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Examining the Long-Term Effects of the Morehouse College Annual Math Competitions Bootcamp: A Case Study

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ABSTRACT: The educational attainment of students from underrepresented groups in Science, Technology, Engineering, and Mathematics (STEM) has been well-documented. Programs such as the National Mathematics and Science Initiative were developed to help level the playing field in STEM education. The literature also emphasizes the importance of Black teachers in classrooms with Black students where the success rates of racial matching lead to higher academic success rates. In this study, we explored the impact of the racial matching concept and STEM education by examining the effect of an annually held Math Competitions Bootcamp at Morehouse College, an HBCU in Atlanta, Georgia. Through the lens of Bronfenbrenner's Ecological Systems Theory, this study examined students' experiences in previous Morehouse College Annual Math Competitions Bootcamps as part of their ecosystems and the impact on their college and career exploration journeys. As part of the student participants' ecosystems, a case study design utilizing focus groups and individual interviews was conducted with a parent, and students (mathletes), who participated in previous Morehouse College Annual Math Competitions Bootcamps. Partnerships between P-12 and postsecondary institutions, specifically minority-serving institutions, can be essential to closing the STEM career gap by hosting P-12 students, hosting campus tours, and out-of-school-time (OST) STEM-related engagement experiences.

INTRODUCTION

Within the last few decades, there has been an increasing focus on increasing individuals' interest in Science, Technology, Engineering, and Mathematics (STEM) careers in the United States. Since the implementation of federal initiatives by the George W. Bush and Barack Obama presidential administrations to increase the number of careers and the number of individuals in the STEM fields, there has been a focus on two general areas: 1) to better prepare students in P-12 education in STEM, and 2) to motivate P-12 students to become interested in and eventually pursue careers in STEM (Exec. Order 13226, 3 C.F.R. 1399, 2001; National Academy of Sciences, National Academy of Engineering, and Institute of Medicine, 2007). Individuals from underrepresented minority groups who identify as Black/African American, Hispanic/Latino, Native American, and/or female continue to be the least represented in STEM careers (President's Council of Advisors on Science and Technology [PCAST], 2010). Racial disparities in STEM-related classes in high schools and colleges are not due to the lack of interest of marginalized populations. Research suggests that Black/African American and Hispanic/Latino students in P-12 and postsecondary institutions are interested in pursuing careers in STEM. However, the issue lies in the lack of support to succeed in STEM courses in secondary and postsecondary settings (National Science Board, n.d.). Black/African American and Hispanic/Latino students are under-enrolled in Advanced Placement (AP) courses. Moreover, the STEM degree attainment for Black and Latino students in 2019 was 15.9%, and only 8.5% of bachelor's degrees. (National Science Board, n.d.). Black/African Americans remain underrepresented in STEM careers in the single digits (NCES, n.d.).

To address this inequity, several national organizations have taken steps to transform the STEM career interests of

Black/African American students into a formidable career option and attempt to close the STEM racial career gap (NuPaths, 2024). *Black Girls Code* and *Black Girls Love Math* are nonprofit organizations that provide opportunities for Black/African American girls to explore their interests in technology and mathematics, respectively, through hands-on workshops guided by mentors in the technology and mathematics fields. They provide the participants opportunities to explore careers in technology and mathematics, respectively (Black Girls Code, n.d.; Black Girls Love Math, n.d.). Similarly, for Black males, *The Hidden Genius Project* provides mentorship and empowers youth to immerse themselves in programming geared to pursuing careers in the tech industry (The Hidden Genius Project, n.d.).

The National Math and Science Institute's (NMSI) primary objective is to eliminate racial and gender disparities and address the inequities in STEM careers (NMSI, n.d.). This objective is achieved, in part, through exposure of children to STEM activities at an early age. NMSI seeks to create a more racial and gender-equitable workforce in STEM by providing professional development to teachers and fostering opportunities for students to explore careers in STEM by partnering with postsecondary institutions that serve predominantly marginalized populations, such as Historically Black Colleges and Universities (HBCUs) (Curry and Milsom, 2022; Gershenson et al., 2016).

The role of stakeholders such as parents/guardians, teachers, and members of their communities has become more significant as it relates to supporting children in their schools and communities in and out of school. As these students prepare to pursue their postsecondary ambitions, it becomes an "all-hands-on-deck" approach, soliciting support from the adults mentioned above to prepare students to eventually have successful careers in STEM (Curry and Milsom, 2022).

