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Advancing Teacher Training Programs at Historically Black Colleges and Universities through Technical Assistance and Federal Investments (Editor's Commentary)

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We evaluated the efficacy of a technical assistance (TA) model for increasing the competitiveness of historically Black colleges and universities (HBCUs) and other minority-serving institutions (MSI) seeking funding to expand their teacher training through the National Science Foundation (NSF)'s Robert Noyce Teacher Scholarship (Noyce) Program. The Noyce Program addresses the President's Council of Advisors on Science and Technology (PCAST) goal to support at least 100,000 new STEM middle and high school teachers. The Quality Education for Minorities (QEM) Network engaged in a series of strategies to broaden participation of Noyce to MSIs, with the long-term goal of diversifying the pipeline of new STEM teachers. Results found that of the 335 active Noyce awards, 39 were awards to MSIs. Of the 39, 23 (59%) were awarded to institutions represented in at least one QEM Noyce TA workshop. This study looks at the potential of TA models for HBCUs and MSIs to generalize across a spectrum of initiatives aimed at strengthening the nation's teacher education programs, and graduating quality STEM teachers.

Keywords: *technical assistance, minority-serving institutions, STEM teachers, teacher education*

The Noyce Program addresses the goal established by the President Obama's Council of Advisors on Science and Technology (PCAST) of ensuring over the next decade the recruitment, preparation, and support of at least 100,000 new STEM middle and high school teachers who have strong majors in STEM fields and strong content-specific pedagogical preparation (Lynch, Peters-Burton, & Ford, 2014). NSF awards over \$5 billion to institutes of higher education (IHEs), however HBCUs received only 1.7 percent of this revenue in the most recent year of data available (Toldson & Washington, 2015). The total anticipated funding for Noyce was \$56,530,000 in 2016 (The National Science Foundation, 2017). The purpose of this study was to assess the impact of technical assistance (TA) for HBCUs that are interested in securing federal sponsorship from NSF's Noyce Program, and explore the potential of TA models to generalize across a spectrum of initiatives aimed at strengthening the nation's teacher education programs, and graduating quality STEM teachers.

LITERATURE REVIEW

HBCUs and the STEM Teacher Workforce

Widening the STEM pipeline in the United States requires full participation by all races and ethnicities (Toldson & Esters, 2012). However, many students of color are underrepresented in K–12 math and science coursework, higher education STEM majors, and ultimately, the STEM industry (Toldson & Lewis, 2012). The Civil Rights Data Collection (CRDC) report, "Revealing New Truths about Our Nation's Schools," revealed deep disparities in access to high-level mathematics and science courses in the nation's largest and most diverse school districts, including New York City Public Schools, Los Angeles Unified School District, and Chicago Public Schools (United States Department of Education Office for Civil Rights, 2012). In public schools serving the fewest Latino and African American students, 82 percent offer Algebra II, 66 percent offer Physics and 55 percent offer Calculus. For schools serving the most African

American and Hispanic students, 65 percent offer Algebra II, 40 percent offer Physics, and only 29 percent offer Calculus (United States Department of Education Office for Civil Rights, 2012).

African American, Latino, Native American, and Asian American populations will collectively comprise approximately 50 percent of the total U.S. population by the mid-2040s (Sanburn, 2015). Given the rapid growth of racial/ethnic minority populations, the U.S. must place a concerted effort on increasing the K–12 preparation and college enrollment, retention, and persistence of underrepresented minority males in STEM. Relative to the composition of kindergarten through twelfth-grade (K–12) students in the United States, the current teaching force lacks racial and gender diversity (Lewis, 2006; Sealey-Ruiz, Lewis, & Toldson, 2014). Teachers comprise the largest professional occupation in the United States; accounting for the most professional employees among college-educated White women, Black women, and Black men (Lewis & Toldson, 2013).

Despite the large number of teachers relative to other professions held by college educated Black men, they represent less than 2 percent of the teaching force, of a student body that is 7 percent Black male. By comparison, White female teachers comprise 63 percent of the teaching force, of a student body that is 27 percent White female. Considering the entire student body, the United States has one White female teacher for every 15 students and one Black male teacher for every 534 students. Today, of the more than 6 million teachers in the United States, nearly 80 percent are White, 9.6 percent are Black, 7.4 percent are Hispanic, 2.3 percent are Asian, and 1.2 percent is another race. Eighty percent of all teachers are female (Lewis & Toldson, 2013).

