ASEE AMERICAN SOCIETY FOR ENGINEERING EDUCATION

Paper ID #36455

Exploring Experiences of Black Engineering Students Transitioning into Predominately White Institutions for Graduate Studies

Mr. Michael Lorenzo Greene, Arizona State University, Polytechnic campus

Michael Greene is a PhD student in the Engineering Educations Systems and Design program at Arizona Sate University, Polytechnic Campus.

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 Engine

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 Engine

Exploring Experiences of Black Engineering Students Transitioning into Predominately White Institutions for Graduate Studies

Abstract

Little is known about how black engineering students experience graduate engineering programs, and even less is known about how they experience the transitions between undergraduate and graduate engineering education. Common graduate student challenges can be further exacerbated when microaggressions, prejudice, and systemic racial barriers are daily experiences, as they are in the case of many Black graduate students attending historically white institutions (HWI). This work explores how different aspects of the black academic experience can converge to impact the experiences of Black doctoral students during their matriculations from undergraduate to graduate studies. The research question addressed by this work is: How do Black engineering students experience the shift in institutional type when transitioning to a graduate program at an HWI from an undergraduate program at an HBCU? This study utilizes narrative interview methodology to capture stories of the lived experience of Black graduate students in engineering. Specifically, there were three inclusion criteria for participants: (1) they had to identify as Black, and (2) be a graduate student currently enrolled in a doctoral program in engineering at a historically white institution in the United States, and (3) attended an HBCU for undergraduate engineering studies. A phenomenographic lens was used during the analysis process to organize and code salient themes identified in the interviews. Pilot study results show that through the process of transitioning from an HBCU, an environment where participants felt valued, and supported, to an HWI for graduate studies brought about a feeling of "culture shock". Having to reform systems of support that provided ample resources for their success was a necessary undertaking for the participants because they were used to the types of support available at the HBCU. Faculty and advisor relations were also very impactful in the process of socializing Black doctoral students in the academy. Understanding the process of how these students identify, and address difficulties and stressors during their transitional period from undergraduate studies to graduate studies in engineering could be particularly insightful in developing effective countermeasures for falling enrollment and persistence rates of Black students in engineering graduate programs

Introduction

Although there has been increasing interest in diversity, equity and inclusion in engineering, Black engineering students on the graduate level are a demographic that has been understudied [1]. Despite an increasing interest in diversity, equity and inclusion in engineering, there has been a stagnant trend in the enrollment of Black engineering graduate students while students from other racial minority groups have shown a steady increase over the last decade [2]. There is little extant research investigating how black engineering students navigate graduate engineering programs, which would give insight into the root cause behind these trends. Even less is known about how they experience the transitions between undergraduate and graduate engineering education, arguably the most challenging of academic transitions. Matriculating to graduate school is a difficult transition due to the increase in workload as well as a rise in the necessary independence and discipline to handle the increased levels of autonomy. External factors such as changes in location, department, and discipline can also bring up challenges for students, who must reform networks, and systems of support to integrate themselves socially, culturally, and academically into their new environment. These challenges can be further exacerbated when microaggressions, prejudice, and systemic racial barriers are daily experiences, as they are in the case of many Black graduate students attending predominantly

white institutions [3]. There have been numerous previous studies that have brought to light that the doctoral experience for Black engineering students is complicated by race, and prejudice given that racism is "inherent in the social practice of higher education"[4], [5]. Doctoral students of color have been found to experience marginalization in three key areas of socialization; faculty mentorship, professional involvement, and environmental support [6]. Black doctoral students specifically have been found to face issues with socialization, especially in terms of overall fit in the program, finding mentorship, and engaging in their institutional environments [7], [8]. A combination of stereotype threat, and racialized stress associated navigating engineering spaces can contribute to an overall negative experience with Black graduate students [9]. Elements of a chilly climate for Black students in STEM include managing stereotypes [3], [10], [11], feelings of isolation [12], [13], as well as feeling both invisible and hyper visible simultaneously [14], [15].

This work seeks to explore how these different factors converge to impact the experiences of Black Doctoral engineering students during their transitions from undergraduate to graduate studies. The transition that will be the focus of this work will be Black engineering students from historically Black colleges and universities (HBCU), a space where the Black identity may be affirmed more easily, that choose graduate studies at predominately white institutions (PWI), where they may be the only Black student, or student of color, in their cohort. The research questions that will be addressed in this work are as follows:

1. What are the lived experiences (stories) of Black Doctoral engineering students in matriculating from historically Black college/university (HBCU) to a predominately white institution (PWI) for graduate studies?

Background

Moving from undergraduate studies to a graduate program is a difficult transition not only due to the increase in workload and responsibility, but also changes in overall culture within the academic setting. Austin (2002) found that when attempting to socialize themselves in graduate programs "[s]tudents must make sense of the academy and its values, its expectations of them as graduate students, [the academy's] conceptions and definitions of success, and the models of professional and personal life that it offers to those aspiring to join the academic ranks" (p. 103). The process of socialization for graduate students happens over the entire tenure of their graduate program and can be especially challenging for underrepresented students in engineering, as a white, heterosexual male dominated discipline [16]. Weidman, Twale, & Stein segmented the process of graduate student socialization into four stages to further elucidate the necessary steps to be accepted as a professional in graduate academic settings. The 4 stages are (1) anticipatory, (2) formal, (3) informal, and (4) personal. The anticipatory stage consists of the period when the student enters a graduate program and begins learning the roles, procedures and norms that are followed. In the formal stage, students are inducted into the program and determine how well they fit within that context [17]. In the informal stage, student begins to learn what is expected in their desired position and shifts from "being student–like to more professional" [6]. In the personal stage, students begin to develop their identity as graduate student, as they embrace their new roles and responsibilities [17]. There is no timeline for how fast students will go through the process of socialization, however, it is imperative that the process occurs for the student to be successful in their graduate program.

