

Increasing the Diversity of Teachers in Mathematics and Science Partnerships

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This study examines teacher diversity in a federally-funded mathematics and science partnership program. Each of the partnerships in the program provided preservice and/or inservice education for teachers in mathematics, science, or both. Researchers used qualitative and quantitative methods to examine the effect of strategies implemented by the partnerships to influence teacher diversity and the relationship of strategy implementation to changes in teacher diversity. There were no significant changes in teacher diversity for the program overall; however, there were significant changes in individual partnerships. Researchers identified categories of strategies for increasing teacher diversity among the partnerships and found that some partnerships employed numerous strategies in a comprehensive manner. While there were no significant relationships between strategies implemented and changes in teacher diversity, the findings suggest the potential for relationships to be revealed with further longitudinal study. Particularly useful among these findings is the identification of a typology of specific strategies known to influence changes in the diversity of mathematics and science teachers.

Mathematics and Science Partnership Initiatives

The performance of American students on international comparisons (e.g., TIMSS) of academic achievement has brought focus to the teaching and learning opportunities students experience in the nation's schools (Stigler & Hiebert, 1999; U.S. Department of Education, 2007). This focus has been particularly intense on the teaching and learning of mathematics and science because of their impact on a variety of fields (engineering, technology, medicine, space exploration) (National Academy of Sciences, 2007; U.S. Department of Education, 2002). In 1999 the Glenn Commission investigated the quality of mathematics and science teaching in the country and examined ways to increase the number and quality of mathematics and science teachers. The resulting report, *Before It's Too Late* (National Commission on Mathematics and Science Teaching for the 21st Century, 2000), highlighted the importance of quality mathematics and science education in preparing students to be competitive in an increasingly global society. High quality teachers and teaching do matter.

Ensuring teacher quality includes improving the characteristics of individual teachers and the characteristics of the teacher population. For example, improving a teacher's subject-specific knowledge in a discipline such as mathematics or science refers to the quality of *individual teachers*. Teacher turnover and a diverse teaching force refer to the quality of the *teacher population*, as a whole. In recent years, national initiatives have provided support for improving individual and population characteristics of the mathematics and science teaching force.

One current national initiative in mathematics and science is the National Science Foundation's Math and Science Partnership Program (NSF MSP). "MSP serves students and educators by emphasizing strong partnerships that tackle local needs and build grassroots support to increase the number, quality and diversity of mathematics and science teachers, especially in underserved areas" (National Science Foundation, 2007, p. 1). The present study was designed to examine, specifically, the efforts of NSF partnerships to increase the diversity of mathematics and science teachers. In particular, we sought to identify strategies supported through the Program to increase the diversity of teachers in partnership activities, and to determine changes in teacher diversity that resulted from those strategies, both in partnership activities and in the participating districts where partnerships operated. Promising findings, when employed on a larger scale, could have the potential to increase the diversity of mathematics and science teachers in the U.S.

In its broadest sense, the term *teacher diversity* may include characteristics such as race, ethnicity, gender, age, experience, and disability. Because the partnerships in this program focused their efforts to increase teacher diversity on race and ethnicity, our analyses were confined to these characteristics. In the present study, teacher diversity was measured by the proportion of minority teachers participating in NSF MSP partnership activities. One focus of our inquiry was to identify partnerships where

teacher diversity changed over a two-year period. A second focus was to examine whether the implementation of specific strategies produced significant changes in the diversity of the partnerships' teacher participants.

Research on Teacher Diversity

The issues that surround teacher diversity described in the literature include: the demographic composition of the teaching force, the importance of having a diverse teaching force, barriers to increasing teacher diversity, and methods and strategies for improving teacher diversity.

The Demographic Composition of the Teaching Force

The student population in America's schools is increasing in diversity. However, the diversity of the country's teacher population has not followed this trend (Dandy, 1998; Newby, Swift, & Newby, 2000; Shen, Wegenke, & Cooley, 2003; Torres, Santos, Peck, & Cortes, 2004). Data from a nationally representative sample of public school teachers indicate that schools made slight increases in the racial and ethnic diversity of the teaching force in the years between 1987-1988 and 1999-2000; however, during this time, the number of male teachers decreased (Shen et al., 2003). Although there appear to be greater improvements in the numbers of diverse teachers in the new teacher population, retention of new teachers could prevent these gains from having a significant impact on the teaching population over time (Darling-Hammond, Dilworth, & Bullmaster, 1996; Kirby, Berends & Naftel, 1999; Shen et al., 2003).

In stark contrast to a student population that is rapidly becoming more culturally and linguistically diverse, many researchers argue that the teaching force is not keeping pace with the diversity of the student population (Branch, 2001; Ladson-Billings, 2005; Tyler, Yzquierdo, Lopezo-Reyna, & Flippin, 2004). Tyler et al. (2004) report that, "As recently as 1996, over 40% of the nation's schools had no teachers from underrepresented groups on their faculties" (p. 23).

The Importance of a Diverse Teaching Force

There are several arguments on the importance of increasing the diversity of the teaching force. One perspective is that a culturally diverse and culturally responsive learning community is necessary in order to reduce gaps in achievement among groups from different backgrounds (Darling-Hammond et al., 1996). Other arguments focus on the need and importance of role models and teachers who can relate to students' backgrounds and experiences (Branch, 2001; Loving & Marshall, 1997; Riley, 1998). Teachers from underrepresented ethnic groups can serve as bridges between schools, families, and communities (Ladson-Billings, 2005).

Further, there are pedagogical benefits of a diverse teaching force. Teachers of color

may have advantages in successfully building relationships and relating to students from minority groups because of their personal experiences and may be able to use those experiences in their practice to connect with learners (Clewell & Villegas, 1998; Darling-Hammond et al., 1996). In a review of literature, Torres et al. (2004) found that there were a limited number of large-scale studies on the relationship between same-race teachers and minority (compared with general) student achievement. Results presented in the available literature indicate mixed evidence of a direct correlation between teacher diversity and student academic performance.

Barriers to Increasing Teacher Diversity

The stages along the path to America's mathematics and science teaching force are often referred to as the teacher "pipeline." Stages in the teacher pipeline include high school graduation, matriculation to an institution of higher education (IHE), achievement of a college degree, fulfillment of teacher certification requirements, and induction into teaching (Torres et al., 2004). Individuals interested in pursuing mathematics and science teaching careers can do so at any of these stages. Alternative certification programs allow individuals with college degrees to be inducted into teaching by working to fulfill teacher certification requirements. Professional development courses allow current teachers to fulfill certification requirements that qualify them to teach mathematics and science without having to be re-inducted into teaching. However, there are barriers that impact the diversity of the teaching force at all of these stages.