The MSIs include: Historically Black Colleges and Universities (HBCUs); Latino-Serving Institutions (HSIs); Tribal Colleges and Universities (TCUs); and Institutions with large native Alaskan student populations or large percentages of Pacific Islanders (Asian-serving; Toldson & Esters, 2012). Results of prior research indicate that STEM majors at MSIs were significantly more likely to have better relationships with faculty and to have a higher sense of “belonging” (Toldson, 2013). MSIs have the potential to produce significant numbers of needed minority teachers. Through the submission of successful Noyce proposals, MSIs can offer strong incentives for students majoring in STEM disciplines to pursue a K–12 teaching career. Noyce support can provide these institutions with access to resources needed to support the recruitment, retention, and graduation of students committed to teaching in high-need K–12 school districts.

Opportunities and Challenges of Teacher Preparation Programs at HBCUs

According to the Institute for Higher Education Policy—IHEP’s February 2014 Issue Brief, *Minority-serving Institutions: Doing More with Less*—MSIs are an important part of the higher education landscape as institutions (Cunningham, Park, & Engle, 2014). MSIs have graduated millions of students of color, significant proportions of whom come from economically disadvantaged communities, where most have never attended college or earned a degree or credential. Yet, MSIs often lack adequate resources to put structures in place to graduate more students of color (Godreau et al., 2015). Additional funding from external sources, along with reallocation of existing funding within the institution to support strategic priorities, and targeted use of student academic and support systems, can go a long way toward helping MSIs and their students achieve success.

In 2012 and 2013, the HBCU Deans’ Think Tank met at Rutgers University to discuss the status of Black education in the United States. Additionally, a major focus of this gathering was to explore the range of potential solutions that should be considered for various stakeholders including, but not limited to, the scholarly and practitioner-based communities across both K–12 and postsecondary contexts who are invested in elevating the status of Black education in the country. More specifically, a key vision for this gathering was also to investigate the challenges as well as the opportunities that HBCUs should explore in their efforts to create a counter narrative to address the dominant narrative that too often speaks of deficits as opposed to the many assets that are critical components found to exist across the Black P–20 educational diaspora.

HBCU School and College of Education Deans at the gatherings noted several major challenges that teacher education programs face in the current educational landscape. With a primary goal of producing high-quality teachers who have a positive impact on the academic readiness of Black students, HBCU Deans categorized their challenges into four (4) major areas: (a) fiduciary challenges; (b) faculty/administrative challenges; (c) student challenges and (d) programmatic/curricular challenges (see Table 1). By adequately facing these challenges, HBCU School and College of Education Deans believe their teacher education programs will be in a unique position to continue their great legacies of teacher training to meet the needs of Black students.

Table 1

HBCU Deans' Reported Challenges

Fiduciary	Faculty/Administrative	Student	Programmatic/Curricular
State and federal funding allocations for operating budgets	Recruitment & retention of productive faculty Aging faculty	High school dropout rates for Black students in K–12	NCATE Accreditation PRAXIS Examination
Financial aid cuts	Faculty workload	Community/family challenges	Prioritizing of academic programs
State's economic downturn	Administrator mobility	Lack of college readiness	Lack of collaboration with other HBCUs and PWIs
Merging of HBCUs by state legislators	Passion for teaching, mentoring and caring relationships	Lack of student motivation	
Decreased public/alumni financial support		Student retention/time to graduation	
Lack of investment in HBCUs by State Boards of Higher Education		Lack of interest in education as a career option	

TA and Outcomes for Teacher Training Programs at HBCUs and other MSIs

TA has been used to address a variety of educational challenges in diverse learning settings. A statewide TA effort was used to help Iowa identify how well high schools prepare students for productive employment, as well as active citizenship (Iowa Department of Education, 2005). A nationwide TA effort was led by the Department of Housing and Urban Development to allow local communities more effectively use federal funding (The H.W. Wilson Company, 2005). For the rural Pacific Region, a special report was issued to the U.S. Department of Education that recommended TA for

- standards and assessment;
- teacher quality;
- literacy and language; principal leadership; and
- students, families, and communities.

The report recommended that TA be used to help stakeholders in the region identify, evaluate at and use research more effectively, work with teacher preparation and school leadership programs, maintain quality rural education, and address social and cultural issues that impede student achievement (Thielen, 2005).

