Proposing an Engineering Gendered Racial Microaggression Scale

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Abstract

Background
Minorities in engineering regularly experience negative statements or behaviors of others that disparage them due to their gender, race, ethnicity, or other identity. Students from engineering have cited these persistent subtle negative statements and behaviors, or microaggressions, as reasons for considering leaving engineering programs or the university entirely. Previous measures of microaggressions have not been designed to capture the unique experiences of minorities within the engineering environment.

Purpose
This research differs from previous work because it incorporates an intersectional perspective by acknowledging microaggressions are not experienced universally for individuals within all groups or institutions (Crenshaw et al. 1993; Wilkins 2012). In the context of a predominantly white institution (PWI) and a historically black college/university (HBCU), the experiences of gender and racial minorities in engineering departments were asked to share their experiences to identify overarching themes in microaggressive language and actions. The research strives to answer, "How do gender and race microaggressions affect student success and persistence in engineering programs?"

Brief Research Methodology and Approach
The preliminary scale used a three phased approach to scaled design to nest the novel scale in the existing literature, previous scales, and from interviews with minority engineering undergraduate students. The current paper presents a preliminary Engineering Gender and Racial Microaggression Scale (EGRMS) to measure microaggressions within the engineering environment.

Preliminary Results
This research expands knowledge on intersectional microaggression experiences of engineering students. The overarching goal is to address the needs of multiple identity groups including the dominant white male student, female students, and students of color.

Keywords Racism, Engineering Education, Sexism

Introduction

      Engineering fields have a persistently low representation of women and minorities, but there has been an increase in women and racial or ethnic minorities (National Science Board, 2020; Roy, 2019). An environment with a limited diversity can expose underrepresented minorities and women to negative experiences in the form of microaggressions (Camacho & Lord, 2011). Microaggressions are "brief and commonplace daily verbal, behavioral, or environmental indignities, whether intentional or unintentional, that communicate hostile, derogatory, or negative racial slights and insults toward people of color" (Sue, Capodilupo, et al., 2007, p. 271). Examples of microaggressions include telling an international student that they speak English well or telling an African American woman her natural hair is not professional. Two-thirds of minorities in engineering report experiences these frequent subtle racist behaviors (Williams et al., 2016). Experiences of microaggressions can contribute to hostile campus

environments for undergraduates and lead to decreased persistence among engineering students of color (Samuelson & Litzler, 2016; Yosso et al., 2009). At the individual level, engineering undergraduates who experience microaggressions may face decreased academic self-efficacy and self-esteem (True-Funk et al., 2020). Additionally, Camacho and Lord (2011) found that microaggressions contributed to a hostile environment within engineering education. Women within male dominate majors like engineering face environments widespread incidents of sexist microaggressions (McCabe, 2009). Among Latinx college students, microaggressions have been associated with negative persistence attitudes (Hernández & Villodas, 2019).

