Corporate Internships, Undergraduate Research, and Finances: Successful African American Engineers' Consideration of Immediate Workforce Entry or Graduate School

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Abstract

This study was based on a multiple case study of two Dominantly White Institutions. Interviews were conducted with 61 individuals including undergraduate and graduate engineering and computer science majors and recent graduates, faculty, and administrators. This study focuses specifically on how students' experiences with corporate internships, undergraduate research, and their financial status informed their consideration of immediate workforce entry or graduate school. The findings from this study indicate that students who participated in corporate internships overwhelmingly intended to pursue the labor market immediately following completion of her/his bachelor's degree. Conversely, students who were engaged in undergraduate research tended to express a desire to pursue graduate school. Finances appeared to play a key consideration in participants' decision to enter the workforce or seek graduate school.

Background

African Americans are severely underrepresented in both the engineering and technology workforce (National Science Foundation, 2019) and in faculty positions in highly ranked schools of engineering (Slaughter, 2009). Engineering employment data reveals African Americans account for 3.4% of all careers in engineering and 4.9% of all careers in computer and information science (National Science Foundation, 2019). Additionally, African Americans make up approximately 2% of the engineering faculties at the top universities (Slaughter, 2009). These data are particularly troubling because, based on the 2010 U.S. Census, African Americans make up 12.6% of the United States' population (Humes, Jones, & Ramirez, 2011). In comparison, White Americans account for 74.9% of engineering and 68.2% of computer science positions while making up 63.7% of the U. S. population; Asian Americans account for 14.4% of the engineering and 20.9% of the computer science profession while constituting 4.8% of the U. S. population. The National Academies have documented the many ways the U.S. may increase its prominence in STEM innovation and chief among them is an increased participation of racial minorities and women in the labor market and in the academy (National Academies of Science, 2007).

The current study is part of a larger study focusing on the experiences of highly successful African American engineers and computer scientists and the institutional context, which enables or impedes their success. In this article, I focus specifically on how students' experiences with internships and/or undergraduate research informed their immediate workforce entry or graduate school. The purpose of this study is to examine two schools of engineering and the experiences of 61 participants: 28 African American engineers and computer scientists, 9 faculty members, 16 administrators, and 8 recent baccalaureate recipients. This data was collected from two dominantly White public research universities. In this study, I employ a multiple case study research design (Yin, 2009) to address the following research question:

> How do institutional agents, programmatic interventions, co-curricular involvement, engagement opportunities, and personal finances influence the intention of pursuing a career in industry or graduate school immediately following baccalaureate degree attainment?

Literature Review

Although academic achievement (e.g., Sax, 2001), and institutional quality (e.g., Zhang, 2005) represent some of the strongest predictors of eventual graduate or professional school enrollment, researchers also have documented how students' socioeconomic background (e.g., Heller, 2001; Mullen et al., 2003) and accumulated undergraduate debt burden (e.g., Eagan & Newman, 2010; Malcom & Dowd, 2012) affect the decision to enroll in graduate school. Mullen et al. (2003) found "students with highly educated parents are more than three times more likely to enroll in first-professional and doctoral programs than are those whose parents have a high school degree or less" (p. 150). Students who have the financial backing from their parents can often make the decision to enroll in graduate school without being forced to consider how they might finance their education or livelihood.

Students from more modest socio-economic backgrounds often face the burden of funding their education through student loans. Eagan and Newman (2010) found underrepresented racial minority (URM) students who carried an average student loan debt of $1,000 were 5.3% less likely to enroll in graduate school as compared to a student without any loan debt. Additionally, URM students who depend on their personal finances (i.e., income from work) to pay for educational expenses had significantly lower probabilities for intending to attend graduate or professional school. Conversely, receiving grants and scholarships appreciably increases the intention to enroll in graduate or professional school (Eagan & Newman, 2010). Similarly, Malcom and Dowd (2012) found students from all racial backgrounds with "typical debt levels" were 10% to 13.8% less likely to enroll in graduate school than students who did not borrow.

