

# **Intersection of Race and Gender on Experiences of Undergraduate Engineering Students in Leadership Roles**

## **Abstract**

This project explores the leadership beliefs, experiences, and knowledge/skills of undergraduate engineering students who have self-identified as having leadership experience at a Research I minority serving institution for Asian Americans and Native Americans, as well as a Hispanic Serving Institution. Thirty-two undergraduate engineering students with self-identified leadership experience were recruited from the College of Engineering across the various majors. In this paper, the perspective of how students described their self-identities and the emerging categories of negative leadership experiences that act as external stressors is presented and discussed specifically for the students that identified as belonging to an underrepresented minority group, including those that were multiracial. The research illustrates how nuances need to be explored to understand how intersectionality of critical race theory with feminist theory increases the complexity of creating an inclusive logic model that can be incorporated into a theory of change that increases academic and professional success of engineers as future leaders within an organization.

## **Introduction**

The professional development of leadership skills by undergraduate engineering students is key to a successful long-term career and has been highlighted by both the profession, academia and government funding agencies as a critical need [1]. Increasing diversity and inclusion in leadership is also critical for technology companies as they become global enterprises [2]. Research on pre-college variables on leadership skills of undergraduate engineering students found that co-curricular experiences result in team-based leadership skill experiences for students. Underrepresented Minority (URM) students that participated in URM organizations expressed greater leadership skill development. However, “students’ precollege characteristics and experiences have minimal contribution to students’ self-reported leadership skills [3, p. 47]” The caveat is that these findings are based on a predominantly White student population and much of the analysis is based on precollege variables and leadership skills development for engineers [2, 3].

There exists a gap in knowledge of leadership experiences, and skills for a diverse population of engineering students that are considered to be millennial [4] students. In particular, missing from existing logic models such as that found in work by Knight and Novoselich [3], is the identification of external stressors that affect the development of leadership skills and may even reduce perseverance of students to sustain in leadership roles. Thus, identifying external stressors students experience, especially for those that are underrepresented, can help researchers develop a logic model that is inclusive for a diverse undergraduate engineering student population for leadership development. The long-term research aim is to address this existing knowledge gap by constructing a logic model that implements the theory of change in designing interventions that increase perseverance in leadership development and also addresses the nuances of how the intersectionality of race and gender can affect this perseverance. Within this paper, the author will present the results on the self-selected identities of the students and discuss how intersecting

identities of race/ethnicity and gender correlate to external stressors of students of color in their roles as leaders. Thus, the research questions are:

RQ1: What are the social identities students self-select to describe who they are?

RQ2: How does the intersection of gender and race/ethnicity identities affect leadership experiences of students of color in engineering?

This research was conducted at a Research I minority serving institution for Asian Americans and Native Americans, as well as a Hispanic Serving Institution. Undergraduate engineering students who self-identified as having leadership experience were recruited from all majors in the College of Engineering. These students were interviewed one-on-one by the principal investigator using a semi-structured interview guide. The students were probed on their beliefs of leader attributes, their personal leader role models, their experiences in leadership roles, and how they viewed their skills as leaders. The research was approved by the institutional review board and all students signed a written consent prior to participation. The interviews took 60-90 minutes and included 32 questions. In total, 32 students were interviewed for this project with a mean age of 22.1 years (range: 18-34 years). There were 4 Bioengineering, 3 Civil Engineering, 6 Chemical Engineering, 5 Computer Science, 3 Electrical Engineering, 4 Industrial Engineering, and 7 Mechanical Engineering students. There were 15 Men, 15 Women and 2 Transgender Women. The study included 9 Asian, 9 White, 4 Black/African American, 7 Hispanic/Latino, and 3 Multiracial students.

## Methods

The theoretical framework for the analysis was to use intersectionality of critical race theory with feminist theory [5-7]. Thus, questions for the interview guide were developed in consultation with two social scientists with expertise on race and gender; as well as test piloting the questions with two underrepresented minority undergraduate engineering students, one male and one female, who were leaders in their engineering societies and who did not take part in the study. The coding of the interviews was done by the principal investigator. The first transcript was coded by the principal investigator and the social scientists were in consensus with the initial codes. Using Grounded Theory by Charmaz [8], the interviews were coded line-by-line using gerunds and the constant comparative method was used to develop a code book during the focused coding phase [8]. From the focused coding, constructs, i.e. categories, of the social identities of the students as well as the factors that influenced their personal experiences were defined. Analytical memos were also being concurrently maintained during the coding processes. Axial coding, again using intersectionality and more specifically an intercategory approach [5], was done after the initial focused coding was completed for all of the themes discussed in the interviews.