Socialization is a key part of ensuring a smooth transition from undergraduate to graduate level responsibilities. Golde identified multiple themes related to graduate student attrition, including incongruence between the student's interest and the department, poor relationships with advisors, and structural alienation of the student [18]. These factors and be exacerbated for Black graduate students when the advisors and administrators, who are necessary for Black student socialization, are handing down lessons surrounding norms and acceptable behavior that is incongruent with the personal identity of the student. Respective institutional cultures espoused at PWIs and HBCUs could be very different, which will strongly influence the overall experience of the student. According to Gasman et al. "high achieving Black students in STEM at PWIs often have to deal with stereotypes that undermine their achievement and are hampered by stereotype threats and negative stereotypes that question their place and abilities in the STEM disciplines" [19], [20]. Previous studies have found also that the "weed out" culture often found within engineering programs at PWIs, plays a significant role in motivation and persistence for students regardless of race, and academic preparation [21]. Contrarily, the culture of STEM programs at HBCUs have been found to approach the socialization process differently, focusing on socializing students in STEM and leveraging student's social capital to help integrate them into engineering [22]. Due to the circumstances under which they were established, HBCU's have historically provided Black students with safe learning environments which affirm their talents in the context of their race, especially in STEM subjects [6], [23]. Students are also supported along their journey toward the doctorate by more readily receiving advising and mentorship from faculty who are of their same race, which matters in the mentorship and advising of Black students. Only a few HBCUs are classified as doctoral granting institutions, yet these institutions are responsible for producing large numbers of doctoral students who may aspire to pursue careers as academics [6]. This work offers a chance to explore further into how students navigate transitioning between these two seemingly conflicting cultures, including how the preparation at an HBCU can help students to deal with barriers that may be exacerbated by being Black.

Methods

The data set utilized for this study is a subset of a larger study exploring the lived experiences of Black graduate students. This larger study utilized a narrative interview methodology to capture stories of the lived experience of Black graduate students in engineering. As an initial recruitment effort, a demographic survey was deployed to targeted institutions through networks of Minority Engineering Program advocates and listservs associated with Black engineering organizations. More than 60 Black engineering graduate students completed the demographic survey because of the snowball sampling that occurred as students shared the study with their own professional networks and peers. The initial inclusion criteria for participants to be interviewed were as follows: (1) they had to identify as Black, and (2) be a graduate student currently enrolled in a doctoral program in engineering at a predominately white institution in the United States, and (3) have engaged in either NSBE and/or BGLOs as an undergraduate student.

A total of 37 interviews were collected from Black graduate students across the nation. Interviews were initiated with a prompt asking participants to share their experiences navigating engineering through undergraduate and graduate school. Participants were encouraged to reflect on how perceived facets of their identity and engagement with specific organizations impacted their experience. Following this narration, a semi-structured approach was taken to follow-up on

specific points based on the stories shared by participants in what is known as the conversation phase. The conversational phase consisted of questions meant to delve deeper into the experiences shared. Interviews were 1.5 – 2 hours in duration; audio and video recorded; and transcribed via Rev. Participants were compensated for their time via a $100 amazon gift card. For anonymity, participants were given the option to choose a pseudonym to attach to their stories, and institution names have been redacted.

From the 37 interviews, four (4) participant stories were chosen to be analyzed for this study. Each participant obtained their undergraduate degree from an HBCU, and at the time of their interview, were enrolled in a doctoral program at Predominately White Institutions. The descriptors and relevant demographic information of the participants are included in Table 1.

Table 1: Participant Descriptors and Demographic Information

				Institutional Type		Region	
Pseudonym	Gender	Program of Graduate Study	Years in Program	Undergraduate	Graduate	Undergrad.	Graduate
Assata	F	Chemical Engineering	4	Private, HBCU	Public, R1, PWI	South	Midwest
Courtney	F	Bioengineering	4	Public, HBCU	Public, R1, PWI	South	Northeast
Ricky	M	Civil Engineering	5	Public, HBCU	Public, R1, PWI	South	Northeast
X	M	Industrial Engineering	2	Private, HBCU	Public, R1, PWI	South	Pacific

Data Analysis

This study utilized a phenomenological lens to organize and code salient themes identified in the interviews. Phenomenology is a qualitative research method used to examine how distinct perspectives are developed through a phenomenon is experience. Utilizing a phenomenological lens is useful tool when examining varying experiences of students in similar situations, such as Black students matriculating from an undergraduate program at an HBCU to a graduate program. In this study, we utilized the phenomenological lens to explore and detail the experiences of Black engineering graduate student transitions, when there is a large change in culture and representation around the students. Understanding the variety of unique experiences and perceptions around the transition from undergraduate studies at an HBCU, to graduate engineering studies at a PWI, can help to understand factors that contribute to the "chilly climate" of engineering as they are highlighted by the intense shift in cultural demographics. This lens will allow the research team to dive deeper into the phenomenon that is the transition itself, and the contexts in which they occur provide invaluable knowledge on how institutions can better prepare for students of color, rather than applying a monolithic, "one-size-fits-all" mentality towards it.