Undergraduate Research

Carter, Mandell, and Maton (2009) examined nearly 500 Black students who participated in the Meyerhoff Scholars program at the University of Maryland, Baltimore County. The authors' analysis indicated that participation in a year-long undergraduate research opportunity positively impacted students' enrollment in STEM Ph.D. programs. These findings support conclusions drawn by other researchers, like Hunter, Laursen, and Seymour (2007), regarding the benefits of undergraduate research in promoting students' pursuit of post-baccalaureate degrees.

Hunter et al. (2006) conducted a comprehensive longitudinal qualitative study of four campuses, which included study participation of undergraduate "rising seniors," who participated in undergraduate research, their faculty advisors, and senior administrators with experience working with structured undergraduate research programs. 90% of student and faculty statements regarding undergraduate research signaled a positive or beneficial aspect. One of the key outcomes of participating in an undergraduate research experience was a "clarification, confirmation, and refinement of career/graduate school intentions" (p. 59). Student participants cited being able to determine a specific area of study and to make some observations about whether or not they were truly interested in a career in research. Also, the opportunity to strengthen participants identity as a "researcher" appeared to play an important role in students' determination. Hunter and her colleagues (2006) found that students felt more confident in their ability to make a decision about applying and at-

tending graduate school. The authors were sure to note that participants may have sought the undergraduate research experience because of previous interest in graduate school. A limitation to this study is that the authors do not address role of race in the experiences and participation of students in undergraduate research.

Although undergraduate research programs help to orient students from all backgrounds toward a commitment to STEM disciplines, URM students continue to face unique sociological and psychological challenges in adjusting to the culture within STEM. Hurtado, Han, Saenz, Espinosa, Cabrera, and Cerna (2007) supported earlier findings from Seymour and Hewitt (1997) in identifying how campus racial climate, the STEM culture, and overly competitive environments in STEM fields can serve as obstacles to URM students' ability to identify with their STEM major. Hurtado, Cabrera, Lin, Arellano, and Espinosa (2009) concluded that participation in undergraduate research programs not only provided URM students with the self-confidence necessary to continue their education in STEM beyond the bachelor's degree, but engagement with the culture of STEM also provided students with the support networks necessary in navigating other potential educational barriers.

Theoretical Perspectives

Paulsen's (2001) perspective on investing in human capital provides an important lens to analyze the considerations of African American engineers and computer scientists as they complete their bachelor's degree. Paulsen defines human capital as "the productive capacities – knowledge, understanding, talents, and skills – possessed by an individual or society; and investment in human capital refers to expenditures on education, health and other activities that augment these productive capacities" (p. 56). In other words, the typical cost-benefit considerations of investing in human capital include the direct and/or deferred costs of the education, foregone earnings, and how these may impact the increased earning potential for the investor. As Perna (2004) has similarly suggested, Paulsen argues that social capital (Bourdieu, 1986) is an important component in mediating the differences in students' resources and knowledge of the benefits and returns on an investment in human capital. This theoretical perspective provides a better understanding of how students may assess their options. Does an individual accept a lucrative salary with an immediate return on the investment in an undergraduate education or does a person forgo earnings, potentially take on additional student loan debt, but increase her/his human capital for future income and expanded career opportunities?

While the notion of investing in human capital focuses on the individuals, a broader understanding of the context for which an individual's decisions are made is demonstrated through how colleges and universities structure opportunities. There has been a recent trend in Public Research Universities moving toward a more privatized model with fewer funds coming from the respective state (Morphew & Eckel, 2009). In order to replace the missing funding, Public Research Universities have increased tuition, placed more emphasis on the external funding of research grants, and began partnerships with corporations to name a few. Slaughter and Leslie (1997) characterize this form of institutional behavior as Academic Capitalism. In essence:

> Academic capitalism deals with market and marketlike behaviors on the part of universities and faculty. *Marketlike behaviors* refer to institutional and faculty competition for moneys, whether these are from external grants and contracts, endowment funds, university-industry partnerships, institutional investment in professors' spinoff companies, or student tuition and fees. (p. 11)

The main argument of academic capitalism is that the movement towards marketlike behaviors may foster mission drift. Schools and Colleges of Engineering at both Private and Public Research Universities have well-established partnerships with industry. In the case for African American engineers and other racial minoritized groups, corporate sponsorships have played an important role in providing needed funds for Minority Engineering Program (MEP) offices.

