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Addressing STEM Teacher Shortages and Racial Disparities: The Promise of AAMUTeach and HBCU Educator Preparation Programs

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ABSTRACT

This article explores how the AAMUTeach program at Alabama A&M University, the state's largest HBCU, addresses STEM teacher shortages and racial disparities in education. Funded by a $2 million grant and modeled after the national UTeach framework, AAMUTeach enables undergraduates to earn both a STEM degree and a teaching certification in four years. The program builds on the university's strong record of producing Black STEM graduates and uses strategies such as scholarships, support staff, and culturally relevant pedagogy. Despite initial challenges, its first semester enrolled 39 students—84% of whom are Black—showing early success. AAMUTeach offers a promising model for diversifying the STEM teaching workforce and improving outcomes for underrepresented students nationwide.

Keywords: Black teacher recruitment, culturally relevant pedagogy, education program development, Historically Black Colleges and Universities, STEM teacher education, teacher shortages

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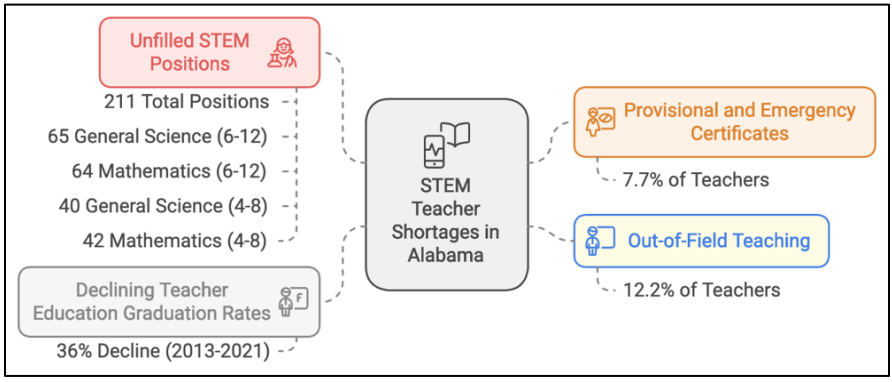
INTRODUCTION

It is no secret that school districts across the nation continue to be in dire need of highly qualified teachers. As of 2023, there were approximately 55,000 teaching vacancies and approximately 270,000 underqualified teachers employed at schools across the United States (Will, 2023). Furthermore, data collected by the U.S. Department of Education (n.d.) on teacher shortage areas revealed that even as recently as 2024, many states continued to experience acute shortages of teachers in areas such as science and mathematics.

While recruitment and retention efforts continue to focus on placing and keeping qualified educators in classrooms, disproportionalities continue to exist when race is considered. Research has shown that the number of Black educators has consistently declined since the 1954 ruling of Brown vs. Board of Education, which banned segregation in public schools (Irving, 1998; Copridge et al., 2023). While calls to improve the recruitment of teachers of color, including Black teachers, have been consistent (Partelow et al., 2017), the number of Black educators across the United States remains at approximately 7% (Ladson-Billings & Anderson, 2021).

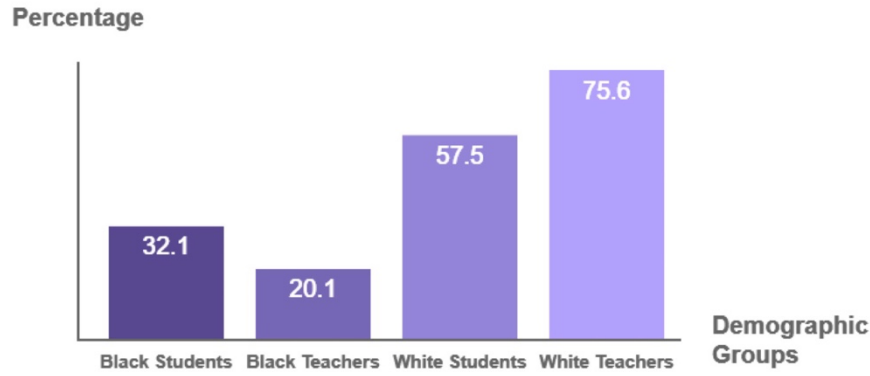
The absence of Black educators in science and mathematics classrooms across the nation is also alarming. For example, even though Black children represent 15% of the student population (NCES, 2023), only 5.4% of natural science and 6.5% of math and computer science educators identify as Black (NCES, 2021). The state of Alabama has not been exempt from both national teacher shortage trends and trends tied to disproportionalities in having highly trained Black educators teach in public schools.

