

THE WRIGHT STEPP WAY: FROM STEM SUMMER PROGRAM PARTICIPANTS TO COLLEGE PROFESSORS

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Many pre-college programs have been created to try to increase the number of Black professionals in science, technology, engineering, and mathematics (STEM) fields. However, few studies have enabled former Black/African American male program participants to share personal narratives on the long-term benefits and burdens from such STEM interventions. We use a critical collaborative auto-ethnographic approach to highlight our journeys from being STEM summer program participants to becoming college professors in engineering and mathematics. We provide in-depth details about our past participation in Wright State University's former Science, Technology, and Engineering Preparatory Program (Wright STEPP). We discuss people inside and outside of the program who provided us with the community cultural wealth that propelled us into academic STEM roles: family, K–12 teachers, college faculty and staff, and classmates.

KEY WORDS: *science, technology, engineering, and mathematics summer program, higher education, Black men*

1. INTRODUCTION

The purpose of this paper is to highlight the authors' individual trajectories from being Black/African American male science, technology, engineering, and mathematics (STEM) summer program participants to becoming college professors. The lead author, Dr. Leroy Long III, is a Black/African American male associate professor and department chair in engineering, while the second author, Mr. Bobby Elam, is a Black/African American male assistant professor of mathematics. In this paper, we include the term Black/African American to indicate that we are both American descendants of Black people who were enslaved. We use critical collaborative auto-ethnography (CAE) to offer unique insights into the lasting effects (both positive and negative) of our past participation in Wright State University's former Science, Technology, and Engineering Preparatory Program (Wright STEPP). We celebrate the fact that the program provided our first formal introduction to STEM careers, and it came with a tuition-based scholarship to Wright State University. However, we critically examine how the STEM summer program affected our choice of colleges and careers. We also discuss the interest/con-

vergence that was necessary for the program to serve local youth from under-resourced urban K–12 public schools.

The Wright STEPP's founder and former coordinators have published papers and been featured in news articles about the program (Beck and Wright State University, 1989; Hannah, 2011, 2015; Malaska, 2010; Mawasha et al., 2006; Olsen, 2015; Retirees Association, 2020; Wright State Media Team, 2014; Yelamarthi et al., 2007; Yelamarthi and Mawasha, 2008, 2010). However, the voices of many past program participants have been unheard, including individuals like us who can uniquely speak to the perceived impact of the program on our careers as Black male college professors in STEM. Overall, the current literature on STEM summer programs focuses on the short-term impacts of such interventions without considering long-term impacts—as told directly from past participants. We seek to fill this gap in the literature.

Leroy shared the following:

- Sadly, in June 2020, I got a text from Mrs. Bonnie Porter—my 7th grade middle school science teacher—saying Dr. Clark Beck—the founder of Wright STEPP—passed away. Through his vision and the support of educators like Mrs. Porter, thousands of students—like me and Bobby—greatly benefited from Wright STEPP. For many of us, the program provided our first formal introduction to STEM careers and it came with a tuition-based scholarship to Wright State University. The program also linked us to high-achieving peers and same-race mentors who provided us with the additional aspirational, familial, social, and navigational capital needed to succeed in STEM.
- Unfortunately, two years before Dr. Beck passed away, Wright STEPP ended due to dire financial issues at Wright State. Since the program positively impacted so many people like me and Bobby, I wondered how to restart or move it. I requested and received budgetary information for the program from the university. I also collected survey data from nearly one hundred previous participants of Wright STEPP. I began co-writing this paper in June 2021 as part of an ongoing effort to reproduce beneficial aspects of the program. Without Wright STEPP, I'm not sure if I would be an engineering professor or STEM professional of any kind, an entrepreneur or leader of an education-based company, or a homeowner with multiple degrees but zero college debt.

Bobby expressed similar sentiments:

- I first heard of Dr. Beck's death, within days of his passing, through a friend on Facebook. While I don't recall ever meeting him, I understand the positive impact he had on Wright STEPP and how it opened up countless opportunities—the experience of spending time on a university campus, real-world applications of STEM activities, a sense of belonging in STEM (seeing students who look like us and come from similar backgrounds in college), and a chance to network with other scholars. In retrospect, it's a great feat that so many Black, first-generation, and low-income students were able to attend Wright State University with a tuition waiver from the program. Working at a college now, where

our goal is to recruit students, I think all educators should aspire to help remove roadblocks—like tuition costs—that prevent many students from pursuing a higher education.