Research Design

The work of Bensimon and Malcom (2012) influenced the research design of this study through their assertion that the key strategy in addressing equity issues on college campuses is not to focus on fixing the student. Rather, it is about transforming the institution, which led me to focus on the ways an institution structures opportunity for African American engineers and computer scientists. Additionally, Harper's (2010) Anti-Deficit Achievement Framework inspired the framing of this study, which is pronounced in the inclusion criteria focusing on student achievement instead of departure.

As a result, my goal was to find universities with records of success in supporting African American engineers. Therefore, I utilized "Diverse Issues in Higher Education's" annual report of the Top 50 undergraduate degree producers of baccalaureate degrees in engineering among African Americans in the United States to identify several institutions to request participation in this study (Borden, 2010). I formally requested participation in the study via email and telephone to the respective campus' School of Engineering Dean's Office. The requests were sent out to a purposeful sample of eight universities, which included four HBCUs and four public research universities. Two schools of engineering at dominantly White public research universities approved my request.

This research investigation is guided by a multiple case study design (Yin, 2009). Two schools of engineering serve as the cases under study with the respective university providing the institutional context for the cases. Students, administrators, and faculty serve as the embedded units of analysis. The case study approach "relies on multiple sources of evidence, with data needing to converge in a triangulating fashion" (Yin, 2009, p. 18). The triangulation of the data increased the trustworthiness and reliability through the data analysis process.

Therefore, this study is based on qualitative data collected from 61 participants: 28 African American engineers/computer scientists, 9 faculty members, 16 administrators, and 8 recent baccalaureate recipients. Study participants were from one of two dominantly White public research universities: Porter State University, which is in the Southeastern region of the U.S., and Baldwin University, which is in the Midwestern region of the U.S. Pseudonyms are used for both the universities and the study participants.

Student participants were recruited through the respective university's minority engineering program (MEP). The director of the program emailed a study recruitment announcement to potential participants. The criteria for participation in this study included the following:

1. Students must identify as African American or Black (including multi-racial backgrounds)
2. Students must be a declared undergraduate engineering or computer science major or recent alum (completed baccalaureate degree within 3-5 years)
3. Students must have achieved success, which is defined as maintaining at least a 3.0 GPA, been involved in a faculty member's research or relevant corporate internship, and has persisted to upper division coursework.

Additionally, key administrators were asked to participate in this study if they had formal responsibilities in the current case study. Administrators included the Deans and Associate Deans of the school of engineering, directors and senior administrators of university wide multicultural student affairs or diversity initiatives, and directors of minority engineering programs. Lastly, the directors of MEP, with knowledge from their experiences in dealing with faculty members, identified faculty members supportive of African American engineers and computer scientists.

Data Collection

Individual face-to-face interviews were the primary method of inquiry for all study participants. Student participants were asked to complete a short demographic and biographical questionnaire prior to the interview. This brief questionnaire gathered information on a range of relevant background characteristics (e.g., parent's income and education). The student interviews lasted approximately 60 minutes; Faculty interviews lasted approximately 30 minutes; Administrator interviews lasted between 30-45

minutes. A semi-structured interview technique was used for all three participant groups, which allowed me to be more responsive "to the situation at hand, to the emerging worldview of the respondent, and to new ideas on the topic" (Merriam, 1998). The interviews were audio-recorded, transcribed verbatim, and checked for accuracy. Please see Tables 1 and 2 for a complete listing of student participants.