As a part of the utilizing the phenomenological lens, each student transcript was initially read through looking for instances of the participant reflecting on their transition to their graduate institution. Structural coding was utilized for the first-cycle coding method. Structural coding applies a content-based or conceptual phrase representing a topic or inquiry to a segment of data that relates to a specific research question used to frame the interview [24]. Structural coding is particularly useful for studies that employ multiple participants, use a standardized or semi-structured data collection protocols, and exploratory investigations to gather topic lists or indexes of major categories or themes [25]. The research team initially analyzed the transcripts

by reading through them and coding any experience, emotions, perceptions, and reflections relevant to their transition to their graduate institution, flagging each relevant passage as "transitions". Analytic memos were also applied to passages that indicate participant experiences or perceptions that were particularly revealing or insightful related to the transition.

The excerpts from the first cycle coding were then analyzed using a codebook that was developed deductively based on the 4 stages of graduate student socialization hypothesized by Weidman et. al (2003).

Findings

To present the results, I divided the salient experiences related to the transition from HBCU to PWI based on the 4 stages of graduate student socialization: anticipatory, formal, informal, and personal. It is important to keep in mind that the socialization is "dynamic and ongoing, without a definite beginning or end" (Weidman et al., 2003).

Anticipatory Stage

Despite the process of socialization being directly related to the culture of the doctoral program that the student is navigating, the process of socialization for an incoming doctoral student starts before well before the students enroll in their graduate institution. The anticipatory stage addresses how the student prepares themselves to enter their graduate program, including the development expectations for what the experience in graduate school will entail. This also includes developing preliminary notions for what it means to be a graduate student, and the increase in intensity level and rigor of the academic work in a graduate program. For Black doctoral engineering students who matriculate from an undergraduate HBCU, these expectations are developed based on the network that has been established both inside and outside of their undergraduate institutional experiences. X, a second-year industrial engineering doctoral student, explains his mindset before beginning his doctoral program, along with a few of the things he was warned about:

> So I'm this top student from [Hometown], go to [Southern HBCU], I'm the big dog there. Super easy. I get everything I want. I get Greek orgs. I get other orgs. I get [honors org]. I get this. I'm still walking on air. All that kind of stuff. My professors have literally told me at this point, about all their failures. One of my professors was like, "I went out there. I was a PhD." He went to UC Boulder. He was like, "I was a PhD student in Physics, and in Applied Mathematics. After the first semester they was like, "You need to drop that Physics. It's not going to work." I'm talking about stories where I'm like, "There's no way that's going to happen to me."

Coming into his program, X was confident that he would be able to handle what was coming, based on the guidance he was given by his professors at his HBCU. This confidence was instilled based on the prior preparation that he had done, as well as his confidence in his own intelligence and academic skills. Being an undergraduate student at an HBCU worked in his favor, to bolster his academic identity within his racial identity, likely because he was surrounded by fellow high-achieving Black students throughout his

tenure at his undergraduate institution. However, when removed from that type of environment and placed in an environment that is more hostile towards his identity, it is much more difficult to maintain that level of confidence and high level of performance, as can be seen later in the results section.

Ricky, a 5th year environmental engineering doctoral candidate at the time of the interview, had a unique beginning in his journey with his Doctoral engineering program. He reflected fondly of how he was made aware of his opportunity to purse a PhD:

> I was able to do internships in undergrad and largely, a part of that was just being interested in STEM and ultimately applying myself. With that being said, I finished up, applied to the pre-PhD program at Pitt. It's funny, the only reason I applied to [Northeastern PWI] was because I met someone at my internship that went to [Northeastern PWI]. He was like, you know, we met over lunch with a group of individuals, he was like, "send me your resume." Seemed like the next morning I received an email from [Northeastern PWI] saying we received a recommendation on your behalf, come out for recruitment weekend, blah, blah, blah. I ended up coming to [Northeastern PWI] for a visit, wasn't even set yet, but I met [Director of Office of Diversity], you already know how he is. Let's be honest, man. I was trying to come here, get the Masters, get on through. You know how that is. I came for the summer internship, was able to work under my advisor that I'm currently working with, love the research. Found out the PhD was going to be paid for, so, hey, that's where I'm at. Didn't even really know what a PhD was, didn't know what a literature review was, didn't know what I was walking into. But, I ultimately accepted it and then made it through up until this point.

Ricky was able to establish a network of professionals through his variety of experiences he engaged at his undergraduate HBCU. Through this network, which he developed during his undergraduate experiences unique to his school, he was able to secure a connection that allowed him to further explore his passion for research and graduate education. This connection led him to a fully funded PhD program.

