

An Exploratory Investigation of the Experiences of Navigating Campus Resources of Black Immigrant Women in Engineering

Debalina Maitra, Arizona State University, Polytechnic campus

Debalina Maitra is a Post-doctoral Research Associate at ASU. Prior to her current role, Debalina Maitra was employed by CAFECS (Chicago Alliance for Equity in Computer Science), a NSF-funded Research Practice Partnership, for almost two years. She completed her Ph.D. in Literacy Education in 2017 with a minor in Qualitative Research Methods. Her research interests are equitable pedagogy, racial equity, culturally relevant pedagogy, and identity. Her latest work at ASU focused on exploring the racial identity of Black engineering students while navigating their professional space and exploring the transition of marginalized students from community college to higher academia and professional fields.

Dr. Brooke Charae Coley, Arizona State University, Polytechnic campus

Brooke Coley, PhD is an Assistant Professor in Engineering at the Polytechnic School of the Ira A. Fulton Schools of Engineering at Arizona State University. Dr. Coley is Principal Investigator of the Shifting Perceptions, Attitudes and Cultures in Engineering (SPACE) Lab that aspires to elevate the experiences of marginalized populations, dismantle systematic injustices, and transform the way inclusion is cultivated in engineering through the implementation of novel technologies and methodologies in engineering education. Intrigued by the intersections of engineering education, mental health and social justice, Dr. Coley's primary research interest focuses on virtual reality as a tool for developing empathetic and inclusive mindsets among engineering faculty. She is also interested in hidden populations in engineering education and innovation for more inclusive pedagogies.

Katreena Thomas, Arizona State University, Polytechnic campus

Katreena Thomas is a graduate student at Arizona State University in the Engineering Education Systems and Design Doctoral program. She is a member of the Shifting Perceptions, Attitudes, and Cultures in Engineering (SPACE) Lab group and her research interests include broadening participation in engineering, engineering leadership, and experiential learning experiences in engineering. She received her B.S. in Industrial Engineering from the University of Pittsburgh and her M.S. in Human Systems Engineering from Arizona State University.

Dr. Meseret F. Hailu, Arizona State University

Dr. Meseret F. Hailu is an Assistant Professor of Higher and Postsecondary Education at Arizona State University. Her research focuses on the retention of minoritized women in STEM higher education pathways. Recently, her work has focused on 1) how Black immigrant women in the U.S. persist in engineering, and 2) how higher education institutions in Eastern/Southern Africa conceptualize and implement equity initiatives. Prior to coming to ASU, Dr. Hailu was a Postdoctoral Research Associate at The Ohio State University. Her research has been funded by FHI 360, the Fulbright Program, the National Science Foundation, and the United States Agency for International Development.

Introduction

Broadening participation in science, technology, engineering, and mathematics (STEM) in higher education has been a problem for several years for minoritized population, especially for Black students [1], [2], [3]. Black students only represent 4.3% of graduates and 5.2% of students enrolled in engineering disciplines. Over the past decade, these numbers have remained consistently low [4]. Black women studying engineering face more challenges and adverse environment and they represent only 1.3% of total Black population [5], [6],[7]. NSF reported that Black students received just 6.2 percent of U.S. science and engineering bachelor's degrees, whereas Black women only held 2% of science and engineering jobs [8]. This is a significant underrepresentation of gender and race [9]. However, the data cited above does not differentiate Black women from immigrant backgrounds or other intersectional identities. The generic term of "Black identity" does not include different cultural and ethnic identities with immigrant backgrounds.

While defining the term immigrant, we used the definition provided by the Migration Policy Institute: foreign-born immigrant refers to persons with no U.S. citizenship at birth; they were born outside the United States and then immigrated in the US as a child. And then, the second generation refers to immigrants who are U.S.-born children of immigrants. It is essential to investigate their college experiences to create an equitable space for all.

The idea of monolithic Black female identity needs to be de-constructed. A specific focus on the Black immigrant women's college experience in engineering appears to be lacking within the literature even though there are some studies dedicated to Black immigrant students' experiences in education [10,11] Even though this space is not much explored, recently, a research study revealed that Black and immigrant girls of color experienced gendered racial harassment, erasure of intellect, and hostility in school [12]. The research questions guiding this study are: What are the experiences of utilizing available on-campus support of the Black immigrant women pursuing Engineering? What are the recommendations identified by those students to lessen the gap in needed services and support?

