

Under-represented & Underserved: Advancing Black Doctors in Engineering

September, 2014

I. Background

As a result of the now-infamous Brown vs. Board of Education case, the percentage of black students attaining University degrees has increased significantly since the 1950's. According to the 2010 US census, however, 82% of black Americans aged 25 or older have a high school diploma, while 18% have earned a bachelor's degree, and only 3.5% have earned an advanced degree (ref.5). Unfortunately, of this small number, the percentage of those that seek a graduate degree in engineering or science are nearly nonexistent.

This problem is quite disparaging, and unacceptable, considering that black Americans make up more than 13% of the U.S. population (ref.5). The lack of representation of highly educated blacks in the Engineering community leads to an overall misrepresentation of the role of blacks in this country. Increasing the number of qualified blacks with advanced engineering training is therefore crucial to absolve this disparity.

II. Problem

Currently there is a large deficit in the number of black students pursuing degrees in engineering beyond the bachelor's. The American Society for Engineering Education (ASEE) annually publishes a profile that includes data taken from 342 U.S. and 11 Canadian engineering colleges. Figure 1 below was taken from this work and clearly illustrates that among the engineering PhDs conferred in 2012, only a dismal amount (4.1%) of those students were black.

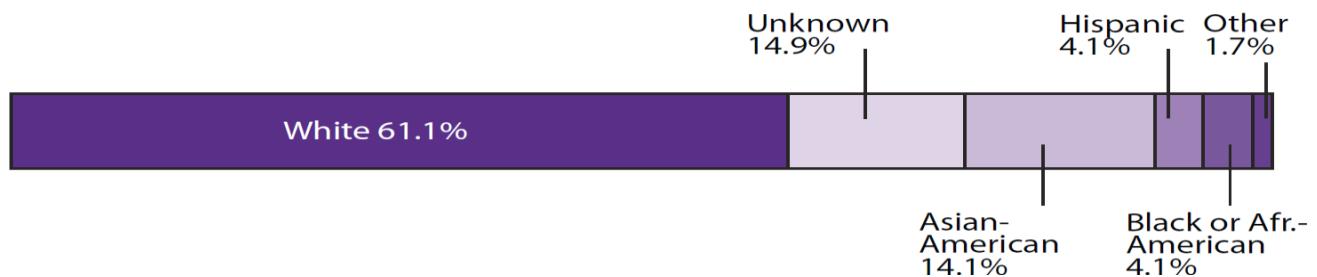


Figure 1: Graph demonstrating the PhD degrees awarded in engineering programs across the US and Canada.(ref .6)

This dearth of qualified black doctorate engineers leaves black communities highly underrepresented and underserved on a global scale. It is not that the employment opportunities for this group do not exist; rather the percentages of black engineering doctoral students are so small that when compared to the rest of the world they are nonexistent.

The problem is not only due to lack of retention, but rather the alarmingly low number of black students enrolling in graduate engineering programs. The 2013 University of California accountability report lists the percentage of students enrolled in graduate programs in Physical Sciences/Engineering by Ethnicity, and is shown below in Figure 2. From this data it is quite apparent that the number of black graduate students enrolling in engineering graduate programs is significantly lower than those of other races (except for American Indians).

