Effect of STEM Faculty Engagement in MSP—A Longitudinal Perspective

A Year 2 RETA Report

April 2006

Prepared for:

National Science Foundation
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Chapter 1. INTRODUCTION

The Math and Science Partnership (MSP) program is a major national research and development effort that supports innovative partnerships to improve K–12 student achievement in mathematics and science. Deep engagement of science, technology, engineering, and mathematics (STEM) disciplinary faculty is a hallmark of this program. The program posits that disciplinary faculty hold the knowledge that K–12 teachers need, and that if faculty are substantially involved, the chain of professional knowledge will be strengthened and result in improved student achievement. Westat's research, evaluation, and technical assistance (RETA) grant aims to examine this assumption empirically. Specifically, we are asking how are STEM faculty engaged in MSP? Does the involvement make any difference in enhancing teacher quality and increasing student achievement? And are there particular circumstances in which certain types of involvement contribute more or less than others on these dimensions? In essence, we ask what works, for whom, and under what circumstance through six research questions:

1. What methods (i.e., strategies, practices, and policies) are being used by the projects to engage STEM faculty in their activities, and how do these differ by type of institution of higher education (IHE)?

2. What levels of involvement are garnered by various methods at different types of IHEs?

3. To what extent does STEM faculty involvement contribute to increases in K–12 teacher content and pedagogical knowledge?

4. To what extent does STEM faculty involvement contribute to student achievement?

5. What are the policy implications for engaging STEM faculty?

6. How does faculty involvement evolve, and does it appear to have the ability to be sustained?

Westat's study is funded over 4 years and includes two major components: case studies of eight MSP projects from three cohorts, and an analysis of data collected from the MSP Management Information System (MIS) on all 48 MSP intervention projects.

The approach to research in year 2 was similar to that in year 1 in that it continues to describe different components related to STEM faculty involvement. Specifically, we explored:

- The institutional context for STEM faculty involvement,
- Resources involved,
- Project efforts to support and engage STEM faculty,

- Resulting level of faculty involvement, and
- Individual and institutional outcomes.

The emphasis of the first 2 years has primarily been on what is happening at the IHE level. While we will continue to look at this issue in the next 2 years, the focus of the study will expand to the K–12 level by examining the impacts occurring among teachers and students as a result of STEM faculty involvement. The second annual report documents our research activities from May 2005 to March 2006. The report contains the following sections:

- Year 2 data collection and analysis methodologies,
- Preliminary findings, and
- Implications for future study.

Chapter 2. Year 2 Data Collection and Analysis Methodologies

2.1 Case Study Component

2.1.1 Site Selection

In addition to the four projects we studied in year 1, we recruited four more projects from MSP cohort 3 to participate this year. The same selection criteria were used as in year 1, including an apparent high level of STEM faculty participation in the projects, often indicated by an important role envisioned by the project for the STEM faculty; the types and levels of STEM faculty engagement proposed; and the number of faculty who had already signed up as participants.

After receiving authorization from MSP program officers, we contacted the projects to assess their interest in participating in the study, and their ability to provide us with existing project data on faculty, teachers, and students. Projects that declined participation were replaced by alternate candidates. Of the four new projects, two are classified as Targeted and two as Institute projects.

Table 2-1 provides information about characteristics of the all eight case study projects. Two projects focus on mathematics, four on science, and two on both mathematics and science. For the lead institutions, three are classified under the Carnegie classification system as Doctoral/Research University-Extensive, three as Doctoral/Research University-Intensive, and two as Master's College/University-1.[1] Six of the IHEs are public and two are private. Geographically, they are located in the East, Midwest, South, and West. In addition, the lead IHEs in all but two projects are working with 2 to 10 IHE core partners. The number of K–12 districts range from 2 to 29, with an average of 10.

Using data from the MIS as a retrospective check, we found that STEM faculty from our 8 case study projects are representative of the 48 MSP projects in aspects such as demographics, tenure status, and faculty rank; they differ in their higher level of STEM faculty involvement: 46 percent of STEM faculty in case study projects were involved in MSP for more than 200 hours as compared to 26 percent in all MSP projects in 2004–05.

[1] We used the old Carnegie classification system as the new one is still being finalized.

Table 2-1.—Characteristics of the full case study sample

Aspect	P1	P2	P3	P4	P5	P6	P7	P8
MSP cohort	1	2	2	2	3	3	3	3
MSP project type	C	T	T	T	T	T	I	I
Content focus	M/S	M	S	M/S	S	S	M	S
Institution type of lead partner								
▪ Carnegie classification								
– Doctoral/Research-Extensive	X	X						X
– Doctoral/Research-Intensive				X	X		X	
– Master's College/University-1			X			X		
▪ Ownership								
– Public	X	X	X		X	X	X	
– Private				X				X
▪ Location								
– East				X		X		X
– South		X						
– Midwest					X			
– West	X		X				X	
Total number of IHE partners	1	2	5	2	5	4	10	1
Total number of K–12 district partners	3	12	29	10	8	2	10	17

C=Comprehensive, T=Targeted, I=Institute; M=Mathematics, S=Science.

Data source: MSP MIS.

2.1.2 Site Visits

In year 2, site visits were conducted to all eight projects, including the four MSP cohorts 1 and 2 projects that we visited last year (RETA cohort 1) and the four cohort 3 projects that we visited for the first time (RETA cohort 2). We spent 2 days at RETA cohort 1 projects and 3 days at RETA cohort 2 projects. Site visits included both interviews (of project leadership, STEM faculty members, education faculty, teacher leaders, inservice teachers, and students) and classroom observation of STEM faculty. Protocols are included in Appendix B. A number of changes were made to the site visits as compared to year 1.

- Most of the site visits occurred in summer, when the intervention for all projects is most intense because of the summer institutes.

- We added interviews of teacher leaders for all projects. We also interviewed STEM faculty from the nonlead institutions.

- For RETA cohort 1 projects, we focused on questions about changes. And given the shorter period of time on site, many of the interviews with STEM faculty were conducted in a group.

As in year 1, each site visit team had two researchers: one from Westat and one external STEM disciplinary faculty member hired as a study consultant. Table 2-2 details the site visit activities.

Table 2-2.—Site visit activities

Activity	Respondent	Number
Interviews	PI/Co-PI/PD	18
	STEM faculty	56
	Education faculty	5
	Teacher leaders	23
	Inservice teachers	105 (some in groups)
	Others (i.e., K–12 students, counselors, principals)	12
Observations	Inservice teacher training	610 in 33 sessions
	Debriefing	41 in 3 sessions

PI = principal investigator; PD = project director.

The data obtained from the year 2 site visits primarily serve a descriptive function, providing researchers with a thorough understanding of STEM faculty involvement in each project. Another objective was to illustrate major cross-cutting issues based on corroboration of evidence. Essentially, there are two layers of triangulation. The first layer is within each project, whereby evidence is triangulated from interviews, observations, and document reviews. The second occurs across projects, whereby evidence is compared and contrasted in the context of each project.

2.1.3 Analysis of Project-Collected Data

Another aspect of the case study is the examination of existing data from the projects. The purpose is to maximize the utility of these data to address our research questions without imposing additional burden on the projects. Specifically, we want to use these data to help construct a detailed analysis of how and in what ways faculty involvement affects teachers and students. However, these models are highly dependent on the type of data available within a project. Therefore, evidence from these models is to be used to support case studies rather than to generalize across projects.

The intent is to examine data with regard to 1) STEM faculty participation, 2) inservice and preservice teacher outcomes as a result of working with STEM faculty, and 3) student outcomes as direct or indirect results of STEM faculty involvement. We have spoken with project evaluators to understand what data are being collected and how these data can be used to address our research agenda.

Because of both logistical and technical challenges of this task last year, our analysis this year focused on RETA cohort 2 projects only.[2] The purpose of these initial analyses is to gain an understanding of and familiarity with the various types of data projects collected. Based on these analyses and our continuing communication with the project evaluators, we will focus on selected projects for more systematic and in-depth analysis in the final year of this study. In this report, we drew on baseline evidence from data collected from five projects (three from RETA cohort 1[3] and two from RETA cohort 2) over the last 2 years.

[2] Of the four projects, we are able to gather some data and results from two based on pre/post teacher knowledge assessment, course evaluation of STEM faculty, and baseline data on students whose teachers participated in the summer institute.

[3] Analyses of data from three RETA cohort 1 projects were conducted after the year 1 report was submitted.

2.2 Analysis of MIS Data

Three modules from the MSP MIS are especially relevant to our study. These are the annual IHE participant survey, the IHE institution survey, and the K–12 district survey as of January 2005 (Appendix C).

