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PREPARING THE NEXT GENERATION OF STEM TEACHERS: ONE HBCUs APPROACH TO THE RECRUITMENT, RETENTION, AND TRAINING OF SCIENCE AND MATHEMATICS TEACHER CANDIDATES DURING COVID-19

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ABSTRACT:

The shortage of science and mathematics teachers in school districts across the United States is not a new problem. However, issues of teacher supply and demand in these academic areas may worsen as the country deals with the COVID-19 pandemic. The AAMU Noyce Teacher Scholarship Program, an initiative funded by the National Science Foundation (NSF), is focused on helping to alleviate critical teacher shortages in Alabama, USA by recruiting and preparing highly qualified science and mathematics teachers. This piece will provide an overview of how the AAMU Noyce Teacher Scholarship Program works to recruit, retain, and train science and mathematics teacher candidates, even in the face of a serious global pandemic.

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Introduction

Alabama A&M University, a Historically Black College and University (HBCU), was awarded a National Science Foundation (NSF) Robert Noyce Teacher Scholarship grant to support the training of science and mathematics majors interested in becoming teachers. Alabama A&M University's Noyce Teacher Scholarship Program (AAMU Noyce) is focused on the recruitment, retention, and preparation of minority undergraduate biology, chemistry, physics, and mathematics majors who, upon completion of their degrees, will teach in public secondary schools in high-need school districts in the state of Alabama in the United States.

This piece will describe features of the AAMU Noyce Program, particularly how the program focuses on the development of undergraduate science and mathematics majors as Noyce scholars. Specifically, this piece will describe how AAMU Noyce seeks to transform the pipeline for recruiting, training, and placing minority science and mathematics majors in classrooms as teachers. Components of the program will be explored, and a discussion of how the program focuses on meeting the needs of scholars, particularly during the COVID-19 pandemic, will be expounded upon.

Now, more than ever, educator preparation programs across the United States of America must "rise to the occasion" of producing qualified science and mathematics teachers. Amid calls for diversifying the teaching profession (Carver-Thomas, 2018), barriers that prevent candidates of color from fully participating in the profession have been discussed in research, specifically as it relates to the recruitment, retention, and support of promising teacher candidates (Carver-Thomas, 2018; Goe & Roth, 2019). AAMU Noyce has taken into consideration some of these barriers and has implemented strategies and approaches to transform how science and mathematics teachers are recruited, retained, and trained, even during a global pandemic.

Defining the Problem

According to the U.S. Department of Education (2020), school districts across the United States continue to experience teacher shortages in the areas of science and mathematics. In the state of Alabama, teacher shortages in science and mathematics remain consistent (U.S. Department of Education, 2020). While the state has developed and implemented several initiatives to address shortages across districts, a number of school districts in Alabama have reported their inability to fill positions that require qualified science and mathematics teachers (Sell, 2019). The AAMU Noyce Program seeks to help alleviate shortages by placing trained science and mathematics students in the teaching profession, specifically to work in high-need school districts. The U.S. Department of Education (2006) defines high-need local educational agencies, such as school districts, as agencies that serve elementary or secondary schools in areas with the following characteristics: 1) A high percentage of individuals from families with incomes below the

poverty line, 2) a high percentage of secondary school teachers not teaching in the content area in which the teachers were trained to teach, and 3) a high teacher turnover rate.

The need for qualified science and mathematics teachers in U.S. classrooms is great. Data from the Programme for International Student Assessment (PISA), an international assessment, revealed that students in the United States continue to underperform in relation to other countries in science and mathematics (OECD, 2019). In addition, national performance data for U.S. students in science and mathematics continue to raise alarms regarding student performances in these two areas, specifically for the state of Alabama. For example, the Nation's Report Card, as published by the National Assessment of Educational Progress (NAEP) in 2015, indicates that students in Alabama performed statistically significantly lower than the national average score on NAEP science and mathematics assessments. The assessments measured science and mathematics performance for students in the 4th and 8th grades.

With a global pandemic that has lasted more than a year, there are growing concerns that the COVID-19 pandemic has significantly impacted education. According to García and Weiss (2020) of the Economic Policy Institute (EPI), the COVID-19 pandemic has impeded both teaching and learning. As noted by the researchers:

> The shutdown of schools, compounded by the associated public health and economic crises, poses major challenges to our students and their teachers. Our public education system was not built, nor prepared, to cope with a situation like this—we lack the structures to sustain effective teaching and learning during the shutdown and to provide the safety net supports that many children receive in school. While we do not know the exact impacts, we do know that children's academic performance is deteriorating during the pandemic, along with their progress on other developmental skills (p. 3).

The researchers went on to explain that the pandemic has also exacerbated inequities that have prevailed in the education system. If left unchecked, the effects of the pandemic could be devastating to an already overburdened system.