Women in engineering may experience microaggressions due to their gender and racial or ethnic identities (Camacho & Lord, 2011). Referred to as gendered racism, women of color experience interconnected racism and sexism because of preconceived perceptions of their race and gender (Essed, 1991). A closely related concept, intersectionality, can determine student experiences at the intersection of multiple identities such as gender and race (Crenshaw, 1989; Ro & Loya, 2015). Intersectionality or the interaction of race and gender forming multidimensional experiences of women and racial or ethnic minorities leads to unique identities uncaptured by unidimensional examinations of gender or race alone (Crenshaw, 1991). An individual's intersectional identities are interdependent, not additive, nor independent (Cho et al., 2013). Intersectionality accounts for the complexity of identities of race, gender, ethnicity, class, and a myriad of other identities. Intersectional identities originate in the multidimensional nature of society and the interaction of these identities with discriminatory treatment (Crenshaw, 1991). For example, a Black woman is simultaneously Black and a woman and may experience racially-based sexism because of the intersection of her race and gender. These negative experiences are not additive but are, in fact, interdependent upon their difference from the dominant society that embodies Whiteness and maleness. Her experiences become more complex as additional dimensions are considered like her class, education, or motherhood status. This example highlights the complexity of individual experiences with microaggressions, and their effects lead to challenges with empirical measurement. Previous research has used a qualitative research design that have produced rich accounts of experiences of microaggressions (Lewis et al., 2016; McGee & Martin, 2011; Sue, Bucceri, et al., 2007; Yang & Carroll, 2018). Unfortunately, all qualitative data has limitations on generalizability to large populations and it can be difficult to empirically examine the scope of microaggression experiences. To capture the extent of microaggressions, scales have been designed to quantitatively document the frequency of occurrence of microaggressions among specific groups like racial and ethnic minorities (Nadal, 2011) or Black women (Lewis & Neville, 2015). Other scales have been written to capture the experiences of only one intersectional group such as Keum et al. (2018) who designed the Gendered Racial Microaggression Scale for Asian American Women (GRMSAAW). One exception to this approach of examining only one or two intersectional identities was Torres-Harding et al. (2012) who included several racial and ethnic identities in the design in the Racial Microaggression Scale (RMS). None of these previous scales have been designed to capture microaggression experiences among engineering undergraduate students across several intersectional identities. This study proposes the creation of a novel Engineering Gendered Racial Microaggression Scale (EGRMS) to capture the unique experiences and effects of microaggressions on engineering undergraduate students. The proposed EGRMS incorporates previous items from existing microaggression scales and modifies them for use within an engineering environment. Additionally, this study used qualitative data collected from 42 individual interviews to generate engineering specific scale items. These interviews occurred at a

predominately white institution (PWI) and a historically Black college or university (HBCU) with engineering undergraduate students who identified as Black men, Black women, Latino men, Latina women, Asian men, Asian women, and White women. This paper first discusses microaggressions, intersectionality, the various scales previously designed, and finally how the EGRMS was designed.

Microaggressions

The term microaggressions was coined by Pierce et al. (1977) during a study regarding media literacy. Their definition was "subtle, stunning, often automatic, and non-verbal exchanges which are 'put-downs' of blacks by offenders" (1977, p. 65). This early definition only included interactions between Blacks and Whites but has since been expanded to include any group that differs from those in the majority of society. In a paradigm-shifting article, Sue and colleagues (2007) examined microaggressions and their effects on the relationships between counselors and their clients. They defined microaggressions as subtle behaviors or statements that denigrate people because of their race, ethnicity, gender, or other identities. Those who perpetrate microaggressions may not be aware of the impact of their words or behaviors have on those around them (Dovidio & Gaertner, 2000). Individuals who experience microaggressions report feelings of paranoia and questioning the interactions with those around themselves (Sue et al., 2008b). Other effects can include feelings of guilt, embarrassment, and decreased self-confidence (Holder et al., 2015).

Research has shown that individual incidents of microaggressions do not cause substantial harm, but the aggregate effects of repeated experiences of microaggressions can lead to a hostile environment, feeling decreased self-esteem and academic self-efficacy, and may contribute to lower degree completion among students of color (Camacho & Lord, 2011; Sue et al., 2008a; True-Funk et al., 2020). Undergraduate students who experience microaggressions have been documented to have lower academic performance and may lead them to change majors or leaving their university or college (Solorzano et al., 2000). Using an internet-based survey, Forrest-Bank and Jenson (2015) found that students at a public urban university who experienced microaggressions were less likely to believe they were able to complete their academic goals and were more likely to engage in substance abuse.

Intersectionality

Attributed to Kimberlé Crenshaw, the term intersectionality began in legal studies literature and challenged the single axis of discrimination thinking of the time. Intersectionality refers to overlapping discriminatory treatment because of the race, gender, ethnicity, or other social position of an individual (Crenshaw, 1989). Intersectionality incorporates simultaneous multidimensional identities rather than a unidimensional identification of a singular identity (e.g., race, gender, or ethnicity). Individuals have multiple simultaneous overlapping identities and function in society while inhabiting numerous social positions and identities at the same time. Individuals from minority identities (e.g., Blacks, women, those with disabilities) may experience subordination by society in automatic processes. Crenshaw (1991) observed, "Intersectional subordination need not be intentionally produced; in fact, it is frequently the consequence of the imposition of one burden that interacts with preexisting vulnerabilities to create yet another dimension of disempowerment" (p. 1249). For example, one individual can be a woman, Asian, a mother, an immigrant, and have a disability, thereby simultaneously