Student Participants

The 36 undergraduate student and alumni participants came from a variety of majors. Table 1 lists all of the participants for Porter State and Table 2 lists all of the participants for Baldwin. These tables include the pseudonym name each participant selected for his or herself, participant's sex, academic standing, major, and undergraduate GPA. Students from Porter State collectively maintained a mean 3.3 GPA and students from Baldwin achieved a mean 3.4 GPA. Approximately 42% of the participants were women. In terms of SES, about 38% of the students' parents earned less than $60,000 per year, 33% earned between $60,000 and $99,999, and about 11% earned $100,000 or more. Over 70% of the students were raised within 100 miles of their respective campuses. Please see Tables 1 and 2 for a complete listing of student participants.

Porter State University

Porter State is a public university in the Southeastern region of the United States. Porter State has over 30,000 students and is characterized as a research university by the Carnegie Classification. This southeastern university has considerable research activity and expenditures. Porter State's undergraduate student population consists of roughly 10% African Americans.

Baldwin University

Baldwin University is a public university in the Midwestern region of the United States. With over 40,000 students, Baldwin is characterized as a research university by the Carnegie Classifications. Baldwin has considerably larger research expenditures, is more selective, and has a more highly ranked school of engineering than Porter State. However, Baldwin's overall undergraduate African American student population is approximately 6%, which is appreciably smaller than Porter State's.

Pseudonym Name	Sex	Academic Standing	Major	College GPA*
Alexandria	Female	Alum	Industrial	3.11
Avery	Female	Junior	Industrial	3.01
Bella	Female	Senior	Computer Science	3.66
Caden	Male	Alum	Computer Engineering	3.08
Carter	Male	Alum	Electrical	3.76
Charlotte	Female	Junior	Computer Engineering	3.14
Chloe	Female	Senior	Chemical	3.3
Damien	Male	Senior	Computer Science	3.12
Elizabeth	Female	Junior	Computer Science	3.7
Ethan	Male	Junior	Computer Science	3.28
Gabriel	Male	Senior	Electrical	3.38
Grace	Female	Senior	Electrical	3.85
Ian	Male	Senior	Biomedical	3.37
Kaleb	Male	Alum	Civil	3.3
Layla	Female	Junior	Biomedical	3.25
Mikayla	Female	Alum	Industrial	3.13
Nathan	Male	Senior	Electrical	3.3
Olivia	Female	Alum	Chemical	3.24
Owen	Male	Junior	Industrial	3.1
Peyton	Male	Junior	Computer Science	3.14
Ruby	Female	Senior	Industrial	3.2
Xavier	Male	Senior	Mechanical	3.15

* Mean College GPA of 3.3 with a Std. Dev. of .21

Table 1. Student Participants from Porter State University (n=22)

Pseudonym Name	Sex	Academic Standing	Major	College GPA*
Andrew	Male	Alum	Mechanical	3.5
Bernard	Male	Senior	Industrial	3.77
Eli	Male	Senior	Civil	3.6
Faith	Female	Senior	Industrial	3.19
Jack	Male	Senior	Aerospace	3.23
Jackson	Male	Junior	Industrial	3.22
John	Male	Junior	Chemical	3.46
Karson	Male	Senior	Biomedical	3.37
Kaydence	Female	Senior	Chemical	3.06
Levy	Male	Alum	Electrical	3.0
Luke	Male	Senior	Aerospace	3.92
Michael	Male	Junior	Electrical	3.8
Sofie	Female	Junior	Chemical	3.1
Vera	Female	Junior	Civil	3.35

* Mean College GPA of 3.4 with a Std. Dev. of .29

Table 2. Student Participants from Baldwin University (n=14)

Data Analysis

Several techniques prescribed by Bogdan and Biklen (2007) and Miles and Huberman (1994) were used to code and analyze the data collected from interviews. I first bracketed my thoughts and perceptions as I read each line of participants' transcripts. The margins of the transcripts were marked with comments regarding initial reactions and summarization(s) of participants' main point(s). After bracketing, a codebook was created with definitions. The codebook was revised several times with a peer-debriefer to reduce the overlapping of codes and for clarification. Then, the transcripts were coded by sorting key phrases under codes using HyperRESEARCH qualitative data analysis software.