The IHE participant survey provides information from all participating MSP projects with regard to faculty profiles, extent of engagement, and types of engagement. Of 1,160 IHE respondents in academic year 2004–05, 740 can be categorized as STEM faculty.[4] The number of STEM faculty respondents represents about 68 percent of the total STEM faculty reported by the IHE institution survey. Our analysis compared STEM faculty experience with education faculty and other IHE participants. Further comparisons among STEM faculty were made by cohort, project type, and institution type using the analysis of variance technique (ANOVA).

In addition, we explored the baseline relationship between project-level STEM faculty participation and school-level student achievement reported by the K–12 survey using two-level hierarchical linear modeling (HLM). The analysis did not include achievement data from 2004–05, which are currently being validated. The experience has given us familiarity with the data and related analysis issues that will serve as preparation for future analysis after multiple years of student achievement and faculty survey data become available.

[4] In the IHE participant survey, we defined STEM faculty as those who either teach in a STEM field or whose research is in a STEM area.

Chapter 3. Preliminary Findings

Our research design is guided by the logic model in Exhibit 3-1. Informed by the literature review and MSP program design, the logic model presents a roadmap to connect different elements of MSP implementation regarding STEM faculty engagement from program design and activities to outcomes. It provides a visualization of the theory of change that we are assessing as we examine whether and how STEM faculty engagement affects educational changes at the K–12 and IHE levels.

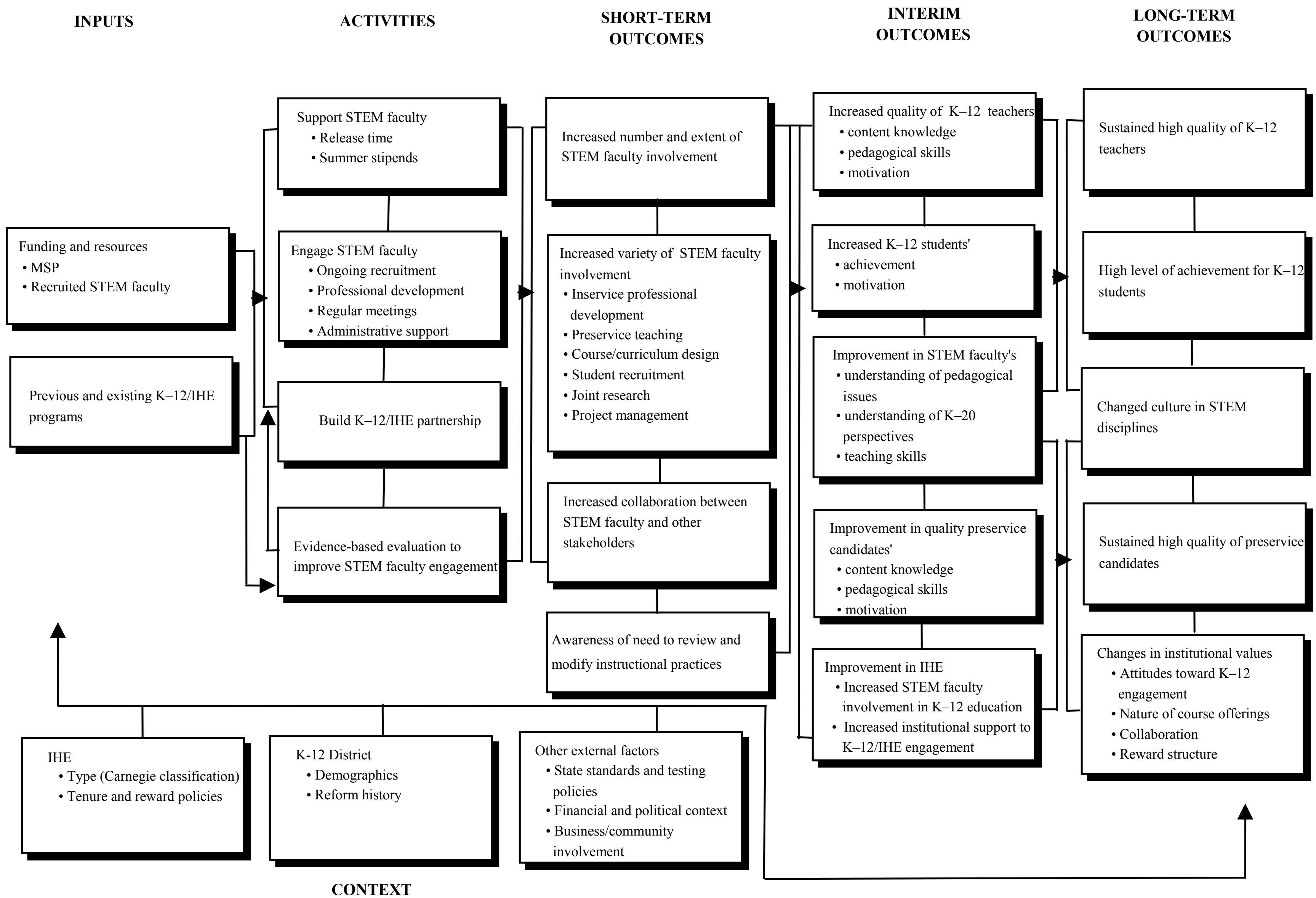
We understand that the change process is not linear and often recursive, but the logic model serves as a framework for understanding critical components in the change process and the hypothesized linkages among them. These various components are described as follows.

- **Context** describes the initial features of the environment in which an MSP project (and STEM faculty involvement) is operating, which includes characteristics of both IHE and K–12 partners as well as other external factors. For our purposes, key IHE characteristics are the type of institution (by Carnegie classification), and tenure and reward policies. Similarly, K–12 characteristics may involve the demographics of school districts (i.e., size, urbanicity, student learning status, teacher turnover) and reform history. External factors include variables such as state curriculum standards and testing policies, financial and political context, and business and community involvement.

- **Inputs** entail funding and direction from MSP, as well as other previous and existing K–12/IHE programs and/or partnerships that may affect the identified outcomes. In an era of educational reforms, it is difficult to find a clean situation in which one can examine the "pure" effect of one initiative. In other words, the effects of a certain reform build on those of other previous or existing reforms, each of which enhance, balance, or sometimes offset the impact of the other. By enumerating these alternative inputs, we will establish a better understanding of what we observed.

- **Activities** are actions taken to reach project goals by employing the project inputs. In this case, the term specifically refers to project efforts to engage STEM faculty, and not to the activities of STEM faculty once they are committed to the project (i.e., "short-term outcomes"). Designing strategies to overcome these barriers and increase the level of STEM faculty engagement is critical to the success of MSP projects. We distinguish four types of activities: 1) support to STEM faculty refers to project strategies in providing extrinsic incentives to engage in K–12 reform such as release time and summer stipends; 2) engaging STEM faculty involves activities that appeal to such intrinsic motivations as ongoing recruitment of faculty members to MSP projects, providing professional development to participating faculty to enhance their understanding of K–12 perspectives, pedagogical issues, and regular meetings about project implementation; 3) building the partnership among participants refers to activities promoting collaboration between faculty and other players; and 4) evidenced-based evaluation to improve STEM faculty engagement refers to the ongoing processes to evaluate STEM faculty engagement and/or efforts to gather and use research and evaluation evidence to improve STEM faculty involvement.

Exhibit 3-1.—Logic model for STEM faculty involvement



- **Short-term outcomes** are the direct and immediate results of the "activities," usually taking place within 1 to 2 years of the project. These outcomes include different measures of STEM faculty engagement such as the number and extent of STEM faculty involvement, types of activities in which STEM faculty are participating (i.e., inservice professional development; preservice training; course/curriculum design for K–12 students, teacher professional development, and IHE STEM or preservice students; study group/learning community; recruitment of both preservice and STEM students; joint research; project management), and the degree of collaboration between STEM faculty and other stakeholders. In addition, these outcomes involve projects' awareness of the need to review and modify institutional practices and policies.

- **Interim outcomes** are specific changes likely to take place in 2 to 3 years in areas where STEM faculty are involved. Although some may argue that the time frame is too short, it represents the expectation of the MSP. Therefore, we hypothesize that these types of changes will occur in both K–12 and IHE sectors. For K–12, we expect to see an increased quality of K–12 teachers and improved student achievement. Since STEM faculty often work with K–12 teachers directly and with students indirectly, we are more likely to see interim outcomes in K–12 teachers. We expect that changes in IHEs will take place in STEM faculty themselves (understanding of K–20 perspectives, and changes in their own teaching skills), preservice candidates (content, pedagogy, motivation), and IHE institutions (STEM faculty involvement, institutional support for K–12/IHE engagement).

