The Role of Historically Black Colleges and Universities in American STEM Education

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ABSTRACT

This paper positions the discussion of leveraging Historically Black Colleges and Universities in the effort to increase diversity in STEM Education. STEM Education can be prominently featured at HBCUs with the outcome of producing STEM graduates that enter into technical fields. As HBCUs shift from their initial founding and look to achieve strategic success in other areas, STEM Education would seem to be a natural fit. However, as with many well-intentioned goals at HBCUs, the ability to be successful in STEM Education hinges on several criteria, including funding, external corporate partnerships and internal collaborations. Given the roadblocks that HBCUs face and have been able to overcome, thus far, anchoring themselves as a cornerstone in STEM Education could prove to be a shift they could master. We conclude with five research questions that should further be explored by HBCUs as an extension of their STEM Education goals. HBCUs are unique institutions that will continue to play a pivotal role in America's postsecondary educational system. Participation in STEM education is just one of the many ways their role will continue to be solidified.

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Diversity, STEM education, Historically Black Colleges & Universities, HBCU, intervention, Google, corporate alliance, Silicon Valley climate, corporate culture, educational partnership.

1 INTRODUCTION

In the United States⁹, a country where heavy emphasis is often placed on the concept of social mobility, education is critical.

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Postsecondary education is now essential for participation in an increasingly competitive technical labor market. The overall number of minority individuals in higher education is steadily increasing, although still not equivalent to the level of participation of White students. Black, Asian, and Latino students have experienced significant increases in postsecondary education participation in the past 10 years. The data on the growth rates of Black students, however, indicate more of a good news/bad news conundrum. Even though the total number of Black students is increasing, the gender gap between Black men and Black women in higher education has grown wider⁸. While Black women students are experiencing notable growth in enrollment and graduation, the participation of Black men is declining and is the lowest of all demographic groups⁸. In spite of barriers and roadblocks, Black students are choosing careers in Science, Technology, Engineering, and Math (STEM). As a result, there is a prime opportunity for Historically Black Colleges and Universities (HBCUs) to become the torch bearers in STEM Education for Black students by building coalitions internally, seeking external federal funding, and developing corporate partnerships and programs.

2 STEM EDUCATION

STEM Education^{10,11} is broadly defined as an interdisciplinary approach to teaching the different, rather broad, subjects of Science, Technology, Engineering and Mathematics using methods and techniques that simulate practical application. In the recent past, and perhaps even today, the aforementioned subjects were taught in a vacuum whereby one subject rarely, if ever, treaded onto the next. However, in practice, these subjects often intersect and overlaps in countless and significant ways.

In 2015, the U.S. Department of Education^{10,11,12,13} stated that only sixteen percent of high school students were interested in STEM careers and had significant proficiency in mathematics that would denote success in a STEM field. They also indicated that nearly thirty percent of high school freshmen had a stated interest in a STEM related field, but over fifty percent of those students would lose interest by the time that they graduate from high school. According to STEMconnector, a search company comprised of companies and nonprofit associations in STEM within the United States, there is a projected need for 8.65 million workers in STEM

jobs by 2018. As an example, Cloud Computing alone has created over 2 million jobs between 2011 and 2015. The U.S. Bureau of Labor Statistics projects that in 2018, over 70 percent of STEM careers will be in computing. These daunting statistics paint a bleak picture of the United States' continued dominance in STEM fields when there are not enough students finding STEM as a field they choose to enter.

While addressing the National Education Association in 2010, President Barack Obama said, "We understand that our nation's prosperity is tied to innovation spurred on by students' engagement in STEM". He continued by saying, "For America to be technologically competitive in the future, our students must become more fluent in complex science and math." If the United States is to meet the demand for world class talent in science, technology, engineering, and mathematics, it is essential that a diverse population be attracted to engineering and other technical fields⁶. In support of that notion, research states that innovation is more creative, more relevant, and has farther reach when produced by diverse individuals or teams¹⁷. Given that the Black population has remained steady in the United States of America, we must begin to understand why there are relatively few Blacks in IT and how they identify with the field^{16, 1,2,3,4,5,18}.