Figure 1: Breakdown of STEM Teacher Shortages in Alabama



At the beginning of the 2022--2023 school year, Alabama had 211 unfilled science and mathematics teaching positions—65 in general science and 64 in mathematics for grades 6--12 and 40 in general science and 42 in mathematics for grades 4--8 (Powell Crain, 2023). Additionally, 7.7% of state teachers were operating under Provisional and Emergency Certificates, whereas 12.2% were teaching outside their certified fields (ALSDE, 2023). Furthermore, the need for qualified teachers in Alabama is underscored by a 36% decline in teacher preparation program graduates between 2013 and 2021 (Patrick, 2023).

Figure 2: Demographic Comparison of Alabama Students and Teachers (2024)



Beyond the overall teacher shortage, Alabama also faces a need to grow its Black teacher workforce to better reflect the demographics of its students. In 2023, while Black students made up 32.1% of all students in Alabama's public schools, only 20.1% of teachers in Alabama identified as Black (ALSDE, 2023). These trends of STEM teacher shortages as well as the underrepresentation of Black teachers present pressing challenges for schools in Alabama and nationwide. In fact, the lack of Black science and mathematics educators is a problem beyond mere disproportionate representation. This lack deprives both Black and White students of valuable educational opportunities. For Black students in particular, this means a missed chance to close substantial academic and opportunity gaps in education. Research shows that Black students who are taught by Black educators are more likely to achieve higher test scores and go to college and are less likely to drop out of high school (Goldhaber & Mizrav, 2021, p. 3). The literature has also highlighted how having Black teachers helps to interrupt the anti-Black biases potentially held by the White students

who they teach (Bristol & Carver-Thomas, 2024, p. 7). Additionally, evidence also suggests that Black teachers tend to exhibit more culturally relevant practices and mindsets than their White counterparts do (Naman, 2009). Consequently, these practices and mindsets seem to be more effective in improving the self-efficacy of all students, including both Black and White students (Blazar, 2021, p. 4).

Unfortunately, despite the urgent need for more Black science and mathematics teachers, our current educational system struggles to produce them. This section describes how a UTeach program, AAMUTeach, has taken on the challenge of helping mitigate STEM teacher shortages in Alabama by focusing on the recruitment and retention of preservice teachers, including those who identify as Black. An overview of the AAMUTeach program and the lessons learned since its inception are discussed.

UTEACH MODEL: ALABAMA'S ATTEMPT AT ADDRESSING THE STEM TEACHER SHORTAGE

To meet Alabama's need for qualified STEM teachers, the Alabama STEM Council secured funding from the state legislature to bring the UTeach STEM educator preparation model to Alabama (Meadows, personal communication, Nov. 1, 2024). Originating more than 25 years ago at the University of Texas at Austin, the UTeach model has proven effective and has expanded to more than 50 universities nationwide. Hoping for statewide impact, the STEM Council, with support from the Alabama Commission on Higher Education, used state funds to offer $14 million in grants for implementation of the UTeach model statewide.

Six universities in the state were awarded grants, including Alabama Agricultural and Mechanical University (Alabama A&M), Alabama's largest Historically Black College and/or University (HBCU) and producer of minority STEM graduates (State of Alabama Office of Minority Affairs, 2024). Alabama A&M is one of just four HBCUs nationwide to earn a UTeach grant (UTeach, 2024), presenting a promising step toward alleviating the shortage of Black STEM educators in the state.