The ecological systems theory (Bronfenbrenner, 1979) allows researchers to understand the network of influences (i.e., family, peer group, school, neighborhood, and society) that may affect youths' postsecondary ambitions in STEM. Bronfenbrenner (1977, 1979, 1994) postulated that human development occurs through reciprocal interaction between an individual and his (her) external environment. This development includes both proximal and larger social contexts, both formal and informal. Bronfenbrenner stressed the importance of studying an individual in the context of the entire ecological system in which growth occurs. The ecological environment includes a set of nested structures, each contained within the next (Bronfenbrenner, 1977, 1979, 1994). Through the lens of Bronfenbrenner's Ecological Systems Theory (1979), this study examined students' experiences in the previous Morehouse College Annual Math Competitions Bootcamps as part of their ecosystems and the impact on their career exploration journeys. The researchers conducted a case study based on a select group of mathletes' experiences in an out-of-school-time (OST) math competitions bootcamp at an HBCU.

Every year since 2012, Morehouse College has hosted a math competitions bootcamp on the campus of Morehouse College in Atlanta, Georgia. This type of activity is also known as recreational math, an example of OST (Lamar, 2017). The primary purpose of the Bootcamp is to increase the engagement of students from underrepresented populations to learn about and enjoy math. Morehouse College hosts the Bootcamp during the summer in August and invites student participants, also known as mathletes, from the surrounding communities to participate in math competitions (Lamar, 2017). The mathletes are invited to Morehouse College campus to participate in hands-on activities, learn about Morehouse College from alumni and campus representatives, take a college tour, and eventually take an exam in grade levels ranging from elementary to high school. The mathletes are mentored by faculty members from Morehouse College. Members of the community, parents/guardians, and chaperones (instructors from mathletes' schools) participate in the event to support and/or assist with the event. The event concludes with a celebratory awards ceremony (Lamar, 2017). For the purposes of the manuscript, the Annual Math Competitions Bootcamp will be abbreviated as "Bootcamp." Figure 1 shows the schedule of the Bootcamp (Lamar, 2017).

OST programs such as the Bootcamp provide an opportunity where underrepresented minority students, primarily Black students in middle school and high school, are exposed to STEM activities such as recreational math to promote or strengthen students' interest in STEM outside of the traditional classroom environment. The goal is to close STEM achievement gaps with students' white counterparts and increase underrepresented students' self-efficacy to attend postsecondary institutions (Carey, 2019; Curry and Milsom, 2022). The next section will review the literature related to OST activities, programming and mathematics self-efficacy.

10:00–10:15	Meditation and Welcome
10:20–11:20	Mini-Math Contest/ Chat with Mathlete Support System
11:25–12:05	Lunch
12:10–1:10	Panel Discussion • Share Math Competitions Journey • Tips to Stay Involved
1:15–1:25	Other Math Competitions
1:30–1:40	Awards
1:45–1:55	Closing Remarks
1:55–2:00	Group Picture

Figure 1. Bootcamp Schedule of Events.

LITERATURE REVIEW

This compilation of articles will examine the scholarly literature focused on OST activities, including after-school and summer school programs. The review will examine the efforts of community stakeholders to increase the interest and representation of Black males in STEM careers through OST activities and school stakeholders participating in a professional learning community (PLC). Additionally, mathematics self-efficacy will be discussed.

OST STEM Programs. There is empirical evidence for the benefits of OST STEM programs. The Search Institute (2020) reported that a longitudinal study examined third to fifth grade students and found that 68% of youth who participated in OST activities, such as after-school programs, reported having positive social interactions, including interpersonal skills. In an evaluation of the state of Colorado's after-school enrichment program, which targeted students who were struggling academically in school, the teachers' record indicated that nearly three-quarters of the students were more engaged in their classes (Search Institute, 2020). Of the same group of students, the teachers observed that more than two-thirds of the students who participated in the after-school enrichment program increased their motivation to learn and were more attentive in their classes (Search Institute, 2020).