The literature contains some articles that features TA being used specifically with MSIs. One study evaluated two approaches for providing TA to HBCUs to increase their participation in Health Resources and Services Administration (HRSA). The study noted HBCUs' tradition

of providing social services to minority and low-income communities, making them uniquely well-suited to participate in HRSA's programs. The two approaches evaluated for TA were to conduct workshops: (a) in a regional setting for 20 HBCUs, and (b) on-site on the campuses of 5 HBCUs. The study determined that regional workshops were the more effective approach to deliver TA to HBCUs (Institute for College Research Development and Support, 1999).

Another study of TA for HBCUs evaluated the Family and Community Violence Prevention Program, managed by the Minority Male Consortium Program, which involved 19 historically HBCUs implementing community based programs to prevent violence in families and communities. Evaluators conducted a needs assessment of the 19 HBCUs to determine TA requirements and identified three broad areas to be addressed at a TA conference: (a) continuity between the program director, evaluator, and staff regarding evaluation design and implementation; (b) improving data collection and analysis; and (c) applying models and theories of violence prevention (Policy Information Center, 1996).

The Lilly Endowment, the Mott Foundation, and the Arthur Vining Davis Foundation provided support for National Council for Accreditation of Teacher Education (NCATE) to initiate a TA network to help improve teacher preparation at HBCUs. The goal of the TA network was to stimulate the number of accredited HBCUs in the NCATE system. According to NCATE's report, fewer than 40 percent of HBCUs' colleges of education were professionally accredited in 1991. By 2000, 80 percent of these colleges of education were accredited or working toward accreditation in candidacy status. At the time of report, there were 82 HBCUs with teacher preparation programs; 50 of which became accredited and 12 in candidacy status. The report also revealed that HBCUs enroll approximately 44 percent of all African American candidates in undergraduate teacher preparation programs ("NCATE", 2001).

The Monarch Center, a federally funded TA center, was established to support MSIs in their efforts to improve their teacher preparation programs. Four guidelines directed the Center's TA approach: (a) influencing new ideas to meet unique needs; (b) understanding the impact of working in ever-changing contexts; (c) building relationships that foster learning in context; and (d) pushing participants toward reaching their goals (Bay, Lopez-Reyna, & Guillory, 2012). Another TA effort was recommended for TCUs to help them improve their financial security by providing consistent federal funding and ensuring strong institutional viability to support their teacher preparation programs (President's Board of Advisors on Tribal Colleges and Universities, 2007).

MSIs are not only the recipients of TA, but also can be the providers of TA. Grambling State University implemented a project to provide technical assistance and dissemination services to the "Fund for the Improvement of Postsecondary Education (FIPSE)" institutions and to non-FIPSE institutions requesting such services. The TA model focused on student assessment, faculty development, curriculum revision, instructional development, and program monitoring and evaluation. Grambling State University replicated and implemented the model they developed, and demonstrated efficacy with improving pass rate of graduates on the National Teacher Examination (NTE), updating curricula, increasing enrollment, and improving their image (Educational Resources Information Center, ERIC, 1989).

Summary of Literature

The review of relevant literature highlights the need for targeted support for teacher preparation programs at MSIs and the potential of TA to meet those needs. Increasing the number of STEM teachers is a national priority that has a higher level of urgency in communities of color, given the paucity of higher level math and science course at K-12 schools educating students of color. MSIs have the potential to add more teachers of color to the pipeline, however they also have unique challenges with respect to funding. TA can be a vehicle to help MSIs secure more funding and improve outcomes for their teacher preparation programs. Research studies highlight nationwide (The H.W. Wilson Company, 2005), statewide (Iowa Department of Education, 2005), and districtwide led efforts to use TA to improve educational outcomes (Thielen, 2005), which have been funded through public agencies and private foundations ("NCATE", 2001). The

literature suggests that regional workshops that include multiple MSIs are effective approaches to deliver TA to MSIs (Institute for College Research Development and Support, 1999). TA for MSIs have been effective in helping MSIs secure federal funding, improve evaluation methods, increase success in achieving accreditation, and strengthening collaboration and networking efforts.