AAMUTEACH – THE UNIQUE STRENGTHS OF ALABAMA A&M'S EDUCATOR PREPARATION PROGRAMS (EPP)

Alabama A&M has long served to fulfill the teacher preparation needs of Black communities within Alabama. Founded in 1875 by William

Hooper Councill, a formerly enslaved minister and educator, the university began as a teacher training institution called the Huntsville State Normal School for Negroes (Alabama Agricultural and Mechanical University, 2025a). This was necessary when Black students were denied access to many Predominantly White Institutions (PWIs), such as the University of Alabama and Auburn University, which did not admit Black students until the mid-1960s (The University of Alabama, 2024; Reid and Herscovici, 2024).

While HBCUs represent just 3% of U.S. postsecondary institutions, they produce 50% of Black teachers and 27% of Black STEM graduates (Arroyo & Gasman, 2014; Copridge et al., 2023; Cain et al., 2018). Similarly, Alabama A&M punches above its weight in regard to educating Black post-secondary students, especially in the STEM fields. Between 2008 and 2012, Alabama A&M awarded 1,226 science and engineering degrees to Black graduates, ranking 18th nationally in such degrees (Gasman & Nguyen, 2016, p. 3). To leverage this large body of Black STEM undergraduate students, leaders at Alabama A&M's College of Education, Humanities, and Behavioral Sciences used the $2 million UTeach grant to launch the AAMUTeach program.

The AAMUTeach program uses the UTeach model to offer a streamlined pathway for undergraduate students in biology, chemistry, physics, or mathematics to earn their bachelor's degree and secondary teacher certification within four years. The program offers scholarships and stipends, employing program-specific staff and faculty to support students both academically and socially. Furthermore, a dedicated AAMUTeach Student Center gives students a place to study and socialize, creating a unique program identity.

As a teacher training program at an HBCU, AAMUTeach offers affordable resources and a supportive environment that attracts and retains Black students. Through culturally relevant practices and effective curricular activities, AAMUTeach nurtures positive relationships between students and faculty (Copridge et al., 2023, p. 2), helping Black students build positive identities and resilience against negative stereotypes (Arroyo & Gasman, 2014, p. 68). These strategies are key to supporting Black students in successfully becoming teachers.

Recruitment

Recruitment is the first step in increasing the number of Black STEM educators in P-12 classrooms. In this regard, AAMUTeach has a distinct advantage over PWIs. As an HBCU, Alabama A&M can leverage its strong networks within Black communities, churches, and schools to attract Black high school graduates (Copridge et al., 2023, p. 2). As proof of this recruitment success, Alabama A&M University saw a 30% increase

in the number of applicants from 2022 to 2023 and admitted a record number of students (Dunkins, 2023) despite a national decline in university enrollment (Campos Seijo, 2022, p. 2).

Internal Recruitment

AAMUTeach leverages the university's recruiting success to attract newly admitted STEM students into the EPP. The first two AAMUTeach courses—*Step 1: Inquiry Approaches* and *Step 2: Inquiry-Based Lesson Design*—are exploratory, introducing first-year students to the teaching profession without requiring them to commit to the EPP. These courses substitute for the university's mandatory orientation courses. Additionally, students receive stipends to cover course costs, enabling them to explore teaching while fulfilling university requirements. In AAMUTeach's inaugural semester, 39 students from within the university were recruited into the Step 1 course, marking the largest initial enrollment among Alabama's six UTeach-grant universities. Notably, 84% of Step 1 enrollees, with an annual average of 28, are Black, highlighting the potential for increasing the number of Black STEM educators in Alabama. Figures 3, 4, and 5 break down the student demographics by major, race, and gender.