Formal Stage

The formal stage is reached when a student is formally enrolled in the graduate program and has begun navigating the spaces related to that graduate program. In this stage the student receives formal instruction related to desired career trajectory, while simultaneously observing senior peers and faculty in professional instances and embrace normative behaviors and expectations. All participants encountered unique difficulties with the shift in institutional culture moving from an HBCU to a PWI, all of which presented new experiences and challenges that must be overcome to successfully navigate their new environments and integrate themselves into their program. Given that there are many changes inherently associated with the transition from undergraduate to graduate school, such as increased workload, autonomy, & expectations for output, the institutional culture shift moving from an HBCU to a PWI is one that has a big

impact on how students respond to and navigate their unique transition. Ricky reflected on the challenges he encountered shortly after he began his graduate academic journey:

> When I was here in grad school, I literally had that mindset that I was still an undergrad. Going to classes, doing the bare minimum. I was always a scholastic achiever so 80% for me was great. Some regard 80% in the PhD program as not going to cut it. Or 75% in the PhD program. Large part of that was me coming into it and not understanding what the pre-reqs were. What was the expectation. I didn't treat it as I should have. It wasn't until I failed my Qualifier that I woke up.

Ricky passed his qualifier on the second try thanks to the support he found in the engineering office of diversity at his graduate institution. However, not all participants were fortunate enough to find graduate institutions with interventions for minority groups in engineering.

The necessary shift in mindset for acclimating to a graduate program is not always second nature for graduate students, both majority & minority; however, when the cultural shift is added on top of that, there are many more dimensions that the student must cope with to maintain a health way of navigating the spaces. Assata, a 4th year chemical engineering graduate student, spoke directly to the institutional differences she noticed in navigating professional academic spaces at an HBCU and a PWI. She reflects on her past research experiences:

> I think the difference with coming from an HBCU is like at [Midwestern PWI] the things people worry about or look at me is like “oh my gosh, you're a Black girl doing that?” I didn't have to worry about that while I was in [HBCU] because all of my friends did research. And we were all black. Like the blackness wasn't a factor anymore. It was just “are you doing good work or not? Did you prepare for your conference? Did you make your poster or not?” That's just what it was.

In her doctoral program, at a PWI, her peers seem surprised that a Black girl was excelling in a subject traditionally thought of as difficult, as engineering often is. A similar phenomenon of cultural dissonance occurred to X when he was attempting to acclimate himself to a new environment after a plethora of changes during his transition.

In the cases of these participants moving large distances, they were often exposed to completely new cultures, both academically and socially, as they navigated the transition from an HBCU to a PWI. With that comes the different aspects such as getting used to a new community, establishing new networks, and adapting to the local culture, which can be wildly different from what they are used to depending on the severity of the transition. The challenges associated with this type of change were made clear in many of the participants stories, though especially salient in the experience of Courtney, an engineering graduate student originally from East Africa. She details her experiences moving from a southern undergraduate HBCU to a northeastern HWI:

> I felt like [Northeastern city] is not as hospitable as the southern hospitality, and the [southern states] versus here. People really don't care. If you say hello, people look at you crazy. I'm like, "Where am I?" That was not the case for me, because in [home country] everybody says hello even though they don't know you. The same thing in [undergraduate]. Well, the HBCU experience is different. So,

> coming here I'm like, "This is completely new, I don't want to talk to anyone." I was getting to the point where I would get really excited… If I'm supposed to meet someone, when they cancel, I get excited. That means I don't have to go anywhere. That's how my first semester was, because I just stayed in my apartment. I think that's because I couldn't take it anymore. So that's how it was.

Courtney's response to the shift in culture that she experienced was not positive, and as a result she chose to withdraw from it and stay in an environment she felt most comfortable. Earlier in the interview, she details her transition into her undergraduate institution from her home in East Africa as smooth, even though there were a stark cultural difference between countries, because it was "very close to what [she] was already used to." When matriculating into a culture that was starkly different than what she was accustomed to, Courtney struggled initially to overcome the changes of the new environment, as she began to be socialized as a Black graduate student at a PWI.

Informal Stage

During the informal stage of role acquisition, the novice learns of the informal role expectations. These "expectations arise and are transmitted by interactions with others" who are current role incumbents. Through meaningful interactions and immersion in the new culture, students receive behavioral clues, observe acceptable behavior, and it is hoped, respond and react accordingly. Students also begin to develop their social and emotional support system among their peers and faculty. Student cohorts develop as a community having a social and emotional identification, cohesiveness, and connectedness. The progress within the socialization process is helped if students are able to develop in-group status with their peers. [17], [26].

One of changes that was identified across all participants was the change in the level of support that the graduate students felt while navigating in their respective engineering environments. Courtney recounts her experience her first year dealing with a male advisor who was international as being disruptive in her attempts to integrate herself as a graduate student in an unfamiliar, and seemingly hostile environment.

> My first PI…you know you have your weekly meetings with your PI. Well, we had this group meeting. It used to be four us and then our advisor, our PI. I was the only non-chinese student in the lab. Sometimes in lab meetings I noticed, now I still remember this, sometimes some of the stuff will be in Chinese. I don't know Chinese. It's just like I don't belong there sometimes in a way, because I can't follow, or the conversation can be in Chinese. Another thing is, with my previous PI, I feel like everything is rushed. It was more of reporting versus having a conversation. So, that was the experience I had that first year.