- In 2018, I was saddened to hear that Wright STEPP had come to an end. I immediately thought about the three summers I participated in the program and the impact it had on so many students. I've always thought highly of Wright STEPP and I believe the way the program was designed is optimal for helping to recruit college students to any school and also help students decide on a career path. Recently, I was tasked with helping to develop a bridge program with a colleague for incoming students at our institution. The more I thought about what this program could be, I kept thinking about replicating college prep activities from the Wright STEPP since they were so influential to me. I can confidently say that without Wright STEPP, I would have lost out on being around a community of peers who pushed me to be stronger academically. I also would have lost out on STEM activities that helped me decide on a college major and eventual career. Wright STEPP's success is a testament to the work of Dr. Beck, Mrs. Porter, and others who helped the program thrive for so long.

2. BACKGROUND LITERATURE

The current literature on pre-college summer enrichment programs includes those sponsored at the national level along with those housed at individual universities. Numerous pre-college summer enrichment programs have been created to improve the proportion of Black students as well as other minoritized and marginalized students who graduate from college and/or pursue STEM careers. Many studies have focused on the short-term impacts of such interventions. Few, if any, investigations have considered the long-term impacts of pre-college STEM summer programs—as told directly from successful past participants like us. We seek to fill this gap in the literature.

Several notable national pre-college summer enrichment programs seek to help minoritized and marginalized students reach their academic goals. TRIO programs “are Federal outreach and student services programs designed to identify and provide services for individuals from disadvantaged backgrounds” (U.S. Department of Education, 2022). In the late 1960s, the term TRIO emerged as a way to label federal outreach programs such as Upward Bound, Talent Search, and Student Support Services. In the 1980s and 1990s, additional TRIO programs were added such as the Ronald E. McNair Postbaccalaureate Achievement Program and Upward Bound Math-Science program. Eight TRIO programs now “serve and assist low-income individuals, first-generation college students, and individuals with disabilities to progress through the academic pipeline from middle school to post baccalaureate programs” (U.S. Department of Education, 2022).

STEM-focused TRIO programs like the Upward Bound Math-Science program have led to participants' (a) improved high school grades in mathematics and science; (b) increased likelihood of taking chemistry and physics in high school; (c) increased

enrollment at four-year and more selective institutions; (d) increased mathematics and science course taking in college; (e) increased postsecondary degree completion overall and at four-year institutions; (f) increased likelihood of earning a degree in a social science field of study; (g) increased likelihood of majoring in mathematics and science; and (h) increased likelihood of completing a four-year degree in mathematics and science (Olsen et al., 2007; Seftor and Calcagno, 2010).

Some national programs specifically seek to increase the number of Black/African American students and other students of color who earn college degrees in STEM fields. For example, the aim of the Louis Stokes Alliances for Minority Participation (LSAMP) program is the following:

To assist universities and colleges in diversifying the nation's STEM workforce by increasing the number of STEM baccalaureate and graduate degrees awarded to populations historically underrepresented in these disciplines: African Americans, Hispanic Americans, American Indians, Alaska Natives, Native Hawaiians, and Native Pacific Islanders. (National Science Foundation, 2022)

At its founding in 1991, LSAMP was originally called the Alliances for Minority Participation (Colorado State University, 2022). In 1999, the program was renamed in honor of Louis Stokes, the first African American elected to congress in the State of Ohio. LSAMP now “provides funding to alliances that implement comprehensive, evidence-based, innovative, and sustained strategies that ultimately result in the graduation of well-prepared, highly-qualified students from underrepresented minority groups who pursue graduate studies or careers in STEM” (National Science Foundation, 2022).

STEM-focused programs for students of color like LSAMP have created beneficial experiences—bridge programs, scholarships, study groups, student organizational support, and undergrad research—that lead to success in STEM (Baber and Jackson, 2018; Hamilton and Parker, 2010). Thus, LSAMP programs have increased recruitment, retention, and graduation rates among students of color (Baber and Jackson, 2018; Jiang et al., 2005). In states with early LSAMP sites like Alabama, for every dollar invested in the alliance more than three dollars have been returned to the state via job creation and higher educational attainment among citizens (Baber and Jackson, 2018). Some LSAMP programs have even produced research results related to broadening student participation in STEM.

In addition to national pre-college STEM summer programs, individual universities have created their own initiatives. For example, at a public university in a large southeastern metropolitan region, a series of one-week-long summer programs have been offered by the university's Center for Education (Cappelli et al., 2019). African American students (29%) represented the largest proportion of program participants. Findings from surveys indicated participants' average confidence in their knowledge of STEM content increased, with Grade 7–12 participants experiencing the greatest increase. Another study reviewed STEM summer pre-college programs at 23 four-year and four two-year institutions (Kitchen et al., 2018). Controlling for background characteristics,

the results from logistic regression models showed that students who participated in a STEM summer pre-college program had 1.4 times the odds of wanting to pursue a STEM career. An investigation involving Black girls (Lane and Id-Deen, 2020) revealed two summer STEM programs were influential in enhancing participants' existing aspirational, social, and familial capital.