- **Long-term outcomes** are the ultimate results that usually occur after year 4 or 5 of the program. We have not found any studies on the long-term effects of STEM faculty involvement. However, based on limited evidence regarding the interim outcomes, our theory of change suggests that K–12 institutions will benefit by sustained high quality of teachers and improved achievement for students. IHEs will benefit from a changed culture in STEM disciplines, sustained high quality of preservice and disciplinary students, as well as changed institutional attitudes toward K–12 engagement, nature of course offerings, collaboration, and reward criteria and policies.

We use the logic model to structure the discussions about different components related to STEM faculty involvement and their relationships with each other. Specifically, we tried to understand 1) the institutional environment for STEM faculty involvement (context), 2) resources involved (inputs), 3) project efforts to support and engage STEM faculty (activities), 4) resulting level of faculty involvement (short-term outcomes), and 5) the individual and institutional outcomes (interim outcomes). We will examine long-term outcomes in the next 2 years of study. Where possible, the discussion begins with findings from the MIS surveys that provide a broad picture, followed by findings from case studies that offer in-depth and nuanced perspectives. In presenting case study findings, care has been taken to remove individual, institution, and project identifiers to protect the confidentiality of the respondents. Selected sections of the logic model will appear as appropriate in the following sections.

3.1 Context: Institutional Environment for STEM Faculty Involvement

In this section, we describe the contextual variables in the IHE and K–12 environments as well as other external factors that may affect STEM faculty by drawing data from both MIS surveys and our case studies. Specific attention was paid to IHEs' tenure and reward policies.

IHE
- Type (Carnegie classification)
- Tenure and reward policies

K-12 District
- Demographics
- Reform history

Other external factors
- State standards and testing policies
- Financial and political context
- Business/community involvement

CONTEXT

3.1.1 IHEs

As shown in Table 3-1, the reward and tenure policies in seven of the eight lead IHEs contain language that recognizes the MSP-like activities, defined as either "outreach" or "service." The one IHE that does not explicitly and directly acknowledge outreach activities recognizes publications arising from such activity in the sense of the scholarship of teaching and learning.

Table 3-1.—Tenure and reward policies at IHEs (case study projects)

Aspect	P1	P2	P3	P4	P5	P6	P7	P8
Outreach/service recognized	X	X	X	X	X		X	X
Other mechanism			X			X		

Data source: Case studies.

Some of the lead IHEs had a record of outreach activities prior to MSP. One university with an infrastructure that long predates MSP guarantees two faculty members per STEM department who are committed to work half time on disciplinary teaching and research, and half time on pre/inservice teacher training. The dual nature of the appointment means that a faculty member could work in STEM education without having to be in "overload mode" all of the time, which was credited by many as a motivator to work on K–20 reforms. At least two lead IHEs recently revised their policies to give outreach/service more weight in tenure and promotion. In one instance, while work in education reform makes "absolutely no difference" when assistant professors are reviewed, it matters increasingly as one moves up the academic ladder.

Findings from last year's study on four RETA cohort 1 projects suggested that despite the relatively policy-friendly environment for disciplinary faculty engagement at the case study universities, traditional reward structures and the perceived status of differential engagement are still considered barriers for faculty involvement in most MSP-like endeavors. Site visits to four RETA cohort 2 projects further confirmed that research and teaching are the principal paths to promotion. Outreach or service, sometimes referred to as "other contributions," is considered to be a distant third and not seen as valuable.

However, the evidence above is the official policy at the macro level. At the department (mezzo) level, the policies were often implemented differently. In one instance, the department policy statement notes "the department generally avoids major service demands on untenured faculty…demonstrated leadership in service is not part of the criteria for tenure." However, the section on appointment to full professor mentions the need to demonstrate significant accomplishments within the department, university, and professional societies, as well as "outreach to the community including civic duties related to mathematics and science education." The example characterizes a general environment in which faculty members are constrained under a tenure and promotion system that emphasizes research, but not the types of activities related to the MSPs. Thus, most of the faculty members participating in the project are tenured, so the younger, less established ones do not have to "sacrifice" time that would otherwise be spent conducting research.

It is interesting to see how policies are translated to the individual (micro) faculty level. When asking about whether they would be rewarded at their institutions for participating in an MSP-type activity, a minority of the STEM faculty thought that it would be viewed positively; most felt it would be either tolerated or ignored. In particular, the environment for one project appears to be unconducive to faculty engagement. According to the PI, neither the university system nor the colleges have written policies encouraging faculty to engage in outreach activities. While the STEM departments appeared to welcome the MSP, the college is 100 percent opposed to this effort, as the dean felt that it "sullied the reputation of the college."[5] There was never an announcement of the MSP award within the college, not even by email. The project basically had to "fight and bribe" for space for the summer institute. The only justification for STEM faculty involvement is that while involvement in MSP in itself does not count toward tenure and promotion, any publications—in the sense of the scholarship of teaching and learning arising from this activity—would count.

We found little change in terms of tenure and reward policy in the four projects that we revisited. STEM faculty from one project almost unanimously believed that current promotion and tenure policies will never change. One STEM faculty member observed: "Any consideration of coupling the three areas (research, teaching, and service) as equal is moving slower than a glacier." Some feel that the most that can be hoped for is for deans and department chairs to broadcast the following type of message in this regard: "There is no reward for doing this, but it is okay for you to do it."

For another project, although the department chair recently revised the merit-raise criteria to reinforce the university's commitment to outreach, it suffered a setback when one participating faculty member with an outstanding record of outreach and teaching, but relatively weak research, was declined promotion in his latest review.

Even for the project that has perhaps the most supportive environment by guaranteeing that two STEM faculty per department will be committed half time to pre/inservice teacher training, STEM faculty still felt that what they are doing is "not on the radar" of the institution, as research is still rated higher in terms of incentives.

3.1.2 K–12 Districts

Table 3-2 shows that case study projects work with multiple K–12 partners. The number of K–12 districts involved is usually a function of the urbanicity of the districts. For example, projects with a smaller number of K–12 partners tend to be located in urban environments, while those that involve a large number of districts are often located in rural areas.

[5] Contrary to the speculation made by some reviewers, this is not a Doctoral/Research-Extensive institution.

Table 3-2.—K–12 context (case study projects)

Aspect	P1	P2	P3	P4	P5	P6	P7	P8
Number of K–12 district partners	3	12	29	10	8	2	10	17
Characteristics of K–12 partners								
▪ Urban	X			X	X	X	X	X
▪ Rural		X	X		X		X	X
Level of district support to MSP								
▪ High	X	X	X	X	X		X	
▪ Medium								
▪ Low						X		X

Data sources: MSP MIS, case studies.

The four RETA cohort 1 projects continue to enjoy a collegial relationship with their K–12 partners. For the RETA cohort 2 projects, the situations are somewhat different. The PIs from two projects that have good relationships with the school districts have had extensive K–12 connections. For example, one project director is from the school district from which most of the teachers originate. She has a strong science background, and her position as a science specialist and many years of classroom teaching has engendered the respect of peers.

Two other projects have encountered some problems. For one project, the primary responsibility of the school districts is teacher recruitment. However, the project leadership expressed disappointment with the level of activity and commitment on the part of some districts, especially the major urban one in which they are located. Consequently, while the project now serves teachers from a broad range of districts, it lacks a critical mass of involved teachers from those districts.

Project leadership from another project expressed deep frustrations in working with the school districts. First, the city department of education did not provide any support with recruitment. Second, the districts did not respond with sufficient buy-in. Some even view the project as competition to the local offerings in professional development. The PI and project director had to call all of the eligible families to encourage their children to attend the summer camp, but they are still a third short of the projected enrollment. The project provided $5,000 per teacher for participation, but many teachers were still not interested. The issues with K–12 districts may be related to "turf." Some observed that districts only wanted IHE participation in projects that they controlled and were uncooperative if they did not have control.

3.1.3 Other External Factors

Contextual factors can either enhance or impede implementation and the impacts of MSP project in general and STEM faculty involvement in particular. As shown in Table 3-3, all projects involved are facing increasing pressure from their states to enforce standards, accountability, and student achievement.

Table 3-3.—External factors (case study projects)

Aspect	P1	P2	P3	P4	P5	P6	P7	P8
State standards and testing requirement	X	X	X	X	X	X	X	X
Other similar programs	X				X			
Financial cutbacks	X							

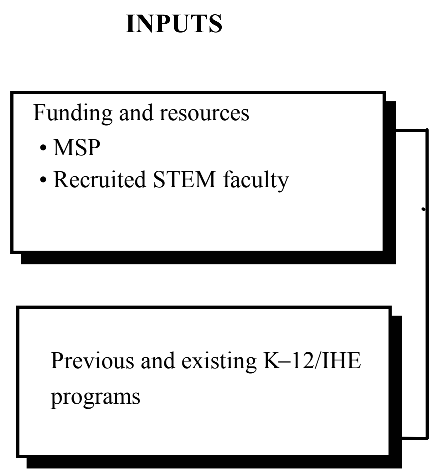
Data source: Case studies.