Courtney later switched advisors, where she was able to develop a professional relationship and communicate in a way that better fits her working style.

> For my current PI, it's more like a conversation. He wants to chat about it and see what I think. He wants to know how I think, and that kind of thing. So, I feel like there was ...but I think I'm doing better than where I started.

X details his experience dealing with his research professor and the overall feelings he had working under his instruction

> More than anything, my research professor, for the first year, gave me a vibe of when I was doing well in classes, he was letting me exert all this energy. It really hurt when I wasn't doing well, and you would just feel his support go. Like, "Oh well, if you don't finish then I'm.... Oh well. If you don't finish, then you don't finish." And you get that vibe heavily. Like, "I'm with you if you got it, if you not with it, I'm not going to support you."

Assata had a similar perception of support from her advisor:

> Because it was very clear to me, while I was in the lab that my advisor wasn't invested in me succeeding. When I came into grad school, I got like a fellowship from the university. And then my first year I got NSF. And so, when I got it, my advisor at the time, sent an email out to the whole department saying, like, "oh, let's congratulate Assata on winning this prestigious fellowship, blah, blah, blah." But what he also didn't include was that whenever I was writing my NSF fellowship application and asking him for help, he didn't even respond to my emails. He refused to help me. And granted I really didn't think I was going to get the NSF award and I hadn't chosen to join his lab, when I submitted. Because you submit, all the way in October and I joined his lab in January. And so, it's like, you want to congratulate me now that I've won this fellowship award, but when I'm get the help, like you weren't there for me.

This was a similar experience sentiment that X harbored towards his advisor, where they are on your side when doing well but not with them when they needed the most support.

Personal Stage

In the personal stage of socializations, students are expected to have formed a professional graduate student identity, and "reconciled the dysfunction and incongruity between their previous self-image and their new professional image as they assume their new role" (Weidman et al., 2003, p. 14). Coming from HBCU, where the Black identity is elevated and bolstered, the participants shows signs of difficulty attempting to integrate the doctoral engineering student identity espoused at large PWIs, into their own identity as a Black engineering graduate student. X faced difficulty trying to reconcile the differences between the culture that was espoused through his institution and his personal identity:

> By the time I hit around November of my first semester at grad school, I had a schizophrenic, nervous, whatever you want to call it, break down. And schizophrenic is a good work because it's based off the word, schism. So, there's a break in your behavior, in your nature. So, my nature starting fighting against the fact that my behavior was trying to... my behavior was trying to become a [Graduate University] student. I felt like there was this need to become a [Graduate University] student, right? And that fought against my nature of who I was. So I had this break down.

In all 4 of the participants, we see difficulties with integrating the graduate student's identity into their own personal identities. In many cases, such as that of X, these students

ended up with some sort of mental health struggle in their attempts to overcome the dissonance between the two identities, while also trying to successfully navigate their program.

Discussion

Based on the lived experiences of the 4 participants in this study, the research team identified multiple changes that occur simultaneously when a Black student matriculated from an HBCU to a PWI for graduate studies. Participants are going from undergraduate level work, to graduate level responsibility, change in representation of those around you, and changes in location. Simultaneously, the student must restart the process of forming support systems to help weather these changes and maintain physical and mental health through the process of socializing themselves in a new environment if they want to be successful. The research team identified two main themes that had a major impact on the transition from an HBCU to a PWI for a Black engineering graduate student: expectations for/preconceived notions of graduate school, difficulties in the socialization process due to institutional culture.

Expectations and preconceived notions of Doctoral program

X developed his expectations for his doctoral program based mainly on the interactions that he had with his undergraduate research advisors, who warned him of the rigor of Doctoral programs. This is consistent with the findings of Amelink et al., who identified interactions with graduate students and faculty while enrolled as an undergraduate, and undergraduate research experience factors that impacted the anticipatory stage of the socialization process in their study of the socialization process of underrepresented engineering doctoral students [27]. Based on the tone X was using when explaining his professors warning, he was not intimidated about the perceived difficulty of the task ahead of him. Coming from an HBCU, X was able to get unique perspective from a Black advisor who had previously navigated graduate engineering at a PWI. This is a unique connection that X was able to make because he went to an HBCU for his undergraduate studies. Austin (2002) found that when attempting to socialize themselves in graduate programs "students must make sense of the academy and its values, its expectations of them as graduate students, [the academy's] conceptions and definitions of success, and the models of professional and personal life that it offers to those aspiring to join the academic ranks" [16]. This idea was then expanded to consider the pre-existing values and beliefs that the student holds, and how these sociocultural factors interact within disciplinary settings [28], [29]. Being an HBCU student affords Black doctoral students different views and values to develop their perspective of predominately white institutions, as well as to develop their expectations for what they are going to be facing in Doctoral programs, as can be seen through the experience of X.

Ricky had a unique experience in his transition because the PhD was not in his initial plan for his future. Since the PhD "fell into his lap", he had an incomplete expectation of what would happen in graduate school. Senge's theory of the learning organization hypothesizes that in any pursuit of higher education, the individual must undergo a fundamental shift of mind in order to grasp a deeper meaning learning [30]. For Ricky, he achieved that mindset shift after he encountered his first major setback in graduate school, which was failing his qualifying exam, the first milestone in the Doctoral degree process. If the student underestimates what is necessary to be successful in their new position because they are unaware of their expectations, as was the case for Ricky when he first entered his doctoral program, the student will be unable to properly carry out their responsibilities to the best of their ability. Fortunately, Ricky developed a strong

network in his department and the office of diversity to use as a support system after running into difficulties in his academic journey.