3. PURPOSE

Using a critical CAE approach, we highlight our individual journeys from being STEM summer program participants to becoming college professors in engineering and mathematics. We provide in-depth details about our past participation in the Wright STEPP. We also discuss people outside of the Wright STEPP that positively influenced our career trajectories into academic STEM roles: family, K–12 teachers, college faculty and staff, classmates, jobs, etc.

4. RELEVANT THEORY

To pursue our goals for this article, we relied on an anti-deficit framework. We chose one that focuses on our often overlooked and undervalued cultural contacts, skills, abilities, and knowledge. Therefore, the theoretical framework we chose was community cultural wealth, as detailed in Yosso (2005). This selection allowed us to speak to the cultural strengths of our families, teachers, classmates, and community.

Building upon decades of critical research, Yosso (2005) introduced a theory to promote the cultural strengths of students of color. Her proposed cultural strengths include navigational, familial, aspirational, social, resistant, and linguistic capital. Furthermore, the Yosso (2005) framework acknowledged students of color's upward struggle toward social and racial justice. We believe this theory is useful for our focus on unacknowledged and unrecognized people and programs like the Wright STEPP that have helped us succeed in STEM.

5. METHODS

Since we use our personal narratives to highlight how a STEM summer program led us to become college professors in engineering and mathematics, we employ a methodological approach that is concurrently collaborative, autobiographical, and ethnographic (i.e., CAE) (Chang et al., 2016). We think people develop knowledge and awareness of the world through lived experience, which also causes us to use a critical constructivist epistemological lens. More specifically, we used a critical paradigm because it “goes beyond mere recording observations, and strives to reform for a better world” (Asghar, 2013, p. 3121). We also used a constructivist paradigm, since it includes descriptive language instead of numerical values and uses multiple tailored methods rather than one predetermined approach (Asghar, 2013). Perceived philosophical and theoretical tensions exist between critical and constructivist approaches; however, we believe us-

ing both critical and constructivist paradigms (Abes, 2009) provides us with richer results and a more in-depth analysis. If we were to only use one approach, we would not be able to tell our unique stories while also calling out institutional and systemic barriers.

5.1 Methodological Approach

First, with CAE, we engaged in self-interrogation and individually analyzed our personal narratives for meaning making (i.e., as both the researcher and data source) (Chang et al., 2016). We relied on the understanding that auto-ethnography begins with the *self*, i.e., the personal biography. Using personal narratives, the researcher goes on to say something about the larger cultural setting and scholarly discourse, taking a sociological rather than a psychological perspective (Glesne, 1999). We also knew that as an extension of auto-ethnography, “CAE offers us a scholarly space to hold up mirrors to each other in communal self-interrogation and to explore our subjectivity in the company of one another” (Chang et al., 2016, p. 26). Thus, we ultimately transitioned from self to communal and collaborative meaning making.

We chose CAE due to its benefits, such as deeper learning about self and others, collective exploration of researcher subjectivity, power-sharing among research participants, community building, as well as enrichment and efficiency in the research process (Chang et al., 2016). However, we did not want to only use CAE, we also wanted to incorporate critical auto-ethnography. We use “data to analyze how structures of power inherent in culture inform some aspect of [our stories]” (Merriam and Tisdell, 2016, p. 521). We felt it was important to discuss our experiences within the context of the U.S. educational system’s racist and classist policies and practices.

5.2 Data Collection and Analysis Approach

In June 2021, we began writing personal reflections for this paper through frequent communication via cloud documents, video calls, text messages, and phone calls. Our data collection and analysis process for CAE included four cyclical steps: preliminary data collection, subsequent data collection, data analysis and interpretation, and report writing (Chang et al., 2016). For the first step, preliminary data collection involved each author constructing narratives via individual self-reflecting and writing. After sharing our narratives with one another and seeking deeper explanations, we moved onto the second step: subsequent data collection via more individual self-reflecting and writing. We again shared our reflections with each other, which led to preliminary collective meaning making. For the third step, we began data analysis and interpretation by individually reviewing and coding our narratives. We then collectively searched for themes and did group meaning making. For the fourth and final step, we engaged once more in individual meaning making, and then began outlining our collected data, reflections, and narratives for collaborative writing of our personal stories.

5.3 Trustworthiness

To maintain trustworthiness for this qualitative study, we used peer debriefing—a process that aligns with CAE’s built-in mechanism of communal dialogue between an individual and others (Chang et al., 2016). We also obtained feedback from Mrs. Porter and some past program participants.