Findings

Internships in Industry

Engaging in an internship with a corporate industry organization was a key component in the experiences of many of the students I interviewed. The Baldwin Success program practically guarantees participants an internship or research experience after their first year. Typically, these experiences are not available until after the second year because students have not quite delved into major specific courses by the end of their first year. Both Porter State and Baldwin maintained mutually beneficial relationships with their corporate sponsors. Corporate sponsors support a number of the MEP programs and the sponsors were seemingly first in line to offer internships to highly successful MEP students. The students I interviewed cited a number of positive outcomes associated with their respective corporate internship. Study participants were introduced to corporate life, were given opportunities to move across the country and in a few cases across the world, and students were able to ascertain a clearer view of their academic and/or career interests.

First, a number of students described the difference in being an undergraduate and being a professional. Students relished the fact they had their own desk or they were the lead on a project. Bernard describes how his internship helped him realize the difference between the corporate world and his collegiate experience. Bernard explains:

> I never been in an actual real sort of corporate environment, all the jobs that I've had were working with people my own age, so working with people sixty years old, who are thinking about retirement, and then working with me 19 years old, it is just sort of interesting.

The internships were 12-week experiences and the company: paid for relocation (in almost every case with the exception of Faith), paid for housing expenses, and paid them a salary. Many students described their ability to put money into a savings account because their only expenses were food and entertainment. Additionally, students were not just put in an office and asked to make photocopies or answer the phone. The interns conducted engineering duties like process improvements, making calculations, doing software verification, project management, and other highly skilled activities.

As a result of engaging in the work of engineering professionals, many students' internships influenced their decisions to stick with a particular major or to switch to a different engineering major or even add a minor. Student participants like Avery were highly engaged in their internships and they were able to apply concepts they were learning in their engineering or computer science courses. Avery gives a clear explanation as to why this was important by stating:

> Actually, I think it was the most influential factor in really knowing what I'm getting myself into. You know because when I took this internship I hadn't really been doing that many [Industrial Engineering] classes yet because I'm just coming off my sophomore year and so you know, I'm not exactly sure what I'm getting myself into, so it kind of was just like "this is what it's like in real life." Then it's funny when I got done and I really got into my core [Industrial Engineering] classes, all this stuff that I did and I saw the industrial engineer there do. I see it again in my schoolwork, so I'm like "oh they really use this stuff."

The types of connections Avery made play an important role in students recognizing the utility in their course concepts. Other students' internships influenced both their academic and career interests. For example, Ethan explains his change of heart regarding computer science and programming:

> After meeting different professionals, and actually my last internship which was information technology, I really started to understand that it may be a better route for me. The computer science at least at Porter State we don't really get a really good understanding of how to work with people. Everything is so competitive you're always programming against your neighbor, or who has to pass this or, the most efficient program. But at the end of the day you have to understand how to translate that to the business side of it. So currently I am sort of debating whether to just minor in computer programming and then go for more of an IT degree. In that regard, both of my internships had shaped me throughout the summers.

The opportunity to gain first hand insights from professionals and through experience played a crucial role in Ethan deciding he would rather work with people instead of being a programmer for the rest of his life. On the other hand, students like Elizabeth were involved in internships, which strengthened their resolve for a particular field of study and career. Elizabeth, a Porter State Computer Scientists, captures this sentiment by stating:

> Well I always knew that I wanted to take on the programming aspect, and work with application, and since I was working with the application that they used within [company] I think that just confirmed what I already knew that I wanted to do.