The available research on barriers to increasing teacher diversity shows several areas of the pipeline where there are gaps. Some of these gaps include too few minority students prepared for post-secondary education as a result of inadequate K-12 education (Gordon, 2005); limited career counseling provided to minority students (Quiocho & Rios, 2000); and financial and economic considerations (Clewell & Villegas, 1998). Another barrier cited is competency testing (either as part of the requirements for a teacher education program or for licensure) for which research indicates higher failure rates for minority students than for White students (Bennett, McWhorter, & Kuykendall, 2006; Darling-Hammond et al., 1996; Kirby et al., 1999; Latham, Gitomer & Zimonek, 1999). As a result of these and other barriers, smaller numbers of minority students enroll in and complete teacher education programs.

Barriers occur at other stages in the teacher pipeline as well. Once teachers are admitted to teacher education programs, they must complete certification requirements and accept a teaching position to impact the teaching force. Minority students who enroll in college are vulnerable to attrition (Nuby & Doebler, 2000; Tyler et al. 2004). Students of color often feel marginalized and socially isolated at majority white institutions, and are taught a curriculum that is not culturally relevant (Quiocho & Rios, 2000; Tyler et al., 2004; Villegas & Lucas, 2004). Villegas and Lucas (2004) report that multicultural education courses generally offer little in the way of preparing

minorities to use their strengths in the classroom, focusing instead on “strategies for helping White preservice teachers to see student diversity as a positive situation” (p. 90).

Teacher turnover is an additional barrier to diversity efforts. The attrition rate is greater for minority inservice teachers than for White teachers (Villegas & Lucas, 2004). One possible reason is that minority teachers are more likely to be placed in low-performing, high-poverty urban schools. In addition to the challenges associated with teaching in urban schools, teachers in these schools receive less support and have less autonomy. Minority teachers also experience unpleasant conditions in non-urban schools with a shortage of minority teachers, such as isolation and increased scrutiny (Mabokela & Madsen, 2003; Quiocho & Rios, 2000).

Methods and Strategies for Improving Teacher Diversity

While there are barriers to increasing the diversity of the mathematics and science teaching force, research has shown several strategies that can be effective in overcoming these obstacles. These strategies focus on targeting efforts for minority groups and focusing on gaps in the teacher pipeline, and include: a) targeting high-minority populations for inclusion, b) recruiting, c) supporting licensure, d) induction into teaching, and e) retention of diverse teachers.

Targeting high-minority populations for inclusion. One of the first methods for increasing the diversity of the mathematics and science teaching force is identifying diverse individuals for inclusion at various stages along the teacher pipeline, including recruiting, licensure, induction and retention. Middle and high schools with high-minority populations must be engaged in rigorous academic activity that prepares students for college matriculation, and tutoring opportunities that expose students to careers in teaching. The nation’s colleges and universities play an important role at the stage of recruiting and licensure. Enhancing teacher education programs at minority serving institutions, such as historically black colleges and universities, and providing additional resources for recruiting diverse students through minority organizations on majority White campuses can be an effective means of reaching additional students of color. Accomplishing the goal of diversifying the mathematics and science teaching force requires coordinated, systematic, and comprehensive efforts and resources aimed at high-minority populations.

Recruiting. One recommended strategy is recruiting activities at various stages along the teacher pipeline. Recruiting strategies might include targeting students in middle school and high school, exposing college students to careers in education, and recruiting adult career changers. Early identification programs expose qualified high school or middle school students to teaching through cadet or tutoring programs. These efforts raise awareness of and interest in teaching as a profession and support and encourage students to prepare for and enter the profession (Loving & Marshall, 1997; Newby et al., 2000). Research shows that college students are inspired by their

work as tutors, and that opportunities to tutor high school or fellow college students often sparks their interest in teaching (Quiocho & Rios, 2000). Programs designed to recruit paraprofessionals to become teachers have also been found to play a role in diversifying the teaching force (Haselkorn & Fideler, 1996). There is evidence that these programs have higher retention rates than many traditional teacher education programs (Dandy, 1998; Haselkorn & Fideler, 1996).

Supporting licensure. The research reveals three types of support that are successful for retaining minorities during the licensure process in teacher certification programs: academic, financial, and social. Academic support is necessary to overcome obstacles created by ineffective K-12 education and testing requirements, both of which negatively impact minority teacher candidates disproportionately (Bennett et al., 2006; Quiocho & Rios, 2000). Academic support takes the form of tutoring for coursework and/or in preparation for teacher-certification tests. Providing financial assistance, including grants and scholarships, is another strategy considered essential for supporting minorities in teacher education programs (Quiocho & Rios, 2000; Tyler et al., 2004). Minority preservice teachers, particularly those enrolled in predominantly white institutions, also cite interpersonal support in the form of mentoring or cohort structures as an important component of effective teacher education programs (Holloway, 2002; Nuby & Doebler, 2000; Torres et al., 2004; Tyler et al., 2004). Delpit (2006) notes that minority teachers who have negative experiences in their preservice education, may choose not to enter teaching, despite being certified. These individuals equate the lack of academic and social support with the field of education and decide not to become a member of the teaching profession.

An additional form of support during licensure is through alternative certification programs which allow candidates to enter the teaching profession by alternative means. Although there is evidence that alternative certification programs serve as a source for recruiting minority teachers (Kirby et al., 1999; Shen, 1998), conclusions are mixed. Findings indicate that alternatively certified teachers are more likely to be female and teaching in elementary schools and express less desire to continue teaching in the long term (Shen, 1998). Therefore, while alternative certification might contribute to diversity in terms of race and ethnicity, it does not in terms of gender (Shen, 1998). While alternatively certified teachers are more likely to teach mathematics and science, alternatively certified minority teachers are less likely to hold a bachelor's degree in mathematics, science, or engineering than alternatively certified White teachers (Shen, 1998).

Induction into teaching. A variety of methods of induction have been instituted to support the transition into the beginning years of teaching. A successful strategy employed during the induction phase is mentoring (Holloway, 2002). Souto-Manning and Dice (2007) describe a mentoring initiative in which two university professors partnered with a Latina first-year elementary school teacher to conduct action research and develop reflective teaching for all three. Souto-Manning and Dice described the partnership as invaluable to the Latina teacher because the teacher reported that her

team members helped her to integrate her intuitive respect for diversity with state and national standards to meet the needs of her students. Souto-Manning and Dice reported that oftentimes minority teachers are not taught how to use their strengths in teaching and may become frustrated or give in to pressures to conform to non-minority cultural norms and expectations.

Retention of diverse teachers. One way for educators and policymakers to support the diversification of the mathematics and science teaching force is to recognize the importance of retaining inservice teachers of color. Research has shown over time that about 15% of America's three million teachers leave their schools or leave teaching each year, and by the end of five years of teaching, 46% of teachers leave the teaching profession (Ingersoll, 2006a, 2006b). According to Grant and Gillette (2006), the percentage of the teaching force that leaves the profession is greater than that of any other professional workforce. Schools searching for mathematics and science teachers already know how difficult it is to find replacements, with turnover rates for mathematics and science teachers at about 16% and 15%, respectively, compared to 9% for social studies and 12% for English (Ingersoll, 2006b).