inhabiting several interacting social positions and identities. The location of this person's experiences as a disabled immigrant Asian mother affects her privilege and oppression based on others' expectations and stereotypes. The various interacting social positions and identities encompass interrelated systems and constructs of power throughout society resulting in symbiotic types of privilege and oppression influenced by racism, sexism, classism, and homophobia. Within engineering, there has been a recent interest in incorporating an intersectional approach to study the experiences of individuals from various intersecting identities. Previous researchers have examined the diverse identities of engineers like exploring diverse young women's racial commitment and persistence within to engineering (Bruning et al., 2015), examining the experiences of women of color in engineering (Wilkins-Yel et al., 2019), or the intersectional experiences of Black women and girls in engineering (Ireland et al., 2018). Despite this trend of incorporating an intersectional approach to research within engineering, there have been no microaggression scales developed to capture the unique experiences of those within the engineering environment. This research explores the development of a novel EGRMS using an intersectional lens.

Previous Microaggression Scales

A substantial share of previous research on microaggressions is qualitative, but there have been some scale development in the past decade (Keum et al., 2018; Lewis & Neville, 2015; Nadal, 2011; Torres-Harding et al., 2012). Some of these scales use an intersectional framework (Keum et al., 2018; Lewis & Neville, 2015), but none of them specifically centers on the unique experiences of engineering undergraduate students. To address this gap in the literature, this scale was an aspect of a multi-year and multi-university collaborative research study to examine microaggressions among engineering undergraduate students. The past decade has seen the development of several scales designed to measure microaggressions among different groups. Nadal (2011) developed the Racial and Ethnic Microaggressions Scale (REMS) to examine microaggressions among college students who identified as Latinx, African American, Asian Americans, and multiracial participants. Nadal found a six-factor model, including assumptions of criminality and assumptions of inferiority. Using a similar methodology, Torres-Harding et al. (2012) developed a Racial Microaggression Scale (RMAS) to measure microaggressions among people of color, and they found support for an eleven-factor model that was similar to the REMS but disaggregated some of the themes and was based on community members rather than college students. Some microaggression scales used an intersectional framework, including the LGBT People of Color Microaggressions Scale (LGBT-POC), which examines the experiences of LGBT people of color with microaggressions (Balsam et al., 2011). The LGBT-POC found support for three subscales, including racism from within the LGBT community, heterosexism within communities of color, and racism from dating partners. The LGBT-POC was the first study to examine microaggressions using an intersectional approach. Also, using an intersectional approach, Lewis and Neville (2015) developed the Gendered Racial Microaggression Scale (GRMS) for Black women. They found a four-factor model including assumptions of beauty and sexual objectification, silenced and marginalized, strong black woman stereotype, and angry Black woman stereotype. The GRMS captures the intersectional experiences of Black women and provides valid scale items. Finally, Keum et al. (2018) created a Gendered Racial Microaggression Scale for Asian American Women (GRMSAAW) with a similar four-factor structure including ascription of submissiveness, assumption of universal appearance, Asian fetishism, and media invalidation.

The GRMSAAW provides intersectional information on Asian American women, but can be applied within many environemtns. Despite the development of these scales, none of them were designed to capture the microaggression experiences of various intersectional identities within the unique engineering environment.

Methods: Scale Design

With the goal of providing universities and engineering programs with quantifiable data on the frequency and effects of microaggressions among undergraduate engineering students, the EGRMS was designed. Incorporating information from the existing literature, items identified from interviews with engineering undergraduates, and items from previous microaggression scales, the EGRMS collects data on microaggression frequencies and their effects. The EGRMS underwent three phases during the initial scale design, a literature review of the studies of microaggressions, a qualitative study of undergraduate engineering student experiences of microaggressions, and the adaptation of existing microaggression scale items to the engineering environment.