Summer OST programs also positively and academically affect students even more if they actively participate and return to the program in subsequent years. In a longitudinal study, McCombs et al. (2020) found that students in a summer academic enrichment program who were randomly assigned to the treatment group performed better in mathematics than the control group. Of the students who attended the camp, those who returned and participated in subsequent summers achieved higher grades than the control group in additional subjects, including English Language Arts, and demonstrated more vital social skills (McCombs et al., 2020).

OST Programs and Their Effect on Career and College Readiness. After-school programs also prepare students to be college-ready. Motamedi et al. (2020) examined the long-term implications for underrepresented students engaged in an after-school STEM program related to career and college readiness. The researchers found that the students who participated in the STEM after-school program were more likely to graduate from high school within four years, more than three times the rates of their peers who did not participate in the program (Motamedi et al., 2020). In addition to OST programs preparing students to graduate from high school and attend college in four years, after-school programs also provided participants an opportunity to become more knowledgeable about careers and the requirements to enter the fields. Of the students actively engaged in the after-school program, 70% of the participants stated that participating in the program gave them the exposure and the know-how to enter the career field and prepare for college (Muzzi et al., 2020).

OST Program and Community Stakeholders. Bradley et al., (2020) examined a unique approach combining a traditional approach utilized in teacher education, the Professional Learning Community (PLC), and the STEM field to increase the success of Black/African American males in middle school and. The STEM program in the study collaborated with faculty from an HBCU to work with teenage Black males in a weeklong summer program. The content represented all STEM areas and included coding and hands-on, engaging activities in mathematics, technology, and engineering and. While the students were engaged in the summer program, their chaperones, who were high school teachers, worked alongside the college faculty and mentors, who were both men and women. They examined the content taught to ensure that it was age-appropriate and applicable.

The primary goal was to determine best practices for sustaining Black males' interests and eventual career paths in STEM. The high school teachers were engaged in the learning community through multiple learning modalities, including individual, small, and large group instruction and activities. Data in the study were collected from the student and adult participants. Researchers used a semi-structured interview protocol to collect data via individual interviews and focus groups. They found that the STEM program successfully increased capacities in young males, such as self-efficacy, and encouraged continued career exploration into the STEM fields. For the teachers, the STEM PLCs provided insightful information on how to troubleshoot issues with teaching Black males and how to better align their teaching with how Black males learn (Bradley et al, 2020).

Building Mathematics Self-Efficacy in P-12 Students. In the field of psychology, self-efficacy was first introduced by Albert Bandura (1977, 1986). He indicated that self-efficacy transcends many academic subjects and disciplines and affects the belief that an individual can accomplish a certain task (Bandura, 1977). Math is a subject that students tend to struggle in (Hackett and Betz, 1989). It tends to create anxiety and can cause students to believe that they may not be successful. Lui and Koirala (2009) examined the relationship between mathematics self-efficacy and high school students' performance in math. This study used a 2002 dataset of nearly 12,000 high school sophomores from more than 750 high schools, including both public and private. The students were issued a questionnaire instrument to determine their views of their experiences at school, future aspirations, and other demographic information (Lui and Koirala, 2009). The study found that the students' mathematics self-efficacy

had a positive impact on their achievement in math. The researchers concluded that math instructors supporting and encouraging their students can foster a positive attitude in their students and create a positive classroom environment.

METHODS

A case study research design was utilized to carry out the current study. Yin (2014) defined one aspect of the scope of a case study as "an empirical inquiry that investigates a contemporary phenomenon (the 'case') in depth and within the real-world context" (p. 16). Additionally, Yin (2014) noted that descriptive case studies describe the phenomenon in detail in its real-world context. This study utilized semi-structured interviews to obtain vivid, in-depth accounts of the experiences of the mathlete and parents' perspectives. Its primary purpose was to examine the effect of the Morehouse College Annual Math Competitions Bootcamp on the student participants' personal and career/college development. The study employed a collective case study approach with the four primary participants in the study (mathletes) and the one parent participant presented as one case. The mathletes' and parent's experiences were time-bound during the summer that each mathlete participated in the Bootcamp, or in the case of the parent, his children participated in the study. The unique perspectives of the mathletes and the parent in the study lend to the emphasis of each mathlete while providing analyses within and across the cases (Stake, 2003). The following research questions guided this study:

1. How did the Morehouse College Annual Math Competitions Bootcamp(s) affect the college/career decisions of the student participants?
2. How did the Morehouse College Annual Math Competitions Bootcamp(s) affect the students' personal growth and development?
3. What influence(s) did the parents/guardians observe their student participants had as a result of attending the Morehouse College Annual Math Competitions Bootcamp(s)?

