

**Mathematics and  
Science Partnerships:  
Summary of  
Performance Period  
2007 Annual Reports**

**Analytic and Technical  
Support for  
Mathematics and  
Science Partnerships**

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## Executive Summary

Our nation's students are underachieving in mathematics and science compared to students in other industrialized nations. International tests of science and mathematics such as TIMSS and PISA (see Schmidt et al., 1999; Gonzales et al., 2004; Lemke et al., 2004) expose a need for improved education in mathematics and science. Education improvement efforts around the country are increasingly focused on the teacher as the most powerful agent of change for improving student learning. Research suggests that increased teacher content knowledge and teaching skills lead to improved student achievement (Cochran-Smith & Zeichner, 2005; Darling-Hammond & Bransford, 2005; Goldhaber & Brewer, 2000; Grossman, 2005; Timperley et al. 2007; Wenglinsky, 2002).

As the limitations of short-term professional development opportunities for teachers have been recognized, there has been widespread interest in sustained university partnerships with local school districts to offer rich professional learning opportunities for teachers and administrators. The U.S. Department of Education's Mathematics and Science Partnership (MSP) Program funds 575 collaborative partnerships between high-need school districts and mathematics, science, and engineering departments at institutions of higher education (IHEs) for the purpose of providing intensive content-rich professional development to teachers and other educators, thus improving classroom instruction and ultimately student achievement in mathematics and science.

Implemented under the No Child Left Behind Act of 2001, Title II, Part B, MSP is a formula grant program to the states, with the size of individual state awards based on student population and poverty rates. The states then award the funding on a competitive basis to local partnerships. Federal support for MSP has increased substantially since the program's inception in FY 2002—from \$12.5 million to \$100 million in FY 2003, when MSP became a state-administered formula grant program.

### *Performance Period 2007 Mathematics and Science Partnerships*

In the following section, we present an overview of the MSP program in Performance Period 2007 (PP07), including findings about the characteristics of MSP projects and participants; the professional development content, models, and activities; and the MSP evaluation designs and outcomes.

### **Characteristics of MSP Projects and Participants**

In Performance Period 2007 (PP07), the Mathematics and Science Partnership Program reached more teachers and students than ever before. Together, approximately 5,200 local educational agencies (LEAs), organizations, and institutions, including over 4,000 IHE faculty members, partnered to form 575 projects across the country. Projects provided over 56,000 contact hours of professional development during PP07. They served nearly 60,000 educators<sup>1</sup> nationwide, thus enhancing the quality of classroom instruction for nearly 2.5 million students.

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<sup>1</sup> Professional development was provided to a variety of teachers, coaches, paraprofessionals, and administrators across grades K through 12.

### ***Amount of Funds***

In PP07, federal MSP resources totaling \$182 million were distributed to the 50 states, the District of Columbia, and Puerto Rico through formula grants.<sup>2</sup> State grants ranged from \$906,246 to over \$23.6 million, with an average of \$3.4 million and a median of \$2.0 million (see Appendix C).

The states funded a total of 575 local MSP projects, with grants ranging from \$9,929 to \$5.9 million. The median project grant in PP07 was \$200,000, and the average project grant was \$353,579. As shown in Exhibit ES.1, more than three-fourths of projects (78 percent) received \$500,000 or less in state funding. Local projects also received a modest amount of supplemental funding from other federal and non-federal sources.

<b>Exhibit ES.1 Project Budgets from State MSP Grants, Performance Period 2007</b>	
<b>Project Budgets</b>	<b>Percent of Projects (N=574)</b>
\$100,000 or less	9%
\$100,001 to \$200,000	43
\$200,001 to \$500,000	26
\$500,001 to \$1,000,000	18
\$1,000,001 or more	4

*Source: Annual Performance Report item IA.5*

### ***Participant Selection***

MSP projects were encouraged to assess the professional development needs of individual schools and teachers and to use this information as the basis for determining which schools and teachers should participate in the MSP program. Approximately half of projects that targeted schools or school districts (51 percent) selected participants based on the need of the teachers or the schools, while just under one-fourth (23 percent) selected participants based on their willingness to volunteer for the program. Conversely, just over one-third of projects that targeted individual teachers (35 percent) selected participants based on the need of the teachers or the schools, while over half (58 percent) selected participants based on their willingness to volunteer.

### ***Characteristics of Project Participants***

In PP07, more than 4,000 faculty members from institutions of higher education (IHEs) were involved with MSP projects, for an average of 7 IHE faculty members per project. Projects are required to establish direct interactions between participants and IHE faculty members in mathematics, the sciences, or engineering. Additionally, two-thirds of the projects (67 percent) reported working with faculty members from education departments.

