expresses issues as a WOC in engineering due to negative peer interactions in her classes. She discusses the following:

> "I know even in my manufacturing processes class, I'm the only girl there in that section, like only one. Then I'm also the only black person in that section. So, it's really hard for me to be like – to try to even ask people questions because it will be like, 'Well, this is obviously the answer.' I'm like, 'It's not obviously the answer to me because I didn't know that.'"

Aalyah prefaces her classroom experience by contextualizing herself as the "only girl" and "only black person" in her manufacturing processes class. She understands the significance of this isolation in her experience with her peers. Aalyah's classmates assume a threshold level of understanding of the concepts as well as a particular way of understanding these concepts when they state, "'Well, this is obviously the answer.'." Aalyah makes sure to point out to them that even though they may find something "obvious," that does not mean that she found it apparent. Aalyah's experience highlights how the chilly climate in engineering can translate to her isolation not only physically but also intellectually since she did not share the same understanding of the concepts in her class as her white male counterparts. As a result, the unacknowledged difference in perceptions perpetuates the engineering education double standard.

Other participants in the study reported similar stories of isolation. Tracy also identifies a financial consequence of the engineering environment in terms of career-based organizational

funding for WOC. She was asked how race has impacted her experiences in engineering education. Tracy discusses her experiences with the college of engineering in the following:

> "Trying to get resources from the college of engineering has been kind of tough, but it's just something that we have to be persistent about. So that's compared to some of the other orgs that aren't necessarily identity-based; we definitely have to try a little bit harder to get some of the resources that we want."

Tracy highlights the lack of resources available to organizations supporting careers after college for WOC because they are "identity-based." As a result, she must be "persistent" with the college of engineering to simply keep her organization running. Tracy also compares her organization to others in the engineering environment and mentions she must "try a little bit harder" to receive the resources. Identity-based organizations that Tracy is a part of must put forth extra effort to receive the resources they need compared to other engineering programs that do not cater to minority student populations. WOC are uniquely affected by the double bind because of this. In order to create a community of people who share the intersectionality of race and gender, Tracy revealed that the college of engineering proved difficult to work with when attempting to acquire resources, which can add stress and take up time. Majority students do not need to go through this to find community in engineering education. Therefore, Tracy reveals how she must maneuver around the double standard in engineering education to create a community of people and resources to help foster personal identity and fuel persistence in engineering.

The six participants in this study told their stories about the double bind in engineering education. Their experiences revealed the double standard for WOC in engineering. The implications of this study include an unacknowledged system of oppression that limit the resources for WOC and further marginalize differing perspectives or intellectual backgrounds. Educators share the responsibility of understanding the double bind of race and gender and why education systems undermine WOC disproportionately more so than other student populations in engineering education. Once this is understood, actions can be taken to disrupt the systems of oppression embedded in the practices of engineering education.

Implications and Recommendations for the Future

The implications of this study involve recommendations to improve the engineering education environment for WOC and strategies for WOC to cope with the marginalization of the double standard. With regard to the former, we suggest educating faculty, administrators, and other academic leadership on how to identify and call out situations involving bias and discrimination. Training for faculty and staff should have the goal to provide psychological safety (Newman, Donohue, & Eva, 2017). The secondary goal is to transform people from bystanders to upstanders (Winston, 2020). This is needed through all levels as participants have experienced microaggressions and microinvalidations from peers to higher administration. This education must include sensitizing these authority figures to the unique intersectional identity of WOC due to the double bind as well as faculty training involving microaggression awareness and steps to alleviate this type of conflict with students. This will help educators understand and better identify the struggles WOC must overcome in the engineering environment (Yamaguchi & Burge, 2019).

To help WOC navigate the chilly climate of the engineering environment, we suggest teaching strategies to deal with marginalization based on the double standard. Specifically, engineering

leaders should help WOC advocate for themselves, identify allies, develop support systems, and support agency development as a WOC in engineering. With these skills, WOC will be better equipped to respond to situations marginalization with confidence and foster their identities as engineers despite negative treatment in the engineering environment.

Summary

While engineering education continues work on broadening participation of TUM populations, this study demonstrates that substantial work must be done to support engineering students who happen to be WOC. With this study, we showed how WOC navigate the double standard of the engineering environment through the themes of microaggressions, engineering socialization, and isolation. The double standard forced WOC to adapt to an unwelcome environment and create systems around them for their own success that are not provided by the engineering education environment. This study opens the discussion for ways engineering colleges can better support WOC students through programs and initiatives that seek to understand and celebrate the unique experiences of WOC in engineering.

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