The literature supports the importance of TA and the need for more MSIs to receive federal support from program like Noyce, however a few gaps should be addressed. First, few research studies examine the macro-level processes that precipitate funding from federal agencies to institutions of higher education, such as federal executive office priorities and acts of congress. Second, very few research studies evaluated the efficacy of TA for MSIs other than HBCUs. Finally, while the existing literature highlights the impact of TA in improving outcomes, few examine the impact of TA on helping MSIs to secure federal funding.

Conceptual Framework

The literature highlights the function and purpose of TA generally, as well as specifically for MSIs, which is to help institutions receive funding and produce positive outcomes from funded programs. The conceptual model illustrated in Figure 1 illustrates the relationship between executive-level priorities, congressional actions, federal agencies that fund institutions, and technical assistance to produce desired outcomes. As the figure shows, the desired outcomes of the project should be twofold: (a) to satisfy the short-term goals of the specific project and long-term goals relevant to macro-level priorities; and (b) to produce information that can be used by the institution, the agencies, and by executive-level officials to set new priorities.

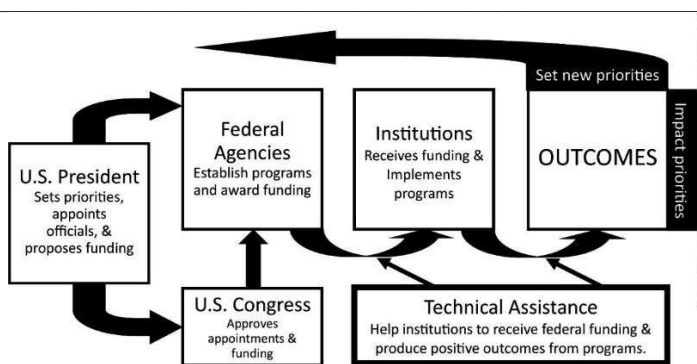


Figure 1. Conceptual model illustrating the relationship between executive-level priorities, congressional actions, federal agency funding to institutions, and technical assistance to produce desired outcomes.

Research Questions

For the present study, the objective was to evaluate whether the TA methods employed by QEM achieved the desired outcomes. Specifically, the overall research questions are:

- Did a significant number of the participating MSIs at QEM workshops submit Noyce proposals in the competition following the workshop? and
- Did a significant number of institutions that submitted Noyce proposals receive Noyce awards in the subsequent NSF Noyce program competition?

Figure 2 relabels the conceptual model with content specific to the presented study.

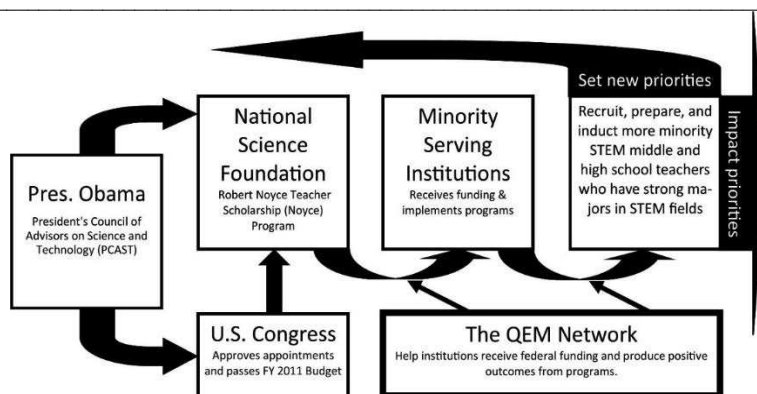


Figure 2. Experimental model illustrating the relationship between President Barack Obama's Council of Advisors on Science and Technology, Congress' the passing of the fiscal year 2011 federal budget, the National Science Foundation's Noyce Program, and QEM's technical assistance to Minority Serving Institutions to receive more funding to recruit, prepare and induct more minority STEM teachers.

METHOD

Over a three-year project period, QEM conducted five Noyce workshops. The first two workshops were held in December 2012 and December 2013. This study focused on activities during and following the three workshops in November 2014 and March 2015. QEM/Noyce workshops participants were two-person faculty teams consisting of a STEM faculty member and a teacher education faculty member from MSIs with teacher education programs that have national, regional, or state accreditation.

Proposal Development Workshop (November 14-15, 2014). Twenty-two participants from 11 minority-serving institutions attended the workshop. Key topics discussed during plenary sessions included: essential institutional elements required for the preparation and implementation of Noyce program proposals; enhancing institutional capacity to produce well-prepared STEM K-12 teachers; and building on-campus collaborations between STEM and STEM education faculty.