Educator preparation programs must prepare a cadre of teachers who can meet the unique challenges of the educational system. Placing the best and brightest students in classrooms as teachers is critical to improving the performance of students in public schools, even in the midst of a global pandemic. The AAMU Noyce Teacher Scholarship Program has taken up the mantle of training undergraduate science and mathematics students who will serve in high-needs public school districts, specifically in the state of Alabama.

Overview of the AAMU Noyce Program

Alabama A&M University's Noyce Teacher Scholarship Program is housed in the university's Department of Physics, Chemistry and Mathematics. The program recruits and prepares undergraduate science (biology, chemistry, and physics) and mathematics students to become science and mathematics secondary education teachers. Students enrolled in the program are considered STEM (science, technology, engineering, mathematics) majors and earn degrees in

their respective fields. To fulfill the requirements of becoming secondary teachers, students add secondary education as a concentration to their degree plans. Upon completion of all degree requirements, students graduate from their respective programs and apply for certification to teach at the secondary level in Alabama (i.e. 6^{th} grade – 12^{th} grade). While the program is open to students from a variety of backgrounds, AAMU Noyce has specifically concentrated its efforts on recruiting, retaining, and preparing minority STEM scholars to become science and mathematics teachers. STEM students who apply and meet initial program requirements are interviewed. If officially accepted into the program, students are provided with scholarship funds in the form of tuition and fees, room and board, books, and funding for teacher certification examinations, as appropriate. Program participants are required to teach in a high-needs school districts two years for every year that they receive financial support.

The AAMU Noyce Program has four specific goals. Each of the goals will be discussed to examine programmatic approaches and procedures, and to describe the specific work that is being done to ensure each program goal is met.

Goal 1: Improve STEM teacher recruitment and retention efforts through a program focused on engaging STEM students who are interested in teaching.

The persistent nature of teacher shortages in the state of Alabama, particularly in the areas of science and mathematics (U.S. Department of Education, 2017), requires that AAMU takes a comprehensive approach to the recruitment of undergraduate STEM students in the teaching pipeline. Therefore, undergraduate STEM students are recruited using a variety of methods.

To aid in program recruitment, AAMU Noyce has partnered with three neighboring community colleges to place STEM students in the teaching pipeline early. Faculty and staff from the community colleges help AAMU Noyce to connect with STEM students early on in their academic careers. Students are provided with an overview of the program and are provided with a direct connection to the AAMU Noyce team to ensure a smooth transition if they decide to transfer from two-year institutions. Support of interested students begins with the assistance of community college personnel who work with the program to provide students with important information about the program.

During the summer, the program offers an intensive internship experience for STEM students. The purpose of the summer internship is to introduce students to AAMU Noyce and to the teaching profession. The summer internship primarily caters to first- and second-year students, and students who hail from community colleges or are new to the university are also formally introduced to the campus and specific STEM departments at the university. All interns are provided with mentors, exposure to science and mathematics pedagogy, and are given a stipend for their participation.

Other recruitment strategies include working directly with faculty in STEM departments who recruit prospective candidates, advertising the program through email and public relations blasts at Alabama A&M University and at the community colleges, and attending community college and university recruitment events.

Once STEM scholars are accepted into the program and make the decision to begin their training as teachers, they are provided with financial and academic support to ensure they are successfully retained in the teaching pipeline. Approaches to retention will be discussed under Goal 3.

Goal 2: Implement a challenging curriculum to ensure scholars are competent in content, pedagogy, and cultural diversity.

All program participants are exposed to a rigorous comprehensive curriculum to ensure their proficiency in science and mathematics content, their development of pedagogical skills, and their abilities to demonstrate their knowledge of issues of equity and diversity in secondary learning environments. Noyce scholars take a range of courses, including courses in their teaching field, as well as methods courses that maximize proficiency in pedagogy and examining issues of equity and diversity in school systems. Furthermore, students complete over 600 field experience hours in diverse learning environments. These curricular experiences align with the National Science Teacher Association's (2020) Standards for Science Teacher Preparation and the National Council of Teachers of Mathematics' (2020) Standards for the Preparation of Secondary Mathematics Teachers.

Knowledge and skill development in scholars are also supported by their participation in monthly Noyce seminars during the academic year. All scholars are required to attend informative seminars that seek to expose them to additional professional development outside of the traditional curriculum. Monthly Noyce seminars include thematic topics focused on teaching and learning in urban and rural high-needs schools in Alabama. Seminar speakers include school district professionals, current secondary science and mathematics teachers, and university faculty. Seminars serve as an additional opportunity to ensure that students are equipped to handle the challenges of teaching in high-need learning environments.

Goal 3: Support program participants to ensure their success during their pre-service and induction periods.