Nearly 60,000 elementary, middle, and high school teachers, coaches, paraprofessionals, and administrators participated in MSP projects in PP07. The number of participants served by individual MSP projects ranged widely from fewer than 2 to 1,540, but the median number of participants served by MSP projects was 54.<sup>3</sup> These participants, in turn, taught nearly 2.5 million students.<sup>4</sup>

<sup>2</sup> The American Virgin Islands, Guam, the Northern Mariana Islands, and Samoa pool their MSP funds as part of their consolidated budget.

<sup>3</sup> The projects that served a very large number of teachers skewed the average (mean) upward to 109, so the median is a better estimate of what the average project looked like.

Seventy percent of MSP participants were regular classroom teachers of core mathematics and/or science content. In order of prevalence, the remaining 30 percent of participants included Title I teachers, special education teachers, school administrators, ELL teachers, gifted and talented teachers, math coaches, paraprofessionals, and science coaches.

***School Levels***

MSP projects are free to determine the grades or school levels in which they provide professional development. In PP07, the vast majority of projects (80 percent) targeted multiple school levels (i.e., some combination of elementary, middle, and/or high school teachers). While the largest percentage of projects (44 percent) served participants from all three school levels, the majority of participants served by the MSP projects (80 percent) were at the elementary and middle school level.

**Professional Development Content, Models, and Activities**

***Professional Development Content***

In PP07, one-third of MSP projects (33 percent) provided professional development in both mathematics and science; 37 percent provided professional development in mathematics only; and 30 percent of projects provided professional development in science only.

Across school levels, scientific inquiry was the most frequently addressed science topic (93 to 95 percent of projects), and chemistry was the least frequently addressed topic (44 to 47 percent). In mathematics, problem solving was among the most frequently addressed content areas (82 to 84 percent of projects), and calculus was the least frequently addressed topic (1 to 13 percent).

***Professional Development Models***

As shown in Exhibit ES.2, the majority of projects (59 percent) conducted summer institutes<sup>5</sup> with school-year follow-up activities. These projects reported offering a median of 100 hours of professional development. Just 1 percent of projects provided summer institutes only, with no follow-up.

The remaining 40 percent of projects provided professional development activities that primarily took place during the academic year. These projects reported offering a median of 74 hours of professional development.

<b>Exhibit ES.2 Average Professional Development Hours, by Professional Development Model Type, Performance Period 2007</b>		
<b>Professional Development Model</b>	<b>Percent of Projects (N=573)</b>	<b>Total Median Hours</b>
Summer institute with follow-up	59%	100
Summer institute only	1	80
Focus on school year activities	40	74
<i>Source: Annual Performance Report items V, A, B</i>		

<sup>4</sup> Students may be counted twice, once as mathematics students and once as science students.

<sup>5</sup> Summer institutes provide intensive learning experiences for a minimum of two weeks during the summer.

### ***Professional Development Activities***

The professional development activities offered by MSP projects focus on increasing teachers' content knowledge in mathematics and/or the sciences and on enhancing their pedagogical skills. The most commonly reported school-year activities were on-site professional development (69 percent of projects), short-term professional development such as workshops and conferences (60 percent), study groups (44 percent), content coursework at colleges or universities (26 percent), on-line coursework (14 percent), distance learning networks (13 percent), and other activities (19 percent).

## **MSP Evaluation Designs and Outcomes**

### ***Evaluation Designs***

In PP07, MSP projects reported on the primary design they used to assess program outcomes. Two percent reported using an experimental design in which teachers, classrooms, or schools were randomly assigned to a treatment or control group. Another 42 percent of projects reported using a quasi-experimental design with a matched or non-matched comparison group. The rest of the projects used less rigorous evaluation designs, such as: assessment of the treatment group only, using pre- and post-tests (20 percent); mixed quantitative and qualitative methods (14 percent); qualitative methods only (11 percent); or an "other" design type (11 percent).

### ***Teacher Content Knowledge Outcomes***

As shown in Exhibit ES.3, approximately two-thirds of teachers (68 percent) who were assessed in mathematics and nearly three-fourths of teachers (73 percent) who were assessed in science showed significant gains in their content knowledge.

<b>Exhibit ES.3</b>			
<b>Percent of Teachers with Significant Gains In Content Knowledge, Among Teachers with Pre-Post Content Assessments, Performance Period 2007</b>			
<b>Content Area</b>	<b>Total Number of Teachers Served</b>	<b>Number of Teachers with Content Assessments</b>	<b>Percent of Assessed Teachers with Significant Gains</b>
Mathematics	34,567	11,696	68%
Science	26,552	11,546	73

*Source: Annual Performance Report items VIII.A. 2, 3, 5, 6*  
*Individual teachers who received professional development in both mathematics and science may be double-counted.*

In PP07, the most frequently reported assessments of teacher content knowledge in mathematics were nationally normed/standardized tests (53 percent of projects). Projects that did not use nationally normed or standardized content assessments often developed their own assessments for their MSP projects. Thirty-nine percent used locally developed tests to assess teacher gains in mathematics content knowledge. In science, the most frequently used instruments in science were locally developed tests (53 percent of projects), followed by standardized instruments (36 percent).