## Results and Discussion

Students were asked to use five characteristics to describe who they are to another person and a summary of the types of identities they selected are shown in Table 1. Similar to the research by Knight and Novoselich, students used self-selected identities that could be categorized under

personal traits and their pre-collegiate experience [3]. Another category of self-selected identities focused on social identities (gender identity, race/ethnicity, sexual identity). For example, students referred to being/having fully abled bodies or being conscious of abilities and the impact it had on experiences. Another example is age, where students spoke of age in the context of being young and how that impacts whether they are valued or respected as engineers.

Table 1. Self-selected Identities Used by the Students

Code	Definition	Example Narrative(s)
Being Able-bodied	Being able bodied or having no physical disability that impacts how a student experiences life.	“No physical disability.”
Being Young	Age centered on being young and the effects it had on personal treatment by others.	“Like a young male.” “Being young. ”
Socioeconomic Status	Low-income, Middle-Class, Wealthy categories were broadly discussed by the students and it have influence on their feelings of education, engineering, and leadership.	Coding as Low-income: “Being poor in Chicago ...” Coding as Middle-class: “I guess I feel like by socioeconomics, middle-class family.” Coding as wealthy: “...middle class or upper-middle class which is in the global sense, wealthy, rich.”
Gender Identity	An individual that self-identifies as a man, woman, or transgender.	“I'm female.”
Race/Ethnicity	An individual that self-identifies as African-American/Black, Asian, Hispanic/Latino, White, Multi-Racial	“I come from a mixed ethnicity background I can relate to both the white end, and the Mexican end.”
Sexual Identity	An individual that self-identifies as straight, gay, or lesbian	Referring to being gay: “my sexuality”

Looking more closely at the pre-collegiate identities, the emerging themes relevant to the discussion presented here are centered around a student’s value systems or knowledge of society that develops during childhood and may directly affect how a student interacts with others when in a leadership role. For example, an African American Woman discussed how she grew up in a rural environment, was from a wealthy family and went to a private school that was predominantly White. In this case, the student stated: “I was raised in a predominately White area, so I don’t have a lot of the accent or physical signs or whatever that people typically associate with Black women and make their judgments based on.” In essence, she “knew” how

to fit in a wealthy and predominantly White environment, and in her narrative, she talked about knowing how to dress, speak and behave. Within her local community growing up, she had both positive experiences and negative, yet in her discussion of negative experiences she felt that race and gender were not factors. However, outside of this environment and despite the depth of her knowledge of social norms based on the dominant society, she still experienced microaggressions:

“I will say there was one time and ironically it was a leadership convention...And one of the girls that I was rooming with told me at one point something along the lines of, ‘Oh you're a lot nicer than I thought you'd be,’ or like, ‘You're really nice for a black person,’ something like that. And I was just like, ‘Did you think I wouldn't be?’ So yeah, that's one experience where I was like this person clearly thought something much different from how I would be.”

Another African American/Black Woman referred to heightened awareness of stereotypes:

“I would say being an African American female specifically that kind of alters the way you travel about your whole career because within our community there's a certain way you carry yourself. We feel like we have to be twice as good as someone without this identification just to get the same amount of credit.”

Table 2. Examples of Coding for Stressors Students Experienced Under the Theme of Sexism, Racism, etc.

