Exploring the Potential for Broadening Participation in Engineering through Community College and Minority-Serving Institution Partnerships

Dr. Bruk T. Berhane, Florida International University

Dr. Bruk T. Berhane received his bachelor's degree in electrical engineering from the University of Maryland in 2003. He holds an M.S. in engineering management from the George Washington University and a Ph.D. in minority and urban education from the University of Maryland. In 2003, Bruk was hired by the Johns Hopkins University Applied Physics Laboratory (JHUAPL), where he worked on nanotechnology and microsystems. In 2005 he left JHUAPL for a fellowship with the National Academies and researched methods of increasing the number of women in engineering. Later that year, he briefly served as a mathematics instructor in Baltimore City High Schools.

From 2005 through 2018, Dr. Berhane directed engineering recruitment and scholarship programs for the University of Maryland. He oversaw an increase in the admission of students of color and women during his tenure and supported initiatives that reduce the time to degree for transfers from Maryland community colleges. The broader implications of his research are informed by his comprehensive experiences as a college administrator. His areas of scholarly interest include: 1) Broadening participation in engineering through community college pathways and 2) Experiences of first and second-generation African diasporic Americans in engineering undergraduate programs.

Mr. Collins N. Vaye, Florida International University

Collins N. Vaye is a first-generation college student and a native of Liberia, West Africa. Currently, he is a 3rd year Engineering and Computing Education Ph.D. student at Florida International University. His research interests revolve around: –Effective Technology Integration in Engineering Education. –Faculty Development, Professional Development, and Technology Supported Learning. –Broadening Participation in Engineering and Engineering Technology within and from Sub–Saharan Africa.

Mr. Joseph Ronald Sturgess, Virginia Tech

Joseph Sturgess is a PhD student in the Department of Engineering Education at Virginia Polytechnic Institute and State University, where he also serves as a graduate research assistant contributing to various projects supporting low-income STEM students and minority-serving institutions. His research interests include community college-minority serving institution partnerships, transfer students, post-traditional students and broadening participation in engineering education. He received his B.S. in electrical engineering from Tuskegee University, a M.S in journalism from the University of Illinois-Urbana Champaign, a M.S. in physics from Fisk University, a M.S. in industrial engineering from the University of Central Florida and a M.Ed. in educational leadership from Texas Christian University.

Mr. Daniel Ifeoluwa Adeniranye, Florida International University

'Daniel Adeniranye' holds a bachelor's degree in Mechanical Engineering, a joint and dual master's degree in Petroleum Engineering and Project Development from IFP School, France and the University of Port Harcourt, and a Project Management degree from the University of Southampton, United Kingdom. He is currently a Research Assistant at the School of Universal Computing, Construction, and Engineering Education, Florida International University (FIU) where he seeks to establish remarkable footprints and make an impact that matters. Prior to joining FIU, Daniel had worked in Dubai for the ministry of Education as a STEM Educator and Lead Instructor. Previous work experience was in the United Kingdom (as an assistant Lead manager) and Nigeria. To date, he has co-authored 2 journal articles, authored 2 Physics textbooks, held many leadership roles and won several awards (one notable one is a World Bank award).

Work in Progress: Exploring the Potential for Broadening Participation in Engineering through Community College and Minority Serving Institution Partnerships

Introduction

It is well documented that a considerable number of engineers and scientists began their post-secondary careers in community college [1,2]. However, what is less recognized is the diversity of community colleges, and how community colleges can contribute to broadening participation in engineering efforts. In particular, the role of community colleges in sending Black and students from other racial/ethnic groups to four-year engineering schools remains understudied [3]. This is noteworthy considering Lattuca and colleagues' [4] statement that, "one solution to the persistent lack of diversity in undergraduate engineering may lie with America's community colleges. The socioeconomic, racial/ethnic, and cultural heterogeneity of community college student bodies make those institutions potentially fruitful recruiting grounds for engineering schools." Indeed, the American Association for Community Colleges reports enrollments in community colleges that mirror the diversity of the U.S. [5]. Similarly, the share of associate of science degrees in engineering awarded to Black and Latinx students is around twice their share of bachelor's degrees in engineering [6]. Nonetheless, the majority of research focused on broadening participation in engineering (BPE) for Black students in particular has excluded the role of community colleges [7].