A closer examination of mathematics and science teacher turnover shows reasons for leaving teaching include pursuing other jobs (28%) and retiring (11%). While 40% of mathematics and science teachers leave teaching because of dissatisfaction, only 29% of all teachers leave because of dissatisfaction. For mathematics and science teachers, dissatisfaction frequently includes poor salary, poor administrative support, poor student motivation, and student discipline problems (Elfers, Plecki, & Knapp, 2006; Ingersoll, 2006a).

Personal reasons, such as departures for pregnancy, child rearing, health problems and family moves are far more often given as reasons for turnover than are either retirement or staffing actions (38 percent for all teachers and 44 percent for mathematics/science). (Ingersoll, 2006b, p.204)

Therefore, retention strategies for mathematics and science teachers must include efforts to improve conditions such as school climate, professional growth opportunities, and access to resources. Research shows that minority teachers are more likely to remain in schools that demonstrate respect for diversity (Jorgenson, 2001).

Summary of the Issue

Educators agree that there is a need to increase the diversity of the nation's mathematics and science teaching force, and that targeted strategies can be effective in addressing this need. The causes of low numbers of minority mathematics and science teachers include substandard K-12 preparation for minority populations, low minority enrollment in teacher credentialing programs, barriers to certification of minority preservice teachers, minorities' decision not to join the teaching force after achieving certification, and attrition of novice and mid-career minority teachers. Studies reveal that minorities are more likely to pursue teaching career tracks, join the teaching force,

and remain in the classroom when strategies aimed at minorities demonstrate that diversity is valued.

In the present analysis, we anticipated that a variety of efforts were being undertaken by the NSF partnerships to increase teacher diversity. This assumption was based on Moyer-Packenham, Bolyard, Oh, Kridler, and Salkind's (2006) finding that about half of the partnerships in the program reported *increasing teacher diversity* as a goal, and identified *recruiting* minority teachers and implementing *social support structures* for minority teachers as elements in their partnership activities. We were particularly interested in efforts to bring about changes in numbers of minority teacher participants in the partnerships, with the goal that identifying these effective efforts might be useful on a larger scale.

The following research questions guided this analysis: a) What strategies are being implemented by the partnerships to influence teacher diversity? b) How are diversity strategies implemented within partnerships in terms of length of time, number of strategies, and comprehensiveness? c) How is teacher diversity among the partnerships changing from year to year? d) Does the number of strategies employed vary by baseline teacher demographics (high-minority, low-minority)? e) Are partnerships offering the resources of the MSP Program to schools and/or districts with high-minority populations? f) Are the changes in teacher diversity obscured by reporting trends? and g) Are changes in teacher diversity related to strategies being implemented to influence those changes?

Methods

The present evaluation used qualitative and quantitative methods to examine archival data on teacher diversity from the National Science Foundation's Math and Science Partnership (NSF MSP) Program. Qualitative and quantitative data were gathered from 48 NSF MSP partnerships. The qualitative data were obtained from secondary sources and included Annual and Evaluation Reports prepared by representatives of the partnerships. The quantitative data were extracted from archival information gathered in the NSF Management Information System (MIS). MIS surveys requested that the Project Investigator (PI) (or a representative) submit specific demographic information on all teacher participants in the MSP project activities.

Qualitative Measures

The qualitative data were the partnerships' Annual and Evaluation Reports submitted to the NSF in the form of written narratives and prepared by the Project Investigator or another representative of the MSP. Because the partnerships were in the midst of five-year awards during our analyses, they had submitted one, two, or three reports. Therefore, the number of documents available from each partnership varied. Researchers analyzed a total of 90 reports written by the 48 partnerships, with

the partnership as the unit of analysis. The analytic method used with the qualitative data was a document analysis of secondary sources (Miles & Huberman, 1994; Patton, 2002). Because of the complex nature of the reports, the research team used hand coding (rather than electronic software) to better preserve the context and content of the information contained in the reports. These data sources were used to identify diversity strategies used by the partnerships.

During the first phase of the analysis, researchers reviewed the written reports of the 48 partnerships for information on teacher diversity. The written reports provided a variety of descriptions of teacher diversity which were the impetus for designing a framework to categorize actionable strategies used by partnerships. During the second phase of the analysis, researchers reread the documents with a specific focus on identifying partnerships that described *actionable* strategies. This phase was guided by the question: What are the strategies that directly describe an *action* being taken by the partnership to influence teacher diversity? This targeted reading resulted in the identification of a framework of major categories of actionable strategies. Subsequent readings winnowed out rhetoric that went beyond the mere description of teacher diversity strategies to the identification of specific actions being carried out by the partnerships.

After determining the major categories of diversity strategies in use among the partnerships, we further determined three dimensions of strategy implementation to identify *high intensity partnerships*. The first dimension was the *length of time* that the strategies were implemented within the partnership. This was determined by identifying the number of years in which diversity strategies were employed. The second dimension was the *number of strategies* that were used over the course of the entire partnership. In some cases, this included the use of multiple strategies within the same year. The third dimension was the *comprehensiveness of the strategies*, defined as strategies that focused on various stages along the teacher pipeline. To provide illustrative insights into the partnerships' work, we used the following selection criteria to identify one exemplary partnership to profile: a) the partnership's demographic data showed an increase in teacher diversity, b) it was a high intensity partnership, and c) it was a high-minority population partnership, in terms of its participating teachers.

Quantitative Measures

The quantitative data were excel files in numerical form extracted from survey items reported in the NSF MIS. Thirty-four partnerships completed the first round of MIS surveys (this MIS administration was referred to as Wave I) and 48 partnerships completed the second round (this MIS administration was referred to as Wave II). Wave II data included the original 34 partnerships and an additional 14 partnerships from subsequent awards in the MSP Program.

We utilized data from three items in two MIS survey tools: *Annual K-12 District Survey for Comprehensive and Targeted MSPs* (for data on inservice teachers) and

Annual Institution of Higher Education (IHE) Survey (for data on preservice teachers). The first inservice teacher item reported demographic information on the *total number of teachers* in participating schools during the given school year, and the second item reported demographic information on the *participating teachers* that actively participated in the MSP during the given school year. Survey items did not request cumulative information on teachers, but rather the items asked partnerships to report teacher information for the given year only. The MIS definition for “participating teachers” was defined on the MIS tool as: “Those teachers who have participated in 30 or more hours of MSP-sponsored activities during a given school year” (Silverstein, Bell, Frechtling, & Miyaoka, 2005, p. 11). The preservice teacher survey item reported demographic information on the participants in each preservice university course or seminar offered during a given school year. Quantitative data were used to identify changes in the diversity of teachers in each partnership.