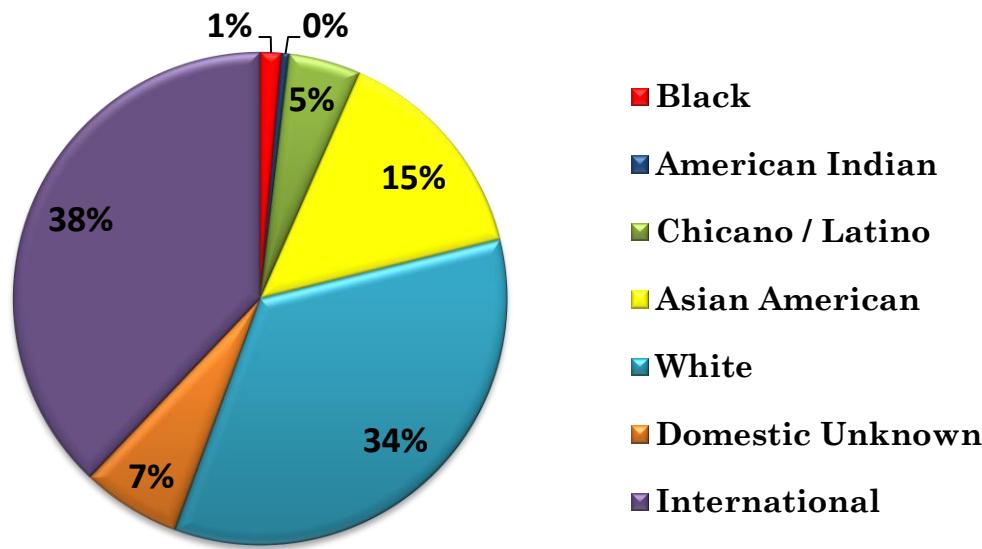


Figure 2: 2012 UC graduate enrollments in Physical Sciences and Engineering by race/ethnicity. (ref .7)

We believe that part of the reason for this lack of continuance through higher education is a deficit of mentorship and knowledge of resources. It is the personal experience of the CABE board members that many black engineering graduates, do not pursue a graduate degree in engineering because they believe that the student loans from college are burdensome enough without compounding more debt by returning to graduate school. The average cumulative debt (undergraduate and graduate) of those who earned doctorates in 2009 was \$41,018 for blacks and \$22,518 for whites. In addition, 27.1% of the black graduates had debt of \$70,001 or more, while only 10.5% of whites had the same amount of debt (ref.4). Many black students are simply unaware that most universities in the United States pay engineering students a stipend to attend a doctoral program, and that the repayment of their student loans is deferred while they are still in school. Aside from that, there are several organizations, both private and federal that award fellowships to promising black engineering students to finish a higher degree. Our intent is to develop programs to highlight these opportunities and channel students to extended resources.

Many studies have also shown that though the number black engineering students that are enrolling in doctoral programs is small, the number of these students who actually remain to finish their degree is extremely minuscule. The retention of black engineering students is much lower than for their white or Asian counterparts. Many

universities do not have the necessary environment to address the needs of this minority student, eventually leading them to leave their respective PhD programs. Take for example Figure 3, which shows the results of a survey taken by students across the entire UC system in response to the statement, "students of my race/ethnicity are respected on this campus." Of all of the races/ethnicities, black students make up the large majority of people who disagreed with this statement. It should be noted that Riverside had the most agreement from black students, making it the most comfortable UC campus for black students. This data is strong evidence that the UC system is in desperate need of a change in the racial climate on each of its campuses. **Here, we propose to implement a program that is directed toward improving the recruitment, retention, and success of black students in graduate engineering programs.**