According to the U.S. Census Bureau, in 2012^{7,8}, 13.1 percent of the United States population was comprised of Black people. Blacks trail behind the national average in terms of degree completion. The 4-year graduation rate for Black students is 63.6 percent compared to the overall U.S. graduation rate of 80.6 percent. The U.S. Department of Education (2010) states that there are more than 8 million Black public-school students, 76 percent attend schools inside urbanized areas that include both city and suburban districts. The majority of Black public schools have fewer certified teachers with degrees in the subjects they teach, which has contributed to many school closings in urban areas. For example, in non-Black public schools more than 75 percent of math teachers had math as their major in college as opposed to 56 percent of teachers in majority Black schools. Of that 56 percent, fewer number of the teachers were certified^{7,8,18}. There is an opportunity for HBCUs to leverage STEM Education, but first, it is necessary to understand how HBCUs came into existence and the numerous hurdles they have had to overcome.

3 HISTORICALLY BLACK COLLEGES AND UNIVERSITIES (HBCU)

HBCUs¹² were founded on the premise of providing Black Americans a place to receive a quality higher education at time when the educational system in the United States of America was still segregated. Prior to the establishment of HBCUs, Blacks were typically denied admission to traditionally White institutions. As a result, HBCUs were birthed, not from an aspect of choice, but one of need. During the Civil War, there was no system for higher education available for Black students. Antiquated laws prohibited Blacks, in some parts of the country, from receiving any type of education. The first HBCU was the Institute for

Colored Youth, now Cheney University, was founded in 1837. Following Cheney were Lincoln University (1854) and Wilberforce University (1856)¹².

Although the aforementioned schools were called universities, it was not until the 1900s that HBCUs offered curriculum at the postsecondary level¹². Prior to the 1900s, HBCUs existed to teach Black students who, up until that time, had been barred any formal education. The 1896 United States Supreme Court ruling in *Plessy v. Ferguson* established the precedent, in public education, that racially segregated schools did not violate the Fourteenth Amendment and therefore Black schools were deemed "separate, but equal" to White schools, despite the preponderance of evidence that Black schools lacked access to the same resources. It was not until the 1954 ruling by the United States Supreme Court in *Brown v. Board of Education* where the "separate but equal" doctrine was rejected on the basis of Black children not having access to equal protection as afforded by the Fourteenth Amendment of the United State Constitution. Despite the ruling in *Brown v. Board of Education*, HBCUs are still needed today. There are 101 HBCUs in the United States, which account for 3 percent of colleges and universities, yet, they produce twenty-seven percent of Black students with bachelor's degrees in Science, Technology, Engineering and Mathematics (STEM) fields.

In the 21st Century, HBCUs have experienced a fundamental shift from the origin of their founding. Today, while only accounting for 3 percent of colleges, HBCUs play a critical role in producing twenty-seven percent of Black STEM graduates, thereby producing a vast majority of disproportionate Black STEM graduates. Even though Black students are deciding to major in IT and Engineering, the racial demographic of the IT and Engineering industry lacks significant Black representation creating a situation where Blacks are woefully underrepresented^{19,20}. By this account, a two-fold issue is revealed: a problem in academia, by which 3 percent of the colleges and universities produce twenty-seven percent of Black STEM graduates, and a problem in society, whereby STEM, and in particular IT and Engineering, fields continue to lack racial diversity^{19,20}.

4 STEM EDUCATION + HBCU

HBCUs are in a unique position to operate as a catalyst to address many of the issues in the United States workforce, and specifically the state of STEM overall. Most HBCUs are collegial in nature and small enough as to where a blending of the four discrete subjects in a practical setting to increase diversity in STEM would bode well for all parties - students, educators, corporations, and the United States workforce overall. For example, Howard West^{14,15} is a joint venture between Google Inc., in Mountain View, CA and Howard University, a HBCU in Washington, D.C., whereby a campus was created at Google's Headquarters.

Howard West was staffed by Google Engineers and Howard University Faculty. The mission of Howard West is to bring rising-Juniors from Howard University to Google, building upon the instruction received at Howard University, to better equip these students with the necessary skillset to not only become a Software Engineer at Google but ultimately enter the technical field.

During the pilot of the Howard West program in the summer of 2016, about thirty students were chosen to participate and spend their summer at Google. While at Google, students took 4 courses, were immersed in the Silicon Valley culture, routinely visited other Silicon Valley corporations, as well as participated in mock interviews and technical interview preparation. The courses the students took were Software Engineering, Fundamentals of Algorithms, Machine Learning and Mobile Application Development. The courses were taught by a Howard University faculty member in conjunction with a Google Engineer. There was an emphasis on project-based learning initiatives as well as practical application.

The partnership between Google and Howard University presents a unique glimpse into how one top Silicon Valley company has decided to invest in and approach its diversity initiatives while jostling with shifting the organizational climate to be more receptive to people of different backgrounds. Additionally, Howard University is building the foundation of establishing solid corporate partnerships in a growing industry that would desperately benefit from the ethnic makeup of its student body population. While the two organizations certainly have common goals, they also have divergent views which then lead to competing goals.