Other students like Ruby, a Porter State industrial engineer, found internships enabling them to engage in different aspects of the company, so they may deduce the type of work they find most enjoyable. Ruby states:

> [Company] has a leadership development program. It's a program where you kind of use a lot of different aspects. You can do supply chain; you can do logistics; they just have a lot of different experiences so that at the end of the program you can kind of know which path, and go to the path that you kind of fit in the most.

The internships are invaluable tools for students like Ruby, who are unsure of the career path interesting them most. They have the unique opportunity to test the waters of different positions while the stakes are a bit lower and before they have to make a full commitment like they will have to do once they receive full-time employment offers.

Lastly, Eli had one of the more interesting internships because it led to him receiving an opportunity to move to London for three months to complete an internship. He completed a successful summer internship domestically with a company and they liked him so much they asked him to come back for a second summer, but this time in London. Eli explains the circumstances of his international internship as he states, "In order to do this opportunity where I go to London and they pay for it and all this. I have to commit that I will work for them for two years after graduation." Therefore, the internship opportunity in London would delay if not eliminate the Eli's entry into graduate school.

Undergraduate Research

Far fewer students who participated in this study took part in an undergraduate research experience. Participants were involved in research at either their respective universities, other universities in the surrounding area, or during the summer some took part in research at universities across the country through special programs. Similar to the internship duties, students who participated in undergraduate research were not stuck cleaning beakers and filing paperwork. Nearly all participants were engaged in the research process. Many students reported favorable undergraduate research experiences and found positive benefits.

Students like Michael, an Electrical engineer at Baldwin, were involved in key aspects of the research process and utilized technology to develop new innovations. Michael describes one of the projects he worked on by explaining:

> [The research labs I worked for were] working on coming up with systems to do kind of artificial intelligence type things, so the first project I worked on was doing image processing, with some cameras that we mounted on the ceiling. Basically, what it boiled down to was I wrote software that would do vision processing on pictures, to try and pick up features of an image so my job was to like locate like a little LED in the image, so like basically I had to kind of learn about some vision processing techniques where you look at the images.

After students like Michael witness how he could utilize his talents in a research environment, there is no surprise that he is interested in pursuing a Ph.D. in Electrical Engineering.

Other students like Sofie learned a valuable lesson about the trials and errors of conducting research. Unlike in a laboratory section of a class, experiments do not always work when individuals are conducting cutting edge research. Sofie, a chemical engineer at Baldwin, worked at a university near Baldwin, she explains her project and

what she learned in the process by stating:

> My freshman year I worked in [University's] National Fuel Energy Laboratory, and I worked using algae as a sort of bio-diesel, so we had a 52-gallon tank of salt water that we were growing algae in for a couple of days, it didn't work, the salt water ate through the lights, but this is something we had to learn.

Some of these challenges associated with engaging in research help students realize the joy in an experiment finally working after a number of failed tests. Students relied on their academic training and creativity to find the break through needed to create a successful experiment. Andrew, who is a Ph.D. student in Mechanical Engineering at Baldwin, explains how his undergraduate research experience at Baldwin got him interested in graduate school as he stated:

> I worked in his lab doing some research and it really got me like, at that point I was like yeah, I like research. I at least want to go get my master's and do research while I'm getting my masters. I don't want it to be a course-based masters. I want to do some research, and so that was the original change, prior to that I had you know the summer before I got here the research program that I did, I did it doing some automotive related research, and that is when I realized that I didn't want to do automotive engineering, it's more of a personal project than it is like a career.

Conducting research is an unknown for students because although they have lab sections in the science courses from high school through college it is not quite the same as conducting original research. The formulaic nature of some lab sections may actually turn some students off to research. When student participants were exposed to conducting original research a number of them described this feeling like a light bulb was lit over their head. A prime example is Gabriel, an Electrical Engineer at Porter State, describes this sentiment by stating:

> The thing I've realized about research is that when you go in they expect you not to know everything. You can figure out what track you need to go on to learn things, and then you go and find books and you find articles and you find other research papers, and you read, and you teach yourself, that's a lot of self-motivation and self-teaching, so that you learn what you need to do. Instead of having a professor that tells you a formula, and take this step, and you get this answer; because that is the exact opposite, it's more of like a self-learning type thing.