Theoretical Framework

Critical Race Theory (CRT) is the foundational framework for our analysis. One of our epistemological assumptions is that color blind policies systematically disadvantage people of color and further creates more inequities. Also, Critical Race Theory encouraged us to generate counter-narratives in the form of discussion, archives, and testimonies from the participants because CRT acknowledges that some groups are socially and culturally marginalized, and their marginalized stories based on their experiences could challenge the dominant discourses and can bring changes [11]. CRT critically examines the social construction of race. However, since this study is focused on Black immigrant women, we felt that their experiences cannot be narrated through CRT only because their level of marginalization is different than their male peers.

According to a study, Black girls and immigrant girls were twice more likely to repeat a grade, be suspended, and be expelled than their White female and White male peers before even acquiring a high school diploma [10]. We expanded on the Critical Race Feminism framework and introduced immigration status and socio-economic status as marginalized intersectional identities that interact with race and gender. Delgado and Stefancic and Harris defined Critical Race Feminism as "It also examines relations between men and women of color, sterilization of black, Latina, and Indian women, and the impact of changes in welfare, family policies, and child support laws. It also analyzes the way the "reasonable man" standard that operates in many areas of the law incorporates a white male bias" [11]. They introduced level of intersectionality with in Critical Race Theory. For example, they stated "Imagine a black woman. She may be oppressed because of her race. She may also be so because of her gender. If she is a single

working mother, she may experience discrimination by virtue of that status as well. She experiences, potentially, not only multiple forms of oppression, but forms unique to her and to others in her class.” [11].

Also, immigrant background often determines the level of access students might have. In previous studies, gender and race have been researched; however, attention to the multiple layers of marginalization was overlooked. Our theoretical framework informed the study's framing; the interview protocol and a deductive codebook developed based on our epistemological foundation.

Methodology

This study took place at LPU, a large public university in the West of the United States. LPU has one of the largest engineering programs in the United States. LPU advertised their engineering program as the most innovative, comprehensive and challenging program in the nation. LPU recently became a Hispanic Serving Institution (HSI) and the total undergraduate enrollment for Black students still remains low at around 4% [13]. At LPU Hispanic enrollment increased 51% for both on-campus and online from 2016 academic year to 2020 academic year. Our study was funded by the institution, hence its a single site study location for our in-depth qualitative study. Our research design was a case study as defined by Cresswell, “A case study is a problem to be studied, which will reveal an in-depth understanding of a “case” or bounded system, which involves understanding an event, activity, process, or one or more individuals”.[14]

We interviewed a total of 45 participants. Out of 45 students 34 students were on-campus, 11 students were online. Out of 45 students 11 students majored in computer science/cyber security. 6 students in informatics, and 5 in biomedical engineering. Rest of them were enrolled in different branches of engineering at LPU for example aerospace engineering, manufacturing, web development, chemical engineering etc. While most of our participants were full time students, some of them were part time students working full time outside of LPU. Some of our students reported their role as parents or responsible for their family members. For this particular study we are reporting data from 16 Black women with immigrant backgrounds. We interviewed our participants with a semi-structured protocol consisting of 30-questions. We asked our members about their perceptions of departmental culture, campus support, mentoring and faculty interactions, professional development, and their future career plans. Each interview lasted between 60-90 minutes. Students were compensated for their participation and they received \$50 cash transfer for their time.

We developed a deductive codebook from the transcribed conversation based on the research questions as suggested by Saldana [15]. Later, first author went through each transcript and open coded them [15].