In one state facing a significant challenge to raise poor student performance, an optional state test has now become mandatory for high school graduation. In addition, the state also developed new grade-specific content curriculum standards. The arrival of the new standards prompted many of the participating schools to begin project activities earlier than planned. Another state makes it a priority to increase the number of mathematics and science teachers. As a result, the university has pledged a fourfold increase in its annual production of credentialed teachers. The initiative was widely supported by corporate leaders, who have made generous donations.

Other programs similar to NSF MSP may also account for some of the activities taking place. In one project for example, a nonlead partner received a $10 million U.S. Department of Education (ED) MSP grant that involves many of the same universities, school districts, and personnel. When asked about the distinction, the project director responded, “Our collaboration between NSF and ED projects has actually received very favorable comments nationally. There has been no problem with STEM faculty.” Both grants employ a co-teaching model. Probably the biggest differences are the requirement of lesson study in the ED grant and the pedagogical focus of the NSF award.

The state funding decision can be a two-edged sword. For example, one state recently cut back funding for university outreach activities. However, it provides additional funding from state subject-matter projects and new funding for teacher preparation programs, both of which were targeted by MSP.

3.2 Inputs: Resources That Go into STEM Faculty Involvement



In this section, we look at resources other than the MSP grant that support STEM faculty involvement (i.e., human capital). We understand that the effects of MSP can build on other previous or existing reforms, each of which enhances, balances, or sometimes offsets the impact of the other.

The MIS data from all participating MSP projects show that while many disciplinary faculty members involved in MSP have had previous experience working with the K–12 sector, 15 percent of the STEM faculty reported that MSP was their first experience in working with K–12 students and teachers. Table 3-4 shows the comparison among case study projects.

Table 3-4.—Previous and existing programs (case study projects)

Aspect	P1	P2	P3	P4	P5	P6	P7	P8
Other previous and existing programs	X	X	X	X	X	X	X	X
Percent first timers	11	0	10	0	0	NA	27	29

Data source: MSP MIS.

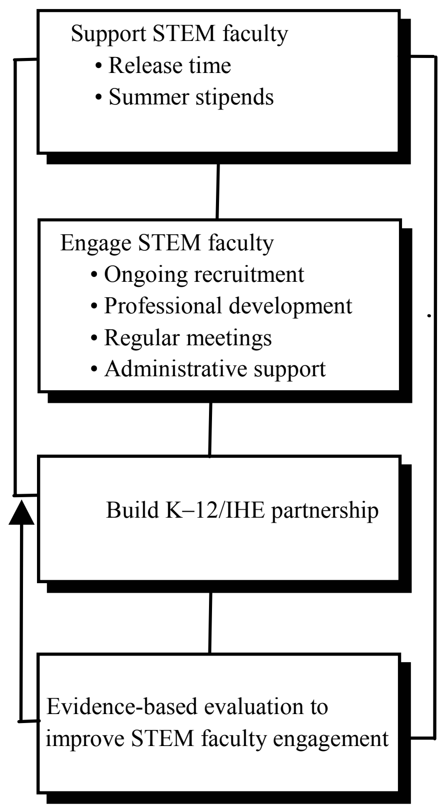
For most case study projects, the MSP is the major source of funding that lead IHEs currently receive to promote STEM faculty engagement in education reform. Case studies found that all of the projects had prior involvement in STEM K–20 education reform, although prior involvement was not one of the conditions of the grant. Last year’s case studies showed that STEM faculty members’ previous involvement in educational reforms were organized at the institutional level in some cases and based on small group or individual initiatives in others.

The patterns for the four RETA cohort 2 projects are similar. For two projects, many of the participating STEM faculty had some kind of prior involvement with K–12 teachers, such as working at the state level in teacher preparation or in an earlier content-oriented teacher preparation program. STEM faculty in the other two projects had limited experiences working with education reforms except on a prior version of the science teacher institute or a pilot program. In one project, while all of the STEM faculty members have been involved in undergraduate education in STEM areas for some time through NSF teaching grants or joint master's programs in science education, STEM faculty involvement in K–12 reforms is relatively new. Faculty members at the community colleges were often involved in teaching remedial courses, giving them insight into the content knowledge of high school students.

3.3 Activities: Projects Efforts to Engage and Support STEM Faculty Involvement

Although the majority of the participating STEM faculty are highly motivated, it still requires considerable effort from project administrators to engage and support faculty involvement, provide a framework in which STEM faculty can work with other stakeholders as a team, and define the direction of faculty engagement. Using evidence from the case studies, we explore project strategies to engage STEM faculty in four types of activities: 1) supporting STEM faculty, 2) engaging STEM faculty, 3) building partnerships, and 4) using evidence-based evaluation to improve STEM faculty engagement (Table 3-5).

ACTIVITIES



3.3.1 Supporting STEM Faculty

Supporting STEM faculty refers to project strategies to provide extrinsic incentives to engage in K–12 reform. Financial support to STEM faculty from most projects comes as course release during academic year and stipends for summer institutes or the school year, depending on the types of involvement expected of them. However, for some RETA cohort 2 projects, faculty were unclear at the time of data collection about how they will be involved during the school year and what the incentives might be. In other cases, involvement during the school year is voluntary and not remunerated.

Table 3-5.—Project efforts to support and engage STEM faculty (case study projects)

Aspect	P1	P2	P3	P4	P5	P6	P7	P8
Support								
▪ Release time	X	X	X		X	X	X	X
▪ Summer stipends	X	X	X	X	X	X	X	X
Engage								
▪ Ongoing recruitment		X						
▪ Professional development for STEM		X	X	X		X		
▪ Debriefing, monthly meetings		X				X		
▪ Administrative support	X							
Build partnership		X	X	X				
Evidence-based evaluation								
▪ Evaluation of STEM activities	X		X	X				X
▪ Use project evaluation to inform STEM involvement								

Data source: Case studies.

3.3.2 Engaging STEM Faculty

Engaging STEM faculty involves activities such as recruiting additional faculty members, providing professional development to participating faculty to enhance their understanding of K–12 perspectives, addressing pedagogical issues, and attending regular meetings about project implementation. One department chair stressed the importance of combining "money talking" and enlightened self-interest when engaging faculty. In addition to providing summer stipends and course release, projects have employed a number of strategies to appeal to faculty's intrinsic motivations.

Ongoing recruitment. We found that most of the RETA cohort 1 projects are still working with the same group of STEM faculty. Indeed, only one project made an effort to engage in ongoing recruitment by providing opportunities for other faculty members to learn about participation in MSP through annual conference and colloquia. At the personal level, a department chair encouraged people whose research is somewhat inactive to pursue other activities such as MSP. Although it is a practical solution, some may argue that faculty whose research is at the cutting edge should be targeted.

Professional development. Half of the projects provided professional development for STEM faculty. One project organized biweekly seminars involving participating STEM faculty, education faculty, and graduate students to learn each others' perspectives, discuss what ought to be taught, and read and discuss articles and books about research on math education.

Another project is built on a "co-learner model," whereby STEM faculty members work with teacher leaders during the summer on pedagogy and the presentation of exemplary middle school curriculum materials.[6] Faculty contributed by assessing the middle school curricula from the perspective of whether it is good science, what students should know and the kind of thinking they will need in college, the problems that students have in moving from the concrete to the abstract, and the level of scientific sophistication of lead teachers. Meanwhile, faculty members were also exposed to the idea of active

[6] The project has 10 collaborative school support teams, each of which has one or two STEM faculty, three lead teachers, the school principal, and a school guidance counselor or social worker. The role of the team is to study the existing curriculum and practice of middle school, develop relevant content components to enrich curriculum, bring lead teachers up to speed with the new curriculum, and serve as a resource for the implementation of the new materials.

learning embedded in the curriculum. After teams of co-learners attend the summer institutes, they will work with assigned districts to provide professional development for district teachers.

Professional development can also come in the form of debriefing after the project activities. At least two projects have such a mechanism, whereby faculty gather together with other participants at the end of a professional development activity to reflect on the day's experience from content and pedagogy perspectives and discuss issues that need to be addressed.

Administrative support. One project has a long history of partnership activity, including direct, targeted invitations to STEM faculty. When approaching faculty, project staff have the support of an outreach center behind them and, accordingly, can promise the faculty members that they will only have to deal with substantive issues and can leave all the administrative and logistical arrangements to project staff.