In the first quantitative analysis, we identified partnerships with teacher demographic data from both administrations of the MIS tools (Wave I and Wave II) to examine changes in teacher diversity between the two administrations. There were 34 partnerships providing data for the Wave I and Wave II administrations. Using these 34 partnerships, the first metric examined the *representation of minority groups* among teachers participating in the partnerships. High representation was defined as minority teachers composing 25% or greater of the participating teachers in the partnership, based on the U.S. population in general, and based on current teacher population demographics (U.S. Census Bureau, 2005). We compiled district demographic data for participating districts and participant demographic data for partnerships. Therefore, we were able to compare the representation of minorities among teachers *eligible* to participate in MSP activities and the representation of minorities among actual MSP participants.

The second metric examined *changes in teacher diversity*. Changes were defined as increases or decreases in the proportion of minority teachers participating in partnership activities, whether it was individual teacher or school participation that influenced those changes. Because of the limitations in the reported data, demographic data were compiled and analyzed in three categories – minority (Nonwhite and individuals of more than one race), White, and race not reported. The number of teachers in each category was computed as a proportion of all participants. This analysis was conducted at the partnership level. After examining changes in teacher diversity, we examined the relationship of strategy implementation with those changes by comparing partnerships that implemented strategies with those partnerships that did not implement strategies.

Results

The results that follow are presented in three major sections. The first section provides descriptive information on categories of diversity strategies implemented by the partnerships and highlights high intensity partnerships. The second section presents

statistical and numerical changes in diversity in the MSP Program overall. The third section examines relationships between strategy implementation and changes in the diversity of participating teachers.

Categories of Teacher Diversity Strategies

The first research question asked: What strategies are being implemented by the partnerships to influence teacher diversity? Of the original 48 partnerships, 42 wrote about teacher diversity, but only 21 provided descriptive information on actionable diversity strategies in use by the partnerships. The others included general statements such as, “teacher diversity is one of the project’s key features” or “increasing diversity is an important goal.” Among the 21 partnerships we identified the following five main categories of diversity strategies in their order of frequency: a) recruitment, b) supporting licensure, c) induction into teaching, d) retention of diverse teachers, and e) targeting high-minority populations for inclusion. These categories, with actionable strategies and specific examples, are presented in Table 1 and described below.

Recruitment. The most common category of strategies was recruitment. This category focused on recruiting diverse high school or college students and partnering with existing organizations. Partnerships included minority faculty as members of the recruiting teams to help recruit minority students. Other recruitment practices included collaborating with staff at community colleges, creating tutoring positions that could be used as a recruiting tool for minority STEM majors to pique their interest in mathematics and science teaching careers, exposing high school and college students to careers in teaching, and designing recruitment materials to target diverse populations.

Supporting licensure. The second most common category of strategies was supporting licensure aimed at individuals already enrolled in teacher education programs. Strategies in this category were designed to help preservice teachers overcome academic or financial obstacles often reported in research as hindering the certification of diverse teaching candidates (Clewell & Villegas, 1998; Darling-Hammond et al., 1996; Kirby et al., 1999; Latham et al., 1999; Torres et al., 2004). Partnerships provided tutoring, either in coursework or as preparation for certification exams. They created support networks for preservice teachers by partnering students with mentors or placing students in cohorts. Partnerships also designed financial supports that assisted with obtaining financial aid for college or offered scholarships to students of color.

Induction into teaching. A third category of strategies supported minority teachers during their first years of induction into teaching. One strategy employed was to provide mentors to new minority mathematics and science teachers. One partnership reported an effort to train minorities and women as mentors and coaches in mathematics to support minority inductees. One partnership reported, “It is not clear that an eye towards increased diversity within the scholarship program and a mentoring program

Table 1
Categories of Diversity Strategies Implemented by Partnerships

<i>Categories</i>	<i>General Strategies</i>	<i>Specific Examples</i>
Recruiting	<p>Target community college students</p> <p>Partner with minority organizations and/or minority leaders</p> <p>Target high school and middle school students</p> <p>Expose college students to careers in teaching</p> <p>Design recruitment materials for underrepresented minorities</p>	<p>Align university curriculum and local community college curriculum; Recruit from area community colleges; Collaborate with staff at community colleges</p> <p>Partner with minority student STEM organizations; Include minority faculty members; Partner with existing minority-teacher recruitment programs</p> <p>Connect with area high school guidance counselors; Partner with high school future teacher organizations; Expose high school students to teaching careers</p> <p>Send college students to diverse public schools to spark interest in teaching; Use high performing and diverse STEM students as college level tutors; Sponsor/develop workshops or conferences on teaching</p> <p>Create recruitment brochures with pictures of diverse future teachers</p>
Supporting Licensure	<p>Individualize education program for participating students</p> <p>Provide social support structures</p> <p>Provide academic support</p> <p>Provide financial aid</p> <p>Provide positive experiences for pre-service teachers</p>	<p>Pair education students with mentors; Train faculty on how to motivate and support students; Solicit feedback from minority student participants</p> <p>Place student interns together in cohorts at cluster schools; Establish (future) teacher support groups at high minority colleges and universities</p> <p>Tutor students in math; Prepare students for certification exams, i.e. PRAXIS, CBEST</p> <p>Establish minority scholarship funds; Offer scholarships or tuition waivers; Assist minorities in applying for financial aid</p> <p>Place pre-service teachers in schools that will likely have openings; Employ teacher leaders as mentors/coaches for practicum students and student teachers</p>

Table 1 (continued)

<i>Categories</i>	<i>General Strategies</i>	<i>Specific Examples</i>
Induction	Provide high quality mentoring to new teachers	Train teachers as mentors
	Provide minority role models to serve as mentors, coaches	Train minorities and women who can provide support to minority inductees
Retention	Provide support for K-12 teachers	Use STEM students as teacher assistants
	Create opportunities for teachers to advance	Train minority teachers to be mentors/coaches/ teacher leaders; Link to or create continuing education/graduate programs in the area
	Provide professional development to urban schools/districts	
	Provide professional development to high minority schools/ districts	
Inclusion of High Minority Populations	Partner high-risk and low-risk schools together	

for induction teachers will yield significant results in these areas.” This quote shows that, although partnerships were aware of strategies described in the teacher diversity research literature, it was still a challenge for them to implement these strategies effectively.

Retention of diverse teachers. A fourth category of strategies focused on retaining veteran mathematics and science teachers from diverse racial and ethnic groups. One strategy employed was to create pathways for teachers’ professional growth. Two of these pathways included opportunities to obtain advanced degrees in mathematics and/or science education and training to become a teacher leader. Teacher leadership provided opportunities for diverse teachers to interact with other leaders at the district, state or national levels. Teacher leaders also received support from college STEM students volunteering in their classrooms. By creating professional growth opportunities, offering professional development in mathematics and science, and providing other benefits associated with participation in an MSP, partnerships improved working conditions in schools and districts as recommended in the teacher diversity literature.

