

WORKING P A P E R

Math Science Partnership of Southwest Pennsylvania

Year Three Evaluation Report

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Summary

The Math Science Partnership of Southwest Pennsylvania (MSP) is one of seven comprehensive partnership projects funded by the National Science Foundation (NSF) in 2003. It includes 48 school districts, four institutions of higher education (IHEs), and four regional educational service agencies known as Intermediate Units (IUs). The NSF award supports 40 of the school districts, and a Math and Science Partnership award from the Pennsylvania Department of Education (PDE) supports the remaining eight. The MSP is headquartered at the Allegheny Intermediate Unit (AIU), the central IU representing also the greatest density of school districts in the region. The region includes the urban periphery of the City of Pittsburgh, several smaller urban areas, suburbs, and rural areas. Total enrollment in the MSP school districts is approximately 114,000 students, with approximately 3,800 teachers who teach math or science topics.

The primary goals of this partnership are to increase K-12 students' knowledge of mathematics and science; to increase the quality of the K-16 educator workforce; and to create a sustainable coordination of partnerships in the IUs, building intentional feedback loops between K-12 districts and IHEs, tapping the discipline-based expertise of the IHEs, and improving the mathematics and science learning experiences for all undergraduates.

The MSP plans to accomplish these goals through three crosscutting intervention strategies:

- *Professional development for content and leadership* is accomplished through academies and seminars for K-12 educators and participating IHE faculty. The overriding purpose of these activities is to equip teachers with the pedagogical, content, and leadership skills necessary to become effective leaders in their institutions.
- *Curriculum alignment and pedagogical and course refinement* is accomplished at the K-12 level through the use of curriculum frameworks, and at the IHE level through the contributions of teachers who spend one to two semesters or a summer on the campuses.
- *Support for and dissemination of research based resources and tools*, which is primarily accomplished through conferences and networks of educators using research-based curricula.

Within each strategy are a variety of planned activities that collectively comprise the overall project implementation plan. This highly detailed implementation plan contains hundreds of action steps across the teams and staff of the MSP. Over the life of the project, the strategies are expected to remain in place, even if the specific activities included within each strategy may change and/or shift in priority.

Project Evaluation and Purpose of this Report

The AIU subcontracted with the RAND Corporation and the University of Pittsburgh to evaluate the project. The evaluation is designed to monitor annual progress in order to offer formative advice to the project, to measure its ultimate success in achieving its goals, and to document how well the model worked for the benefit of future initiatives that may seek to replicate it. The project and the evaluation commenced in September 2003. To guide the evaluation, RAND identified the following four evaluation research questions that will be addressed over the course of this project:

1. Have MSP partners developed and implemented a comprehensive intervention targeting math and science curriculum and achievement? If so, how?
2. Have institutional practices and support structures changed at K-12 districts and IHEs participating in the MSP? If so, how?
3. Have math and science instruction changed in K-12 districts participating in the MSP? If so, how?
4. In what ways have student outcomes and course taking changed in K-12 schools and districts implementing the MSP? If change occurred, what is the connection between implementation of the MSP plan and these changes?

This report is the third in a series of five planned annual evaluation reports detailing the evolution of the Math Science Partnership of Southwest Pennsylvania. The primary purpose of this report is to provide formative assessment of activities to date.

Key Findings from Year Three Data

Our analysis of the Year Three data identified a number of key findings. We have organized our discussion of the findings using the MSP logic model framework of Inputs, Activities, Outputs and Outcomes.

Key Findings on Inputs

The Leadership Action Teams (LATs) offer important input which guides the planning and implementation of MSP activities. In the Year Two report, we noted that taking critical steps toward leadership and scheduling time to attend the Leadership Action Academies (LAAs) were issues that the K-12 LATs needed to address. In large part, these issues have been resolved, as the LATs have exhibited increased independence of the MSP coordinators and attendance at the LAAs has improved. However, the factors that account for LAT success remain elusive and appear to vary according to context. In most cases, a recursive process that includes administrative leadership and teacher initiative seems effective.

The LATs are also critical in IHEs, but it is more difficult to discern the underlying processes that account for the success of these teams. In some cases, these LATs were driven by a few individuals that were

solely responsible for keeping faculty members involved. Other IHEs have LATs with more extensive faculty involvement. Both approaches seem to work well within the context of their institutions. As the project progresses we will continue to study how LATs are configured and the impact that has on partnership building.

Key Findings on Intervention Strategies/MSP Activities

Of the MSP professional development activities, the Teacher Leadership Academies (TLAs) continue to show improvement, with the academies demonstrating more integration of content-based pedagogy and leadership development in Year Three. As highlighted in the Year Two report, one strength of the TLAs is the opportunity they provide for direct interaction between K-12 and IHE faculty, which facilitates awareness and appreciation for different cultures.