Despite the preconceived notions the participants had about graduate education, all acknowledged the switch in mindset that was necessary once they were enrolled in doctoral programs at PWIs; however, these shifts in mindset are multifaceted and involve changes to both their professional and personal identities. Often rocky transitions in and of themselves, this mindset shift is often spurred on by some type of shortcoming, or some sort of misalignment between the values of the institution of and can affect their wellbeing in different ways.

Difficulties Navigating Institutional Culture

The first two stages of socialization center around graduate students determining their fit within the program and learning what is expected of them in their new role [17], which is often thought of as one of the outcomes of a student-advisor relationship. Adapting to these new expectations in graduate school is a daunting experience but can be overcome given the proper guidance and support. There were many dissonant interactions in the beginning of the participants graduate journeys regarding students getting accustomed to navigating engineering environments on the graduate level at a PWI. Some of the participants struggle with academics, others struggle with dealing with navigating hostile environments or perceiving hostile environments or dealing with racialized experiences that were previously irrelevant. Multiple participants reported being overwhelmed and needed to seek out mental health assistance while navigating their new graduate environments. For Black doctoral students, as they try to internalize new values that do not align with the values espoused in their undergraduate experiences, they will reach a point where they must decide whether to sacrifice values or identity traits that do not align with the institutional socialization process. One of the most jarring aspects of transition to from HBCU to PWI that occurred for Black graduate students is moving from an environment with a high minority population to an environment with a low minority population. One of the biggest changes that was identified in the matriculation of Black Graduate Students was the change in the level of support that the graduate students felt while navigating in their respective engineering environments.

The research team identified a similar phenomenon across multiple participants, where a low point is hit, like a failed qualifier or class. With the right support they bounce back with a better grasp on the situation. The final stage of the graduate student socialization indicates that the students must internalize their professional roles and integrate their new identities into their everyday interactions [31]. X falls back on his faith to lead him after he has a nervous breakdown due to prolonged exposure to a culture that espoused values counter to his own. Rather than assimilating into the identity of the graduate student at his university, X chose to put forth the time and effort to find the necessary support to preserve his personal identity while navigating engineering spaces at a PWI. Constant reminders of race make Black graduate students self-conscious being one of few navigating the space. This can lead to pressures to be the representation for Black people as failure will reflect poorly on the Black students coming after them. Because Blackness “wasn’t a factor” at the HBCU, Assata felt that she was valued more for the quality of the work she produced, and her professional accomplishments; whereas,

at her graduate PWI, her peers seem surprised that a Black girl is doing something as difficult as engineering.

Each of the four participants interviewed were exposed to a completely new culture, both academically, and socially in their transitions because they moved from an HBCU to a PWI. The critical mass of Black students at HBCUs creates an environment where negative racialized experiences rarely occur because the students are surrounded by fellow Black scholars who are often very high achieving. At PWIs, Black students in engineering are constantly reminded of their race as they encounter stereotype threat, microaggressions, and the overall hostile environment of engineering [32]. Moving from her home in East Africa, Courtney details her transition into her undergraduate institution as smooth, even though there were a stark cultural difference between countries, because of the welcoming environment that was cultivated around the HBCU she was attending. In contrast, at her graduate institution, Courtney was placed a new environment where the culture is completely foreign to her. And, as seen through her narrative, she struggled initially to overcome the changes of the new environment, as she began to navigate her new environment as a Black graduate student attending a PWI.

It has been found in multiple studies that departmental culture has a significant impact on the way students perceive their doctoral studies. This can include faculty cues and interaction, norms and practice and the nature of engineering as a discipline [33]–[36]. Faculty play a huge role in how the departmental culture is disseminated among the doctoral students. If the faculty assume that doctoral students thrive in the same conditions that they could, it can create misalignment between what the advisor provides as support and what the student needs to progress their socialization within their programs [18], [33], [37]–[39]. In many of the stories in this study, there were cases of faculty providing insufficient support for the Black students under their tutelage, while also reaping the rewards of the work put in by the students without providing proper recognition. This type of interest convergence often leads students to feel as though they were using a tool for increasing diversity. This exploitation is a very difficult dynamic to address for the student due to the power dynamic present between an advisor and their students; therefore, often the solution comes down to the capabilities, network, and vocality of the student.

Implications, and Conclusion

This work was an exploratory study that examines the experiences of Black engineering graduate students, who have matriculated from HBCUs to PWIs for graduate studies. All of the participants of this study expressed grate difficulties in their first few semesters as they attempted to learn how to navigate their new environments. One unique aspect of the socialization process for Black engineering graduate students is the choices between personal and professional identities that they often must make in order to successfully navigate engineering environments. Three main factors added difficulties to the transition for the Black graduate students analyzed for this study: culture shock from the shift in institutional culture, lack of institutional support with regards to retention efforts, and conflicting cultural values.

