

# WORKING P A P E R

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## Math Science Partnership of Southwest Pennsylvania

### Year Four Evaluation Report

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## Summary

The Math Science Partnership of Southwest Pennsylvania (MSP) is a collaboration among 53 K-12 school districts, four Intermediate Units (IUs),<sup>1</sup> four Institutions of Higher Education (IHEs), and other strategic partners in Southwest Pennsylvania. The goals of the partnership are to increase K-12 students' knowledge of mathematics and science; increase the quality of the K-16 educator workforce; and create a sustainable coordination of partnerships in the IUs. RAND, in collaboration with the University of Pittsburgh, is conducting a five-year evaluation of the partnership. The evaluation is measuring the effectiveness of the partnership, its impact on institutional practices and policies at partner educational institutions, changes in math and science instruction, and changes in student outcomes. This document represents the Year Four evaluation report. It is intended to lay groundwork for the evaluation team's culminating final assessment.

## Focus on Participation

This report differs from the earlier annual evaluation reports, which focused primarily on analyzing data about intervention activities, reform implementation, and interim progress toward goals. For this year's report, the evaluation team chose instead to use participation levels as an analytical focus to identify promising practices among MSP partners and to use only a subset of MSP data to zero in on the impact of participation.

The rationale for this choice is as follows: *Participation* in MSP activities should lead to *implementation* of reformed policies and practices, which in turn lead to *attainment* of project's goals. Although most of the evaluation data collection focuses ultimately on measuring outcomes, participation is a crucial first step toward desired outcomes.

The MSP intervention includes professional development intended to enhance content knowledge and leadership, support the alignment of curriculum and pedagogy with reform goals, and disseminate and support the use of research-based resources and tools. The impact of the MSP on both mid- and long-term outcomes will likely be stronger in districts that participate more in these activities and weaker in districts that participate less. Measuring participation is therefore central to this evaluation for two reasons. First, participation may help to explain differences in observed effects across districts. Second, correlation between participation and outcomes can support a case that the MSP is responsible for those changes.

The team defined measures of participation for four of the evaluation's main data collections: (1) For K-12 district case studies, the evaluation team chose a measure of staff participation: *total hours adjusted for staff size*, or THASS--to contrast high- versus low-participating districts. (2) For principals surveyed in each of the 48 districts, the team supplemented THASS with another proxy for MSP participation, principals' involvement in *Lenses on Learning*, a mathematics professional development course for school leaders. (3)

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<sup>1</sup> IUs are publicly funded educational service agencies, serving as regional intermediaries between local control school districts and the Pennsylvania Department of Education.

For student achievement, the team used the THASS variable and measured its relationship to various indicators of student performance. (4) For IHEs, the evaluation team identified faculty members as high-participating, based on the estimated total hours of participation. For each of these areas, the team identified changes observed since the beginning of the MSP and explored their relationship to participation levels. The key findings appear below.

## **Key Findings**

### **K-12 school district case studies**

In high-participation districts, there were observed changes in curriculum and teaching practice. Observations and interview data suggested increased teacher understanding and awareness of the value of research-based teaching practices and materials, which in turn have affected curriculum choices. In addition, many professional development participants felt they possessed deeper content knowledge in math and science.

Observations indicated that math teachers are benefiting from MSP activities that focus on the use of active learning, and are pleased with what they are learning. Moreover, in all but one of the case study classroom observations in high-participating districts, elementary math instruction was rated as *effective* to *exemplary* and included active student learning opportunities. Generally, classroom observations in districts with less participation yielded somewhat lower ratings.

Case-study observations tended to rate science classroom instruction somewhat lower than math. While instruction was typically purposeful and well-planned, implementation of the lessons seemed more challenging. Lessons were often “short circuited” by a lack of time. However interviews suggested that teachers have appreciated and benefited from the Teacher Leadership Academies (TLAs) and on-site academies.

Some of these changes may be attributable to the MSP. Teacher leaders and some teachers who have received training at on-site academies have demonstrated changes in the way they approach what they teach as well as the way they implement lessons.

### **Survey of Principals**

The evaluation team surveyed principals in 2004 to collect baseline data on principals’ views, attitudes, policies, and practices on a range of subjects related to the MSP. In 2006, the evaluation team administered the same survey to assess principals’ responses after further implementation of the MSP project.

The evaluation team observed several changes from the baseline survey. In the 2006 survey, principals reported higher levels of agreement that they are knowledgeable about national standards for science, knowledgeable about the district science curriculum, and prepared to support teachers in implementing the science curriculum. They also reported an increase on a parallel set of mathematics questions,

although this difference was not significant. The principals reported being more comfortable serving as math and science instructional leaders, including discussing concrete examples of instructional practices with teachers, observing classrooms, examining student work, and providing feedback on teaching. Finally, principals responded more strongly that developing a professional learning community—giving teachers time to prepare lessons, work with other teachers, attend professional development—encourages effective instruction.

Principals' responses concerning district and school policies and practices also changed significantly. On two scales, which include items such as the regional curriculum framework, testing policies, access to computers and calculators, and the quality of district adopted instructional materials, principals reported higher on the scale that these items "encourage effective instruction". The effect size for these changes is greater than those associated with leadership skills.

Some of these changes may be attributable to participation in the MSP—specifically, to *Lenses on Learning*. Principals who had taken the *LoL* training placed a higher value on mathematics and science instruction, the effect of quality resources, and the importance of supporting continuous professional development for their teachers. These principals also reported greater commitment to providing a supportive environment for reform-based pedagogy. Finally, principals who have attended *LoL* said they held a deeper understanding of what constitutes good mathematics and science lessons and a greater confidence and ability to support them.