The TLAs raise one key implementation issue: how teacher leaders will adapt the material for use in on-site academies. Due to time constraints, varying participation rates, and limited resources, teacher leaders often had to decide on short notice how to adapt these academies to conditions in their own schools. Although some degree of customization is expected, these adjustments raise questions about the degree to which these on-site academies can be modified while preserving the original intent. Because the on-site academies are a critical element in the development of communities of learners, the evaluation team will continue to monitor, through our case study districts, the types of modifications made to the on-site academies, the conditions that create them, and their impact of the changes.

The content deepening seminars (CDSs), though well-received, continue to face challenges related to marketing and participation by K-12 teachers. Specifically, CDSs were not well attended. One reason for this may be that teachers were at the end of a professional development credit cycle. Most teachers had accumulated the needed credits and the incentives for participation were low. Finding ways to encourage teachers to sign up for these IHE led seminars, rather than other seminars sponsored by other organizations (e.g. science museums, for profit teaching organizations), continues to present challenges for the MSP. This year the MSP attempted a number of efforts to increase participation in the IHE-led CDS, and it will be interesting to see if they are successful in increasing attendance. The IHE faculty members continue to try to identify unique ways to market and highlight the benefits of the CDS to the K-12 community.

Key Findings on Outputs

In addition to teacher and principal leaders, teacher fellows (TFs) are one of the major outputs of the MSP activities. While the other MSP activities and their outputs are aimed at reaching a broad audience of teachers, the TF program encourages the development of relationships between an individual teacher and higher education faculty. Thus, the TF program continues to be a critical link in building the partnership between K-12 and IHEs.

Last year we heard from fellows that spending a full year on an IHE campus was important in building relationships between participating IHE faculty and the TF. This theme was echoed in our TF interviews this year. Fellows who participated for a semester said that if given the opportunity again, they would opt for the year-long fellowship. However, factors such as being out of touch with their students, not really knowing what to expect from the experience, and concern over benefits had been important factors that they considered when making their initial decisions. Finding ways to address these concerns before TFs make decision about the duration of the fellowship may increase the likelihood that teachers will participate for a full year and gain the maximum benefit from the experience.

Key Findings on Outcomes

Although it is too early in the project to begin to see mid-term and long-term outcomes, examples of short-term outcomes are evident, such as increased awareness of cultural differences, increased partnerships, and the use of data in decision-making. These outcomes and others were discussed in considerable detail in Chapters 4 and 5. Below we list some themes that emerged from our analysis of these outcomes. We believe that these themes are important to the continued achievement and sustainability of the outcomes described in our logic model.

Variations in K-12 Participation

Patterns among the districts are beginning to emerge. One striking pattern is also a most logical one. Districts that show the most evidence of MSP impacts are those that are doing the most to implement the program, such as having high attendance at MSP activities, following project requirements, and providing teachers with an opportunity to reflect on what the MSP means within the context of their own teaching. Harder to discern is whether high levels of participation in the MSP are facilitated by certain district characteristics, making district involvement easier, or whether participating in the MSP strengthens certain district characteristics, making the impact of the MSP much more evident. It is difficult to answer this question at this early stage of our analysis.

Competing Reform Initiatives

Increasing teacher and administrator awareness of research-based practices and materials is an important early step toward changing practice. However, once teachers and administrators work to implement these practices, they must also contend with competing reform initiatives in their schools and districts. Data gathered in Year Three suggests that this was an issue for teachers, particularly science teachers, as they struggled to embrace their new understanding and awareness. Competing math reform initiatives as well as inadequate planning and preparation time for inquiry-based activities were common concerns. This issue may account for one of the trends we observed in the analysis of the teacher and principal survey data: responses from science teachers and responses from principals about science assigned lower ratings on a variety of activities than math teachers and principals responding about math. Whether the scale was measuring time spent on active learning, or emphasis of professional development on certain topics, the science responses ranked lower than math responses, with few exceptions. This finding is not

surprising, and may in fact be a natural outgrowth of the emphasis on testing and accountability that is present in mathematics and not present in science. This should change as testing and accountability in science ramps up.

IHE Recognition and Value of MSP Impact

Sustainability of the partnership between K-12 school districts and IHEs depends, in large part, on the IHE's recognition of the benefits of participating in MSP. What are IHEs gaining as a result of participating in the MSP? Moreover, how do IHEs value the benefits they are receiving from the MSP? Interviews with IHE faculty members indicate that the one of the primary benefits is the exposure to pedagogy and, in particular, inquiry-based teaching practices. This was not a stated goal of the project, although it might have been a goal of some of the PIs in writing the grant. Perhaps they realized that IHE faculty would not be receptive to receiving professional development with K-12 teachers and the only way to bring them into the project was as experts. However, the unintended consequence of this may be improved teaching of undergraduates at IHEs.