Participants. The primary participants included four mathletes who had previously participated in the Annual Math Competitions Bootcamp at Morehouse College. Their demographic information is shown in Table 1. The secondary participant is a parent of mathletes who participated in a Bootcamp.

After Institutional Review Board approval was received from Morehouse College, the students were recruited via convenience and snowball sampling through email correspondence. Three of the mathletes participated in a focus group interview and one mathlete participated in an individual interview due to scheduling concerns. The parent participant was interviewed individually.

Data Collection Procedures. All five of the participants were interviewed via semi-structured interviews and asked the same questions in individual or focus group formats (see interview protocols below). The virtual interviews were between 30 minutes and 1 hour. Once receipt of the consent forms was verified, each participant was asked to provide verbal consent to participate in the interview and have the interview recorded before the interview began. The participants' identities in the interviews were preserved by changing their 'screen names' to their pseudonyms. Their cameras were then turned off prior to the Zoom interviews commencing.

Mathlete Interview Questions

1. Why did you choose to participate in the Morehouse College Annual Bootcamp?
2. Please describe your experience participating in the Morehouse College Annual Bootcamp.
3. What specific impact(s) did the Morehouse College Annual Bootcamp have on your personal development?
4. What specific impact(s) did the Morehouse College Annual Bootcamp have on your career/college decisions?
5. How did you decide to get involved with the

Table 1. *Demographic information for study participants who were mathletes.*

Mathlete Name	Race/ Ethnicity	Gender	Age	Grade First Participated in Bootcamp	Major in College	Year Graduated	Career Goal
Destiny	Black/ African-American	Female	26	11th	Biomedical Engineering (minor in Biology); Currently in medical school	May 2020; projected 2028	Physician
Nancy	Black/ African-American	Female	22	7th	Neuroscience	May 2024	Physician
Lindsay	Black/ African-American	Female	22	7th	Biochemistry (minor in Biology); Currently in medical school	May 2024; projected 2027	Physician
Saga	Black/ African-American	Female	22	7th	Math Education, then Science Education	August 2023	Physician

Morehouse College Annual Bootcamp? Who invited you to participate? Did you believe that you could be a strong math student due to attending the Bootcamp?

6. What grade(s) were you in when you participated in the Bootcamp?
7. Were there activities/programs like the Bootcamp provided in your schools?
8. What did you learn about yourself as a result of attending the Bootcamp?

Parent/Guardian Interview Questions

1. How were you informed about the Bootcamp?
2. What were the reasons that influenced your decision to allow your students to participate in the Bootcamp?
3. Can you speak to your students' dispositions before, during, and after their participation in the Bootcamp?
4. How did you feel seeing your students participate in the Bootcamp?

Data Analysis. The researchers transcribed each interview recording and analyzed the data using thematic analysis. Generally, the process of thematic analysis involves coding the data into themes and categories by identifying and analyzing repeating patterns of information (Braun and Clarke, 2006). The first step in the data analysis involved reading the transcripts and noting ideas about meaningful patterns through hand-coding. The second step involved identifying preliminary codes using an open coding system, which consisted of coding the entire data to generate significant social insights (Saldaña, 2013). The next step included generating themes within the data. The last step involved ongoing analysis to refine the specifics of each theme using thematic mapping of the data. For each thematic segment, representative quotations and interpretations described the content of that segment (Braun and Clarke, 2006; Creswell and Poth, 2018). Triangulation was achieved through multiple data sources (i.e., multiple interviewees) and adequate engagement with the data; member checking of transcripts and results aided in establishing credibility (Creswell and Poth, 2018; Merriam and Tisdell, 2016; Padgett, 2017).

RESULTS

The three themes identified from this study were: cultural pride, exposure to HBCUs, and increased confidence.

Theme One: Cultural Pride. This theme provided perspectives on the racialized personal growth and identity development of the mathletes, acquired from attending the Bootcamp, and the perspective provided by the mathlete parent. The Department of Mathematics at Morehouse College was intentional in fostering cultural pride in the greater Atlanta community through a community outreach initiative. Dr. Lamar and her colleagues initially reached out to schools where Black students were underrepresented but interested in math to share information about a recreational math OST opportunity. This community outreach initiative, the math competitions bootcamp, provided an annual opportunity where minority students could compete against each other in math and make new connections and friends that looked like them (Lamar, 2017).