As noted by Lee (2017), teaching STEM subjects "is difficult to do well, even for veteran teachers" (p. 1). Mentorship and support of science and mathematics teachers, including prospective and in-service teachers, have been discussed as important aspects of teacher development (Schneider, 2008; National Council of Teachers of Mathematics, 2013).

A key feature of the AAMU Noyce Program includes participants being provided with mentorship and support as they complete program requirements. To aid in retention of students, Noyce scholars have access to a team of faculty members, including STEM and education faculty, who provide scholars with guidance in their field, timely answering of questions, assistance with solving issues that arise, support with navigating university processes and procedures, and resources needed to be successful as a teacher in training. Scholars are also encouraged to attend national and regional conferences in their field with faculty mentors, as appropriate. Mentorship and support are also extended as Noyce scholars transition to serving as in-service science and mathematics teachers.

Goal 4: Increase the pool of highly qualified science and mathematics teachers working in high-need schools, including high-need rural schools in north Alabama.

Meeting the first three goals of the AAMU Noyce Program will allow the program to add qualified minority science and mathematics teachers to the pool of highly qualified teachers in the state. The AAMU Noyce Program seeks to recruit and prepare a total of 21 undergraduate science and mathematics students to become teachers in north Alabama. Scholars receive training that will prepare them for working in urban, suburban, and rural learning environments. Currently, the program has eight (8) participants and is in the process of onboarding additional candidates. Current program participants include five (5) biology candidates, two (2) mathematics candidates, and one (1) chemistry candidate. All of the scholars identify as being members of a minority group and have each committed to working as teachers upon completion of their respective programs.

The COVID-19 Pandemic: Turning Challenges to Opportunities

Even in the midst of the COVID-19 pandemic, AAMU Noyce continues to rise to the challenge of meeting program goals. For example, since all in-person events were discontinued, attending in-person recruitment events was not possible. Instead, the AAMU Noyce team has made efforts to attend and participate in a variety of online recruitment events and activities that target traditional university students as well as science and mathematics students transferring from community colleges. Furthermore, as a result of the pandemic, AAMU Noyce has boosted outreach on virtual platforms, including increasing program marketing through email blasts, increasing interactions with prospective candidates using virtual platforms such as Zoom, and introducing prospective candidates to the program's website, which includes follow up discussions regarding program requirements. These approaches have allowed the Noyce team to continue to market directly to a targeted audience of students, at both the university and community college levels.

Retention and support activities have also been conducted differently due to the COVID-19 pandemic. All in-person meetings for current scholars were stopped, which lessened scholars' in-person interactions with the support team. Therefore, adjustments were made for the team to meet with scholars using virtual platforms. Noyce scholars continued to attend scheduled monthly seminars and were provided with necessary support from the AAMU Noyce team. In some instances, issues or challenges that scholars encountered were able to be dealt with immediately due to the nature of the university conducting business virtually as opposed to in person.

In García and Weiss' (2020) report, the researchers made the following sentiment: "The COVID-19 pandemic is overwhelming the functioning and outcomes of education systems—some of which were already stressed in many respects" (p. 3). While the researchers' report discusses lessons that have been learned thus far from educational research conducted on the impacts of the pandemic on education, the AAMU Noyce program has implemented strategies to ensure scholars are learning their own lessons about teaching, learning, and issues of equity and

diversity during a global pandemic. One major opportunity that has emerged from the pandemic has been to expose candidates to key issues of concern in science and mathematics classrooms, particularly in the context of the COVID-19 pandemic. Therefore, while monthly seminars are structured to expose candidates to a variety of educational contexts, important issues that have arisen due to the COVID-19 pandemic are discussed during seminars. Scholars are provided with curricular experiences that are supported by current knowledge of issues that impact teaching and learning in science and mathematics classrooms.

Despite the impact that the pandemic continues to have on the field of education, and teacher education, AAMU Noyce continues its efforts in recruiting, training, and supporting science and mathematics teacher candidates. The COVID-19 pandemic presented opportunities as well as challenges for the scholarship program. As such, lessons learned during the pandemic will help the AAMU Noyce team identify the best ways to engage and prepare prospective science and mathematics teachers.

Conclusion

The shortage of science and mathematics teachers across the nation will continue if educator preparation programs are unable to produce highly qualified science and mathematics teachers who can keep up with the demands of school systems. More recently, the shortage of teachers across the United States has been described as "…a crisis exacerbated by the pandemic" (García & Weiss, 2020, para. 1.), even as the lasting effects of the pandemic on education, and specifically teacher education, has yet to be seen. The AAMU Noyce Scholarship Program is one program that has taken up the mantle of preparing the next generation of science and mathematics teachers in hopes of mitigating teacher shortages in science and mathematics that are bound to come.

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