This work-in-progress is the first paper presented as part of a larger five-year study funded by the National Science Foundation. The broader study focuses on the current state of community college-to-four-year Historically Black Colleges and University (HBCU) pathways in engineering for Black undergraduates. In the latter part of the project, the study will also explore the nature of collaborations designed to bring faculty, staff, and administrators from community colleges (CCs) together with HBCU counterparts to re-envision what partnerships and improved pathways can look like. The research is also situated within a new three-year study funded by the Department of Defense that creates scholarships and co-curricular support designed for CC students to smoothly transfer to HBCUs and other Minority Serving Institutions (MSIs). In the sections that follow, we present the current state of literature on community colleges and HBCUs in the context of engineering CC and transfer. We also explain why a focus on four-year *HBCUs* is particularly relevant for BPE CC/transfer research on Black engineering students.

Literature Review

Not only are CCs very diverse, but they offer a very supportive environment as well as relatively small class sizes and student-to-teacher ratios [8]. Other research has shown that for Black engineering students in particular, CCs can provide effective advising, information on transfer, and easy-to-navigate opportunities on campus such as scholarships or mentoring programs [9]. Nonetheless, issues that have led to enrollment declines at CCs in recent years – particularly against the backdrop of COVID-19 – have had a particularly deleterious impact on Black populations [10].

For their part, four-year HBCUs are lauded because of their commitment to nurturing Black undergraduates in engineering and other STEM fields [11]. HBCUs are also regarded as more welcoming learning environments than four year predominately White institutions (PWIs). Indeed, PWIs have been criticized for fostering more competitive spaces and engineering/STEM

cultures that push away underrepresented populations [12]. Moreover, in the context of more overt racism in recent years in across the U.S., HBCU enrollment has increased as Black students seek safer spaces [13].

The limited research that documents Black engineering and other STEM pathways from CCs to HBCUs provide encouraging findings. Jackson's [13] research on Black women who started out at a CC and eventually transferred to an HBCU indicated that the students found their CCs and HBCU offered similar welcoming campus cultures. This same study [13] also noted that Black collegians in engineering or other STEM fields had better academic outcomes than Black students who transferred to four-year PWIs. Despite these findings and the potential for positive outcomes with CC-to-HBCU engineering pathways, the vast majority of engineering/STEM transfer research has been situated within PWIs or Hispanic Serving Institutions [14, 15, 16]. This suggests that the potential of CC-to-HBCU engineering pathways has yet to be realized.

Motivation and Research Question

This work-in-progress paper is motivated by both the lack of research on CC-to-HBCU engineering pathways. It is also motivated by the realization that community college to HBCU transfer rates are not tracked at a national level [17]. As such, not only is the *potential* for improving CC-to-HBCU engineering pathways yet to be realized, but the *current* state of CC-to-HBCU of these pathways has not been investigated. Further motivating this work is data that shows that while Black CC enrollment rates are on par with Blacks' share of the U.S. population [5], Black associate of science (A.S.) degree completion rates in engineering – while better than their comparable rates at the B.S. level – have not yet reached parity [6]. In addition, Black students have the lowest transfer rates of any racial or ethnic group across all disciplines. Moreover, the engineering education community has yet to begin disaggregating engineering transfer data by racial and ethnic demographic groups, so transfer trends in these disciplines in particular remain unknown.

In an effort to begin filling these lacunae, in this article we present preliminary results of research related to engineering transfer for four HBCUs and their top four sending CCs. We provide transfer data for Black engineering students for the 2019-20 academic year (the most recent year for which transfer information for all four institutions was available), as well as A.S. degree completion information for these sending CCs. With this as background, the research questions that we answer in this paper are, 1) *What is the current state of engineering transfer, retention and graduation for students who transition from community colleges to Historically Black Colleges and Universities?* and 2) *What is the current state of A.S. degree completion in engineering for community colleges that are the top sending institutions to these Historically Black Colleges and Universities?*

Methods

To answer our first research question, we performed a Google search to find the institutional research websites for each of the 15 HBCUs that offer bachelor's degrees in engineering. After we accessed the official institutional research website, we searched deeply to

obtain publicly available data on engineering transfer students from community colleges disaggregated by race. Of the 15 HBCUs, only four provided publicly available information through these websites: 1) North Carolina Agricultural and Technical (A&T) State University; 2) Morgan State University; 3) Florida Agricultural and Mechanical (A&M) University; and 4) Howard University. The data that we were able to obtain is presented in the Results section in Table 1.