Figure 3: Breakdown by Major of Students in Introductory Courses

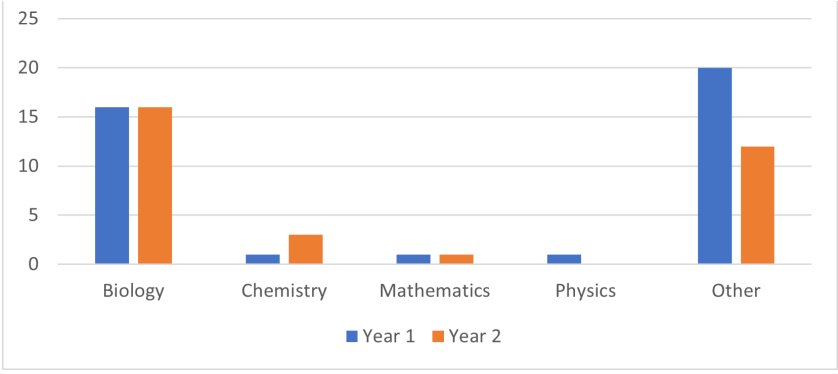


Figure 4: Racial Breakdown of Students in Introductory Courses

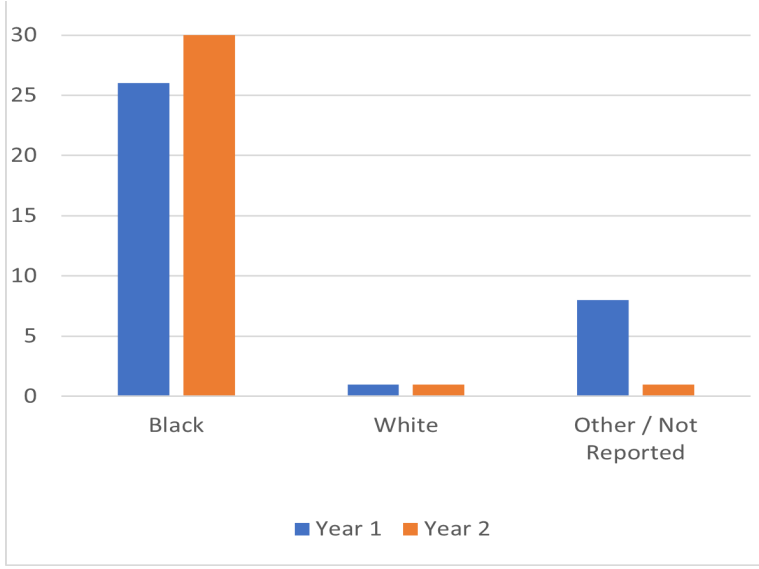
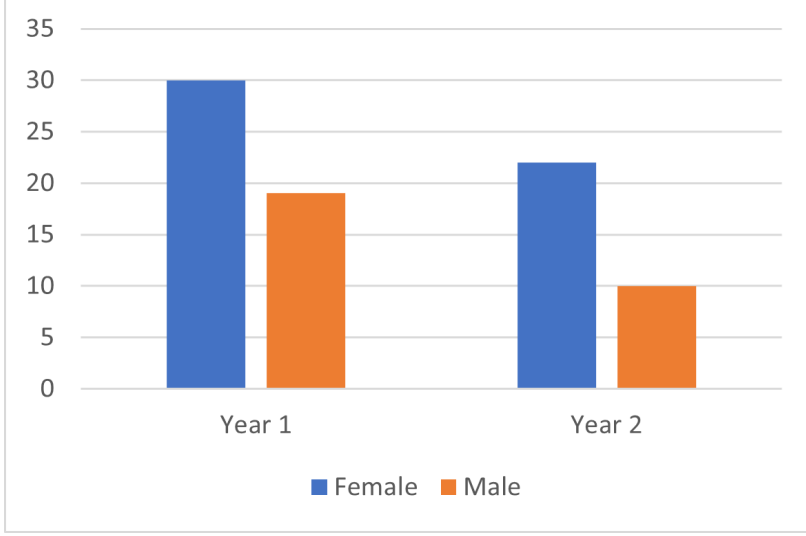