Targeting high-minority populations for inclusion. The final category of strategies included actions for targeting high minority teacher populations in high minority schools/districts. Some partnerships recruited high minority schools and/or districts to be involved in their activities. This was an actionable strategy that included additional minority teachers in MSP activities and gave minority teachers access to MSP resources. Some demographic changes within partnerships were influenced by adding high minority schools to the partnership. When the schools added to the partnership included high minority student populations, their inclusion often increased the diversity of the mathematics and science teachers. This was true because schools with high minority student populations often had a more diverse teaching force than schools with low minority enrollment. This strategy was linked to minority teacher retention because the introduction of MSP resources into high minority school settings had the potential to increase job satisfaction by improving access to resources and opportunities for teachers’ professional growth in underserved schools.

High Intensity Partnerships

The second research question asked: How are diversity strategies implemented within partnerships in terms of length of time, number of strategies, and comprehensiveness? In terms of the *length of time* that partnerships had implemented diversity strategies, there was no conclusive evidence from the reports on the length of the implementation of various strategies. For example, when partnerships indicated a diversity strategy in two separate reports (e.g., Year 1 and Year 2), researchers could not determine if the strategy was ongoing across the two years, or if the strategy was planned in the first year and implemented in the second year.

In terms of the *number of strategies*, the 21 partnerships that provided descriptive

information on actionable diversity strategies implemented an average of about three strategies per partnership, with a range from one to seven strategies. (See Figure 1.) Five partnerships addressed diversity using only one strategy, while 16 implemented multiple strategies. The six partnerships that implemented four to seven strategies were viewed as high intensity partnerships because they employed multiple strategies to impact teacher diversity. For example, some partnerships employed a collection of recruitment strategies aimed at community college students, high school students, and university students not currently enrolled in teacher education programs to increase the scope and intensity of their recruitment efforts. Other partnerships coordinated strategies for minority students enrolled in licensure programs to provide a combination of academic, financial, and social supports. These partnerships supported minority students enrolled in teacher education programs by creating support groups or cohorts for students, providing financial aid at the university, pairing minority students with mentors, and offering tutoring services to support students' performance in licensure courses.

In terms of the *comprehensiveness of the strategies*, partnerships provided support structures for minority teachers at various stages along the teacher pipeline from high school, through teacher training, and into the teaching profession. The most common category implemented by partnerships was recruitment for candidates not yet enrolled in a licensure program. In addition to recruitment strategies, some partnerships employed additional induction strategies, acknowledging that recruiting diverse candidates into teacher certification programs does not ensure that these candidates enter the teaching force. Other partnerships implemented recruitment strategies along with strategies to support candidates while they were enrolled in teacher education programs and seeking licensure. A few partnerships worked to improve the retention

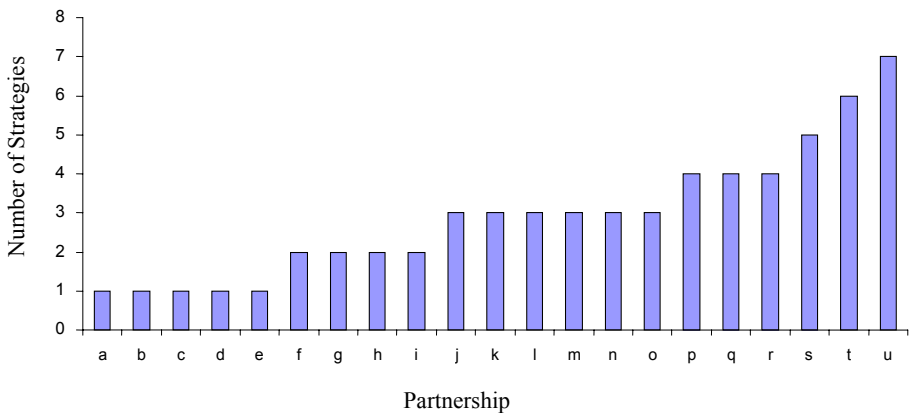


Figure 1. Range and distribution of diversity strategies by partnership.

of inservice teachers along with their recruitment activities. Additional partnerships targeted teachers in urban and high minority school districts for professional development. One partnership coordinated their efforts by supporting candidates enrolled in a certification program, beginning teachers through induction, and inservice teachers through professional development. These examples demonstrate coordinated implementation plans to address critical points along the teacher pipeline for minority candidates.

One Exemplary Partnership

One of the partnerships was notable among the others along several dimensions. First, the partnership made increasing teacher diversity a clear priority, and it showed a statistically significant increase in the diversity of its teachers. This partnership demonstrated how to “be purposeful and deliberate in how they increase diversity” (Torres et al., 2004, p. 18). It was one of the few partnerships that reported diversity data in its annual reports, in addition to providing this information for the MIS. It analyzed changes in the demographics of teacher candidates: “Particularly notable is the 111% increase in Chicano/Latino/Latino American participation for Year 2 (up to 19 in Year 2 from 9 in Year 1) and the 65% increase in the number of female participants (up to 43 in Year 2 from 26 in Year 1)” (Year 2 Annual Report). Tracking these data allowed the partnership to examine the effects of its strategies on increasing teacher diversity. The partnership began with large minority representation and increased this representation over time.

This partnership employed multiple strategies to address diversity comprehensively. For example, it partnered with local community colleges and STEM departments to recruit future teachers, sought a grant to provide scholarships to students, and offered teacher certification test preparation workshops. The partnership sought alternative means of supporting preservice teachers: “...With significant support from [MSP] PI’s, [a] director worked closely with other campus units to get approval for a proposed Careers in Teaching Theme House for undergraduates, ...with dorm space for 24 future teachers” (Year 3 Annual Report). While this campus housing may not have been approved specifically for minority students, teacher diversity research identifies cohort models as beneficial to minorities, in particular, crediting their success as a result of close professional relationships with mentors and cohort members (Torres et al., 2004). There were also workshops for English Language Learners and assistance in preparing scholarship applications. These services were not limited to minority preservice teachers in the partnership, but addressed obstacles that have been reported to disproportionately hinder minorities from entering the teaching profession (Darling-Hammond et al., 1996; Torres et al., 2004).

The partnership demonstrated awareness of potential obstacles to increasing diversity and worked towards overcoming those obstacles. For example, in one report they described the challenge of recruiting minority students into mathematics and

science teacher education. “It continues to be a challenge to recruit underrepresented students into the [teacher pipeline] at [the University] due to relatively low numbers of Latino and African American students on campus in general. In Year 2, direct action was taken to recruit underrepresented students such as recruiting through campus cultural and political organizations” (Year 2 Annual Report). The partnership’s actionable strategies for addressing challenges demonstrated a commitment to increasing the diversity of its teachers.