Because of variations in the ways in which data are shared at each university, we note that there are some inconsistencies in what we present in this table. For instance, Florida A&M and Morgan State University provide information both on the number of Black engineering transfers overall, including those who transfer from other four-year universities, and those who transfer from community colleges. In this case, we provide data first on the number of Black engineering transfers overall, and then parenthetically list the number of Black engineering transfers from community colleges. On the other hand, North Carolina A&T provided only the numbers of Black engineering transfers overall on their websites, but did not disaggregate these numbers by sending institution type. In this case, we note that the number of Black engineering transfers from community colleges was unavailable (U/A). Another inconsistency is the specific years for which transfer data is reported by each university. In some cases, data was available as far back as fall 2016, while in other cases, data was available for terms as recently as the fall 2022 incoming class. Florida A&M University provided transfer data from 2016-2022, while the other three institutions listed data for only some of those years.

As for the other universities, we were not able to find publicly available information on their respective institutional research websites. We then contacted each institutional office directly via email to request the engineering transfer data for Black students. In some cases, we were directed to a data request form, which we have subsequently completed and are currently awaiting a response. In other cases, we have not received responses from our emails. In the coming months, we plan to continue contacting these institutional research offices to try to obtain the information that we are requesting. We are also working to contact the respective offices at the four schools listed above to provide data points that we show unavailable in Table 1.

Beyond the institutional research offices, we also visited the Integrated Postsecondary Education Data System (IPEDS) online. We were able to obtain transfer enrollee data disaggregated by race for all HBCUs, but not by engineering major. In an attempt to address the retention and graduation component of our research question, we were also able to extract engineering completion data for the HBCUs, but this information was not disaggregated by enrollment type (transfer vs. first time in college students). This demonstrated to us the extent to which Black engineering retention/graduation student data is limited and motivates future work beyond this work-in-progress paper. We describe our future work in more detail toward the end of this paper.

To answer our second research question, we again visited each of the four HBCUs' institutional research websites to identify the top four sending CCs for 2019-20. However, only Florida A&M University and Morgan State University provided data on the number of students that matriculated from community colleges. So, a second inclusion criterion, community colleges in geographic proximity to the HBCU, was considered for Howard University and North Carolina

A&T University. Thus, for example, in the case of Howard University, we included Montgomery College and Northern Virginia Community College since these are some of the closest CCs in geographic proximity to Howard University.

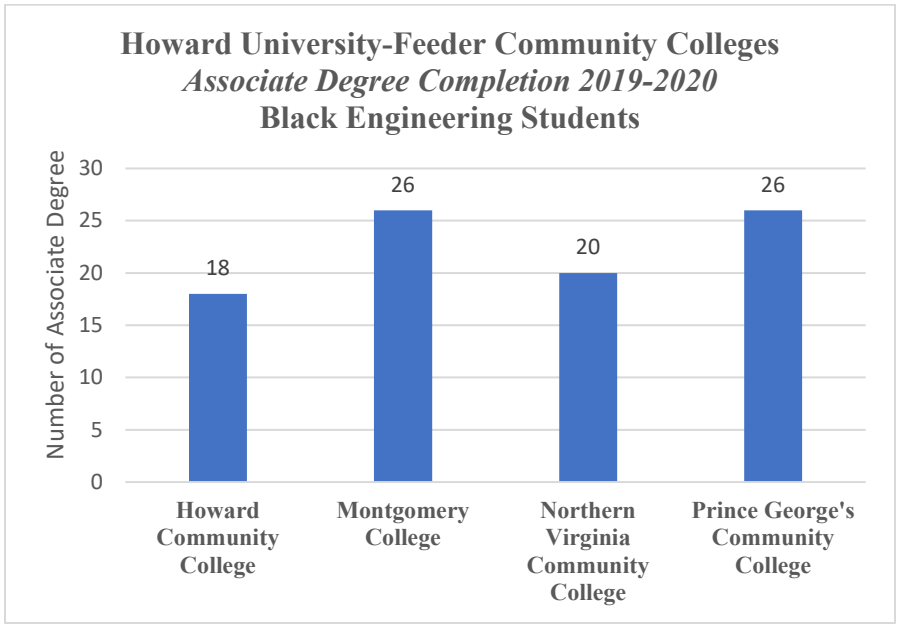
Using the *ipeds-completions-201920-STEM-associates-ccs* dataset [6] provided to the lead author by the Community College Research Center, we applied a few filters. These filters included *CIP Code* (14000 series for Engineering) and *Black* to create a pivot table for each HBCUs and their top sending ("feeder") CCs. In the Results section we provide data on the A.S. degree completion outcomes in engineering for these sending institutions.