Follow-up Workshop (November 15, 2014). Nineteen (19) participants from nine institutions whose Noyce proposals had been declined for funding in fiscal years 2012, 2013, or 2014 attended the follow-up workshop. The workshop focused on ways to strengthen their declined Noyce proposals. Participants met with consultants one-on-one to discuss reviewer comments and receive feedback on strategies for addressing the issues raised to make their proposals more competitive.

Proposal Development Workshop (March 27-28, 2015). Participants consisted of two-person faculty teams from 9 minority-serving institutions with accredited teacher education programs. Plenary session presentations by NSF's Noyce Program Directors, QEM consultants, and the project's external evaluator focused on teacher preparation and professional development, particularly at MSIs. Breakout sessions, with NSF Program Directors and QEM consultants as facilitators, provided specific feedback on participants' project ideas.

QEM developed and administered a questionnaire for participants to complete at the end of the workshop to help assess the effectiveness of the workshop. Respondents assessed the overall workshop using a Likert scale to rate the workshop's organization, clarity of goals, usefulness of assistance offered, the potential usefulness of the materials provided, and the length of the workshop. In addition, participants were asked about specific topics for which they may need additional guidance.

QEM analyzed the responses and sent an analysis summary, along with verbatim written comments from respondents, to NSF Noyce Program officers and consultants participating in the workshop. Responses were also used to inform the consultants planning of follow-up TA.

Additionally, QEM staff made follow-up telephone calls or sent emails prior to Noyce Program deadlines to assess the progress being made by workshop participants and QEM consultants in finalizing the proposals. A follow-up impact survey was sent by email to determine the number of participating teams submitting a Noyce proposal by the September deadline. QEM periodically reviewed the NSF Noyce award database to identify teams/institutions receiving awards.

Given the recent span of the project, we were not able to measure the long-term impact of the TA. However, information on short-term effects of the workshops was collected through follow-up impact surveys and telephone interviews. Some of the summative outcome (and impact) questions related to the results and benefits produced as a consequence of the project's activities include determining

- the number of proposals submitted;
- if, and how, participants shared workshop materials with their colleagues;
- the number and nature of partnerships established with other faculty as well as with the K–12 school districts in their region; and
- how participants incorporated strategies discussed in the workshops into their proposal as well as their research and teaching.

RESULTS

Over the course of the three-year period, QEM conducted four proposal development workshops and one follow-up workshop under this award. One hundred thirty-eight (138) faculty members attended the proposal development workshops and 19 attended the follow-up workshop. Participants came from 55 distinct MSIs (43 HBCUs, 11 HSIs, and 1 TCU).

Of the eleven institutional teams that came to the November 14–15, 2014, proposal development workshop, ten teams responded to a proposal submission follow-up survey. Two (2) of the teams (20%) indicated they submitted Noyce proposals by the March deadline. Additionally, of the nine (9) teams that attended the November 15, 2014, follow-up workshop, eight (8) responded to the proposal resubmission follow-up survey. Four (4) of them (50%) submitted Noyce proposals.

All 22 workshop participants of the November 14–15, 2014, Proposal Development Workshop completed the Workshop Evaluation Questionnaire (100 percent response rate). One hundred percent of workshop participants strongly agreed or agreed with the following statements:

- I have a clearer understanding of the requirements and organizational/structural elements of both the Teacher Scholarship and Capacity Building tracks;
- I have a greater appreciation for the potential of strong internal and external collaborations in our efforts to recruit, retain, and graduate well-prepared future teachers; and
- I am more confident now about my institution's ability to prepare a competitive proposal.

November 15, 2014, Follow-up Workshop: Seventeen (17) of the 19 follow-up workshop participants completed the Workshop Evaluation Questionnaire (90 percent response rate). Ninety-four (94) percent of respondents strongly agreed or agreed that the discussion of reviewer comments helped them to better understand the parts of their proposals they can improve and that they were more confident about the competitiveness of their revised Noyce proposals.