Statistical and Numerical Changes in Teacher Diversity

The next set of research questions focused on a statistical examination of the MIS data on teacher diversity. This analysis was separate and distinct from our analysis of strategy implementation. Of the 34 partnerships involved in the Wave I and II administration of the MIS tools, 24 partnerships reported usable data on teacher demographics in both waves. These 24 partnerships, representing 50% of the original 48 partnerships in the MSP Program, were the subjects of our statistical analysis.

Changes in teacher diversity. Research question three focused on identifying changes in teacher diversity from year to year. This analysis included 24 partnerships that reported data on teacher demographics for Wave I and II of the MIS. We compared the proportion of participating minority teachers with the number of eligible teacher participants in schools. The proportions analysis revealed that there were no significant differences in teacher diversity for the overall program; however, there were significant differences in minority teacher participation between Waves I and II in seven partnerships, $p < .05$. In three of the partnerships, minority teacher participation increased significantly; in four partnerships, minority teacher participation decreased significantly. Of the three partnerships with increases, one implemented teacher diversity strategies. Of the four that decreased significantly, none implemented actionable strategies to influence teacher diversity.

Large minority populations and strategy implementation. Our fourth research question asked whether the number of strategies employed varied according to the baseline teacher demographics of the partnerships. We considered whether partnerships with high percentages of minority teacher participants tended to implement more actionable strategies to increase diversity. To establish guidelines for determining “large minority populations,” we used demographic data from the U.S. Census Bureau’s 2005 American Community Survey (U.S. Census Bureau, 2005). According to the Census data, Nonwhites make up 25.3 percent of the U.S. population. Therefore we defined “large percentages of minority teacher populations” to be above 25 percent of the total population of teacher participants. Of the 24 partnerships, seven reported minority representation to be above 25 percent in both Waves I and II. For example, one partnership reported that 44.7 percent of its teacher participants were Nonwhites, with the largest racial group being African Americans; while another partnership reported minority participation to be at 51.6 percent, with Latinos as the largest ethnic

minority group in this partnership. Of the seven partnerships with large minority populations, four reported implementing diversity strategies (57.1%). Of the 17 partnerships *without* large minority populations, only three partnerships implemented diversity strategies (17.6%).

Representation of minority teachers in participating districts. Our fifth research question was: Are partnerships offering the resources of the MSP Program to schools and/or districts with high-minority populations? To examine whether partnerships were including districts with more diverse teacher populations, we again examined demographic data from the 24 partnerships that reported in both Waves I and II. We compared the percentage of minority teachers in the *districts served* by the partnerships, the percentage of teachers in the district who participated in partnership activities, and the percentage of *minority teachers in the district* who participated in partnership activities. The purpose of this examination was to make comparisons between district demographics in Waves I and II and rates of participation for minority and non-minority teachers. In 12 of the 24 partnerships, the percentage of minority teachers in participating districts increased. However, overall, the percentage of minorities in the participating districts decreased between Wave I and Wave II. In Wave I, there were 13,240 teachers in the districts targeted by the 24 partnerships. Minority teachers represented 33.6% of this teacher pool. In Wave II, there were 17,350 teachers in the 24 partnerships. The population of minority teachers decreased to 26.9% of the teacher pool. While the total number of teachers in the participating districts increased, the percent of minority teachers in the districts decreased. This indicates that more teachers and schools, in general, were involved in MSP-supported activities, but that those teachers and schools had smaller proportions of minority teachers during Wave II.

Given the low numbers of minorities in the teaching force in general, minority teachers must participate in mathematics and science activities at higher rates than Whites for diversity to increase among mathematics and science educators. During Wave I, while an average of 43.4 percent of all teachers and 39.7 percent of eligible White teachers in the targeted districts took part in partnership activities, an average of 50.6 percent of the *eligible minority teachers* in those districts participated. Similarly, in Wave II, the average percentage of teachers in targeted districts who participated in partnership activities was 33.7 percent for all teachers and 30.1 percent for White teachers, while it was 43.4 percent for the eligible minority teachers in the districts. Therefore, in both Waves I and II, a larger portion of the eligible minority teachers participated in partnership activities than the eligible White teachers, indicating that eligible minority teachers in these 24 partnerships are participating at higher proportions than eligible White teachers.

Our sixth research question asked if the changes in teacher diversity were obscured by reporting trends. One limitation of the available data was large increases in numbers of teachers *not reporting* their race or ethnicity in Wave II. Variance in the results, in terms of percentages of minority and White participants, is due, in part, to changes

in the percentage of participants for whom race was not reported. We analyzed the incidence of this reporting trend by computing the proportion of participating teachers whose race was not reported to determine if there were significant differences between Wave I and Wave II. When the proportions were compared and confidence intervals were computed using SPSS software, changes in the proportion of teachers for whom race was *not reported* was present between Waves for 12 of the 24 partnerships, with 8 partnerships showing significant increases in not reporting and 4 partnerships showing significant decreases in not reporting. For example, in two partnerships, the percentages of participants *not reporting* their race jumped from 8.7% to 100% and from 0% to 95.1%. The majority of partnerships in which the incidence of not reporting race increased were partnerships where no diversity strategies were implemented. The two partnerships that implemented the most strategies (six and seven strategies) significantly decreased their *not reported* category, and thereby increased the number of teacher participants for whom race was reported.

Differences between Strategy Implementation and Changes in Teacher Diversity

The final research question assessed any differences between the two Waves and the absence or presence of actionable diversity strategies. To conduct this analysis, we compared partnerships with actionable strategies to those without actionable strategies among the 24 partnerships that reported demographic data in both Wave I and II of the MIS. Among the 24 partnerships, there were seven with actionable diversity strategies (determined from the qualitative reports) and 17 without actionable strategies. We examined whether changes in teacher diversity were related to the implementation of diversity strategies (absence or presence) and different years of implementation (Wave I vs. Wave II). Specifically, we performed a 2x2 factorial ANOVA where factor 1 was Wave (which indicates Years 1 and 2 of the data collected from the partnership) which had two levels (Wave I and II). The second factor was strategy implementation which also had two levels (actionable versus non-actionable strategies). The dependent variable was the number of minorities who participated in the study. Therefore, the number of minorities was treated as a continuous variable. It was found that there was no main effect for strategy $F(1, 44) = 0.65, p = .43$, Wave $F(1, 44) = 0.01, p = .94$, or interaction, $F(1, 44) = 0.22, p = .64$. The means show that in Wave I there were 122 minority participants in partnerships without actionable strategies and 26 minority participants in partnerships with actionable strategies. In Wave II, there were 92 minority participants in partnerships without actionable strategies and 67 minority participants in partnerships with actionable strategies. This indicates that there was a numeric increase in the number of minority participants in partnerships that implemented strategies; however, there was not a statistical main effect for strategy implementation.