Codes	Sample Excerpt
Student Experience on Campus	<p>I've actually had I think a good amount of success in the tutor center, the engineering school tutoring center. Before the pandemic happened, I was there a lot, a good portion of the week. I think there was only one instance where a tutor made me feel like weird or uncomfortable, but that was in the actually one of the math tutoring centers. But otherwise, pretty much I've always had good experiences. And then my advisor for the engineering college has been great. She seems to really care about the students, and always tries to find a way to help, and is good just to even talk to and get stuff about school off of my chest. At my other school, the advisors weren't that great. So, I've been really happy with her.</p> <p>Question: Are there any other academic support units that you use, or anything else?</p> <p>Participant: No. Other than just talking to my professors or TAs every once in a while.</p>
Gaps in Needed Service and Support	<p>I don't really see a lot of people that look like me, so when I did work on campus I wanted to make sure that I was representing for the freshmen that were coming in that were Black kids, or an African, that they knew that people that looked like them were on campus. you ever heard of [the student organization] or have you heard of [another campus resource], ' this and that, just trying to create some sort of community on campus”.</p>
Faculty Interaction	<p>A lot of times, since both the students are heavily male, it's a very competitive environment, it can lead to a lot of toxicity especially in an online form. Some teachers don't know how to handle that. I just don't look at the chat rooms for a lot of the Zoom classes because it's messy. At least, it's only really happened for my calc class because he doesn't really look at the chat. All my other professors are pretty good at monitoring it but it's a lot of like, if you have a somewhat feminine sounding name, they will immediately start saying stuff to you that is obviously not appropriate, bringing a whole lot of political opinions that just shouldn't be talked about in classroom settings. I'm all for respecting your political opinions, but I can confidently say in the past four years, there's been some stuff I've just I don't know for me things of that nature. One thing I do remember is we have a person has a very obvious learning disability in one of our classes. When you go to the discord chats, because he's not a part of that discord chat, there is people making comments about the way he talks, the way he acts, joking about how he interacts with the professor in ways that are just obviously, it's disrespectful. [example where faculty member failed to check content moderation and that made minorities including women and people with disabilities experience microaggression]</p>

Table I: Codes and Excerpts

There are some of the codes and their excerpts mentioned on the table 1. We had those codes based on our interview protocol and finally they helped us to understand the on-campus experiences of those Black women. For example, we had questions on mentorship and we coded those deductively as “relationship with mentors”. We had questions on their input to meet the gaps in needed service and support and we coded them as gaps in needed service and support. All the codes presented in the table are deductively coded. Salience of intersecting identities represents the strain of being a Black woman in engineering.

Findings

Participants generally described experiencing race-based microaggressions, gender-based stereotypes, and often navigated through lack of resources and invisibility, even those experiences were prevalent while interacting with classmates and professors. However, immigrant identity generally did not largely impact their experiences of utilizing on campus resources even though at times they mentioned about the impact of their immigrant identity overall.

Student Experience

When exploring students' experience with on-campus services we found that students valued peer-to-peer support on campus. For example, they relied on the Black African Coalition, National Association for the Advancement of Colored People (NAACP), and other multicultural-biracial support groups, DART. Also, students mentioned professional resources like PLAST, which is X leadership and service team, and fellowships offered through the Center for Gender Equity in Science and Technology. Then students also nurtured their interests like gardening and wood printing through on-campus clubs during the pandemic. However, most of them reported a lack of peer to staff and faculty relationships. Students also mentioned that interaction with staff and faculty members who identify as one of them is missing in their college experience.

For example Barbara [in person, Civil Engineering, expected graduation 2023] explained her example of using campus support.

I used it a lot last year. I had M H as my advisor, but he left this semester. It's just, it sucked because he was such a good advisor. He was really helpful. He helped me with my classes and he helped me with scholarships. He would just check in on me daily basically. That was really nice. Tutoring, I really hate asking for help, so I didn't necessarily use tutoring...DART (safety escort)... "This semester when I was there, I used safety escort because I would work until 10 o'clock sometimes on I think it was Tuesday, Thursday or Friday nights. I lived in university housing and to walk from the gym to university housing at 10 o'clock at night wasn't the best idea. So I would just take a safety escort. I used DART twice because I have a torn meniscus, so sometimes my leg acts up when I walk too much, DART is transportation for disabled students.

Another pertinent theme that emerged from the data was the struggle to find basic information; for example, lack of information about transferring credit to save money and the process of transferring the courses with the degree program. Students reported that they often did not know about essential resources like online tutoring services, mentor programs, and scholarship information which should be introduced to them formally from the first day of college. For example, Oakley [in person, Software Engineering, expected graduation Spring 2022] mentioned,

Oh yeah, unfortunately. So with my personal situation, I could not receive as much FAFSA as probably a student that would apply with a parent because I don't have a parent to apply with. So a lot of my finances for the first three and a half years of my degree, I was paying out of pocket from my paychecks at work. And then this past year, unfortunately, they said that I make too much money outside of work to even get any FAFSA. So now it's my first time taking out loans and now I have that to worry about. And it's just, yeah, it's a lot of pressure.

Also, students reported a lack of support for upper-division engineering classes. Our findings suggested that there is a lack of program-specific academic resources for the students. A major concern also emerged from the data that due to overall negative experiences, some students might not continue their specific degree programs.

Lack of Mentorship

Those women also reported navigating the academic spaces without mentorship. Those experiences might not be exclusive to the group, they might be generic to Black women in engineering.