Most of participants grew up in predominantly white environments or had few Black teachers. The mathletes and the parent of mathletes demonstrated pride in being part of a majority and seeing many other participants who looked like them (Black students) who also shared a joy for math, as opposed to typically being in the minority. Saga mentioned that her teacher, who is Black, recommended that she attend the Bootcamp to be around like-minded Black students :

> *The teacher who took me to the competition was my first Black math teacher and one of two that I ever had. She thought that it would be good for me to* [go to the Bootcamp to] *be around other students like who enjoyed math.*

Destiny shared similar sentiments as she was one of a few Black students in her school and who also enjoyed math, "… *coming from a predominantly white place, it was nice to see so many brilliant minds of a similar color as me*…" Nancy concurred stating,

> *I am not around many African Americans or anything like that, so I like being in this competition, like the setting, the people. Everything was different, so it was not my usual "comfort zone." However, it was just nice being able to embrace that. Moreover, that is something that I've carried into college until today, like embracing the environment around me.*

The parent respondent, Elvis, echoed similar sentiments that he observed in his mathletes, who also attended predominately white schools. Elvis attended the Bootcamp with his children and observed the joy that they had engaging with the other mathletes:

> *...with my children kind of growing up more in white communities, this is a great opportunity for them to kind of mingle with their own and learn something different. I was overcome with happiness to see how excited my daughters were*

> *to talk about their experiences and seeing* [them] *compete in competitions with other Black students who enjoyed math.*

The Bootcamp was a one-of-a-kind opportunity in the Atlanta metropolitan area where minority students not only engaged in a math competitions bootcamp but also learned about the site where the Bootcamp took place, at the prestigious, all-male HBCU, Morehouse College.

Theme Two: Exposure to HBCUs. This theme spoke partially to the mathletes' college and career development as previous middle school and high school students. The earlier elementary, middle, and high school students are exposed to colleges, particularly students from underserved groups, the higher the likelihood that they will attend college (Curry and Milsom, 2022).

The Bootcamp included a schedule packed with fun and math, but participants also got some career and college readiness from the math faculty and college administrators. The event began with an overview and history of Morehouse College followed by a student panel where participants heard from Bootcamp alumni. Although the mathletes in the current study all lived in the Atlanta area and were aware of Morehouse College, none of them had been to the campus. Holding the Bootcamp at Morehouse College, an HBCU, provided an opportunity for the participants to visit a college they otherwise might not, especially as the four mathletes identify as females.

All four of the mathletes and Elvis' children expected to attend college. Early exposure to college is important as it relates to career and college readiness and ultimately attending college (Curry and Milsom, 2022). As mentioned in the previous theme, three out of the four participants were raised and attended schools where most of the students were white. Those participants had never been to an institution where most students were Black. This was the first time all participants, including the parent participant, had visited an HBCU campus. Saga said, "*The Bootcamp made it where I was able to visit an HBCU. It was also like an opportunity to discover Morehouse.*" Saga went on to share how the Bootcamp helped her learn more about Morehouse.

> *I felt like I did not know, even though I had been in Atlanta for so long, I had not discovered much about Morehouse. I really liked the part at the beginning where the professors talked about Morehouse. There is so much history here!*

Similarly, Nancy reported,

> *It is my first time on the* [HBCU] *college campus, and that was new to me; it was very foreign. I was very* [familiar with] *middle school, elementary school, and a little bit of high school settings. However, nothing like the* [HBCU] *college campus ever, and on top of it, having grown up in a predominantly white area and having grown up in a primarily white schooling system.*

Destiny discussed how holding the Bootcamp at an HBCU helped her consider HBCUs for college saying, "*Before the Bootcamp, I was only looking at* [Predominantly White Institutions (PWIs). *I know Morehouse is for all guys, but I enjoyed seeing a lot of Black students and teachers around campus.*" Elvis, a long-time Atlanta resident, had himself not been on the campus of Morehouse College. He also had not known about the Bootcamp or that it was held there. In fact, he learned about the Bootcamp from a close friend, who is a faculty member in the mathematics department at Morehouse College and served as a mentor for the Bootcamps that his daughters attended. Elvis said,

> *I heard about this math thing from a close friend who attended my church. He mentioned that there was this math event where the students compete at Morehouse, and he recommended that my girls participated. I took him up on his offer.*

The mathletes gained a sense of cultural pride, learned more about and visited an HBCU they had not previously, and also learned about how much confidence they had in and out of the classroom.