5.4 Authors’ Positionalities

We both identify as straight Black married men who were born and raised in the same small city and suburb in the Midwest. We were both born into middle-class college-educated two-parent households, although Leroy later lived in a single-parent household. We attended the same urban, public, and predominantly Black elementary, middle, and high schools, where Bobby became a starting varsity football player. We later enrolled in different universities. Leroy used a tuition-based scholarship from the Wright STEPP to stay near our hometown and attend Wright State University, a historically White institution (HWI). Bobby moved to the Southeast to attend a historically Black college or university (HBCU), where he became a member of a historically Black fraternity, Phi Beta Sigma. After college, we both became faculty members at HWIs.

6. FINDINGS

6.1 Unlocked Dreams

As a past participant in the Wright STEPP, Leroy shared the following thoughts and memories:

- My mom was a first-generation college graduate and pioneer in computer science, but before middle school, I didn’t understand much about her career. I mainly knew that her well-paying job was related to the desktop computer we were fortunate to have at home. My dad was a first-generation college graduate who worked in a civilian job at the local air force base, but I also didn’t realize how the military connected to STEM. Wright STEPP helped me connect STEM careers like my mom’s and those at the local air force base to the computer I used at home and the math and science classes I took at school. Nearly two decades after graduating from the program, I still remember learning about a variety of STEM careers, creating code for my first website, and designing paper airplanes for in-class activities.
- Wright STEPP helped me dream of breaking barriers to become a STEM professional. Like my family and K–12 teachers, program coordinators believed in providing us with the best possible education. They were aware of the minoritization and marginalization of Black people in STEM fields, yet they thought I was capable of becoming the first engineer in my family. Their enduring love

and optimism supplemented the limited resources given to our urban schools and communities.

- To this day, I am still grateful for the encouragement we received from coordinators of Wright STEPP who complimented us and recognized us with awards. They made us believe we could dream big by not only wanting to become future STEM professionals but leaders. As displayed in the cover photo from a Wright STEPP alumni group, program leaders had us believe, ‘I must do my best to be the best, so that I will be ready when my time comes!’ I had no idea those words would help propel me into a pioneering career as a Black male engineering professor. As a teenager, I never dreamed of becoming a college professor, but I knew it was possible after meeting Black men like Dr. Beck and Dr. Ruby Mawasha—a former engineering administrator at Wright State University. Their leadership roles with Wright STEPP helped me understand the power and impact of earning the academic title of ‘Dr.’

Likewise, Bobby shared his thoughts and memories about the Wright STEPP:

- My parents were big on education inside and outside of school—to give my siblings and I a professional advantage through exposure to future career fields. My older brother was the first person I knew who participated in Wright STEPP. When the opportunity came for me to join Wright STEPP, there was no hesitation for me to join the program. My parents were satisfied with my brother’s experience and they trusted Mrs. Porter’s leadership of the program since she also taught my brother in middle school.
- Since my older brother and sister majored in computer science, my introduction to STEM came at an early age. This initially led me to believe that the only major to select was computer science. My interest in computers started when my sister brought a desktop computer home from college. I remember having to use command prompts to get Windows to launch. I was disappointed my sister had to take the computer back to school because I wanted us to have a computer in our home full-time. My parents did not push me or my siblings to pursue STEM, but they held academics in high regard and they wanted us to excel in the classroom even while playing varsity sports.
- The activities we completed in Wright STEPP were helpful in my growth as a STEM scholar, and it helped me make decisions on a college major. One memorable activity involved having to design our own website. It was something so simple, but it was fun to be introduced to coding that way. This was at the beginning stages of my introduction to social media, so I was intrigued throughout the whole process. Interestingly enough, when I was a junior in college, I had to take a programming class and I enjoyed it just like I did when having to create my own webpage. Not all activities we completed in Wright STEPP were enjoyable for me. We were tasked with putting together a battery motor. As this was our initial introduction to engineering, I was not a fan since I was not able to get the motor to work. This led me to not want to pursue engineering as a major.

However, when I took some pre-engineering courses in college, I found those courses to be engaging.

- Out of all the activities, field trips, and classes we had, the math courses were my favorite. Before joining Wright STEPP after eighth grade, my love for math was up and down in school. I struggled in my seventh grade math class, but I was fortunate to have an eighth grade teacher who later sparked my enjoyment for the subject. Wright STEPP helped solidify my long-lasting love of mathematics. I was fortunate to have teachers and professors in mathematics who were Black. Some of my Black college classmates did not have many, if any, past same-race educators. For a while, I took this for granted, but all of my past teachers and professors are a part of why I attended grad school and later became the professor I am today. The way they molded me is the way I try to mold my students.