## **Student outcomes**

Student achievement is the ultimate measure of the MSP's impact. Outcomes data through Year Four of the evaluation have not shown significant relationships between MSP participation and student math achievement. However, benchmark and other data show encouraging changes in short-term and mid-term outcomes. Such changes are generally accepted as necessary precursors to changes in achievement, although for the most part these changes cannot be causally attributed to the MSP. Additional data from Year Five will enable recalculating achievement models for more cohorts of students, in science as well as math, over more years of project implementation, and with a fourth year of participation data.

## **IHE partners**

A number of findings related to the MSP were observed among IHE faculty. These centered on building partnerships with K-12 educators, classroom teaching, and planning classes.

Many high-participation faculty members, especially those involved in TLAs and the math/science leadership teams, reported strong relationships with the MSP Coordinators and other MSP staff, who, as employees of the IUs, are K-12-based.

High-participating faculty members also reported that attending TLAs helped them to become better teachers. These faculty members benefit from participating in the MSP through improvements in the quality of their teaching. This benefit derives, at least in part, from teaching being valued at their institution and counted towards professional advancement. However, respondents also noted that some

teachers who implemented teaching practices promoted by the MSP saw their student evaluation scores decline, possibly due to the additional demands placed on students. Therefore, although MSP participation may lead to improved pedagogy, the potential for poor student evaluations should be considered by the administration when making tenure considerations.

High-participating faculty members also noted the compatibility of MSP goals and their IHE's goal to provide a strong teaching certification program. Many respondents recognized that participation in the MSP had afforded their institution's teacher certification programs more regional recognition among K-12 districts, and more national recognition among peer institutions. This recognition of the value of MSP involvement facilitated faculty participation in MSP activities.

## Emerging Themes

Several cross-cutting themes related to high participation in the MSP emerged from the Year Four analysis.

**Curriculum and teaching.** A common thread across the data from K-12 districts and the IHEs is that changes in the curriculum and in teaching practice have occurred in high-participation partners and that some may have resulted from the MSP. Teacher leaders and some teachers who have received training at on-site academies have demonstrated changes in the way they approach what they teach as well as the way they implement lessons. Further, principals report a deeper understanding of what constitutes good mathematics and science lessons; and IHE faculty report changes in how they plan and deliver their courses.

**Time management.** The MSP is a long-term, time-intensive intervention that involves considerable training and professional development time. Time management issues thus pose a substantial concern. High-participation districts appear to have been more successful in meeting the time management challenge posed by the MSP's professional development requirements. Schools nonetheless struggle to enact the on-site professional development, in part due to reductions in the number of hours available for training, and planned sessions are often supplanted by competing priorities and professional development needs. IHE partners struggle with time management in a somewhat different way. Scholarship and teaching are more highly valued in the promotion and tenure process and thus they struggle to find time for MSP activities.

**Leadership and advocacy.** There has been consistent evidence across the first four years of MSP implementation that some advocacy is needed in schools to champion a reform initiative such as the MSP. At times this advocacy has started with teachers, at other times, with administrators. However, there is also evidence to suggest that administrative support, and perhaps, advocacy, is required for such an intensive effort to be sustainable. At the IHE, similar issues emerge. The evaluation team has reported in the past that partnership, especially at the IHE level, is forged first and foremost, via individual faculty. While an institution may indicate a policy of partnership in the MSP, this is often translated through a few faculty members who advocate for the efforts. Across the four years of the MSP to date, there has been considerable effort by the Deans of participating IHEs to forge relationships with one another and

articulate their support of the MSP and its sustainability. One example of this has been the Dean's Dinners and a joint policy statement regarding the importance of faculty involvement, especially in relation to promotion and tenure. Even with these efforts, planning for sustainability among the IHE partners seems less tangible among faculty than among some K-12 school and IU partners.

**Adaptation and sustainability.** The annual MSP implementation plans have acknowledged the need to promote sustainability among partners beyond the five-year NSF funding period. Over time, K-12 and IHE partner institutions change, as do priorities and resources. K-12 changes sometimes occur rapidly. This is exacerbated by staff turnover or changes in teaching assignments, diluting the training effect within a particular grade level, discipline, or school. Districts' adaptation of the implementation plan helps to address these issues. However, the project and the schools struggle to balance "acceptable" versus "fatal" adaptation for meeting the goals of the project at particular sites.

Higher education faculty work more independently than do K-12 teachers. Consequently, adaptation is less problematic for individual faculty at the IHE level. Adaptations to curricula or pedagogy are much more likely to stay with that particular individual and there are fewer opportunities for dissemination across colleagues. Moreover, higher education faculty do not as often work from a common syllabus and incoming faculty members may choose to teach courses quite differently than their predecessors.

Cultural issues, both in K-12 and IHE, also present challenges in adaptation and sustainability across the partnership. The K-12 institutional environment is designed to be amenable to public policy change through state and local control. There has been visible evidence of how much both federal legislation and state mandates impact how education is organized and delivered as a result of various state standards and assessments and other policies stemming from No Child Left Behind. The more recent flurry of educational accountability measures has created an environment where change is expected. This is less evident in IHEs currently, though new efforts are afoot to bring similar measures of accountability to bear in post-secondary education.

**The achievement horizon.** Evidence is strong that change is occurring among K-12 educators and IHE faculty. However, it remains unclear how long it may take for these changes to affect student achievement. Many questions regarding the achievement horizon remain, notably whether factors beyond the reach of a reform such as the MSP are pushing the horizon further away despite best efforts. The evaluation's final report will attempt to shed more light on this issue.