March 27–28, 2015, Proposal Development Workshop: Seventeen (17) of 18 workshop participants completed the workshop evaluation questionnaire (94% response rate). The questionnaire solicited feedback regarding participants' overall rating for the workshop. All of the respondents (100%) gave the workshop an overall rating of "excellent" or "very good" on organization, clarity of goals, usefulness of assistance offered, potential usefulness of material provided, length, and quality of presentations. All of the respondents (100%) strongly agreed or agreed with the following statements:

- I have a clearer understanding of the requirements and organizational/structural elements of both the Scholarship and Capacity Building tracks offered through the Noyce Program;

- The discussion of common strengths and weaknesses in Noyce proposals and the feedback on our project summary will be helpful as we prepare our institution's Noyce proposal; and
- I have a better understanding of what current research says about how to strengthen teacher preparation efforts on campus.

Summary of Results

A search of NSF's awards database showed that of the 335 active Noyce awards (as of May 6, 2016), 39 were awards to MSIs (includes HBCUs, TCUs, and HSIs with 40% or higher minority enrollment). Of the 39, 23 (59%) were awarded to institutions represented in at least one QEM Noyce workshop. Twenty (20) of the Noyce PIs/co-PIs from the current list of MSI grantees attended a QEM Noyce proposal development workshop. The funded proposals, totaling \$20,859,360 are listed in Table 2.

Table 2

NSF Awards to 23 Minority-Serving Institution Teams Represented at QEM Workshops that have Received Noyce Funding

Project Title	Institution	Award Amount
Building CAU Capacity to Prepare STEM Teachers for High Need K–12 School Districts	Clark Atlanta University	\$295,911
Science, Technology, Engineering, and Mathematics for English Language Learners (STEMELL) Program at Lehman College	CUNY Herbert H Lehman College	\$459,295
Noyce Explorers, Scholars, Teachers (NEST): Fostering the Creation of Exceptional Mathematics and Technology Teachers in New York City	CUNY New York City College of Technology	\$774,397
Delaware State University Scholarships for Teachers in Mathematics and Science	Delaware State University	\$1,199,999
MaSTEC TF/MTF Capacity Building Project	Florida Memorial University	\$293,421
Fort Berthold Bridge to Master of Science in Science Education (FBB-MSSE) Project	Fort Berthold Community College	\$150,000
Project SEED (STEM Educators Expansion Directive) for Candidates in Chemistry and Environmental Science	Hostos Community College	\$299,079
Howard University Science Teacher Certification Program (HU-STCP)	Howard University	\$331,888
Recruiting, Developing, and Retaining Tomorrow's Outstanding STEM Teachers in Oklahoma	Langston University	\$1,449,955
Morehouse College Noyce Pre-Service STEM Teacher Initiative	Morehouse College	\$1,199,583
Morgan State University Noyce Capacity Building Project	Morgan State University	\$297,983
North Carolina A&T Teach STEM Scholars	North Carolina Agricultural & Technical State University	\$1,191,780
Preparing Future Mathematics and Science Teachers through the Noyce Scholarship Program at Savannah State University and Savannah Technical College	Savannah State University	\$1,421,715
Capacity Building: Spelman's STEM Teacher Education Pipeline (SSTEP)	Spelman College	\$300,000
Project Tiger Teach (PTT)	Tennessee State University	\$1,189,490
Robert Noyce Mathematics Teacher Scholarship Program	Texas A&M International University	\$1,199,971
Phase I Robert Noyce Teacher Scholarship Program: Future STEM Teachers in South Texas (F(ST)2)	Texas A&M University-Kingsville	\$1,199,731

Table 2 continues

Building Capacity for Preparing Teacher-Engineers for 21st Century Engineering	University of Texas at El Paso	\$287,703
Noyce Scholarship Support for Community College Transfer Students	University of Texas at San Antonio	\$1,384,705
Project Firebirds Reinventing STEM Teaching (Project FRST)	University of the District of Columbia	\$2,146,100
Central Virginia Undergraduate Mathematics Scholarship Program (CVUMSP)	Virginia State University	\$1,449,960
Noyce/MSTI Teacher Fellows Master Teacher Fellows Program	Xavier University of Louisiana	\$1,137,496
STEM Educational Engagement: Engaging Biology, Chemistry, Mathematics, Physics and Computer Science Majors in Becoming Teaching Professionals at the Kindergarten–12 Level	Xavier University of Louisiana	\$1,199,198
Total		\$20,859,360

Proposal development workshops. The analysis indicated that participants experienced little difficulty with finding a STEM or STEM education partner. Additionally, the analysis indicated that participants found the review and feedback on their project summaries very beneficial. At the workshop, several participants had one-on-one discussions with either an NSF Program Director or a QEM Consultant, which they reported as being informative.