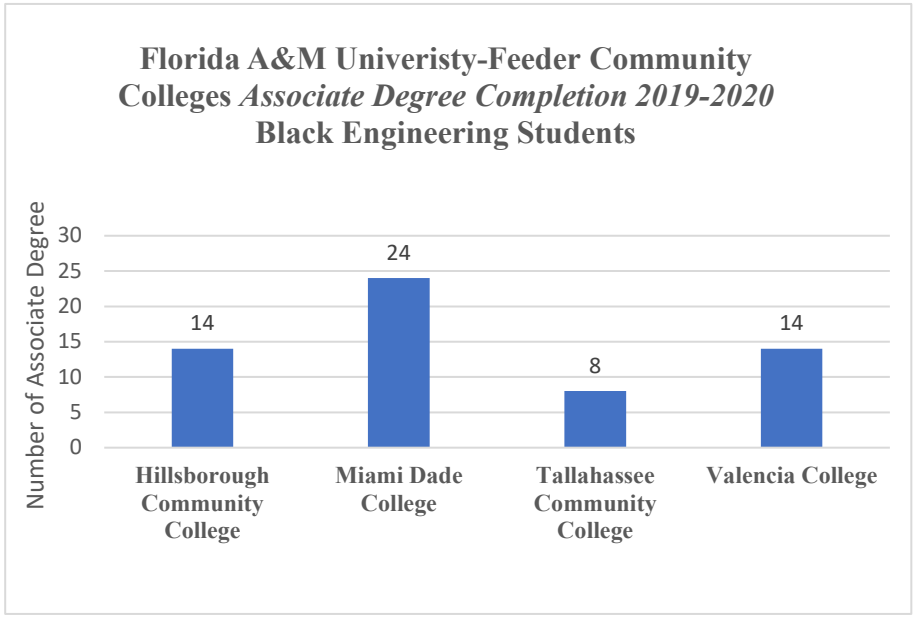
Results

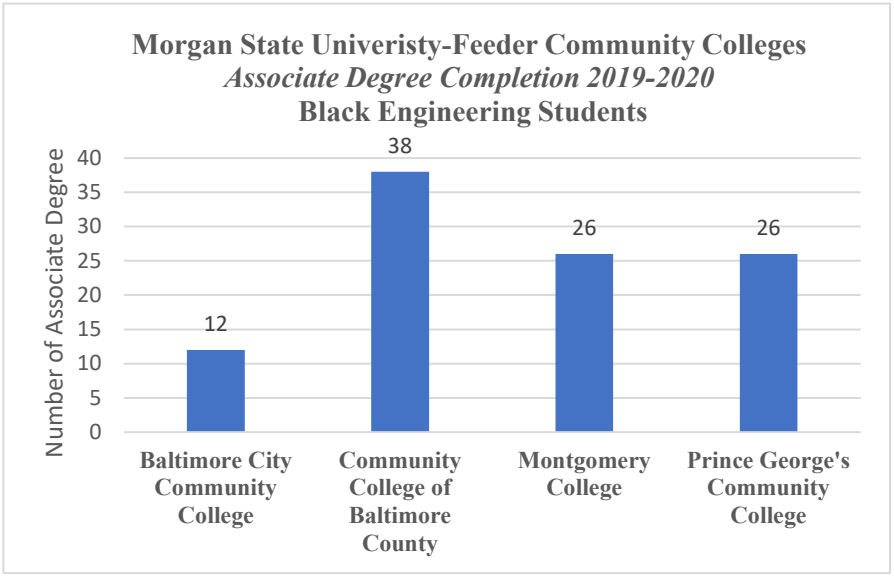
Table 1 below provides the engineering transfer data for the four HBCUs referenced earlier and Figure 1 below provides A.S. degree completion information for these CCs.