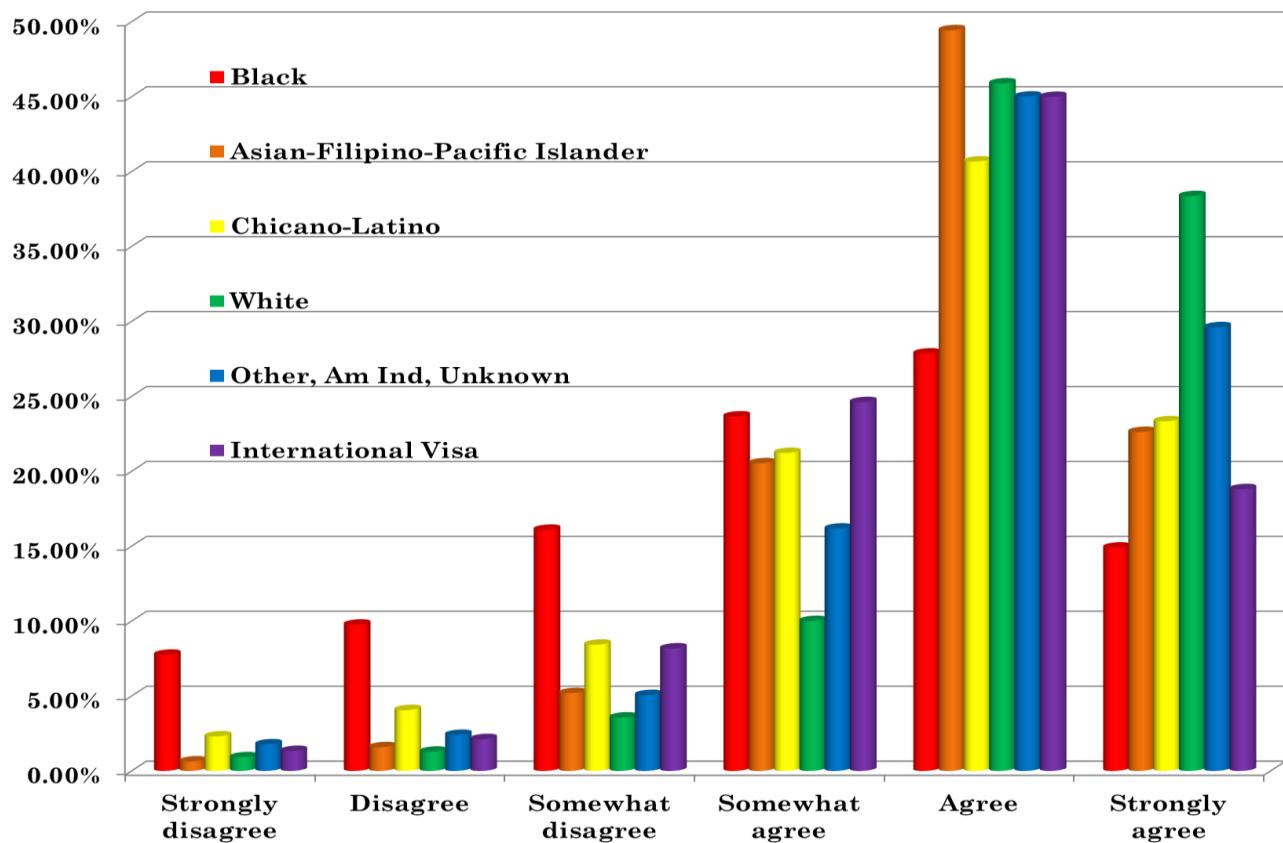


Figure 3: UC-wide response to "Students of my race/ethnicity are respected on this campus" in 2012. (ref.7)

III. Introduction

The Council for the Advancement of Black Engineers (CABE) is a non-profit 501 (c)(3) organization based in the Inland Empire. Founded in 2012, the organization was formed as a means to funnel well qualified black PhDs into companies, universities, and communities.

Our mission is to employ ideas that "create passion" in black engineering students to pursue PhD and postdoctoral work, thus gaining advanced knowledge. As such students will drive innovation, become solution banks to technical challenges facing our world, and arm themselves to compete globally.

The CABE consists of a board of predominately black engineers that are dedicated to the recruitment, retention and enrichment of the next generation of black engineers. As such, we have founded this organization, which will utilize our diverse skill sets and backgrounds to propel these students to the next academic level. The primary function of the organization is promotion, retention, and professional development via mentorship for black undergraduate and graduate engineering students.

Within the founding board are engineers from several disciplines who have successfully navigated their way into industry and/or academia. Each individual brings to the organization a unique perspective on the challenges existing for current black engineering students and probable solutions to those challenges. Also within the board are current engineering students (both undergraduate and graduate) and postdoctoral researchers who can advocate for and give direct mentorship and support black engineering students on a hierachal basis. For more information on our founding board, please refer to the appendices.

We have developed relationships with well-established engineering organizations such as the National Society of Black Engineers (NSBE) and the Los Angeles Council of Professional Black Engineers (LACPBE) to draw from their achievements and experience to help our program flourish. We have also created an alliance with The Bourns School of Engineering within the University of California, Riverside (UCR) that will enable us to share available resources and guide them to the goals they are seeking. Several faculty members in the Bourns College of Engineering at UCR are excited about this mentoring program and are already committed to support the organization.

IV. Abstract / Business Case

This program will strive to help students recognize the value proposition of advanced skills that make PhD/postdoctoral work attractive by providing increased opportunities, links to academia and industry, personal development, and key partnerships. We will work directly with students to provide solutions to obstacles which may cause them to forgo advanced degrees, such as: confidence, financial hurdles, family care, and lack of knowledge, network and access to resources.

In conjunction with our mission, our goal is to develop and introduce an increased number of postdoctoral engineers who will establish a beneficial presence of black professors and industrial leaders in our society. This is an important achievement to become role models and encourage undecided youth and undergrads to pursue an engineering career.