Although no statistically significant relationship was found due to the small sample size, we chose to examine the subset of seven partnerships more closely because they were

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essentially the only partnerships with a comprehensive set of data on teacher diversity. A detailed examination of the strategies implemented by these seven partnerships is presented in Table 2. Five of the seven partnerships fit our definition of “high intensity partnerships” because they implemented four or more actionable strategies. The demographic data from these seven partnerships are presented in Table 3. As this table shows, the overall number and proportion of minority teachers increased for these partnerships. One of these partnerships was one of the three partnerships previously reported to show a statistically significant increase in minority teacher participation. In these seven partnerships where actionable strategies were implemented, the *number* of minority teachers increased in five of seven partnerships, and the *proportion* of minority teachers increased in four of seven partnerships (71 percent and 57 percent, respectively). In comparison, for the 17 partnerships reporting demographic data in both Wave I and II with no actionable strategies, the *number* of minority teachers increased in 5 of 17 partnerships, and the *proportion* of minority teachers increased in 6 of 17 partnerships (29 percent and 35 percent, respectively). Though not statistically significant, these findings provide early evidence of the potential for relationships to be revealed with further longitudinal study.

Limitations

Due to large proportions of missing MIS data and incomplete descriptive information, our findings are limited. Both the quantitative and qualitative data were self-reported and there was no system to determine whether or not these data were complete and reliable. In some instances, MIS information did not add up and data disaggregated by gender did not match data disaggregated by race and ethnicity. For example, one project reported that 19 Native American teachers from one school district participated in MSP activities. Yet, the same school district reported having no Native American teachers. Other data were incomplete for all years the partnership received NSF funding, and there were great fluctuations in participant numbers. To address these limitations, we analyzed the program overall and individual partnerships in an attempt to provide the reader with several views of the data that were available.

In addition to missing data, the data were also limited in their scope. For example, the definition for “participating teachers” included only “Those teachers who have participated in 30 or more hours of MSP-sponsored activities during a given school year” (Silverstein et al., 2005, p. 11). This definition of participating teachers could have significantly impacted the reporting of all teacher participants. The available data reported only inservice teacher demographics and omitted preservice teachers. The data available for preservice teachers reported only on course enrollment, and information for large portions of the preservice teacher population was missing; therefore, we determined that these data were unreliable. Other investigators who have analyzed this data set have reported that gender was not reported for thirty-two percent of the preservice teachers and race/ethnicity was not reported for thirty-seven percent

Table 2
Actionable Strategies Implemented in Seven Partnerships with Demographic Data

<i>MSP</i>	<i>Category of Strategies</i>	<i>Actionable Strategies Implemented</i>
A	Recruitment	Target community college students
	Recruitment	Target high school students
	Recruitment	Partner with minority organizations and/or minority leaders
	Recruitment	Expose college students to careers in teaching
	Preservice – Supporting Licensure	Diminish academic obstacles
	Preservice – Supporting Licensure	Provide financial aid
	Inclusion of High Minority Populations	Provide professional development to schools/districts with high minority student populations
B	Recruitment	Target community college students
	Recruitment	Target high school students
	Recruitment	Expose college students to careers in teaching
	Preservice – Supporting Licensure	Individualize education program for participating students
	Preservice – Supporting Licensure	Diminish academic obstacles
	Retention	Create opportunities for teachers to advance
C	Recruitment	Target high school students
	Recruitment	Partner with minority organizations and/or minority leaders
	Preservice – Supporting Licensure	Provide financial aid
	Induction	Increase positive experiences during induction

Table 2 (continued)

<i>MSP</i>	<i>Category of Strategies</i>	<i>Actionable Strategies Implemented</i>
D	Recruitment	Target community college students
	Preservice – Supporting Licensure	Individualize education program for participating students
	Preservice – Supporting Licensure	Create support groups/cohorts
	Preservice – Supporting Licensure	Provide financial aid
E	Recruitment	Expose college students to careers in teaching
	Recruitment	Send diverse STEM students into K-12 classrooms as teacher assistants
	Inclusion of High Minority Populations	Provide professional development to urban schools/districts
	Inclusion of High Minority Populations	Provide professional development to schools/districts with high minority student populations
F	Recruitment	Target high school students
	Recruitment	Tailor recruitment efforts to underrepresented students
G	Preservice – Supporting Licensure	Create support groups/cohorts
	Preservice – Supporting Licensure	Provide financial aid

(Silverstein et al., 2005). Therefore, it was not possible to track changes in diversity among preservice teachers with any certainty.

Discussion

This investigation examined the efforts of partnerships in the NSF MSP Program to increase the diversity of mathematics and science teachers in their partnership activities. Here we discuss the strategies implemented by the partnerships, changes in the diversity of mathematics and science teachers in the partnerships, and the implications of these findings for increasing the diversity of mathematics and science teachers in the U.S. population.

Table 3
Demographic Data in Seven Partnerships with Actionable Strategies

MSP	Total Participants		Minority				White/Caucasian				Not Reported				Number of strategies implemented
	W/I	W/II	W/I	W/II	W/I	W/II	W/I	W/II	W/I	W/II	W/I	W/II			
	<i>N</i>	<i>N</i>	<i>N</i> (%)	<i>N</i> (%)	<i>N</i> (%)	<i>N</i> (%)	<i>N</i> (%)	<i>N</i> (%)	<i>N</i> (%)	<i>N</i> (%)	<i>N</i> (%)	<i>N</i> (%)			
I	42	25	12 (28.6)	7 (28.0)	30 (71.4)	18 (72.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	4				
II	3	35	0 (0.0)	9 (25.8)	3 (100.0)	26 (74.3)	0 (0.0)	0 (0.0)	0 (0.0)	4					
III	76	342	34 (44.7)	215 (62.9)	8 (10.5)	72 (21.1)	34 (44.7)	55 (16.1)	7						
IV	97	53	38 (39.2)	15 (28.3)	59 (60.8)	37 (69.8)	0 (0.0)	1 (1.9)	2						
V	293	545	69 (23.5)	136 (24.9)	211 (72.0)	360 (66.1)	13 (4.4)	49 (9.0)	2						
VI	164	169	6 (03.7)	7 (04.1)	153 (93.3)	147 (87.0)	5 (3.0)	15 (8.9)	4						
VII	62	287	20 (32.3)	77 (26.8)	39 (62.9)	209 (72.8)	3 (4.8)	1 (0.3)	6						
Total	737	1,456	179 (24.3)	466 (32.0)	503 (68.2)	869 (59.7)	55 (7.5)	121 (8.3)							

Strategies Implemented by the Partnerships

Five categories of strategies were identified in use among these partnerships, with *recruiting* most common among the strategies, followed by supporting licensure. The major focus of recruiting was on high school and college students to draw more minorities into teacher certification programs. A second strategy that was common among the partnerships was support for teacher licensure. Partnerships implemented social and financial supports for teacher licensure students. According to Villegas and Lucas (2004), “Recruitment efforts, although essential, will not result in a more diverse teaching workforce unless issues of preparation and retention receive greater attention” (p. 96). Although recruiting is one effective strategy for increasing teacher diversity, more comprehensive and long term solutions are needed that focus on other parts of the teacher pipeline to have lasting effects. In addition, changes in the diversity of mathematics and science teachers as a result of these partnerships’ recruitment strategies will likely not be noticeable until years after partnerships have completed their funded work. Therefore, it will be challenging to connect these efforts to changes in the diversity of the U.S. teacher population.