In addition to the above-mentioned activities, projects need to be sensitive to the needs of STEM faculty, who are often confronted by multiple and sometimes competing demands. One project's experience is particularly illustrative. During our site visit last year, STEM faculty expressed a concern for being stretched too thin by multiple responsibilities and time demands. Since then, the project changed the strategy by requiring intense STEM faculty involvement only in the year when their content area is featured in the summer institute. In addition, it combines involvement in preservice with inservice in curriculum design—an activity called "write-our-own-curriculum." Currently, the project is requiring all partner IHEs to implement a common standards-based, year-long undergraduate science course sequence for future teachers. It involves a revision to the General University Requirements (GUR) and affects a prerequisite for admission to the elementary education program at the graduate level. In the first 2 years of the grant, scientists at each partner institution spent half of their release time in multidisciplinary GUR working groups to determine course outcomes, design instructional units, and plan assessments. In each subsequent year, a different content area will be selected so that faculty do not have to contribute as lead instructors if their content areas are not targeted in the year. Finally, the evolving curriculum for preservice elementary teachers can be trial-tested on current elementary and middle school teachers via the summer academy. The decision to streamline faculty responsibilities and create a sense of ownership had major implications for engaging STEM faculty within the project as well as for its trajectory and overall vigor.

3.3.3 Building Partnerships

Projects used various strategies to promote collaboration between STEM faculty and other project participants.

- To bridge the philosophical divide between IHE participants, one project holds biweekly seminars for STEM faculty, education faculty, and graduate students. In each seminar, participants discuss the literature they read regarding what courses need to be offered and how they should be taught for inservice and preservice programs. For other projects, cultural and personality differences are resolved on an ad hoc basis rather than by formal strategies.

- During the summer institute, a number of projects held daily debriefings to report progress and discuss emerging pedagogical and administrative issues. Such debriefings were regarded as instrumental in facilitating cooperative relationships.

- Monthly meetings are another way team members gathered together to discuss problems, obtain feedback, identify resources, and provide encouragement. One co-PI said, "teams are working well, they are more strongly bonded now. They exhibit collegiality and camaraderie."

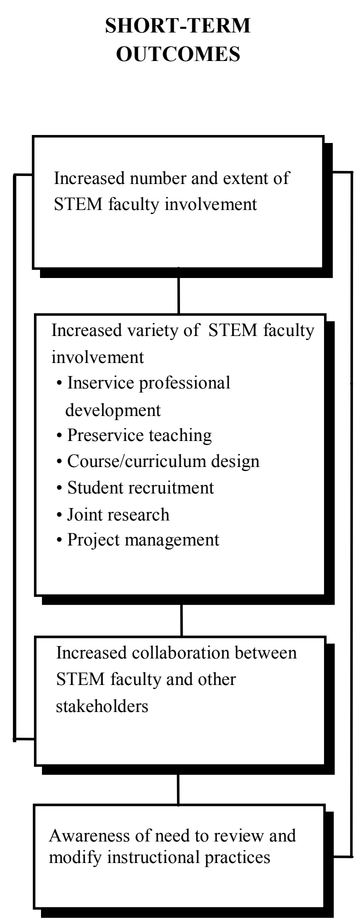
- One project used specially selected teacher leaders to support IHE/K–12 exchange. The experience of jointly designing and delivering the curriculum “converted” some people, and the PI observed an “attitudinal shift.”

3.3.4 Using Evidence-Based Evaluation to Improve STEM Faculty Engagement

Evidenced-based evaluation to improve STEM faculty engagement refers to the ongoing processes to evaluate STEM faculty engagement and/or efforts to gather and use research and evaluation evidence to improve STEM faculty involvement. Although all projects are required to conduct an evaluation, the evaluation of STEM faculty involvement is relatively weak. About half of our case study projects have built this element into the evaluation framework to collect data on aspects of STEM faculty involvement such as course evaluations of summer institutes, interview/focus groups, and observation. One project developed a matrix system by tracking faculty involvement in different events and rating each faculty’s MSP involvement. Different types of activity, linked to project strategies and objectives, are rated on a scale of 1 to 5. The outcome-based system, originally a monitoring mechanism from a previous statewide school university partnership, was adapted by the project to its own use. Ratings on individual STEM faculty were provided by leaders of different tasks. The data have been used internally to monitor trends but have not been shared with individual faculty members.

Overall, it is unclear how data on the accomplishments of teachers and corresponding student achievements have been used to guide the directions of STEM faculty involvement, as none of the projects have explicitly addressed this correlation.

3.4 Short-Term Outcomes: STEM Faculty Involvement in MSP



Short-term outcomes are the direct and immediate results of the activities, usually taking place within a year or two after their conclusion. These outcomes include different measures of engagement such as the number and extent of STEM faculty involvement, types of activities in which STEM faculty are participating (i.e., inservice professional development, preservice training, course/curriculum design, study group/learning community, student recruitment, joint research, project management), and the degree of collaboration between STEM faculty and other stakeholders. Drawing on data from both the MIS and case studies, this section looks at the participating STEM faculty, the extent of their involvement, the types of activities in which they are engaging, and how well they are working with other participants.

3.4.1 Participating STEM Faculty and Their Involvement

The MIS IHE institution survey shows that 1,084 STEM faculty participated in MSP activities during 2004–05. We define STEM faculty as IHE participants who identified a STEM area as the primary field of instruction or research (see Table 3-9). In this way, we avoided the structural issue regarding where faculty "live" in their IHEs. For example, in some IHEs, STEM education faculty are in the education department, while in others, they are located in the STEM departments. Of these STEM faculty identified by the project, 740 responded the IHE participant survey—representing 64 percent of the total 1,160 IHE respondents[7]. As shown in Tables 3-6 to 3-9, of these 740 STEM respondents:

- Sixty-one percent are male and 86 percent are white. Compared to other types of IHE participants, STEM faculty are more likely to be male, while education faculty are more likely to be female.

- Compared to other types of IHE participants, STEM faculty are more likely to be tenured and full professors. Three-fourths (76 percent) of the STEM faculty have tenure or are in tenure-track positions, and 54 percent are either full or associate professors.

- Of all STEM participants, only 34 percent are from Doctoral/Research Universities–Extensive. The proportion is significantly lower than other IHE participants in this category.

- While the MIS made a distinction between the fields of research and institutions, it is not unexpected that most STEM faculty teach in the same field of research. Overall, the top three STEM fields represented in MSP are mathematics, biological science, and chemistry. It is interesting to note that 19 percent of STEM faculty conducted research in education.

Table 3-6.—Demographics of STEM faculty during the 2004–05 academic year (all MSP projects)

Demographic characteristic	Total faculty (n=1,160)	Faculty type STEM (n=740)	 Education (n=320)	 Other (n=100)
Gender				
Male	53.9%	60.9%	40.6%	44.0%
Female	41.8	35.4	54.7	48.0
Unknown	4.3	3.6	4.7	8.0
Race				
White	84.8	86.2	82.8	81.0
Black	5.1	3.8	7.5	7.0
Asian	4.0	4.1	4.1	3.0
American Indian	0.4	0.5	0.3	0.0
Native Hawaiian	0.3	0.5	0.0	0.0
More than one race	2.0	1.9	1.6	4.0
Choose not to respond	1.2	1.1	1.3	2.0
Unknown	2.2	1.9	2.5	3.0
Ethnicity				
Hispanic or Latino	10.9	11.1	10.9	10.0
Not Hispanic or Latino	83.4	84.2	82.8	80.0
Choose not to respond	1.2	0.9	1.6	2.0
Unknown	4.4	3.8	4.7	8.0

NOTE: Shading indicates the item is significant at the .05 level. Percents may not add to 100 because of rounding.

Data source: MSP MIS.

[7] We examined the respondents in the 2003–04 and 2004–05 surveys from the Comprehensive and Targeted projects (Institute projects were only included in 2004–05) for evidence about faculty retention. The 2003–04 surveys had 481 STEM faculty respondents, and the 2004–05 surveys had 673 . Of the 2004–05 respondents, 384 (57 percent) responded to the surveys in both years, and 289 (43 percent) responded for the first time. Of the 2003–04 respondents, 97 (20 percent) did not respond to the survey in 2004–05.

Table 3-7.—Tenure status and faculty rank of STEM faculty during the 2004–05 academic year (all MSP projects)

Tenure status and faculty rank	Total faculty (n=1,160)	Faculty type: STEM (n=740)	Education (n=320)	Other (n=100)
Tenure status				
Tenured	50.5%	59.5%	38.8%	22.0%
On tenure track	15.9	16.9	17.2	5.0
Not on tenure track	13.4	12.2	15.6	16.0
Not applicable to my position/at my institution	20.1	11.5	28.4	57.0
Faculty rank				
Professor	25.6	31.2	17.2	11.0
Associate professor	19.7	22.8	16.6	6.0
Assistant professor	16.9	18.4	16.9	6.0
Instructor	5.3	5.9	4.7	2.0
Lecture	3.3	4.5	1.6	0.0
Adjunct faculty	2.4	2.0	3.1	3.0
Administrator with instructional responsibility	7.4	6.6	10.0	5.0
Administrator without instructional responsibility	4.3	0.5	3.8	34.0
Other	12.0	7.3	19.1	24.0
Not applicable at this institution	0.4	0.5	0.3	0.0
Not applicable for my position	2.8	0.1	6.9	9.0

NOTE: Shading indicates the item is significant at the .05 level. Percents may not add to 100 because of rounding.