As such we intend to directly impact the following for Black Engineering Students:

- Increase the number of students matriculating into PhD and Postdoctoral engineering programs at the Bourns School of Engineering (UCR)
- Increase the number of students who successfully complete the PhD and postdoctoral engineering programs
- Reduce the financial hardship associated with pursuing an advance degree in engineering
- Provide mentorship and a support program directed toward undergraduate and graduate students

V. Proposed Solution

The CABE has begun to develop and implement a program to mentor black engineering students through their undergraduate education in terms of retention, graduation, encouragement, and recruitment into PhD and/or postdoctoral work. The ultimate goal is to provide them with the tools required to achieve positions as engineering faculty or industrial leaders in our global economy. We have chosen The Bourns College of Engineering (BCOE) at UCR as our university of focus for several reasons:

- a. Being a minority-serving institution in the University of California (UC) system, BCOE has a plethora of highly qualified students who we believe should be encouraged to continue their education past the bachelor's degree.
- b. Many of our board members are alumni of this great institution, and this is their way of giving back to the university and "paying it forward" to the next generation of black students in current attendance.
- c. We have established relationships with professors on the UCR campus who are very excited to assist us in our goal and be a part of the process.

Introduction of Solution

Though the initial program will take place at the Bourns College of Engineering, our hope is to expand this program (once successful) to other campuses, initially in the University of California system, and ultimately across the country. We will utilize relationships with Historically Black Colleges and Universities (HBCUs) to recruit students between UCR and other campuses. As part of the UC system, we will also take advantage of the distinguished UC President's Postdoctoral Fellowship to help bring qualified black engineering PhDs to UCR or to send

Bourns graduates to other UC campuses for their postdoctoral work. For more information, please see our proposed organizational structure in the appendices.

Application of Solution

We anticipate that by creating a pipeline from the undergraduate level through the faculty and industry level, we are encouraging the students to stay involved with the program and mentor the students below them, just as they are simultaneously being mentored from above. The immediate mentoring plan that we will use consists of the following steps:

- 1) Identify all black engineering students (both undergraduate and graduate) at The Bourns College of Engineering. Having student board members has been a significant asset within our organization. We will also work with the university administration and the local NSBE chapter.
 - a) For each undergraduate student, assign a series of mentors depending on the student needs from a pool of the following: an undergraduate peer, a graduate student, a faculty member, and a professional engineer. The student will interact with these mentors, and we will make the assignments based on which mentors they tend to gravitate toward.
 - i) The undergraduate peer mentor will help the student get the support they need from other students in their program. The peer mentor will ideally be at least 1 or 2 years senior to the mentee, and can assist them in crossing boundaries introduced at the University programming level.
 - ii) The graduate student mentor will help the student to find a research lab to work in, and will be a source of graduate school knowledge. They can help the student apply for graduate school, provide tips on fellowship applications, professional certifications, and studying for the Graduate Record Examination (GRE), etc. They can also provide the student with honest evaluations on their graduate school experience.
 - iii) The faculty mentor will help to ensure that the student understands what he/she is accountable for, and will offer help if the student is having any problems in the department. The professor can also assist the student in finding a research lab, where he/she will find another faculty mentor. Having a close relationship with the student, the mentor may even be able to provide letters of reference for the student should he/she require.
 - iv) The professional mentor will provide the student with insight into industry trends, information about possible internship opportunities, and an understanding of how advanced degrees fit into the industrial landscape. This will present opportunities for students to obtain firsthand knowledge and experience on current issues that companies are facing, as

well as help them to build a network of professionals who can later help them with the inevitable job search.

- b) For each graduate student, similarly assign a series of mentors from the following: a peer mentor, a faculty mentor, and a professional engineer mentor.
 - i) The graduate peer mentor will operate in mainly the same way as in the undergraduate peer mentor.
 - ii) The graduate faculty mentor will play a much more important role for the graduate student, as they will act as a secondary academic mentor apart from the student's research advisor. For instance, the graduate faculty mentor can act as a mediator between the graduate student and their principle investigator should any issues arise. Without any mediation, the problems could possibly escalate and lead to the student leaving the program. They can also offer the student additional career advice, and can provide letters of reference.
 - iii) The graduate professional mentor will act in much the same way as in the undergraduate case, with an additional emphasis on job placement and career counseling.
- 2) Once mentors have been assigned to students, we plan to have several ways to make sure that the mentor/mentee relationship is going smoothly.
 - a) A minimum of quarterly check-ups with the mentors (at all levels) will be required, and will help to keep the students on track with their goals.
 - b) An anonymous evaluation system will be developed so that we can determine if the student/mentor match is suitable. If it is not, changes to the assigned mentors will be implemented.
 - c) Professional development workshops will be held often on campus, including some focused specifically on successful mentoring/being mentored. Other workshops, including *Applying to Graduate School and Fellowships*, *Time-Management*, *Financial Planning*, and *Searching for Employment after Graduate School* will be held as well.
 - d) Research/poster seminars will be held to give the students an opportunity to present their research in a formal environment and receive feedback on their progress and presentation skills.
 - e) We will implement a program to track the success of the students throughout their careers, so that we can determine the prosperity of the program throughout the years, and have a method of determining what areas require the most improvement.