Theme Three: Increased Confidence and Self-Efficacy In and Out of Math. This theme addressed the students' increased self-efficacy in math due to their Bootcamp participation as well as the effect it had on the mathletes' career and college decisions. The participants spoke of their love and passion for math. Once students indicated their desire to participate in the Bootcamp competitions, they received materials based on their grade level. The content was decided on by the math faculty at Morehouse in consultation with local math teachers. The Bootcamp included some of the Morehouse math faculty who served as mentors, and members of the community who were there to cheer on the mathletes and assist with the event where needed. The mathletes' math teachers and their parents/guardians served as chaperones and sources of support (Lamar, 2017).

All of the mathletes in the study as well as Elvis, on behalf of his children, indicated how participating in the Bootcamp increased their level of self-confidence in their personal lives as well as their math self-efficacy. For example, Destiny reported that participating in the Bootcamp made her feel more confident in her math skills,

> *I would say, maybe more confident as well. I think doing that exam solidified that maybe my math*

> *skills were pretty well off. It made me a bit more at ease that you know I am learning what I should be learning in school.*

Saga also indicated that

> [The Bootcamp] *had a huge effect on my confidence, and I could go into those other math competitions with those other schools. The Bootcamp taught me to approach those with a spirit of curiosity, not a fear of inadequacy and inferiority. That was useful at Oxford because I was doing things I had never done before, and it was a steep learning curve. I was not great on my first try, and I think before the Bootcamp that would have crushed me after it.*

Another mathlete shared that participation was beneficial to her confidence in math and helped build her confidence level in other areas of her life, demonstrating personal growth as well. Lindsay shared,

> [The Bootcamp] *did make me more confident in math. It was nice that I could put my time into it, and I won my section. So, I think it made me more confident in general and made me realize how hardworking and driven I can be when I put my mind to it. Thus, it made me a harder worker, more confident in my study, and even in other parts of my life.*

The parent discussed observing his children's boost in self-confidence after attending the Bootcamp. He reported, "*I could see the changes in them. I mean, I could see a lot more self-confidence in them. I could see a lot more focus on whatever they did. They applied to the* [university] *and got in.*"

The creation of the Morehouse College Annual Math Competitions Bootcamp not only provided the mathletes with the skills to succeed in math but also the opportunity to learn more about themselves. The mathematics faculty at Morehouse College, led by Dr. Lamar, led an event where brilliant minority, primarily Black, students learned the rich history of one of the most prestigious HBCUs, learned from and were mentored by renowned minority math faculty members, and were encouraged by an army of community members and their support system (teachers and parents) to compete amongst each other in a fun and healthy competitive atmosphere. Most importantly, the mathletes who participated in this study gained invaluable assets for themselves such as cultural pride and the confidence to solve challenging math problems and establish clubs at their schools while making new friends and life-long memories.

DISCUSSION AND IMPLICATIONS

The results of this study emphasize the African proverb, "It takes a village to raise a child." The Annual Math Competitions Bootcamp resulted from a collaborative approach involving multiple stakeholders ranging from the mathletes to the community members, including the host site (Morehouse College), one of the HBCUs in Atlanta, Georgia. The OST programming approach during the summer allowed the students to participate in an experience that combined a math competition exam with college and career experience. The event resulted in former mathletes who learned more about themselves than the passion they have for math. This section will discuss one resounding theme of the study, the implications for P-12 and university stakeholders and future research.