Partnerships have the potential to impact diversity all along the teacher pipeline; however, most efforts in these partnerships neglect the induction and retention years of teaching. Because research indicates that lack of support influences minority preservice teachers’ decision not to enter teaching even after obtaining certification (Delpit, 2006), financial, academic, and social supports play an important role in encouraging preservice teachers to complete certification requirements *and* enter teaching. Research on high attrition rates of teachers, particularly minority teachers and new teachers, are cause for concern (Ingersoll, 2006a, 2006b; National Commission on Teaching and America’s Future, 2003). Providing mentoring programs and minority role models for new teachers may help prepare novices to use their diversity as a strength in the classroom (Holloway, 2002). However, few partnerships reported induction strategies and opportunities for professional growth as a way of improving minority teacher retention.

An additional strategy for increasing minority recruitment and retention is the inclusion of high-minority populations to improve access to resources and teacher development opportunities, such as the NSF MSP Program. High minority schools are often underserved, low-performing schools where the attrition rate for teachers is understandably greater. However, as these results showed, the percentage of minority teachers in participating districts decreased over time. When partnerships include high minority schools in their activities, they bring resources and professional development that otherwise might not be available to minority teachers. Adding high minority schools to the partnership increases the likelihood that minority teachers have opportunities to participate in mathematics and science professional development, such as additional certification and leadership training. By providing high minority schools and districts with access to resources and certification in STEM fields, federally-funded programs

have the potential to increase the number of minority teachers entering and remaining in the teaching profession.

Results indicated that there were a handful of high intensity partnerships. Some high intensity partnerships used a number of different strategies to target one population in the teacher pipeline; while, others showed comprehensiveness in their strategies, that is, they used strategies to influence different populations along the teacher pipeline. As the exemplary partnership showed, they employed numerous strategies, teacher diversity increased significantly, efforts were coordinated along the teacher pipeline, and they devised innovative methods for influencing change.

Changes in the Diversity of Mathematics and Science Teachers in the Partnerships

Our findings indicate that there were no statistically significant changes in teacher diversity for the overall MSP Program based on these data; however, there were significant changes in seven individual partnerships (with three increasing in diversity and four decreasing). These findings are not surprising, as changing a population characteristic like teacher diversity takes time, and these data were collected over a relatively short time span.

When comparing partnerships with high-minority populations to those where there was not a high-minority population, a larger percentage of the high-minority population partnerships implemented actionable strategies for increasing teacher diversity. This indicates that when there were more minority teachers, actionable strategies were more likely; and when there were fewer minority teachers, actionable strategies for increasing teacher diversity were less likely. Preliminary findings based on the strategies employed by demographics of teacher participants (high-minority, low-minority) warrant further study. These results suggest that partnerships with diverse teacher participants may be more likely to implement actionable strategies for increasing teacher diversity.

The findings revealed that the overall percentage of eligible minority teachers in the participating districts decreased between Wave I and II as schools were added to the partnership activities, indicating that partnerships did not show increases in targeting high-minority populations for inclusion. However, while overall results show a percentage decrease in eligible minority teachers, 12 of the 24 partnerships did increase the percent of eligible minority teachers in their participating districts.

To increase the diversity of the teaching force, minority teachers must participate in recruitment, licensure, induction and retention efforts and enter and stay in teaching at higher rates than White teachers. One result is promising in this regard. In Waves I and II, the eligible minority teachers in the districts participated at higher rates than the eligible White teachers in the districts. This indicates that, although the number and proportion of minority teachers in participating schools did not increase in these partnerships, the eligible minority teachers in the participating schools were involved in MSP activities at higher rates than White teachers.

When we compared partnerships that implemented actionable strategies with partnerships with no actionable strategies, we found no statistical relationships to changes in teacher diversity. However, there were numerical differences in teacher diversity between the partnerships with actionable strategies and those with no actionable strategies. These initial patterns warrant further longitudinal study.

Implications for Increasing the Diversity of the Teacher Population

Are partnerships truly invested in the NSF MSP Program goal of increasing teacher diversity? From this evaluation, it appears that some partnerships are and some are not. Based on these findings, there have been no significant increases in teacher diversity for the program participants, and there is no evidence that partnership activities have yet influenced an increase in the diversity of mathematics and science teachers in the U.S. population. Changing a population characteristic, like teacher diversity, takes time. The impact of current efforts by these partnerships could take many years to come to fruition.

There are several implications of these results for increasing the diversity of the teacher population. More attention and focus needs to be shifted to areas of the pipeline that go beyond simply recruiting more teachers (Ingersoll, 2006a, 2006b). As indicated previously in this report, minority teachers have a higher rate of attrition than non-minority teachers. Efforts aimed at induction and retention of minority mathematics and science teachers should be complementary to efforts aimed at recruiting teachers into the teaching force. Coordinated retention strategies that support teachers and improve working conditions can change the perception that mathematics and science education are fields that isolate and do not support teachers of color. As the results show, there are signs that actionable strategies can have positive influences on teacher diversity. Plans to increase teacher diversity require coordinated efforts, and these efforts are enhanced when partnerships employ numerous strategies in a comprehensive manner that influences various points along the teacher pipeline.

While some of the partnerships in the MSP Program do provide exemplars for implementing diversity strategies, in other partnerships, when there were fewer minority teachers, the partnerships were less likely to implement actionable strategies. Eligible minorities must participate at higher rates than eligible Whites to increase the diversity of the teaching force. A true effort to change the diversity of the mathematics and science teacher population will require actionable plans that incorporate state and national agencies, federal policies, financial incentives, educational leadership, and a serious commitment to this work.

Conclusion

This study considered strategies used by partnerships in the NSF MSP Program to increase the diversity of its participating teachers and demographic changes in

minority teacher participation in relation to those strategies. While there were no significant increases in the diversity of teachers in the program overall, there were significant increases and decreases in minority teacher participation for individual partnerships. The results showed that individual partnerships made progress in terms of the inclusion of minority teachers and high-minority populations, the use of comprehensive strategies aimed at various stages along the continuum of the teacher pipeline, and providing increased access to partnership resources and activities for minority teachers. However, these strategies and changes in teacher diversity were only evident in a small number of partnerships.

Perhaps most important among these results are the categories of actionable strategies being implemented to increase teacher diversity across multiple stages of the teacher pipeline. It is the balanced focus on these categories (recruitment, supporting licensure, induction into teaching, retention of diverse teachers, and targeting high-minority populations for inclusion) that has the potential to produce meaningful effects on the diversity of the mathematics and science teacher population.

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