- 3) Financial support will be made available for students so that they can travel to conferences to present their work, or to job interviews. Students will apply for travel funds, and a committee chosen by the board will review and approve the applications. We will also provide the students with tools and information to help migrate student loan programs; students will have access to deferment programs/criteria, consolidation, and other income sources to lessen the financial burden of graduate school.

VI. Future Direction/Long-term Focus

After the program has been implemented the CABE board will hold periodic reviews at least annually in order to determine the outcome statistics and assess what aspects of the program have been most successful. The criteria that we will use to determine the success of the program will include an increase in such parameters as: number of black engineering students enrolling at UCR, number of black engineering students retained in their programs, amount of financial awards to black engineering students, number of black engineering students graduating from UCR (both undergraduate and graduate), and number of outside awards given to the students in our program. If success warrants, after several years we hope to clone and reproduce the program; first at the nearby UCs (Irvine, Los Angeles), and then to the California State Universities (Fullerton, San Bernardino, Pomona).

When the program has proven successful at several University campuses across Southern California, we will expand the program throughout California and beyond. It is our hope that by this time the recently established UC-HBCU initiative will have taken root, and we will be able to easily spread our program into the HBCU system, giving us access to an even greater supply of highly capable HBCU students and faculty (ref.8).

VII. Results / Conclusion

The CABE is dedicated to implementing a solution to fill the current deficit of black engineering doctoral students in the United States. We propose to mentor these students from undergraduate through their PhD and beyond. The program is designed to keep the students involved throughout their entire academic career, and to provide them with the support necessary to ensure that a higher percentage of black engineers are completing doctoral programs in the US. We anticipate that by providing students with these tools and services, they will become competent and competitive engineers in industry and/or academia, allowing them to better serve their communities and our nation and compete in the global market place.

VIII. Appendices

Appendix A – Founding Members (Biographies available upon request)

President: Steven Henderson, P.E.

Vice President: Elmer Thomas, M.S.

Secretary: Ricardo Davis, B.S.

Treasurer: Cash Sutton, III, P.E.

Mentorship Chair: Dr. Desiré Whitmore, Ph.D.

Membership and By-Laws Chair: Karon Myles, B.S.

PhD Board Representative: Leopold Green

Undergraduate Board Representative: Dante O'Hara

Legal Representation: Richard Nevins JD

Academic Advisor: Dr. Ernest Levister, Jr. M.D.

Appendix B – References

- 1) Baker, J.G. (1998). Gender, Race and Ph.D. Completion in Natural Science and Engineering. *Economics of Education Review*, 17(2): 179–188.
- 2) Brazziel, M. E., & Brazziel, W. F. (2001). Factors in decisions of underrepresented minorities to forego science and engineering doctoral study: A pilot study. *Journal of Science Education and Technology*, 10(3): 273–281.
- 3) Kaba, A. J. (2013). Black Americans, Gains in Science and Engineering Degrees, and Gender. *Sociology Mind*, 3(1): 67-82.
- 4) Kaba, A. J. (2012). The exclusion of black women from national leadership positions in the United States: Taxation with limited representation. *Sociology Mind*, 2(2), 133-140.
- 5) United States Census Bureau (2010). Black Population
<http://www.census.gov/prod/cen2010/briefs/c2010br-06.pdf>
- 6) American Society for Engineering Education, Engineering College Profiles and Statistics Book (2012). <http://www.asee.org/papers-and-publications/publications/college-profiles>
- 7) University of California Accountability Report (2013).
<http://accountability.universityofcalifornia.edu/#http://accountability.universityofcalifornia.edu/>
- 8) University of California, Office of the President HBCU initiative
<http://www.ucop.edu/graduate-studies/initiatives-outreach/uc-hbcu-program/>
- 9) Council for the Advancement of Black Engineers <http://www.thecabe.org/>