Alyssa [In Person, Expected graduation Spring 2023, Biomedical Engineering, Second generation Jamaican] not at LPU, but outside LPU, one a Code2040, and another at summer internship:

Yeah, outside of LPU. This summer, recently I joined a program called Code2040 which is for Black and Latinx students. So I joined that and then there's this mentor that I connected with.

That's been helping me out, and then also the internship that I did this summer was also a big help that I connected with people through there as well. Her narrative also echoed a lack of mentorship with in the institution.

Amanda [in person, Mechanical Engineering, Second generation-Somalian] expresses this sentiment, as well. She explains how she has not had a Black professor, but fortunately she has her father, who is an engineer but still wishes there was someone at her institution. she articulates how:

My father, he gets me through it a lot by saying, "I've done it before, I've been here before, I failed this before, too," so it makes me, [feel] like okay with what I'm doing. But having somebody in the layers of LPU, I would say, saying that same thing, reassuring me or showing me how to get to the next step, would also be really helpful, knowing that somebody that looks like me did that too.

Similar to the way that Amanda found mentorship outside of her institution, another student Grieselda [online, an asylum seeker, Graphic Information Technology major, expected graduation Spring 2022] reported that she has no mentor at LPU, and she reported of having a mentor outside of LPU, Burundian male mentor.

Reese, [in person, an Electrical Engineering student, first generation African] reported of having a female Black mentor outside of LPU. She personally prefers women faculty as she thinks women understand her situation better than men do. In her words

I think in general, no, it doesn't, but me personally, I feel like I relate more and feel more comfortable whenever it's a woman. Just because I feel like we would have had more similar backgrounds and she would just understand my position better than a man would be able to.

Faculty Interactions

Not only lack of shared identity mentors, our participants often recalled incidents of negative experiences from faculty members while interacting with them. For example, Brandy recalled,

Because, we have to think about our hair. Then, of course, I'm sure you know the negative stereotypes associated with getting angry. It's like even when I'm blatantly disrespected, I still have to keep my cool, which has happened. I've had someone questioned my intelligence, I've had a professor call me an angry black woman, I've dealt with a lot of stuff being at LPU. But I still have to figure out how to keep a calm face in the face of adversity. Especially, because I don't want it to reflect badly on myself or anyone coming up after me. Because, I know it's not necessarily my job to represent for my race. But at the same time, people do tend to have interactions with people and go throughout their daily life based on that one specific interaction. That's definitely something else that I have to consider.

Not only microaggression from classmates and professors, at times students perceived professors as distant and not available. Another student Brenda [Immigrant, Online student, Software Engineering major, expected graduation Fall 2021] mentioned

Professors have been pretty busy. So, I haven't really been able to interact with them. So it's mostly just other classmates. It doesn't seem like they try to do it to be mean. I guess that's just how they naturally act. I don't know.

In another example Cristy [Second generation Jamaican immigrant, on campus student, Robotic Engineering major] recalled the implicit faculty bias;

One of my classes for robotics, he was from India. Just by having him for two semesters, I know how he is and I know that if you are from India [inaudible 00:41:14] Indian, he automatically likes you a lot more than the rest of the class, which to me, it was like, "Okay, well, that's not fair in general," because there'll be times where he would tell that student information that we needed on the assignment, so that student wouldn't have to tell people he was home in office hours, or then if enough people ask, then he would say it in class, but he did a couple times say it to that student in office hours, who we were like, "Okay, well, I didn't even know about that," and he wouldn't even say it in class. You'd have to learn by word of mouth, which I know that he does.

Recommendations from Students

This study provided a platform for those women voices and they also suggested some recommendations for the institutes based on their isolating experiences. Those recommendations might be helpful for other academic institutions.

- Financial worries remained a constant stressor for most of the participants. Students recommended that the department should consider awarding more scholarships. Jayden [In person, expectation graduation may 2022, air transportation major] mentioned that

Honestly, it sounds superficial, but I think the best thing to do is just investing in scholarships or grants because college in itself is expensive. Everybody knows that, but if you were to want to include more people in specifically, if you were on the diversity aspect and you're like, how can I include black women more? I think the best thing you can do is just like monetary compensation. I don't know, I mean, that seems like the biggest factor for me is like and one thing, I feel like a lot of students stress about is how am I going to afford next semester? So you see people applying for scholarships all semester, like me or grants or whatever it is trying to keep student loans down. So as an inclusion factor, the best thing is, I think that's the biggest stressor. At least for me in the engineering field is just monetary and stuff.