### ***Student Achievement Outcomes***

As shown in Exhibit ES.4, among the 48 percent of students with assessment data in mathematics, just over one half (52 percent) scored at the basic level or above and nearly half (45 percent) scored at the proficient level or above. Among the 30 percent of students with assessment data in science, 50 percent scored at the basic level or above and 49 percent scored at the proficient level or above.

<b>Exhibit ES.4 Percent of Students Scoring at Basic or Above, Among Students Taught by MSP Teachers And Assessed In Each Content Area, Performance Period 2007</b>				
<b>Content Area</b>	<b>Total number of students taught by MSP teachers</b>	<b>Number of students with assessment data</b>	<b>Percent of assessed students at basic level or above</b>	<b>Percent of assessed students at proficient level or above</b>
Mathematics	1,284,911	610,868	52%	45%
Science	844,749	253,216	50	49
<i>Source: Annual Performance Report items VIII.B. 1, 2, 3, 4, 5, 6, 7, 8</i>				

In PP07, most MSP projects that measured student achievement used state assessments; 81 percent in mathematics and 69 percent in science. In addition to the use of state assessments, about one-quarter of all projects used locally developed tests to measure student achievement—26 percent in mathematics and 27 percent in science.

### ***Project Characteristics Associated with Gains in Teacher Content Knowledge<sup>6</sup>***

Few project characteristics were associated with improved teacher content knowledge; however, two findings were significantly associated with gains in content knowledge across both disciplines. First, as expected, projects that described the status of their implementation as “fully developed” reported larger proportions of teachers with significant gains than did projects describing their implementation phase as “new.” Second, projects that used standardized tests reported lower proportions of teachers showing significant gains than did projects that used locally developed tests. It is noteworthy that both of these findings were highly statistically significant.

There were several other statistically significant associations between project characteristics and gains in teacher content knowledge. Mathematics projects that targeted individual teachers were more likely to report significant teacher pre- to post-test gains in mathematics content knowledge than were projects that targeted schools or districts. Science projects with lead organizations such as a non-profit, a regional educational agency, or other organization reported larger proportions of teachers showing significant gains than did projects where the lead organization was a local education agency. Also, science projects that included a summer institute with follow-up activities reported larger proportions of teachers with significant gains than those that those with other professional development models (e.g., those that focused on school year activities or those that offered summer institutes with no follow-up).

### ***Projects with Rigorous Designs***

Thirty-seven final year projects completed an experimental or comparison group design and submitted data for both groups. Screening of these projects using the *Criteria for Classifying Designs of MSP Evaluation* revealed that very few projects succeeded in meeting all of the criteria for implementing a rigorous design—either an experimental or quasi-experimental design to evaluate the

<sup>6</sup> Note that these analyses measure the extent of association between characteristics and teacher gains in content knowledge and therefore do not support any inferences about causal relationships. Further, given the fact that the percent of teachers with gains on varying content knowledge tests is a coarse measure, even the findings of significant associations should be viewed with caution.

impact of their program components on outcomes for teachers and/or students.<sup>7</sup> One project met all the criteria for implementing an experimental design, and three projects met all of the criteria for implementing a quasi-experimental design. Three of the four projects attempted to measure outcomes in teacher content knowledge, teacher classroom practice, and student achievement, while one focused on measuring student achievement.

### ***Conclusions***

Unlike many teachers participating in more typical professional development programs, teachers who participate in the MSP program receive intensive and sustained content-rich professional development from college and university faculty partners from science, mathematics, engineering, and education departments, as well as from other professionals, that integrates mathematics and science content with effective pedagogical strategies. Many of these teachers have the additional advantage of receiving ongoing support in the form of mentoring and coaching from faculty and master teachers as they begin to implement their new knowledge and practice in their classrooms.

MSP program indicators show that the number of educators being served by MSP projects is increasing—to nearly 60,000 in PP07—and that over two-thirds of these educators are exhibiting significant gains in their content knowledge (68 percent in mathematics and 73 percent in science). These educators, in turn, are enhancing the mathematics and science education of their students—nearly 2.5 million in PP07.

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<sup>7</sup> The *Criteria for Classifying Designs of MSP Evaluations* (see Appendix B) was applied to the evaluations of all final year MSP projects that reported using an experimental or comparison group design. Most projects implemented multiple evaluations, assessing the effects of various outcomes, including teacher content knowledge, teacher practices, or student achievement. Each of their evaluations, for which data were provided for both the treatment and comparison groups, was reviewed separately.