Figure 5: Gender Breakdown of Students in Introductory Courses



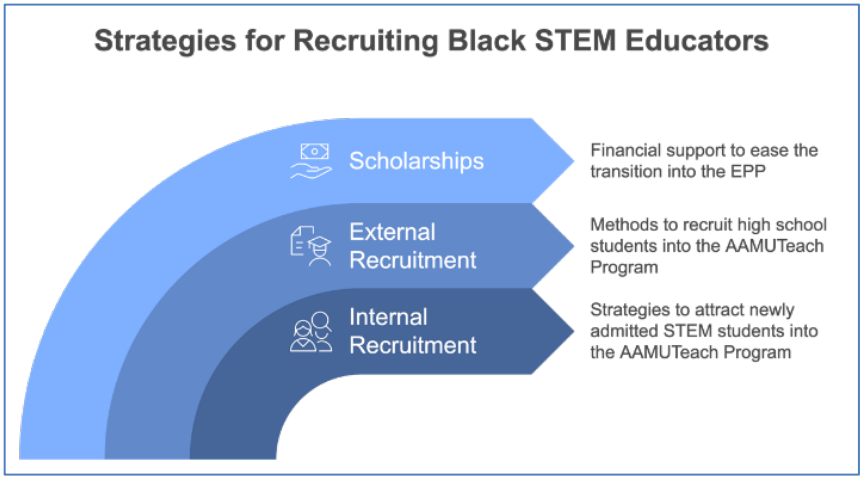
External Recruitment

This year, AAMUTeach implemented multiple strategies to recruit high school students, with outcomes expected next fall and beyond. The primary approach involves participation in university-sponsored recruitment fairs, where AAMUTeach sets up a recruitment booth and distributes informational materials to attract prospective high school students statewide.

A more targeted approach involves school visits. The AAMUTeach Advisor/Recruiter collaborates with the Alabama Education Association (AEA), attending Future Teachers of Alabama (FTA) meetings in local high schools to share program details with students who have already shown an interest in teaching.

To reinforce this recruitment pipeline, AAMUTeach is offering multiple $15,000 AAMUTeach-FTA Scholarships to support students during their first two years at Alabama A&M. These initial years are financially challenging for education students, as they often do not qualify for teacher education scholarships until their third year, upon formal EPP admittance. The AAMUTeach-FTA Scholarship aims to attract students who might otherwise be deterred by financial constraints.

Figure 6: Strategic Approaches



Affordability & Accessibility

AAMUTeach addresses the financial challenges faced by Alabama A&M, of whom 85% receive financial aid and 69% receive Pell Grants (Dunkins, 2023). The program provides tuition reimbursements to STEM students before they are even admitted into the education program. AAMUTeach also provides financial support to cover costs often

overlooked by traditional scholarships such as travel expenses, background check registration fees, test registration fees, and expenses for building a professional wardrobe.

Making AAMUTeach accessible supports access to higher education for traditionally underrepresented groups beyond only Black students, such as low-income and first-generation students. In 2020, 30% of Alabama A&M's undergraduate population was first-generation college students (Alabama Agricultural and Mechanical University, 2025b). Guiding disadvantaged students into the STEM teaching profession is essential, as their personal experiences can enable them to empathize with and effectively support their own future students, who might come from similar backgrounds. The professional journeys of these educators can serve as powerful models, demonstrating viable pathways to college for underrepresented students.

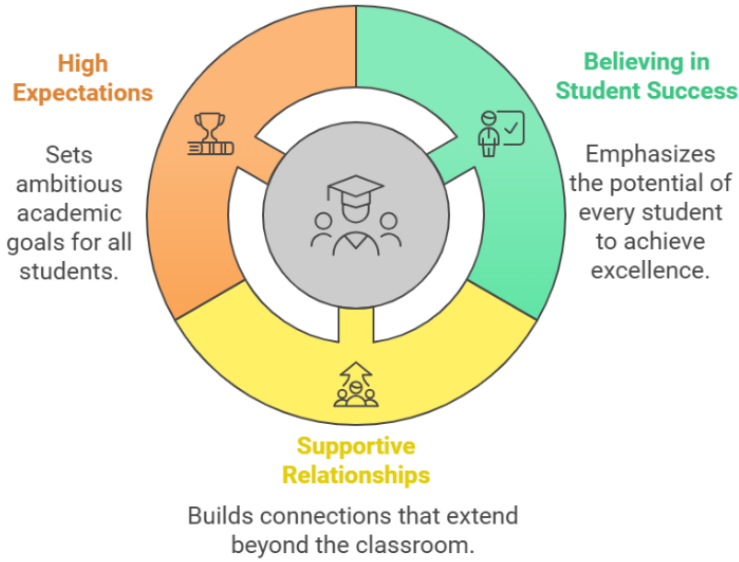
Pedagogical Practices for Successfully Educating Black Students