First, a thorough literature review was conducted to identify microaggression research context, accepted definitions and types of microaggressions, methodological approaches, and objectives of the studies. We found undergraduate education was the context of about a third of research on microaggressions. Over half of the articles examined in the literature review examined the types of microaggressions. A similar number of the examined articles took a qualitative approach and the rest took a quantitative approach. Two primary research objectives were found in the literature review with the study of the effects of microaggressions and the experiential accounts of study participants.

Second, to identify unique components of microaggression within the engineering environment, forty-two individual interviews were conducted with engineering undergraduate students at both a PWI and an HBCU. Included in the participants were seven intersectional identity groups: White women, African American men, African American women, Asian men, Asian women, Latino men, and Latina women. Six participants from each identity group were asked to take part in an individual interview. The interviews were semi-structured with an interview protocol used with all participants, but interviewers allowed participants to share information about their experiences. Interviews lasted approximately one hour and were recorded for later transcription. All participants were provided a gift card for their participation in the study. All data collection procedures were reviewed for ethical compliance by the Institutional Review Board (IRB) at Iowa State University (IRB Number 18-231). Following the interviews and subsequent transcription, using a grounded theory approach, microaggression themes and items were identified (Case & Light, 2011). Twenty-one items were identified as specific to the engineering environment.

Finally, previous microaggression scales were reviewed as they examined microaggressions among individuals from similar racial, ethnic, and gender identities (Keum et al., 2018; Lewis & Neville, 2015; Nadal, 2011; Torres-Harding et al., 2012). Twenty-one scale items from these previously developed items were adapted to the engineering environment. All items were then grouped into seven microaggression themes: myth of meritocracy, ascription of engineering knowledge and ability, pathology of cultural communication skills, isolation, assumption of criminality, hidden language, and inappropriate humor. Table 1 provides an overview of these themes.

Discussion

The research proposed the development of a novel Engineering Gender and Racial Microaggression Scale. The EGRMS will be developed to measure intersectional experiences of microaggressions among undergraduate engineering students. The EGRMS would allow researchers to examine microaggressions across the discipline and identify areas of specific concern. This novel scale will provide researchers, university administrators, and engineering departments information of the scope of microaggressions, possibly improve the engineering environment for minority students, and may lead to greater persistence among these same students.

The initial development of the EGRMS will focus on the piloting of a preliminary scale to identify potential issues surrounding the wording of items, completion rate of participants, and an early insight into the experiences of microaggressions. Once any issues have been identified and addressed a refined scale will be fielded at the PWI and HBCU campuses for comparison across differing academic engineering environments. Finally, an analysis of the EGRMS for item and theme validity will be conducted and reported for those who wish to examine microaggressions in their departments or colleges.

This research addresses the need for a scale to measure microaggressions in the unique engineering to provide data to better understand the breadth of microaggressions experienced by students. The development and validation of the EGRMS will impact engineering students and academic leaders as it enables the collection and analysis of microaggressions across many engineering departments and colleges.

Acknowledgements

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Table 1. Microaggression Themes, Definitions, and Example Items

Theme of Microaggression Items	Definition	Item example
Myth of Meritocracy	Acceptance into university/engineering program was associated with race or gender	Someone suggested that my accomplishments are related to my gender.
Ascription of Engineering Knowledge and Ability	Abilities and knowledge in engineering are because of race or gender	Someone evaluated my engineering abilities as average or below average.
Pathology of Cultural Communication Skills	A rejection of diverse communication skills and styles.	Someone repeated a statement to me with a slower, more pronounced tone.
Isolation	Being the only person of a race, ethnicity, or gender in classroom, lab, or study group	Someone made me feel left out of the conversation.
Assumption of Criminality	Assuming individuals are criminals because of race or gender	Someone gathered their personal belongings closer to them in an engineering school setting.
Hidden Language and Inappropriate Humor	Back handed compliments and humor intended to denigrate others	Someone complimented me and it felt like an insult.