Instead of getting a step-by-step guide and always ending up with the correct experiment. Students like Gabriel fell in love with investigating a topic, looking at how other researchers may have tackled a similar problem, and then make the appropriate modifications to find success.

Lastly, a few students had the opportunity to participate in research programs at other universities across the country during the summer. These programs were a little more comprehensive in nature because they often had not only a research experience, but they also provided professional development in terms of providing insights into graduate school and the application process. For instance, Michael completed a research program at an elite northeastern university.

> There is the research component and then there was also a component where they talk where you learned about graduate school and particular doctoral studies and like what faculty and people who do the industry research what they do. We learned about that environment and also the aspects of the application process, you know, we had like advisors that were current grad students there, so we got kind of their experience, learned from them.

The programs like the one Michael attended made clear connections to the research experience and participants future career plans. Applying for undergraduate admissions is very stressful and confusing and applying to graduate school can be equally if not more stressful for students. Especially, students, who are not familiar with the graduate admissions process or are not receiving the types of guidance they might have received in high school to complete college applications. Programs like the one Michael attended help demystify the process and give students the knowledge they need to be successful.

Immediate Plans after Undergraduate: Graduate School versus Industry

It is clear student participants, who were exposed to undergraduate research, were more likely to strive for an advance degree in engineering, computer science, or a related STEM field. Conversely, students who participated in corporate internships were more likely to want to work immediately after completing their baccalaureate degree. Although, some did express plans to obtain a Master's in Business Administration later.

Among participants who were interested in working immediately after their undergraduate experience there were a range of responses from students who found their calling in life to students who were more apathetic and were just tired of school. Nathan, from Porter State, was a student who was a bit undecided, but he gives an interesting take on all the different options and his rationale for them by stating:

> I've considered a lot, I've talked to a lot of different people and I guess, my perspective in regards to that was at first, graduate, and get a job if I could, but if not then just go back to school and go ahead and get your masters, and maybe in engineering, I also considered getting my master's in business, because I've talked to an electrical engineer who told me that it may actually be more beneficial to me for me to do it like that.

Nathan's response was typical among students who were undecided about graduate school or not.

Corporate industry is very alluring to underrepresented students who come from lower socioeconomic backgrounds. Students like Carter, who is currently working towards a master's degree in electrical engineering fielded multiple offers from companies ranging from $60,000 to $80,000 a year with only a bachelor's degree. Furthermore, when Carter was an undergraduate he made so much money during the summers he graduated with $25,000 in a savings account. As Professor Hall, an African American faculty member at Baldwin it is preposterous to think a 21-year-old college graduate would forgo making $75,000 a year to become a graduate student with limited income and possibly continued poverty for themselves and their family. Professor Hall believes:

> Collectively in academia we do a terrible job of even explaining to students why getting an advanced degree is important, even for industry it's important because who are they going to retain when times get tough? We just don't explain that, what comes across often is faculty complain, we like to complain like anybody else, faculty here do not often don't pay attention to the vibes they're giving out, their appearance, just sort of how people view them, and so many students of color probably look at most faculty and say "why would I want to be like them? I want to be like the person who is out in industry" you know and so we just don't explain that to them and don't give them the right vibes, so the only way they see a different world is if we actively pluck them in and bring them into the lab. Thankfully most of the faculty who do that are good role models and are not the stereotypical walking around with the holes in their soles of their shoes and things like that and dowdy clothes, so they get a good exposure, these people are normal, they have families, they are regular human beings like the rest of us and turns out love what they do.