Follow-up workshops. The participants were very eager to hear feedback on their proposals during the one-on-one meetings. Overall, the participants provided positive comments including: “Since we had a small group, it was much easier to get specific feedback rather than receive general overall comments,” “The experiences were very exciting and motivating. It will help us in resubmitting the proposal and be successful,” and “Great suggestions regarding specific weak areas of the proposal.”

Overall, participants wanted more training about other topics relative to the Robert Noyce Scholarship Program. Preparing a budget and writing a successful evaluation plan appeared as recurring themes. This feedback was incorporated into planning for follow-up workshops. Additionally, the participants provided recommendations on enhancing the workshop. These recommendations included having the opportunity to review funded proposals and hearing about the experiences of Noyce scholars. Participants referenced that learning about the impact of Noyce support on Noyce scholars may motivate them to submit competitive proposals.

DISCUSSION

This study evaluated the efficacy of QEM’s TA model for increasing the competitiveness of MSIs seeking funding to expand their teacher training through the NSF Noyce Program. Noyce is one of over 300 funding opportunities offered by NSF in which institutions of higher education, including MSIs, are encouraged to apply. MSIs in general, and HBCUs specifically, are underrepresented in most NSF funding opportunities.

MSIs being underrepresented in the Noyce Program is particularly problematic, given the purpose and scope of ensuring over the next decade the recruitment, preparation, and support of at least 100,000 new STEM middle and high school teachers. African Americans, Latinos, Native Americans, and some Asian ethnicities are underrepresented in STEM fields. In addition, the U.S. Department of Education found that high schools with the largest percentage of Black and Latino students were the most likely to omit important math and science courses.

In our review of the literature, we found evidence that HBCUs are important incubators of STEM teachers of color. However, fiduciary, faculty/administrative, student, and programmatic/curricular challenges can undermine HBCUs best efforts to recruit, retain, and prepare teachers. Although the Noyce Program is a vehicle for strengthening teacher preparations programs, many of these challenges also reduce MSIs competitiveness when submitting Noyce proposals. TA can help MSIs secure more funding and improve outcomes for their teacher preparation programs through Noyce.

QEM's TA model included preproposal review, workshops, and follow-up activities. This study investigated whether a significant number of the participating MSIs at QEM workshops submitted Noyce proposals in the competition following the workshop; and if a significant number of institutions that submitted Noyce proposals receive Noyce awards in the subsequent NSF Noyce Program competition.

Results of this study indicated that a cross-section of MSIs participated in QEM's Noyce workshops and the participants responded favorably to post-workshop survey items. A search of NSF's awards database showed that 39 Noyce awards went to MSIs and of the 39, 23 (59%) were awarded to institutions represented in at least one QEM Noyce workshop. The proposals funded to MSIs who participated in the QEM workshop total \$20,859,360.

This study found evidence that QEM's TA made an impact on MSIs ability to secure funding to improve their teacher preparation programs through Noyce. However, several limitations should be considered within the context of the findings. First, since Noyce is a new initiative, researchers were not able to gather good baseline data to ascertain MSIs level of involvement in the program, prior to QEM interventions. Nevertheless, researchers could determine that MSIs success rate in the Noyce Program exceeded similar NSF funding opportunities. Also, this study used survey data and observations of secondary data to determine the impact of QEM's interventions. A more controlled approach, which also survey MSI principal investigators that did not participate in QEM would have yielded more robust findings.

Beyond the research, this study demonstrates what is possible when thoughtful executive actions lead to innovative strategic priorities and funding opportunities for MSI, and the importance of TA to facilitate equitable funding and diverse outcomes. Future research in this area should further examine interconnections of the macro-level processes that precipitate funding from federal agencies to institutions of higher education, such as federal executive office priorities and acts of Congress. Future research can also examine the efficacy of TA for MSIs using more controlled research methods. Finally, perhaps the most compelling aspect of this inquiry is related to individual projects that NSF funded. The titles of the awards, listed in Table 2, represent MSI innovations in STEM teacher preparation that have the potential to transform K-12 education in the United States. The young lives that MSI-trained teachers can touch in school districts across the most deserving districts is an outcome that is worth replicating in other federal programs and private foundations, and a national imperative that merits deeper analysis.

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