- Under the umbrella of Black identity, the clubs should also consider exploring different black identities like Haitian culture, Caribbean culture, and African culture. Black identity is not monolithic and our study findings corroborated that the intersectional black identities should be included and welcomed more at educational institutes and professional organizations.

- Students recommended providing an easy access guide to scholarships and other resources available to them.

- Students also provided recommendations for their campuses to create programs that address the problem of a lack of networking among Black students. Sheena [in person, May 2021, Electrical engineering] recommended,

I guess one thing I would do is somehow make it easier for Black engineering students to find each other, I guess. Or even just black STEM students in general. I think there is a chapter of the National Society of Black Engineers here on campus. I think Yeah. But I didn't know that until probably after the second semester of after I transferred in to it. And that was only because I was working on a non-school related project. And I was trying to find, I used to volunteer for, what's it called? It was basically an organization that promotes commercial space travel, because that's the industry I want to go into. And so, I was looking for student groups that I could potentially get volunteers from. So, I was looking at all the different STEM and business groups and stuff. And I was like, Oh, I didn't even know there was,

- Tracking students if they are staying in their major after completion of degree and then revise the specific degree program based on their suggestions.
- Students recommended detailed talk on cultural appropriation and gender inequity. One student said, “because women honestly do not understand what they are protected under”.
- Our participants conveyed an immediate need to hire more black administrators and to invite more women of color at the career fair. For example, Dianna [in person, Computer System Engineering, expected graduation SP 2020] suggested,

I would take the initiative to hire Black women engineers, that's first. I would also change the ... each engineer has to take their, you have LPU 101 and then you have your Engineering 101, like FSE 101. So every engineer has an engineering class that they have to take, and I would make sure that in those engineering classes, in the LPU 101 class, there is appropriation. They really go into depth about cultural appropriation and gender inequality. What I mean by that is they go over Title Nine and all that stuff, they breeze over it, they really say, read it on your own, they don't talk about it, because women honestly do not understand what they are protected under, women do not understand ... it's some things that took me, not even trial and error, but for my friends to say "No, that was wrong. That's illegal... When they have these speakers like we have for our career fairs, we have speakers come, I would prefer them to start having more black people, more people of color, more women to speak at these functions on behalf of the school of engineering. What else would I do? I would start hiring more black administrators, that's where it really starts and it trickles down. If you have more black people who are in on those meetings, who are in on the decision making, then more will get done for our people. When you have a room full of white old men who don't understand what's going on in the black communication and black culture and what's okay and what's not okay, this stuff isn't getting done, so you need to hire more people higher up so that the trickle down effect could happen.

Discussion

This research is significant because a specific focus on Black immigrant women's college experience is largely missing from the literature.

Our study helps fill this gap by showing how Black women navigate on campus resources and when its not available to them, they often take initiative. They appear to work extra hard to fill the missing resources on campus. There was some support and resources available to those women, however directional help was missing for them. Many of them even did not know how to navigate basic institutional services like tutoring services. Engineering programs across the country are looking for ways to enhance the experiences of Black students in both undergraduate and graduate school. Utilizing recommendations directly from students who have already navigated these spaces previously provides

insight to the institutes, and they should be leveraged in efforts to improve these engineering environments.

Some of those narratives might be common to Black women in general since our study focused largely on the Black women pursuing engineering at LPU. More research should focus on how those experiences might converge and diverge from the narratives of other marginalized groups of women at different institutes. It will be interesting to examine the role of immigration status and layers of trials and challenges Black women navigated through vs those experiences of Black women without immigrant background.

Conclusion

Through this research we position how Black women, specially from immigrant backgrounds, have experienced lack of resources, lack of mentors in addition to racialized microaggression along with gendered segregation as they navigate their academic pursuit. Our findings suggested that they contribute to creating more culturally engaging environments, and deal with competing priorities, often taking care of role strains at their studies and outside of school while limited institutional resources are available for them.

This paper will hopefully create dialogues around the experiences of Black immigrant women in engineering, and their voice will reach the policymakers and educators nationally so that they are better supported in their programs. This paper also aims to identify the gaps in needed support and services directly from the students. Recommendations from the students are the stepping stone to re-evaluate the student need at the departmental and institutional level. Also, we believe some of our findings might have implications for other marginalized groups. To this end, this paper connects to the conference theme of understanding inclusion, equity, access, and diversity to broaden participation focused on the issues such as intersectionality of race and gender.

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