Recruiting Black students is a critical first step, but retention remains a significant challenge, particularly within STEM fields, where minority students are one-third less likely than White students to complete a bachelor's degree (Kendricks et al., 2019, p. 4). However, research has shown that "HBCUs have higher retention and graduation rates for African American students than predominantly [W]hite institutions" (Kendricks et al., 2019, p. 4). Culturally relevant pedagogical practices—such as those employed by AAMUTeach, and HBCUs in general—have proven to be important in retaining and supporting Black students.

Pertinent Tenets of Culturally Relevant Pedagogy

In *The Dreamkeepers* (2022), Gloria Ladson-Billings defines effective approaches for educating Black students through "culturally relevant pedagogy" (p. xxi). Research by Copridge et al. (2023) suggests that culturally relevant pedagogy is a key feature of Alabama A&M's EPP (p. 24), contributing to its success in training Black educators and preparing all educators to successfully teach Black children. While the tenets of culturally relevant pedagogy are expansive, Alabama A&M's EPP, including the AAMUTeach program, emphasizes three core culturally relevant practices: believing that all students can succeed; fostering supportive relationships beyond the classroom setting; and having high expectations for Black students.

Figure 7: Pertinent Tenets of Culturally Relevant Pedagogy



Believing that all students can succeed. A key tenet of culturally relevant pedagogy is the belief that *all* students can succeed (Ladson-Billings, 2022, p. 47). While this idea may seem simple, its implementation can be difficult, as many teachers harbor subconscious biases that perceive Black children as inferior, believing that "failure is inevitable for some students" (Ladson-Billings, 2022, p. 48). AAMUTeach counters these stereotypes by exposing students to experiences that affirm their potential, such as attending lectures by Nobel laureates or screenings of films celebrating Black scientists' contributions to the space race. These efforts aim to shield "students against negative stereotypes" (Arroyo & Gasman, 2014, p. 68) by celebrating Black students' excellence and affirming Black students' identities (Copridge, 2023, p. 28).

Fostering supportive relationships beyond the classroom setting. To help students succeed, it is essential to address external barriers outside the classroom (Ladson-Billings, 2022; Arroyo & Gasman, 2014). AAMUTeach trains its faculty and dedicated STEM education advisor to serve as mentors and role models to strengthen Black students' paths to success. The program also supports extracurricular STEM activities, such as sending students to present at STEM education conferences around the country. Furthermore, AAMUTeach supports students beyond the

classroom through the development of a peer community. The program uses a cohort model, placing students into many of the same classes to encourage community development, and organizes social events such as bowling nights and ice cream socials. Finally, AAMUTeach has created a dedicated student lounge where students can gather for study sessions, socialize, and even get a cup of coffee.

Maintaining high expectations. Believing that every student can succeed leads to expectations of high academic achievement. As alumni of Alabama A&M and other HBCUs, many AAMUTeach faculty and staff understand the need for excellence, constantly reminding students of "the history of their university and the pride that students should have in continuing the legacy of their respective institutions by educating future generations" (Copridge et al., 2023, p. 23).