Understanding the process of how these students identify, and address difficulties and stressors during their transitional period from undergraduate studies to graduate studies in engineering will be particularly insightful in developing effective countermeasures for falling enrollment and persistence rates of Black students in engineering graduate programs. Moving forward towards future works in this realm, exploring what aspects of the undergraduate HBCU

experience help to prepare Black engineering students to navigate the PWIs on the graduate level. A possible avenue to explore this could be to identify experiences that bolster Black engineering identity in a way that persists through matriculation into a hostile environment, such as a PWI.

References

[1] C. M. L. Phillips, J. S. London, W. C. Lee, A. S. Van Epps, and B. A. Watford, "Reflections on the messiness of initiating a systematic literature review on broadening participation in engineering and computer science," *Proc. - Front. Educ. Conf. FIE*, vol. 2017-October, pp. 1–8, 2017, doi: 10.1109/FIE.2017.8190482.

[2] J. Roy, A. Erdiaw-Kwasie, C. Stuppard, and T. King, *Engineering & Engineering Technology By the Numbers*, 2nd ed. Washington, D.C.: American Society for Engineering Education, 2021.

[3] E. O. Mcgee and W. H. Robinson, *Diversifying STEM: Multidisciplinary Perspectives on Race and Gender*. Rutgers University Press, 2020.

[4] R. E. Gildersleeve, N. N. Croom, and P. L. Vasquez, "'Am i going crazy?!': A critical race analysis of doctoral education," *Equity Excell. Educ.*, vol. 44, no. 1, pp. 93–114, 2011, doi: 10.1080/10665684.2011.539472.

[5] G. Gay, "Navigating marginality en route to the professoriate: Graduate students of color learning and living in academia," *Int. J. Qual. Stud. Educ.*, vol. 17, no. 2, pp. 265–288, 2004, doi: 10.1080/09518390310001653907.

[6] R. A. Blockett, P. P. Felder, W. Parrish III, and J. Collier, "Pathways to the Professoriate: Exploring Black Doctoral Student Socialization and the Pipeline to the Academic Profession R eginald A. B lockett-Indiana University-B loomington," 2016. [Online]. Available: https://www.census.

[7] G. L. Garner, *Managing Heterosexism and Biphobia: A Revealing Black Bisexual Male Perspective*, no. May. 2008.

[8] P. Felder, "On Doctoral Student Development: Exploring Faculty Mentoring in the Shaping of African American Doctoral Student Success," *Qual. Rep.*, vol. 15, no. 2, pp. 455–474, 2010.

[9] E. O. McGee, "Devalued Black and Latino Racial Identities: A By-Product of STEM College Culture?," *Am. Educ. Res. J.*, vol. 53, no. 6, pp. 1626–1662, 2016, doi: 10.3102/0002831216676572.

[10] M. L. Ridgeway, E. O. Mcgee, D. Naphan-Kingery, and A. J. Brockman, "Black Engineering and Computing Doctoral Students' Peer Interactions that Foster Racial Isolation and Impostor Feelings," Crystal City, Virginia, Apr. 2018.

[11] N. A. Hollingshead, S. M. Meints, M. M. Miller, M. E. Robinson, and A. T. Hirsh, "A Comparison of Race-related Pain Stereotypes held by White and Black Individuals," *Jounral Appl. Soc. Psychol.*, vol. 176, no. 1, pp. 139–148, 2018, doi: 10.1111/jasp.12415.A.

[12] M. Ong, J. M. Smith, and L. T. Ko, "Counterspaces for Women of Color in STEM Higher Education: Marginal and Central Spaces for Persistence and Success," *J. Res. Sci. Teach.*, vol. 55, no. 2, pp. 206–245, 2018, doi: 10.1002/tea.21417.

[13] L. T. Ko, R. R. Kachchaf, A. K. Hodari, and M. Ong, "Agency Of women of color in

physics and astronomy: Strategies for persistence and success," *J. Women Minor. Sci. Eng.*, vol. 20, no. 2, pp. 171–195, 2014, doi: 10.1615/JWomenMinorScienEng.2014008198.

[14] J. M. Smith and J. C. Lucena, "Invisible innovators: how low-income, first-generation students use their funds of knowledge to belong in engineering," *Eng. Stud.*, vol. 8, no. 1, pp. 1–26, Jan. 2016, doi: 10.1080/19378629.2016.1155593.

[15] K. G. Wilkins-Yel, J. Hyman, and N. O. O. Zounlome, "Linking intersectional invisibility and hypervisibility to experiences of microaggressions among graduate women of color in STEM," *J. Vocat. Behav.*, vol. 113, no. October 2018, pp. 51–61, 2019, doi: 10.1016/j.jvb.2018.10.018.

[16] A. E. Austin, "Preparing the next generation of faculty: Graduate school as socialization to the academic career," *J. Higher Educ.*, vol. 73, no. 1, pp. 94–122, 2002, doi: 10.1080/00221546.2002.11777132.

[17] J. C. Weidman, D. J. Twale, and E. L. Stein, "Socialization of Graduate and Professional Students in Higher Education, a Perilous Passage?," *The Journal of Higher Education*, vol. 74, no. 6. pp. 719–719, 2003. doi: 10.1080/00221546.2003.11780868.

[18] C. M. Golde, "The role of the department and discipline in doctoral student attrition: Lessons from four departments," *J. Higher Educ.*, vol. 76, no. 6, pp. 669–700, 2005, doi: 10.1080/00221546.2005.11772304.