6.2 Extended Family

Leroy shared his reflections about the faculty and other students he met through the Wright STEPP, which he looked upon as an extended family:

- I not only recall some of the class activities from the Wright STEPP, but I also remember the bus rides, lunch breaks, and field trips we took together. I was able to bond with other like-minded kids who excelled in STEM—many of whom were Black like me. It helped that some of us attended the same school(s) and we were all from Dayton Public Schools. It felt like we were a part of an extended family and village in STEM, which pioneering women and Black professionals like my mom did not have when entering the field.
- The extended family and village I formed in Wright STEPP included teachers and mentors too. Mrs. Porter became like an aunt or motherly figure. I'm not sure if I would have ever participated in Wright STEPP if it wasn't for her. Like my mom, she was a Black woman who believed I would excel in the program. To this day, Mrs. Porter still publicly shows support of my personal and professional accomplishments. While writing this paper, I recently met her for a meal to catch up and show my appreciation.
- Some of the program participants and assistants became extended family members too since those older Black students seemed like big cousins or siblings. Several of them attended Wright State University, helped me with academics, hung out with me, and they even support my STEM initiatives to this day. One of the program coordinators, Dr. Mawasha, worked as an engineering administrator at Wright State. He served as an uncle or father-like figure. While I was an undergrad student, he routinely met with me to offer advice and he happily wrote requested letters of recommendation. He linked me with a faculty member who provided me with an undergraduate research position and he brought an organization to campus that led to my first internship. He also encouraged me to apply to grad school as a back-up plan to working in industry and talked

with me about salaries for individuals with a BS vs. an MS and PhD. Although I didn't realize it at the time, while I was still in undergrad, he began to intentionally prepare me to later become a college professor.

Bobby shared similar views:

- Wright STEPP helped me improve my technical skills as well as my social skills. Another thing I still remember about being in the program are the kids I rode the bus with each summer. Some of them went to my school, so I was already familiar with them and was able to easily have conversations with them. While this was great and it helped me feel comfortable, the aspect of the program I really enjoyed was working with students from other schools. Being around different learning styles helped me grow as a student. The people I met during Wright STEPP allowed me to grow my social network. If I were to see any of them in person today instead of through our connections on social media, I would definitely stop to catch up with them. Some of the instructors and mentors in Wright STEPP were Black. They were encouraging and supportive. This pushed me to try to excel in areas above and beyond math courses.
- Being a part of Wright STEPP gave me early experiences of working with peers who shared a common goal. This definitely helped me grow as a high-achieving student-athlete. Participating in varsity football gave me additional opportunities to bond with other students. There were plenty of after-school activities I participated in with my teammates because I knew it could strengthen our bonds like in Wright STEPP. It led to me viewing my football teammates as extended family members too. These experiences helped me become the man I am today. The importance of having people to talk to or relate to cannot be overlooked, and it definitely helped me get and stay on the right path.

6.3 Navigation Routes

Leroy reflected on how the Wright STEPP influenced his decision-making process with respect to continued educational advancement:

- I used the tuition-based scholarship I received from the Wright STEPP to attend Wright State University. Although I applied and was accepted elsewhere, I could not pass up the opportunity to avoid college debt by allowing me to attend a university so close to my hometown that I had already learned to navigate. I underestimated the socially isolating and racially hostile environment I would encounter in engineering at Wright State. In hindsight, I wish I had explored funding opportunities at HBCUs because I now know they provide a nurturing college climate and they are the leading producers of Black STEM graduates. As first-generation college graduates, my parents did not know about HBCUs other than the local one my father attended. Instead, they encouraged me to attend Wright State because of its strong STEM programs and the benefits of me being able to graduate college without debt.

- While attending Wright State, I used my scholarship and experiences from Wright STEPP to major in engineering. Having access to a personal computer at home, knowing my mom worked with them at work, and gaining experience coding a website made me initially think I should major in computer engineering. I quickly realized that despite my positive experience designing a website, I did not like the coding projects in my first computer science course. So, I decided to switch to mechanical engineering where I could pursue my interest in art and design. I never regretted my decision to switch majors.
- Finishing undergrad without debt—due to my tuition-based scholarship from Wright STEPP—influenced my decision to attend grad school. The community cultural wealth I developed from Wright STEPP made me confident about furthering my education in engineering. I benefited from the continued mentorship I received from Dr. Mawasha who was an engineering administrator at Wright State throughout my time there. He helped me navigate the grad school application and selection process. I ultimately pursued a Master's to further my engineering knowledge and a PhD to one day start a K–12 STEM school. I became a faculty member to teach and mentor students plus broaden participation via research on successful interventions like Wright STEPP.