Experiencing Racism	Experiencing acts of racial discrimination, hostility, stereotyping and/or suppression based on the individual's race/ethnicity by an individual in the dominant social group.	African American man: “She would talk like...I don't know how to even explain it because talking black isn't a thing but talking in a way that she would think that I will appreciate, and I didn't.”
Experiencing Sexism		Asian Woman: “I was once told in a math class I was taking that I was the ‘hot girl’ in class. This was coming from a student that I've never met, like, it was appalling enough, but then he followed up with, ‘So, how are you doing better than me?’ as if I couldn't be beautiful and also incredibly smart. And it got to the moment when I realized that the way people view me isn't always a good thing, just because I come off as traditionally beautiful, and I pander well to the male gaze, doesn't mean that's an appropriate thing to say, ever, and I don't

		think he would have ever said that to a single man.”
Disproving Stereotypes	Behaving or acting in a manner that actively disproves a stereotype, such as working harder than the rest to be considered equal.	Multiracial woman (Latina and White): “...my mom, when I was growing up, she always told me ... ‘As a brown woman, you have to prove yourself twice, once because you're brown and once because you're a woman.’ ... And I think that definitely follows being in a leadership position as well. Because there are times when people don't take me seriously, when people don't want to follow what I'm doing and so I have to prove myself. I have to become more knowledgeable, I have to become more patient, I have become stronger mentally so that I can prepare for being in a leadership position where nobody will take me seriously.”
Conforming to the Dominant Social Group	Experiencing social pressure to conform to the dominant social group. Such as “Act like a guy” if you are a woman or “not be aggressive, angry, loud, etc.” if you are a woman or man of color.	Latina woman: “The way I converse definitely a male thing because I definitely talk a little bit differently when I'm with family and people I know very well.”

External stressors such as microaggression, discrimination, etc. also emerged from the data, see Table 2. For example, different forms of microaggression were experienced by the URM students. URM Males had narratives that included actively disproving a stereotype to not appear aggressive, e.g. “I try to be...not aggressive at all.” Across Race/Ethnicity groups of Women, gender-based discrimination in the form of sexism was a dominant category. However, for URM Women, working harder than the rest was a significant stressor. For example, URM Women stated that they have to “work twice as hard to be considered equal” as a prerequisite before respect was given by others. Some URM students stated racism did not affect them or they did not care, see Table 1 Racism narrative. Yet, the same student declined a higher leadership role because of the person they perceive as racist and a “bad leader.” The student spoke of: “I was offered to become a [redacted] which is a senior [redacted]. I declined because the boss of the [redacted], he's not a good leader, so I didn't want to be around him...”

Also, an emerging factor appeared in discussion by the students when they were acting in a leadership role and interacting with others external to their university environment. In these situations, students spoke of how their identity of being young could result in negative

experiences, here referred to as Ageism. In this case, several students discussed how they perceived being treated as not capable or to inexperienced to take on a leadership role by their peers or engineering professionals in industry. These discussions also were consistent among many of the students and seemed to be stronger for Women that were or appeared young regardless of depth in formal or informal training they had in leadership skills. For example, an Asian Woman spoke of:

“...so, one time I was taking a group of girls in Women in Computer Science over to one of the companies in Chicago. It's called [redacted]. And when I got there, I'd been corresponding with someone in charge for a while, and, when I got there, the man said, well a) he didn't think that I was...because I looked so small and so young he'd assumed that somebody else was in charge...”

Similar examples were illustrated by the students, where they felt that their leadership was questioned because they were young and therefore did not conform to the perceptions of the people they were interacting with outside of their institution.

In summary, this research illustrates, there are still several nuances that need to be explored to build a logic model for a diverse student population of undergraduate engineering students and their leadership experience. For example, students have a complex network of self-selected identities they use to describe who they are as individuals. There were several external stressors based on gender (i.e. sexism) and race/ethnicity (i.e. microaggressions). However, URM Men, URM Women and Asian Women consistently discussed how their intersecting identities affected the stressors they experience in order to conform to the dominant social group or to gain social acceptance (being seen as equal or being treated fairly). Thus, an inclusive logic model needs to consider the external stressors based on intersecting identities.

### Limitations

The students who participated in this study self-selected or self-identified themselves as leaders. Missing from this research are students that had leadership aspirations but decided to either not pursue their aspirations or left a leadership role due to external stressors. Including these students would help validate the findings of variables that can act as barriers and validate findings of stressors for undergraduate engineering students of color in leadership roles. Finally, although this study included a diverse student population, it was for a minority serving institution. Therefore, future research could include studying whether the external stressors that emerged from this study are similar for students at different types of institutions, e.g. Historically Black Colleges and Universities (HBCUs), PWIs, teaching colleges, and women's colleges, or whether new types of stressors emerge.

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