[19] M. Gasman, T.-H. Nguyen, C. F. Conrad, T. Lundberg, and C. F., "Black Male Success in STEM: A Case Study of Morehouse College," *J. Divers. High. Educ.*, vol. 10, no. 2, pp. 181–200, 2017.

[20] M. J. Chang, O. Cerna, J. Han, and V. Sàenz, "The contradictory roles of institutional status in retaining underrepresented minorities in biomedical and behavioral science majors," *Rev. High. Educ.*, vol. 31, no. 4, pp. 433–464, 2008, doi: 10.1353/rhe.0.0011.

[21] T. R. Morton, "Being vs. Becoming: Transcending STEM Identity Development through Afropessimism, Moving toward a Black X Consciousness in STEM," Walls, 2015.

[22] K. G. Wilkins-Yel, A. Arnold, J. Bekki, M. Natarajan, B. Bernstein, and A. K. Randall, "'I can't push off my own Mental Health': Chilly STEM Climates, Mental Health, and STEM Persistence among Black, Latina, and White Graduate Women," *Sex Roles*, vol. 86, no. 3–4, pp. 208–232, 2022, doi: 10.1007/s11199-021-01262-1.

[23] A. Ndumu and S. Walker, "Adapting an HBCU-inspired framework for Black student success in U.S. LIS education," *Educ. Inf.*, vol. 37, no. 2, pp. 219–229, 2021, doi: 10.3233/EFI-211511.

[24] K. M. MacQueen and G. Guest, *An Introduction to Team-based Qualitative Research*. 2008.

[25] J. Saldaña, *The Coding Manual for Qualitative Researchers*. SAGE Publications, 2016.

[26] D. J. Twale and F. K. Kochan, "Assessment of an Alternative Cohort Model for Part-Time Students in an Educational Leadership Program," *J. Sch. Leadersh.*, vol. 10, no. 2, pp.

188–208, 2000, doi: 10.1177/105268460001000204.

[27] C. T. Amelink and C. D. Edwards, “EXPLORING THE SOCIALIZATION EXPERIENCES OF UNDERREPRESENTED ENGINEERING GRADUATE STUDENTS,” 2020. [Online]. Available: www.begellhouse.com

[28] N. Curtin, A. J. Stewart, and J. M. Ostrove, “Fostering Academic Self-Concept: Advisor Support and Sense of Belonging Among International and Domestic Graduate Students,” *Am. Educ. Res. J.*, vol. 50, no. 1, pp. 108–137, 2013, doi: 10.3102/0002831212446662.

[29] B. Gopaul, “Applying Cultural capital and field to docotroal student socialization,” *Int. J. Res. Dev.*, vol. 7, no. 1, pp. 46–62, 2016.

[30] P. M. Senge, “The fifth discipline: the art and practice of the learning organization,” *Choice Reviews Online*, vol. 44, no. 05. pp. 44-2797-44–2797, 1990. doi: 10.5860/choice.44-2797.

[31] D. J. Twale, J. C. Weidman, and K. Bethea, “Conceptualizing Socialization of Graduate Students of Color: Revisiting the Weidman-Twale-Stein Framework,” *West. J. Black Stud.*, vol. 40, no. 2, pp. 80–94, 2016.

[32] E. O. Mcgee, *Black, Brown, Brusied: How Racialized STEM Education Stifles Innovation*. Harvard Education Press, 2020.

[33] L. M. Portnoi, A. A. L. Chlopecki, and D. Peregrina-Kretz, “Expanding the Doctoral Student Socialization Framework: The Central Role of Student Agency,” *J. Fac. Dev.*, vol. 29, no. 3, pp. 5–16, 2015, [Online]. Available: https://www.questia.com/library/journal/1P3-4003712961/expanding-the-doctoral-student-socialization-framework

[34] S. K. Gardner and B. J. Barnes, “Graduate student involvement: Socialization for the professional role,” *J. Coll. Stud. Dev.*, vol. 48, no. 4, pp. 369–387, 2007, doi: 10.1353/csd.2007.0036.

[35] D. Gottlieb, “Process of Socialization in American Graduate Schools,” *Soc. Forces*, vol. 40, no. 2, pp. 124–131, 1961.

[36] J. Weidman and E. Stein, “Socialization of Graduate Students to Academic Norms,” *Res. High. Educ.*, vol. 44, no. 6, pp. 641–656, 2003.

[37] C. M. Golde, “Beginning Graduate School: Explaining First-Year Doctoral Attrition,” *New Dir. High. Educ.*, vol. 1998, no. 101, pp. 55–64, 1998, doi: 10.1002/he.10105.

[38] M. N. Davidson and L. Foster-Johnson, “Mentoring in the preparation of graduate researchers of color,” *Rev. Educ. Res.*, vol. 71, no. 4, pp. 549–574, 2001, doi: 10.3102/00346543071004549.

[39] C. M. Golde and T. M. Dore, “At cross purposes: What the experiences of today’s doctoral students reveal about doctoral education.,” *Pew Charit. Trust.*, vol. January, pp. 1–63, 2001, [Online]. Available: http://files.eric.ed.gov/fulltext/ED450628.pdf