Bobby also shared his thoughts and reflections on the influence the Wright STEPP had on furthering his education in STEM:

- I was ready to create my own path and be a bit different from my brother. The decision and ability to attend an HBCU was a tradition that began with one of my grandfathers. By the time I was ready to select a college, this was a family legacy I wanted to continue. Among the HBCUs attended by members of both sides of my family: Alcorn State University, Howard University, Meharry Medical College, Morehouse College, Paine College, Spelman College, Tennessee State University, and Tuskegee University. As a result, I was introduced to many wonderful HBCU experiences. After all the dynamic experiences—orientations, football games, and graduations—I knew I wanted to attend an HBCU. While I had two HBCUs to choose from that were not too far from home, I had only visited one of them during a 9th grade field trip. Since I wanted to be a bit farther away from home, I never put these two schools on my radar. If there were more visits to those campuses, my mind could have been changed.
- When it came down to choosing a school. I remember randomly getting a postcard from Bethune-Cookman University. It was far from home, 14 hours away, but close enough to my sister—who lived about two hours away—that I felt comfortable moving there. When I went for my campus visit, I remember experiencing the same feeling I had experienced while being on so many HBCU campuses as a kid. I felt like I belonged. I was immersed in an environment with people that looked like me, but we were not all the same. I was able to fit into a new environment, although the southern customs/language/dress were different from familiar Midwest customs.

- My time in undergrad at Bethune-Cookman was a great experience. While there were some tough moments, ultimately, I was prepared with enough knowledge to be able to succeed. Majoring in mathematics was a decision that I almost regretted making. I had tough college professors who wanted to push us to be stronger students, but when you are in an unfamiliar place and people you are used to confiding in are so far away, it was challenging at times to feel confident in myself. I persisted because I was able to build a small network with classmates—where we encouraged each other. This type of bonding wasn't new to me, as this was something similar to what I felt while participating in Wright STEPP. I knew I wasn't alone in my struggle, so I never gave up or quit. After making it through my first semester, changing my major never crossed my mind and I never had doubts about finishing my degree. My undergraduate advisor, who was Black, encouraged me to join LSAMP and to attend graduate school. Being around students who were determined to succeed in STEM and Black people who were advisers, professors, and deans helped me realize that I could work in higher education. In my day-to-day role as a professor, I lean into these experiences and frequently retell my story as a way for my students to learn from me.

7. DISCUSSION

Using a critical CAE approach and the community cultural wealth framework (Yosso, 2005), we highlight our individual trajectories from being Black/African American male STEM summer program participants to becoming college professors. Through support from our families and participation in the Wright STEPP, we gained additional aspirational and resistance capital that helped us dream of and persist in STEM careers. The program provided us with an extended family of peers and mentors who strengthened our familial and social capital within various STEM fields. The Wright STEPP also bolstered our navigational capital for success in STEM.

Like findings from other pre-college STEM summer programs (Kitchen et al., 2018; Olsen et al., 2007; Seftor and Calcagno, 2010), we believe the Wright STEPP (a) improved our high school grades in mathematics and science; (b) increased mathematics and science course taking in college; (c) increased our likelihood of majoring in mathematics and engineering; and (d) increased our likelihood of completing a four-year degree in mathematics and engineering. We also gained access to an extended family in STEM and learned how to navigate STEM environments. Similar to existing research on pre-college STEM summer programs, Leroy directly benefited from the scholarship he received and used from the program (Baber and Jackson, 2018; Hamilton and Parker, 2010). Bobby was able to obtain other scholarships due to the high grade point average we needed to remain in the Wright STEPP.

Although we have similar positionalities, it is important to note that there were differences in our aspirational, familial, and navigational capital. Leroy initially aspired to be a computer engineer due to his mother's career, the computer at his home, and his

positive experience designing a website in the Wright STEPP. While attending an HWI, he ultimately pursued mechanical engineering en route to becoming an engineering professor at an HWI. On the other hand, Bobby wanted to be a mathematician because of his academic success in classes at school and the summer program. He maintained his goal while pursuing mathematics, at an HBCU, on his journey to becoming a mathematics professor at an HWI.

There were not only differences in our aspirations but also in the way we navigated higher education. Leroy attended Wright State University due to his desire to attend a local university via the tuition-based scholarship he received from the Wright STEPP. His decision to attend Wright State University was also influenced by the fact that both of his parents are first-generation college graduates and his father is the only known member of his family to have attended an HBCU. Unlike Leroy, Bobby chose to attend Bethune-Cookman University because his older siblings, parents, grandparents, and several other family members graduated from an HBCU. He also attended Bethune-Cookman University because he was interested in moving away from his hometown and state.