Data source: MSP MIS.

Table 3-8—Institution type of STEM faculty during the 2004–05 academic year (all MSP projects)

Institution type	Total faculty (n=1,160)	Faculty type: STEM (n=740)	Education (n=320)	Other (n=100)
Doctoral/Research University-Extensive	41.8%	33.6%	53.1%	66.0%
Doctoral/Research University-Intensive	12.2	14.3	9.7	4.0
Master’s College/University-1	24.9	27.2	23.4	13.0
Master’s College/University-2	0.9	0.9	0.3	2.0
Baccalaureate College-Liberal Arts	6.5	7.3	5.3	4.0
Baccalaureate College-General	2.7	2.4	3.1	3.0
Associate’s College	8.3	10.8	2.8	7.0
Tribal college/university	0.2	0.1	0.0	1.0
Unknown	2.7	3.2	2.2	0.0

NOTE: Shading indicates the item is significant at the .05 level.

Data source: MSP MIS.

Table 3-9.—STEM faculty primary fields of instruction and research during the 2004–05 academic year (all MSP projects)

Primary field	Instruction	Research
Astronomy	1.6%	1.5%
Atmospheric Sciences	0.8	0.4
Biological Science	18.6	13.6
Chemistry	12.6	9.7
Computer Science	0.4	0.9
Education	3.2	18.8
Engineering	7.0	6.5
Geosiences	5.3	4.6
Mathematical Sciences	40.8	30.1
Ocean Sciences	0.4	0.8
Physics	7.8	5.3
Other	0.9	4.2
Not applicable	0.4	3.5

NOTE: Percents may not add to 100 because of rounding.

Data source: MSP MIS.

The MIS data also show that more than 80 percent of the STEM faculty spent over 40 hours during 2004–05 in MSP activities (i.e., preservice activities, inservice activities, project management), and about 41 percent reported over 160 hours of engagement (Table 3-10). These percentages are slightly higher than the level of involvement found last year—75 percent and 34 percent, respectively. However, compared to other IHE participants, the proportion of STEM faculty spending more than 200 hours is relatively lower.

Table 3-10.—Number of hours STEM faculty spent on MSP during the 2004–05 academic year (all MSP projects)

Hours of involvement	Total faculty (n=1,160)	Faculty type		
		STEM (n=740)	Education (n=320)	Other (n=100)
Less than 20 hours	8.5%	8.6%	7.8%	10.0%
20 to 40 hours	11.3	12.2	10.0	9.0
41 to 80 hours	16.6	17.6	16.6	10.0
81 to 160 hours	17.5	20.8	11.3	13.0
161 to 200 hours	9.7	11.4	6.6	7.0
More than 200 hours	36.4	29.5	47.8	51.0

NOTE: Shading indicates the item is significant at the .05 level. Percents may not add to 100 because of rounding.

Data source: MSP MIS.

The number of STEM faculty involved in the eight case study projects varied considerably, from 5 to 46 with an average of 22 per project (Table 3-11). The percentage of tenured or tenure-track faculty is similar to the MSP average. In general, the participating faculty represent less than 10 percent of the total number of faculty in the departments from which they come.

Table 3-11.—Extent of STEM faculty involvement (case study projects)

Aspect	P1	P2	P3	P4	P5	P6	P7	P8
Number of STEM involved in development/ delivery of MSP activities*	46	8	25	16	46	11	19	5
Trend*					NV	NV	NV	NV
▪ Increasing		X						
▪ Constant			X	X				
▪ Decreasing	X							
Percent tenured or tenure track	67%	100%	85%	69%	88%	100%	43%	82%
Amount of involvement								
▪ Percent more than 40 hours	89	88	85	100	100	50	100	88
▪ Percent more than 160 hours	50	63	55	75	47	50	77	38

NV: Not available.

Data source: MSP MIS, case studies (aspect marked with *).

Faculty participation usually involves 2 to 8 weeks over the summer, depending on the length of the summer institutes. For projects that require commitment during the school year, the extent of involvement varied markedly—from 2 days a month to 50 percent of the participant's time.

Although many projects stated increasing the number of STEM faculty participation as a goal, we found that the majority of the projects we revisited worked with the same group of faculty. One project added 1 more faculty participant, while another began with 105 faculty members in the initial year and dropped to 46 in the third year because one component of the project was streamlined and consolidated.

While the quantitative change was small, one PI noted improvement in the quality of involvement. "They (STEM faculty) are more comfortable, they know where they fit and they function better." He continued, "We hope the number will go higher but are thankful for what we have." He indicated that they will try to involve more faculty members in activities such as course design. Others noted some challenges in recruitment. Several respondents said summer is "research time," so it is difficult to draft research faculty to work in the summer institute. Others mentioned fatigue as a factor; one said that the project "dominates my existence."

3.4.2 Types of Involvement

According to MIS, 73 percent of the STEM faculty involvement was reported in an inservice activity, while engagement in preservice activities and project management were around 40 percent each (Table 3-12). Because a faculty member can be simultaneously involved in multiple types of activities, the reported percentages add up to more than 100 percent. Compared to other IHE participants, STEM faculty have relatively less involvement in project management. Tables 3-13 to 3-15 provide an in-depth look at STEM faculty engagement in each type of activity for faculty who reported more than 40 hours of total involvement.[8]

[8] It is important to note that data in the following section are presented using total faculty as denominator, whereas in our first annual report, we used applicable faculty (of those who checked the category). For example, if we report that 20 percent of the STEM faculty participated in preservice recruitment, we mean 20 percent of the total STEM faculty. Last year, we meant 20 percent of the STEM faculty who reported activities in the preservice area.

Table 3-12.—Types of involvement for STEM faculty participating in Comprehensive or Targeted projects during the 2004–05 academic year (all MSP projects)

MSP activity	Total faculty (n=1,058)	Faculty type: STEM (n=673)	Education (n=292)	Other (n=93)
Preservice	41.4%	41.6%	47.3%	21.5%
Inservice	69.9	73.3	69.5	47.3
Management and/or other MSP-related activities	47.0	39.8	55.5	72.0

NOTE: Shading indicates the item is significant at the .05 level.
Data source: MIS.

Inservice activities. The pattern of STEM faculty involvement in inservice activities is not very different from other IHE participants, except education faculty are more likely to support adjunct positions for K–12 master teachers at the IHE.

Across all MSP projects, the most common activities for STEM faculty are conducting workshops with K–12 teachers that increase general content and/or pedagogical knowledge (58 percent), and remaining on call for classroom teachers (45 percent) (Table 3-13). In addition, over 20 percent of the faculty were involved in conducting targeted workshops, aligning curricula to standards, participating in activities to motivate students to take challenging courses, helping teachers utilize technology, and establishing learning communities.

Table 3-13.—Specific inservice activities of STEM faculty participating in Comprehensive or Targeted projects* during the 2004–05 academic year (all MSP projects)

Inservice activity	Total faculty (n=837)	Faculty type: STEM (n=526)	Education (n=236)	Other (n=75)
Conduct workshops/institutes/courses with K–12 teachers that increase general content and/or pedagogical knowledge	53.4%	58.0%	52.1%	25.3%
Remain “on call” for classroom teachers	42.9	44.9	45.8	20.0
Conduct targeted workshops/institutes/courses with K–12 teachers	30.6	31.0	33.9	17.3
Align K–12 mathematics and science curricula to other courses/standards	27.5	26.6	31.4	21.3
Participate in activities that motivate K–12 student participation in challenging mathematics and science courses	25.6	28.1	23.7	13.3
Help K–12 teachers utilize technology for course content innovation	24.1	26.8	21.6	13.3
Establish/provide STEM learning communities/study groups	21.3	19.8	25.4	18.7
Conduct a review of K–12 course curricula	18.3	16.5	23.3	14.7
Mentor a K–12 teacher in a shared discipline	18.2	18.4	20.8	8.0
Design STEM courses specifically for elementary/middle/high school teacher certification programs	17.8	17.5	22.0	6.7
Work one on one with K–12 students	13.4	14.8	11.4	9.3
Support adjunct positions for K–12 master teachers at your IHE	9.9	8.0	14.8	8.0
Establish/provide externship opportunities for K–12 teachers	8.6	7.0	11.4	10.7
Participate in activities that encourage high school students to enroll in IHE courses	7.5	8.7	5.5	5.3
Develop/redesign traditional STEM units or courses for in-depth immersion in a single topic	7.4	7.8	7.2	5.3
Provide traditional STEM courses at alternative venues	7.0	8.2	5.9	2.7
Help K–12 schools utilize computer-communications technology for challenging course delivery	5.5	5.1	6.4	5.3

*The survey for Institute projects did not include these items.
NOTE: Shading indicates the item is significant at the .05 level.
Data source: MSP MIS.