Professor Hall physically embodied his own words because when I interviewed him I noticed his attire as he wore a well-tailored dress shirt and slacks, Italian leather loafers, and a pristine handcrafted automatic movement Swiss timepiece. More importantly, however, students like Andrew and Jack cited how Professor Hall encouraged them to attend graduate school. As a result, Jack was accepted to and will be attending a Ph.D. program in Mechanical Engineering at an elite university in the Midwest. While, Andrew, a Ph.D. student in Mechanical Engineering at Baldwin, explained to me his initial apprehension in pursuing the Ph.D. degree by saying:

> I knew I wanted to go to grad school; I knew I wanted to do research. I didn't know I wanted to do the Ph.D. with that whole-time commitment process to the Ph.D. I was like, you know I don't know, you know, because I didn't know if I really wanted to be a faculty member, and you know at that point in time I was like

> if you get a Ph.D. your only option is to go and teach you know or if you're lucky enough you can become research and development at some company.

Professor Hall talked him through his options and demystified the Ph.D. degree and explained to him the pros and cons for his various options.

The Dean of Porter State's School of Engineering provided an additional insight for trying to push more underrepresented racial minorities into graduate school and the professoriate from the perspective of needing more underrepresented racial minority and women faculty members. Dean Gutierrez states:

> So, having a faculty population, having a more diverse faculty is very, very critical to that, not only because they see somebody, but because that person is more than likely to be able to talk to them and relate to them. Put it in the case of women faculty, or women, you know not underrepresented, just women, if you have a department that does not have any women faculty, so who does that young women student talk to? Not about the technical issues of the field, but about the idea that you know, why would I even think about doing graduate work and being faculty, I don't see anybody like me that does that, you have one in the mix and it changes already because now there is somebody that can talk to how do you bring a family up, how do you do these things.

Dean Gutierrez emphasized the need for Schools of Engineering to make the diversification of both the faculty and student body a priority.

Discussion

The consideration processes of highly successful African American engineers and computer scientists provide important insights for both policy and practice. The findings of this study suggest that exposure to corporate industry internships and undergraduate research experiences played a role in the consideration processes of study participants. Students who had experiences geared around a corporate internship were more likely to express interest in entering the job market immediately after completing her or his bachelor's degree. Conversely, students who had experiences focused in undergraduate research opportunities appeared to have an inclination to explore graduate opportunities at either the master's or doctoral level.

Lastly, students' financial concerns and obligations also contribute an important function in students' consideration of graduate school or entering the workforce. The prospects of earning $70,000 to $80,000 with a bachelor's degree was an important consideration for students whose family expects an immediate financial return.

There are particularly meaningful insights gleaned from this study regarding the role of corporate sponsorship of Minority Engineering Programs. The MEP offices in this study are provided funding by the university for staffing, but few funds were allocated for programmatic efforts. As a result, programs, which have clear patterns of success, have occasionally gone unfunded. MEP offices have been forced to solicit funds from corporate sponsors and funding agencies. Corporate sponsors in many respects serve as wonderful partners with MEP offices by providing needed funding and employment opportunities for MEP participants. On the surface, the collaboration between MEP offices and corporate sponsors seems ideal. However, while the motives for corporate sponsorships may seem completely philanthropic, these corporations' main goal is to increase profitability. Therefore, in utilizing Academic Capitalists perspective (Slaughter & Leslie, 1997), caution is needed in relying too heavily on corporate sponsors because some sponsors may utilize their partnerships to exploit the MEP offices for their vital resources, which are highly successful racial minoritized engineers and computer scientists. These corporations may not always have the MEP participants' long-term best interest in mind. The potentially short-term win of a high starting salary has to be measured with the longer-term trajectory and consideration of completing a masters or doctoral degree.

MEP offices with corporate sponsorships should ensure students are exposed to a range of workforce development opportunities including graduate school. MEP offices must provide a balance between corporate sponsorship involvement and graduate school opportunities. For example, if there is an event to meet with corporate recruiters, there should also be an event to meet with graduate school recruiters or graduate students. This balance will give students an opportunity to fully explore all of their options and make an informed decision regarding how best to utilize and invest in their human capital.

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