Our individual interests and unique families played differing parts in our aspirations and ability to navigate higher education. In retrospect, it would have been helpful if the Wright STEPP partnered with or exposed us to other local universities besides Wright State University. There are two local HBCUs called Central State and Wilberforce that could have been a better fit for us than the universities we attended. There is also a local community college called Sinclair that offered smaller class sizes and more instructor support for introductory STEM classes, in which the credit hours could have transferred to Wright State University.

Besides exposing program participants to other local universities before college, Wright State University could have hired many more Black faculty and staff members. The only Black STEM faculty member that Leroy encountered at the university was Dr. Mawasha, who was one of the program coordinators from the Wright STEPP. Leroy could have received more mentorship and support if Wright State University had hired many more Black faculty and staff members. Since the Wright STEPP lasted for decades, it is surprising that more alumni of the program and Black faculty and staff members from around the country were not hired to support Black STEM students at the university. Finally, we do not understand why we were never solicited for feedback on the program nor were we asked to help fundraise when Wright State University began to experience serious financial issues.

8. IMPLICATIONS

There are several STEM education, policy, research, and practice implications worth noting. By replicating the program, educators can help hundreds or thousands of additional minoritized students—including Black males—succeed in STEM. It is important for Black boys to participate in programs that allow them to interact with other high-achieving Black boys and highly educated Black men who can provide them with the community cultural wealth needed to succeed in STEM. Policy makers should consider the costs of tuition at public and private universities while finding ways to reduce the

financial burden and total costs of attendance for Black males and other marginalized students. With access to more tuition-based or full scholarships, Black boys can consider attending universities that value their academic, not just athletic, potential. To better understand the unique experiences and programmatic efforts concerning Black males as well as other marginalized and minoritized populations in STEM, researchers should encourage more use of critical and collaborative auto-ethnography. Black males have unique perspectives and experiences that can advance extant research. Practitioners should apply for and use government, corporate, and other funds to increase the number of culturally relevant K–12 STEM courses and programs that are made available to Black males.

9. CONCLUSIONS

Limited research has focused on Black youth's participation in national or local pre-college STEM summer programs. Rarely have such studies presented findings from successful past participants, especially Black men who became college professors. Although some investigations have considered short-term impacts of pre-college STEM summer programs, more work is needed on the long-term effects of such initiatives with respect to Black boys and men. Additional research is needed that acknowledges assets Black youth already possess and uses anti-deficit theories to analyze their experiences.

Using critical CAE, we offered unique insights into the lasting effects (both positive and negative) of our past participation in the Wright STEPP. The program linked us to high-achieving peers and same-race mentors who provided us with the aspirational, familial, social, and navigational capital needed to succeed in STEM. By participating in the program, we were able to unlock our dreams while aspiring to not only become STEM professionals but also leaders. The Wright STEPP also made us feel like we were a part of an extended family and village in STEM. Due to our time in the program, we learned how to navigate our STEM majors and careers while having to do so in historically White spaces.

Without participating in the program, Leroy is not sure if he would be an engineering professor or STEM professional of any kind, an entrepreneur or leader of an education-based company, or a homeowner with multiple degrees but zero college debt. It was a life-changing experience. Bobby can confidently say that without the Wright STEPP, he would have lost out on being around a community of peers who pushed him to be stronger academically. He also would have lost out on STEM activities that helped him decide on a college major and eventual career.

REFERENCES

- Abes, E. S. (2009). Theoretical borderlands: Using multiple theoretical perspectives to challenge inequitable power structures in student development theory. *Journal of College Student Development*, 50, 141–156.