Most faculty, particularly STEM faculty, receive little or no training to teach. Consequently they teach as they themselves have been taught, typically using a lecture-based format. As a result of MSP participation, faculty members have begun to incorporate concepts from the TLAs in their own classrooms. At issue, however, is whether there is an existing infrastructure within IHEs to recognize and to reward faculty for their increased awareness and change in teaching practices.

With regard to promotion and tenure, many IHEs view faculty participation in the MSP as community service. This method of recognizing MSP participation holds little value to faculty members because they can gain service credits through less labor-intensive methods than the MSP. Other IHEs are willing to recognize faculty participation in the MSP as research, provided that publications are forthcoming. For STEM faculty, this is a challenge, because publishing in one's own discipline is more widely acknowledged as scholarly research than publishing in other fields (i.e. science or math education). Furthermore, there are few mechanisms in place to reward faculty members for adopting pedagogical innovations acquired from MSP-related professional development. Moreover, junior faculty, who potentially have the most to gain from exposure to the MSP teaching strategies, are being discouraged from spending too much time on MSP activities because they are considered "risky" to their careers. Enhancing IHE recognition for MSP involvement is a key issue, not only for MSP sustainability, but for how the MSP communicates the value of its activities to the IHEs.

Managing Change

Year Three was a pivotal phase in the MSP. The first and second years of the project focused on establishing infrastructure, which required rather rigid adherence to MSP policies. Now, the MSP appears to be entering a phase that permits greater accommodation and flexibility. The MSP is also undergoing a change from a research and development project supported by the NSF to a more locally based education reform. This transformation will clearly be an area of interest for the evaluation team. A

key component of this transformation is the MSP Coordinators, who are responsible for coordinating MSP activities in the district. As the project progresses, the MSP Coordinators will be supported by the IUs, who may have different expectations of MSP coordinators and their role in the districts.

With greater flexibility in response to K-12 and IHE partners comes added risk for a dilution of the MSP program and theory of action. As the MSP adapts to accommodate institutional contexts (a necessary step for sustainability), it will be important to consider fidelity of implementation in regard to outputs and outcomes as well.

Communication

Communication between partner institutions remains an important issue. During Year Three, there was evidence of continued improvement in communication between IHE and K-12 partners. However, there was room for continued improvement. Some K-12 and IHE participants still perceived the program as non-responsive to specific needs. Given the scope and scale of the project, some confusion may have to be tolerated as inevitable; the project will need to come to terms with how much misperception it can accept and what threshold must be crossed to signal a problem.

Linking the Student Teacher Pipeline between K-12 and IHEs

Student teachers need exposure to the communities of teacher leaders being developed in K-12 settings. This exposure can be accomplished by placing student teachers with MSP-participating teachers. This will afford student teachers opportunities to be mentored on the implementation of reform-oriented teaching strategies and to be fully supported in their first experiences implementing them. Student-teaching experiences will help improve the pipeline of new teachers feeding into the MSP schools and other schools in the region, thus ultimately building more capacity of highly qualified teachers in southwest Pennsylvania. IHE faculty members indicate they are convinced of the benefits of this synergy, and are working to enact it; however, thus far the strategy has met with only limited success. District administrators, and the students themselves, often have discretion over student teacher placements and can undermine this planned strategy. Moreover, IHE faculty often have little influence over student teacher placement, as it is handled by a staff person or administrator who may not be closely involved in the MSP. For the strategy to fully succeed, more-integrated and focused management of student teacher assignments will be needed.

Individual and Institutional Partnership

One theme that emerged from the IHE interviews was the view that partnerships are complex and that building them is the responsibility of all involved in the MSP. Institutions can only do so much to foster partnership between individuals and similarly individuals cannot force institutional partnership. A key question about sustainability is whether the individual relationships that have been built will continue after the NSF funding period is complete. Relationships take time to maintain, and if they are not valued by the institutions, there may be insufficient motivation for the partnerships to continue.

Student Achievement

The most current achievement data are from early in the project's implementation. Statistical models assessing change in MSP districts' PSSA math proficiency relative to a group of matched Pennsylvania school districts revealed no evidence of project impact at this early stage. The same analysis did find a statewide trend of increased proficiency on the PSSA, a fact that is useful when interpreting benchmarking trends, where more districts are meeting the math targets set by this project. There is no clear trend in science. Over the next two years the evaluation will place increased focus on achievement outcomes and, to the extent possible, developing plausible explanations for how the MSP project has influenced achievement.