5 DISCUSSION

There are several issues which have the potential to be explored by researchers on the horizon of HBCUs and STEM education, one of which is the access to resources. By resources, we can begin an analysis of basic, publicly available and accessible information, such as university endowments. If we declare the assumption that endowments are for the long term fiscal solvency and growth of the university, and not for spending on any one program and that endowments are not necessarily easily accessible monetary reserves, we can see large discrepancies in terms of access to capital, even if for long term growth and solvency. For example, Howard University, in Washington, D.C., as of June 2016, had the largest endowment of any HBCU with \$578 million. That ranks Howard University 160th among all schools. If we contrast the endowment of Howard University with Harvard University, the difference is staggering. Harvard University, which is the wealthiest institution, at the same time frame, June 2016, had an endowment of \$35.7 billion. To put those numbers in context, Harvard University has an endowment that is about 62 times that of Howard University, the wealthiest HBCU. Essentially, what we are beginning with is a place of 160th for the top HBCU that has an endowment that is roughly 2 percent of Harvard University,

the wealthiest institution of higher education. While Harvard University is the wealthiest, we need not look to Harvard to see stark differences. Howard University's endowment equates to around \$57,000 for each student while Vanderbilt University's endowment equates to an excess of \$300,000 per student. Even though Howard University has the largest endowment of all HBCUs, beginning from a place of 160th would mean that HBCUs simply do not have the assets to gain investments of those schools with multibillion-dollar endowments. In fact, if we were to sum the top ten HBCU endowments we would not eclipse 2 billion dollars. It is the access to capital and resources that allow programs like Howard West to come to fruition. Additionally, it is companies like Google that have the potential to bridge shortfalls in funding for HBCUs if there are benefits to all parties involved.

STEM Education initiatives, which seek interdisciplinary approaches to teaching with an emphasis on practical applicability, should be explored and integrated across the curriculum. In conjunction with STEM Education, an avenue of research worth investigation is the notion of STEM fatigue. For example, there may be students who may have been pushed in the direction of STEM, perhaps by guidance counselors, parents, teachers, media and by virtue of attending specific mathematics and science centric high schools (i.e. Preparatory/Magnet Programs) whereby once they arrive to college, they simply no longer wish to pursue STEM as other career options become available to them. Frameworks that show STEM partnerships across different schools and colleges within universities should be developed to denote the subject matter overlap and expectation for project based and practical application. Regardless of the obstacles, HBCUs are capable of working together, pooling their resources and creating an understanding that harkens back to the original conception of HBCUs, and that is to ensure their students have level footing to fully participate in the national and global economy. Research questions that emanate from this topic are:

- What characteristics and strategies utilized by HBCUs increase recruitment or retention in STEM programs?
- Does teaching STEM topics in a culturally inclusive way affect student interest or learning at HBCUs?
- Have HBCU alliances with tech corporations influenced minority student career choice for STEM fields?
- What elements of the HBCU culture can be positively attributed to success in STEM disciplines and career fields?
- How are HBCUs uniquely positioned to combat STEM fatigue among minority students?

All of these questions enter into the heart of addressing the unique environment of HBCUs and their role in providing the proper climate for minority students to thrive in STEM. By investigating these questions, the attributes of HBCUs which facilitate student engagement in STEM can be unpacked. In addition, the opportunities for growth of these Universities in terms of development of programs and creation of interventions to foster

interest and support for STEM education, is both relevant and necessary. Once we begin to have a fuller understanding of the role of STEM Education, we can begin to explore the role corporations should play, outside of internships, in student engagement at the undergraduate level for preparation to enter their respective fields. Presently, universities have goals as do corporations, and those goals often times do not dovetail. However, STEM Education may create an avenue for these goals among different entities to become mutual.

4 CONCLUSIONS

As the demand for talent in STEM fields continues to increase exponentially, the need for diverse perspectives and representation in those areas grows also. In order to continue interest and innovation in those areas, especially for minority students, HBCUs are well positioned to take a leadership role in the creation of STEM scholars. HBCUs already benefit from an inclusive culture, and legacy of achievement which make them an excellent environment to facilitate education in the STEM disciplines. While there is a concerning underrepresentation of Black students, specifically Black males, in STEM fields, this research seeks to understand how to make STEM education more fertile for these populations. Also, the examination of the partnerships and programs at these Universities will provide a better understand of how to facilitate successful engagement of minorities in STEM areas to yield greater participation and success overall.

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