- Asghar, J. (2013). Critical paradigm: A preamble for novice researchers. *Life Science Journal*, 10(4), 3121–3127.
- Baber, L. D., & Jackson, J. (2018). *From the edge of success to the center: Development of LSAMP Alliances, 1987–2017*. IINSPIRE LSAMP Research Brief 2.
- Beck, C. E., & Wright State University. (1989). *Wright STEPP (Wright State University Engineering Preparation Program)*. American Association of State Colleges and Universities.
- Cappelli, C. J., Boice, K. L., & Alemdar, M. (2019). Evaluating university-based summer STEM programs: Challenges, successes, and lessons learned. *Journal of STEM Outreach*, 2(1), 1–12.
- Chang, H., Ngunjiri, F., & Hernandez, K. A. C. (2016). *Collaborative autoethnography*. Routledge.
- Colorado State University. (2022). History of LSAMP. Retrieved May 9, 2022 from <https://cowyamp.colorado-state.edu/history-lsamp/>.
- Glesne, C. (1999). *Becoming qualitative researchers* (2nd ed.), New York: Longman.
- Hamilton, T., & Parker, R. (2010). UMCP LSAMP: 15 years of successful retention and graduation of underrepresented minority students. *Women in Engineering ProActive Network*.
- Hannah, J. (2011). AT&T presents \$10,000 for Wright STEPP program. *Wright State University Newsroom*. Retrieved August 22, 2021 from <https://webapp2.wright.edu/web1/newsroom/2011/08/10/att-presents-10000-for-wright-stepp-program/>.
- Hannah, J. (2015). Sensing victory: Wright State and Wright STEPP alum Adrienne Bolds-Ephrem flying high with Air Force sensors unit. *Wright State University Newsroom*. Retrieved August 22, 2021 from <https://webapp2.wright.edu/web1/newsroom/2015/02/25/sensing-victory/>.
- Jiang, X., Sarin, S., Williams, M., & Young, L. (2005). *Assessment of the NC-LSAMP Project: A longitudinal study* [Conference presentation]. 2005 American Society of Engineering Education Annual Conference, Portland, OR, United States. <https://peer.asce.org/15213>.
- Kitchen, J. A., Sonnet, G., & Sadler, P. M. (2018). The impact of college-and university-run high school summer programs on students' end of high school STEM career aspirations. *Science Education*, 102(3), 529–547.
- Lane, T. B., & Id-Deen, L. (2020). Nurturing the capital within: A qualitative investigation of Black women and girls in STEM summer programs. *Urban Education*, 0042085920926225.
- Malaska, D. (2010). STEM program STEPPS into Dayton's core to prepare next wave of high-tech professionals. *Velocity*. Retrieved August 22, 2021 from https://www.hivelocitymedia.com/features/STEPP3_25_10.aspx.
- Mawasha, P. R., Yelamarthi, K., & Lam, P. (2006). *Building a bridge for students to transition from high school to college* [Conference presentation]. 2006 Annual Conference & Exposition, Chicago, IL, United States. Retrieved from <https://peer.asce.org/618>.
- Merriam, S. B., & Tisdell, E. J. (2016). *Qualitative research: A guide to design and implementation* (4th ed.) Jossey-Bass.
- National Science Foundation. (2022). Louis Stokes alliances for minority participation (LSAMP). Retrieved May 9, 2022 from <https://beta.nsf.gov/funding/opportunities/louis-stokes-alliances-minority-participation>.
- Olsen, R., Seftor, N., Silva, T., Myers, D., DesRoches, D., & Young, J. (2007). *Upward Bound Math-Science: Program description and interim impact estimates*. U.S. Department of Education.
- Olsen, S. (2015). College of Engineering and Computer Science's Wright STEPP program receives donation. *Wright State University Newsroom*. Retrieved August 22, 2021 from <https://webapp2.wright.edu/web1/newsroom/2015/10/29/college-of-engineering-and-computer-sciences-stepp-program-receives-donation-from-att/#:~:text=Wright%20STEPP%20is%20an%20education,them%20about%20STEM%2Drelated%20occupations>.
- Retirees Association. (2020). Clark Eugene Beck Sr., 91, Assistant Dean, College of Engineering and Computer Science. *Wright State University Newsroom*. Retrieved August 22, 2021 from <https://www.wright.edu/retirees-association/article/clark-eugene-beck-sr-91-assistant-dean-college-of-engineering-and-computer-science>.

- Seftor, N. S., & Calcagno, J. C. (2010). *The impacts of Upward Bound Math-Science on postsecondary outcomes 7–9 years after scheduled high school graduation*. U.S. Department of Education.
- U.S. Department of Education. (2022). *Federal TRIO programs—Home page*. Retrieved May 12, 2022 from <https://www2.ed.gov/about/offices/list/ope/trio/index.html>.
- Wright State Media Team. (2014). College of Engineering and Computer Science receives donation for Wright STEPP program. *Wright State University Newsroom*. Retrieved August 22, 2021 from <https://webapp2.wright.edu/web1/newsroom/2014/04/16/wright-stepp-program-receives-donation-from-att/>.
- Yelamarthi, K., Guttenahalli, S., & Mawasha, P. R. (2007). *Introducing pre-college students to engineering through a weather balloon project* [Conference presentation]. 2007 ASEE North Central Section Conference.
- Yelamarthi, K., & Mawasha, P. (2008). A pre-engineering program for the under-represented, low-income and/or first generation college students to pursue higher education. *Journal of STEM Education: Innovations and Research*, 9(3–4), 5–15.
- Yelamarthi, K., & Mawasha, P. R. (2010). A scholarship model for recruitment and retention in STEM disciplines. *Journal of STEM Education: Innovations and Research*, 11(5–6), 64–71.
- Yosso, T. J. (2005). Whose culture has capital? A critical race theory discussion of community cultural wealth. *Race Ethnicity and Education*, 8(1), 69–91.