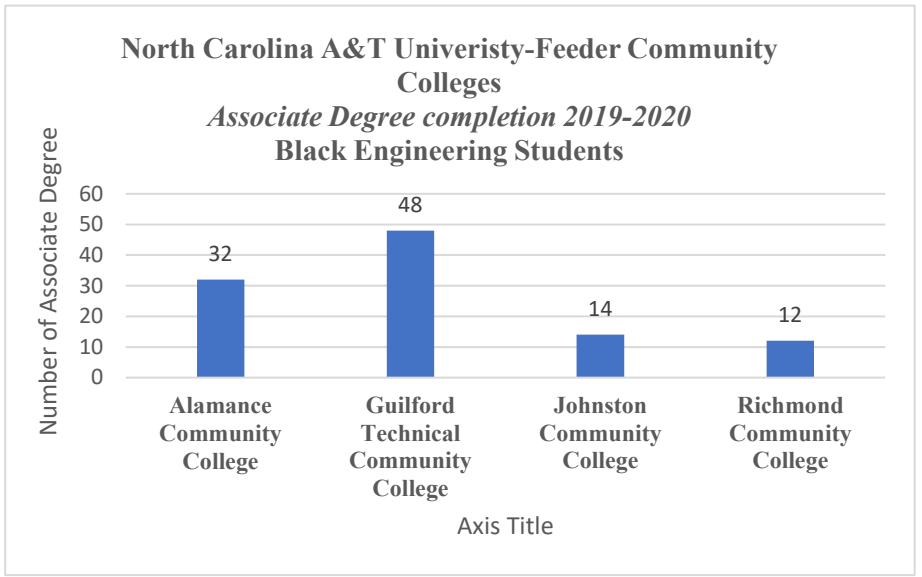
University	***Fall 2016***	***Fall 2017***	***Fall 2018***	***Fall 2019***	***Fall 2020***	***Fall 2021***	***Fall 2022***
North Carolina A&T University	unavailable (U/A)	U/A	U/A	46 (U/A)	43 (U/A)	49 (U/A)	47 (U/A)
Morgan State University	31 (16)	37 (25)	38 (18)	24 (13)	24 (11)	U/A	U/A
Florida A&M University	21 (21)	40 (36)	50 (45)	45 (43)	33 (23)	47 (34)	63 (48)
Howard University	U/A (U/A)	U/A (U/A)	13 (U/A)	13 (U/A)	8 (U/A)	5 (U/A)	7 (U/A)

Table 1. Numbers of Black Engineering Transfer (Community College) Students Matriculating in the Fall at Select HBCUs









Data Source: Integrated Postsecondary Education Data System (IPEDS) [6]

Future Work and Conclusion

While these initial data begin to provide a type of baseline that can help us answer our two research questions, several additional steps are necessary to make our findings more impactful. First, it is crucial to obtain additional engineering transfer data for the remaining HBCUs that we have yet to hear from. It is also crucial to know what the retention rates of Black engineering transfer students to understand how many of them persist to degree completion. We are also interested in understanding how long it takes them to persist given the well-cited challenges in navigated the degree plans that engineering transfer students often face. While this has been studied in general across engineering programs, again, it is unclear what the trends are for HBCUs in particular. Furthermore, it is important that we contextualize these data by situating them alongside comparable data at other institutions. For example, we hope to gather data on the number and retention/graduation rates of Black engineering transfer students at four-year HSIs and PWIs. Given that prior research has demonstrated that Blacks enjoy higher success rates and more welcoming environments at HBCUs, we would expect that the overall retention/graduation rates are strong even if transfer rates remain low.

Similarly, it is important to benchmark our A.S. degree completion rates against the total number of eligible Black engineering students in CCs. That is, to understand how to analyze and react to the numbers of Blacks with AS degrees in engineering, we should look at these data in comparison to the total numbers of Blacks who *could* have earned A.S. degrees in a given year. In addition, we note that to look at trends over a period of time, we should look at A.S. degree awards over a timeframe similar to that referenced in Table 1. Next we, note that it is important to look at enrollment data at CCs in engineering, which future research within the IPEDS database will allow us to do. We note here however that enrollment data alone does not indicate how many students are on track to earn A.S. degrees. One indicator or proxy that can help us identify the number who were "on track" might be to identify the number of CC undergraduates who were nearing completion of 60 credits in engineering majors for that year.

Finally, we note that quantitative information alone will not tell us the "whole story" of what is happening with respect to engineering community college enrollment and transfer for Black students. Qualitative research conducted alongside quantitative research adds a dimension to the "story" that reveals what institutional stakeholders see with respect to these pathways. Future work will gather the perspectives of faculty, staff, and administrators who can help identify trends, opportunities, and challenges for increasing the numbers of CC engineering students who transfer to HBCUs. We plan to document these perspectives – including the viewpoints of both CC and HBCU institutional agents – beginning later this year and we intend to report these data in future publications for this project.

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