All of the case study projects involve STEM faculty in inservice professional development (PD), and 80 percent of the STEM faculty reported participation in this area. Our case studies found a variety of models for providing professional development, with none of the eight projects identical in their approaches and strategies (Table 3-14). Specifically, we found the following patterns:

- Providing PD for inservice teachers is the main focus for STEM faculty involvement in seven projects.
- With the exception of one project, STEM faculty work in teams. While teacher leaders serve as team members in the seven projects, only five also involve education faculty.
- Of seven projects involving team effort, STEM faculty play a leading role in three, serve as equal peers in three, and function in a supportive role in one.
- Two projects see STEM faculty contributions primarily in providing content, while STEM faculty are expected to be involved in both content and pedagogy in the other six projects.

Table 3-14.—Model of STEM faculty involvement in providing professional development for inservice teachers (case study projects)

Aspect	P1	P2	P3	P4	P5	P6	P7	P8
PD a major component		x	x	x	x	x	x	x
STEM faculty role								
▪ Sole provider								x
▪ Work with team	x	x	x	x	x	x	x	
➢ Team composition								
– Education faculty		x		x	x	x	x	
– Teacher leaders	x	x	x	x	x	x	x	
➢ STEM role on team								
– Leading			x			x	x	
– Equal	x	x			x			
– Supporting				x				
Expectation of STEM contribution								
▪ Content				x	x			
▪ Content+ pedagogy	x	x	x			x	x	x
Degree of centralization of PD delivery								
▪ Centralized	x	x	x		x	x	x	x
▪ Decentralized				x				
Duration								
▪ Summer	x						x	x
▪ Summer + year-long		x	x	x	x	x		
Grade level								
▪ Grade/span specific	x	x		x	x	x		x
▪ Mixed grade			x				x	
Involvement of K–12 students						x		
Graduate degrees/credits								x

Data source: Case studies.

Other features are more related to the structure of PD rather than particular involvement of STEM faculty.

- Seven projects provide PD in centralized locations; one project has a tailored approach in providing PD to 10 different school districts. The content of the PD as well as the timing of delivery are determined by teams of teachers, administrators, and STEM faculty.

- While all PD is primarily delivered in the summer, six projects include year-long follow-ups.

- The majority of the PDs are grade/span specific, but two projects provided PD to mixed grades/spans. The rationale for the grade/span-specific model is that teachers can apply what they have learned immediately to classes they will be teaching. The mixed grade/span approach is used so that teachers can see where their own instruction fits in the chain of knowledge.

- PD is provided directly to teachers by seven projects. One project uses a Collaborative Teaching Laboratory (CTL) professional development model in which instructional staff includes college disciplinary faculty, education faculty, high school teachers, preservice students, and high school student tutors. They provide a summer camp for high school students who failed the state mathematics exams. The hypothesis is that the best environment to improve teaching skills is on-the-job teaching in the presence of supportive instructional staff, and that significant amounts of content can be learned by teachers informally.

- Only one project offers PD as part of a master's degree program.

Preservice activities. As shown in Table 3-15, the patterns of involvement of STEM and education faculty are different. STEM faculty are more likely to teach or co-teach a content course, while education faculty more often engaged in activities such as developing/revising courses to align with standards, proving students with teaching experience before formal student teaching, involving K–12 master teachers in the preservice program, and participating in efforts to link the preservice process to national teacher certification activities. More than 20 percent of the STEM faculty reported involvement in teaching a preservice content course, mentoring preservice students, developing courses to align with standards, and developing an innovation as part of a traditional course.

Table 3-15.—Specific preservice activities of STEM faculty participating in Comprehensive or Targeted projects* during the 2004–05 academic year (all MSP projects)

Preservice activity	Total faculty (n=837)	Faculty type: STEM (n=526)	Education (n=236)	Other (n=75)
Teach or co-teach a preservice STEM content course	29.2%	26.2%	14.4%	4.0%
Mentor preservice students	27.2	23.2	30.9	5.3
Develop/revise preservice courses to align with national, state, and/or local standards	25.6	20.5	31.8	4.0
Develop an innovation as part of a traditional preservice course	25.4	20.3	25.4	4.0
Participate in preservice recruitment activities	25.1	19.8	23.3	12.0
Design preservice STEM courses specifically for elementary/middle/high school teacher certification programs	23.9	17.9	24.6	6.7
Provide preservice students with experience in K–12 classroom settings before formal student teaching	22.7	16.0	30.1	10.7
Involve K–12 master teachers in preservice program	19.5	10.8	18.6	8.0
Provide preservice students with opportunities to participate in local school district inservice activities	19.2	10.5	24.2	8.0
Participate in efforts to link the preservice process to national teacher certification activities	16.2	5.7	14.8	1.3

*The survey for Institute projects did not include these items.

NOTE: Shading indicates the item is significant at the .05 level.

Data source: MSP MIS.

Six of the case study projects involve STEM faculty in preservice preparation. The two projects not involving STEM in preservice training are Institute projects. Because the year 2 site visits occurred primarily in the summer when few preservice activities were taking place, our findings in this area are not as extensive as for the inservice training. Nevertheless, Table 3-16 shows that:

- Four projects involved STEM faculty in teaching preservice content courses, three of which also involved them in course and curriculum design.

- Two projects involved STEM faculty in preservice student recruitment and student mentoring only. Of the four projects where STEM faculty teach content courses, three also involved STEM faculty in student mentoring and two in student recruitment.

Table 3-16.—Model of STEM faculty involvement in preservice area (case study projects)

Aspect	P1	P2	P3	P4	P5	P6	P7	P8
Teach content courses		X	X	X	X		NA	NA
Course/curriculum design		X	X		X		NA	NA
Student recruitment	X		X	X		X	NA	NA
Student mentoring	X		X	X	X	X	NA	NA

NA = not applicable.

Data source: Case studies.

Project management activities. The MIS data displayed in Table 3-17 show that STEM faculty reported a lower level of involvement in project management as compared to other IHE participants, especially in serving as a member of partnership management structure, working on project-relative evaluation or with RETA projects, attending national MSP conferences, and helping develop joint databases or facilitate data sharing between partners. Only about 30 percent of STEM faculty reported involvement in management of the partnership.

Table 3-17.—Specific project management activities of STEM faculty participating in Comprehensive or Targeted projects* during the 2004–05 academic year (all MSP projects)

Management and other MSP-related activity	Total faculty (n=837)	Faculty type: STEM (n=526)	Faculty type: Education (n=236)	Faculty type: Other (n=75)
Serve as a member of the partnership management structure	34.9%	29.8%	41.5%	49.3%
Conduct research on teaching and learning in math and science	22.6	18.8	32.6	17.3
Work on project-related evaluation activities or with RETA projects	18.6	11.8	30.9	28.0
Help create formal links between all MSP core partners	17.7	16.3	19.9	20.0
Attend national MSP conferences	16.1	12.7	21.6	22.7
Help develop joint databases or facilitate data sharing between K–12 and IHE partners	13.5	8.6	20.8	25.3
Participate in the development of policies to reward IHE disciplinary faculty for their involvement in K–12 education	9.3	9.1	9.3	10.7
Enlist support from STEM industry/business personnel who work in disciplinary fields related to your own	6.0	5.1	7.2	8.0
Help align teacher certification program requirements among partner IHEs	4.5	4.0	6.4	2.7

*The survey for Institute projects did not include these items.

NOTE: Shading indicates the item is significant at the .05 level.

Data source: MSP MIS.

All of the case study projects involved STEM faculty in project management and joint research (Table 3-18), and 31 and 12 percent of faculty respectively reported activities in these areas. It is not uncommon for faculty to ask "what's in it for me to get involved?" In addition to more altruistic goals of improving the quality of students and teachers, one PI was trying to make a connection between faculty involvement and the reality that research is the primary consideration when it comes to tenure and rewards. She noted that the pedagogical research conducted by education faculty is mostly about K–12 learning. Research about teaching STEM at the IHE level is a relatively unexplored area in which STEM faculty have a significant role based on their MSP experiences. This may explain the importance STEM faculty placed on joint research as part of their MSP experience.