The Importance of School Stakeholders in a Child's Microsystem and Ecosystem to Further the Child's Career and College Development. Bronfenbrenner's Ecological Systems Theory (Bronfenbrenner, 1977, 1994) emphasized the importance of stakeholders within a child's ecosystem. As it relates to the Bootcamp, the mathletes and the parent participant indicated various volunteers that affected them as part of the Bootcamp. The parent who participated in the study stated that a friend from church, a math faculty member at Morehouse College who served as a mentor during the Bootcamp that his children attended, recommended that his children attend the Bootcamp:

> *I was informed of the Bootcamp by a good friend at the church who invited me and my children. He has always been very supportive of the education of my children. So, he brought that to our attention, and we were excited to join!*

After attending a Bootcamp session, Saga, one of the mathletes, mentioned how two mentors, also math faculty at Morehouse College, introduced her to a professor at a university she attended to conduct research. Saga credited the mentors for overcoming her fear of approaching the instructor. As a result of working with that professor, Saga applied to and was accepted to become a Rhodes Scholar and attend the University of Oxford in Oxford, United Kingdom:

> *I went on to* [university name] *after high school, and* [the mentors] *knew a professor in the Math Education Department and were able to connect me to her. And so, thanks to them, I joined her research team, and we studied culturally responsive math and science teaching. So that was very fun. Working under her was impactful, and I would not have gotten there if they had not introduced me. Then I applied for a larger scholarship, the Rhodes Scholarship, after leaving* [university name], *and*

in my interview, they asked many questions about the Bootcamp competition. Hence, they were very interested in that. I think that was part of why I ended up getting it.

Curry and Milsom (2022) discuss the importance of exposure to OST activities like the Bootcamp that can impact the student's career and college development and fill in gaps where parents/guardians may need help. This study yielded implications for two groups of stakeholders: P-12 institutions and Minority Serving Institutions.

Implications for P-12 Institutions. As mentioned previously, school systems are an essential component of a child's microsystem. Children spend much time learning in school. However, OST activities such as after-school and summer enrichment programs can help students who need to improve their grades and behavior or provide an opportunity for students to be exposed to careers (Brand and Valent, 2014; Pyne et al., 2020). Additionally, for students who require credit recovery or other support, OST activities can provide students the opportunity to graduate from high school in four years (Motamedi et al., 2020). Bradley et al. (2020) indicated in their study that all teachers ought to know how to work with students of color, which will be helpful in supporting students' success in math. Math instructors must understand how to build mathematics self-efficacy in order to help their students succeed in mathematics. Lui and Koirala (2009), found several strategies that were helpful in increasing the students' math self-efficacy. Math instructors can improve students' belief that they can accurately solve math problems by working with students to help them set their learning goals. Moreover, actively encouraging their students to persist, study, and work harder is also effective (Lui and Koirala, 2009). The Bootcamp mathletes in the study indicated that the encouragement and mentorship that they received from the Bootcamp mentors and community members were essential in their Bootcamp and post-Bootcamp successes.

Implications for Minority-Serving Institutions. Studies have emphasized the importance of students from underrepresented backgrounds benefiting from mentors and teachers who look like them (Bradley and Young, 2020; Curry and Milsom, 2022). Most minority-serving institutions, such as Hispanic-Serving Institutions (HSIs) and HBCUs, are in their respective communities. Outreach coordinators and admissions offices of minority institutions can contact local elementary and middle schools to host the students on their campuses for campus tours or events highlighting their signature programs. For these students, early exposure to colleges and universities, especially in their communities, can provide career exploration in environments they would not otherwise attend independently (Curry and Milsom, 2022).

This case study examined the effect of participants' time engaged in a math competitions bootcamp at Morehouse College, an HBCU, on their career and college journeys. Data were collected through individual interviews and focus groups with former participants, also known as mathletes and one parent. The participants indicated how various stakeholders, including Bootcamp mentors, family, and friends, impacted their personal growth as well as career and college journeys by cementing love for STEM, which eventually confirmed their career ambitions in the STEM professions. The Bootcamp provided opportunities for the participants to be proud of their culture, and provided exposure to an HBCU through a college tour and speakers discussing the history. Partnerships between P-12 and postsecondary institutions, specifically minority-serving institutions, can be essential to closing the STEM career gap by hosting P-12 students, campus tours, and OST engagement experiences.

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The manuscript was written through contributions of all authors. All authors have given approval to the final version of the manuscript.

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ABBREVIATIONS

AP: Advanced Placement; HBCU: Historically Black Colleges and Universities; HSI: Hispanic-Serving Institutions; IRB: Institutional Review Board; NMSI: National Math and Science Institute; OST: Out-of-School Time; PLC: Professional Learning Community; PWI: Predominantly White Institutions; STEM: Science, Technology, Engineering, and Mathematics

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