This expectation for students to "experience excellence without deceiving them about their own academic achievement" (Ladson-Billings, 2022, p. 108) is reflected in their performance on the Educative Teacher Performance Assessment (edTPA). This portfolio assessment is required for teacher licensure in many states. Nationwide, in 2020, 75% of secondary mathematics students and 85% of secondary science students met the passing score of 37 (edTPA, 2020). In contrast, the mentoring and tutoring system of Alabama A&M's EPP—which AAMUTeach students will also follow—led 100% of its STEM education students to pass the edTPA from 2018 through 2022, with average scores of 42.6 in secondary mathematics and 46.7 in secondary science (Department of Teacher Education and Leadership, 2022).

LESSONS LEARNED ENTERING YEAR TWO

The first year of implementing the AAMUTeach program presented several challenges, both anticipated and unexpected. By elucidating these challenges and the efforts made to overcome them, insights can be offered to other institutions seeking to enhance their STEM education programs or implement similar models.

Financial Constraints

Unlike traditional EPP models, AAMUTeach's field experiences begin in *Step 1* from the students' very first semester in the program. Not surprisingly, these early field experiences can present financial challenges, particularly for first-year students in an exploratory course for a field to which they have not yet committed.

Background Checks & Transportation

Before being allowed into public schools, AAMUTeach students must complete a background check, which requires a $49 fee and travel to an off-campus fingerprinting facility. During the inaugural semester of the program, many students struggled to pay for this requirement, causing delays in their background checks and consequently in their field experience placements.

To alleviate these delays, AAMUTeach contracted with the background check company, Fieldprint, Inc., to pay for students' registration fees. Now, students register for their background checks in class during the first week of the semester. The fees for this registration are charged directly to AAMUTeach program, significantly expediting students' field experience placements and alleviating some of their financial burden.

Transportation for background checks and for field experiences posed additional difficulties. As predominantly first-year students and from lower socioeconomic backgrounds, most of the students in the *Step 1* courses do not own vehicles. Furthermore, the local public transit system either does not travel to the necessary locations or the travel time is prohibitive. AAMUTeach addressed this transportation problem by providing reimbursements for students' ride-share costs and university transportation to field experiences.

Internal Recruitment Communications

One unforeseen challenge was communicating with current Alabama A&M students for recruitment. Owing to university policies preventing mass emails and withholding student emails for recruitment purposes, AAMUTeach could not reach potential candidates directly.

The solution was a partnership with the university's Freshman Academy, which advises all incoming and first-year students. AAMUTeach conducted an informational campaign to educate the Freshman Academy's advisors and directors about the details of AAMUTeach. Now, Freshman Academy advisors send a brief, 2-minute survey to incoming and first-year STEM students to gauge interest in exploring the field of teaching (and receiving a stipend) by taking the *Step 1* or *Step 1&2 Combo* courses instead of the mandatory orientation courses. The Freshman Academy then enrolls interested students in the appropriate AAMUTeach course.

CONCLUSION

Through its early stages, the AAMUTeach program shows significant promise for addressing both Alabama's STEM teacher shortage

and the racial disparity in its teaching workforce. With strong Black student enrollment in its initial years, the AAMUTeach program models potential ways that other educator preparation programs can work to diversify the STEM education field.

By employing culturally relevant pedagogy, fostering mentorship and community, and addressing financial and logistical barriers, AAMUTeach has cultivated a supportive environment that attracts and retains Black students in STEM education pathways. These efforts reflect a broader strategy for increasing equity and excellence in education—a strategy that other institutions, including PWIs, can adapt and expand upon.

However, furthering this impact requires substantial investment. Targeted funding for scholarships, mentorship programs, and resources for underrepresented students, alongside the integration of culturally relevant pedagogy is essential. These measures not only enhance the recruitment and retention of Black STEM educators but also elevate educational outcomes for students of all backgrounds.

Even in its nascent state, the AAMUTeach program demonstrates that building a diverse and robust teaching workforce is achievable. As the U.S. grapples with systemic educational inequities, programs like AAMUTeach offer potential blueprints for fostering a teaching workforce that is reflective of and responsive to the needs of all students.

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Bios

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The authors used Napkin. AI to create graphic figures.