Table 3-18.—STEM faculty involvement in other areas (case study projects)

Aspect	P1	P2	P3	P4	P5	P6	P7	P8
Joint research	X	X	X	X	X	X	X	X
Project management	X	X	X	X	X	X	X	X

Data source: MSP MIS, case studies.

In addition, case studies revealed that while some projects seek to expand faculty roles in different activities, others, especially those from earlier MSP cohorts, are directing faculty involvement in a more focused manner. For example, with the integration of curriculum design into a summer institute, faculty in one project agree that their involvement was more varied and differentiated than had been the case in the first year when everyone did everything, but it was altogether "too much" in 2004. The project decided to keep focused by running the summer institute on a subject rotation basis.

In another project, the disciplinary dialogue component was streamlined, and faculty members are now working more with the K–12 students on special projects (e.g., science fairs, visits to laboratories and other facilities, offering assembly demonstrations in the schools) than with teachers during the academic year. Summer activities are focused on teachers, as faculty cultivate the content knowledge of professional development providers who then, in turn, work with the mathematics and science teachers in their schools and districts.

3.4.3. Collaboration With Other Participants

One of the key features of MSP is the emphasis on partnership. Because the concept of partnership was not clearly defined by NSF, we assume it entails formal institutional cooperation arrangements as well as interpersonal collaboration among participants. Case studies offer a chance to explore the nature of collaborations between STEM faculty and other participants such as education faculty, teacher leaders, and teachers (Table 3-19).

Table 3-19.—STEM faculty collaboration with other participants (case study projects)

Aspect	P1	P2	P3	P4	P5	P6	P7	P8
Education faculty	NA	O	NA	+	O	-	NA	NA
Teacher leaders	+	+	+	+	+	+	+	NA
Teachers	NA	+	+	+	+	+	+	+

+ denotes a positive relationship, O suggests a neutral relationship, and – indicates a contentious relationship.

NA = not applicable.

Data source: Case studies.

Education faculty. Half of the case study projects involve STEM faculty working with education faculty. The relationship between the two is collegial in some cases and problematic in others, depending as much on personalities as discipline. It is still unclear whether attaining cooperation between STEM and education faculty indeed has yielded more benefits than costs at the early stage of collaboration.

In a project where STEM faculty serve as resources, bonds among team members were deepened. STEM faculty were regarded as "a sounding board" for different ideas. A STEM faculty member said that it is "important for the faculty involved to be as flexible as possible…the challenge was trying to figure out what to do." "Listening to everyone" was the approach he used to find an answer.

Because the idea of team teaching used in many projects is new to the faculty, many observed that it is just as challenging for STEM faculty to work with each other as for STEM and education faculty to work together. However, two challenges are often mentioned with regard to personality and pedagogical differences. In an observed class taught by one PI, the team teaching appeared to work with and to be well received by the teachers. The hospitable personality of the PI and her expressed ideas of how people learn helped this process. This ideal was not always obtained according to multiple respondents. Another STEM faculty member described his course as "content-centric" and said that he was "highly skeptical of pedagogy." He believed that teachers were mostly interested in the content and not overly enthusiastic about learning "tricks." The interviewed education faculty member felt that he could hold his own as a co-teacher with the mathematics content in his course. However, he reported that some education faculty were treated like "second class" people by the STEM faculty. He felt that collaboration depended on personalities, and said the "STEM faculty do not always listen to education faculty." In this case, it appears that STEM faculty are more interested in teaching MSP-related classes if they do not think they have to be experts on pedagogy and, in particular, on the state standards and on developmental level of the students. In addition, the expectation for unconventional teaching methods (i.e., not straight lecturing) for many hours in a summer institute would be difficult for many.

Responses from another project continue to bring us issues similar to last year. Some have to do with campus politics and personality concerning "who's calling the shots and who's leading." An education faculty member put it in another way, "At times people (mathematicians) may need to take more responsibility. We may need to learn not to be so controlling and depend on everybody doing their part." Some mathematicians were said to be more "laid-back" in getting the job done on time. However, everyone seems to agree that they have worked out the problems or at least have "agreed to disagree." Mathematicians said they used to have a "disdainful" attitude toward education faculty, but "as soon as we work with them, you come away with a whole different attitude. The collaboration also changed the perception of education faculty regarding the math content people. We are less perceived as being in an ivory tower." In spite of differences, the cooperation between mathematicians and education faculty appears to be genuine.

Serious tensions between STEM and education faculty were found in one project. These were especially "volatile" in one team, and were triggered by differences of opinion about pedagogical strategies, especially around the issue of balance between lectures and activities, and were often personal. There was also contention about the introduction of formal mathematics language into the discussions with the students. The education faculty member felt that it should be done after high school students have become familiar with "manipulatives," while the mathematician thought it should be introduced much earlier. The STEM faculty member said the relationship was difficult because "we speak a different language," while the education faculty member felt that the STEM faculty member came in with an attitude of "let me show them what's going on." Maintaining that STEM faculty have a lot to learn about instruction, both conceded that the disagreement "diminished the voice of the high school teachers."

Teacher leaders. In seven of the case study projects, STEM faculty work with teacher leaders. Roles for teacher leaders varied by projects. In a few cases, they acted mainly as school liaisons. In many instances, they also serve as co-instructors in the summer institutes. The relationship between STEM faculty and teacher leaders appears more collegial in general than that between STEM and education faculty.

In one project, for example, teacher leaders enjoy a good relationship with mathematicians, many of whom serve as school liaisons with three to five schools. On school visits, faculty talk to teacher leaders, observe classes, administer surveys, and provide equipment. They found teacher leaders to be very open and receptive. Teacher leaders were impressed by what mathematicians pick up on school visits and how they pay attention to what children are doing. In preparing for the summer institute, they enjoyed watching mathematicians struggle with the same issues and learn how the same problem can be explained in different levels. "We naturally included them and do not see the difference. It is like a family…there is no intimidation."

The STEM faculty generally liked working with the teachers. One described the relationship as excellent, because they are open to differences regarding classroom management and interaction. In general, the teachers felt that they have learned a lot. One teacher noted that their critiques of the way STEM faculty taught and worked with the students were evidence based, and hence perceived during the debriefings as being constructive.

Our first visit to one project last year found "cultural differences" in the STEM faculty-teacher relationship. The teachers did not feel they were being treated as peers in the MSP. The situation this year appears to have eased through the careful selection and hiring of a new class of six teachers. All six teacher leaders were drawn exclusively from the ranks of year 1 project-related teacher teams. All attended the first Summer Academy, making them familiar with the goals and aims of the project. Teacher leaders felt that their responsibilities in the partnership were to "keep it alive during the school year" through classroom visits, lesson study work with teachers, and Community Forums with parents. One remarked that they are the "teacher voice" and the "learning bridge" from the IHE to K–12. In their first 6 weeks, teacher leaders helped test the life science curriculum for the Summer Academy, facilitated in the planning of lesson study, and took part in the Academy preparation—but not the teaching. They did not have telephones or email addresses at the time of the site visit, but they felt otherwise included in the life of the partnership, citing an invitation to the PI's home as an example of inclusion. We observed that teacher leaders were not given any formal teaching or large group discussion leadership roles in the daily immersion classes. However, we saw a teacher leader with demonstrable subject matter knowledge and pedagogic sophistication working informally with small teams of high school teachers during the class.

K–12 teachers. STEM faculty work with K–12 teachers in seven case study projects. However, our data about K–12 teachers so far has been limited to inservice classroom observations and short group interviews after an inservice class session. In general, we found that K–12 teachers were generally enthusiastic about the material and responsive to STEM faculty.

The quality of the collaboration between STEM faculty and the K–12 teachers was rated as high by both groups. According to the teachers, the professors are receptive to their needs. Many of the teachers have ongoing contact with the professors, and they anticipate that they will be able to go to the professors for additional guidance and follow-up even after the program ends. In fact, many teachers had feelings of trepidation about working with STEM faculty at a prestigious institution and expected to have more difficulties communicating with such people of "exceptional intelligence." However, they were pleasantly surprised at the ease with which the professors could relate to them and their concerns as K–12 teachers. One important advantage of collaborating with STEM faculty cited by the K–12 teachers is the nontraditional approach they take to instruction. They spoke highly of the fact that there was a "lack of lectures." One relatively experienced teacher commented that in the past, when considering professional development programs (i.e., through the school or school district), he wanted to "find ways to do integrated learning, not just sit there and listen to a teacher or professor deliver lectures," but that it was not always easy to do.

With respect to the STEM faculty's perspectives on working with teachers, the STEM faculty were forced in some instances to adjust their expectations of what teachers know and do not know. As one professor indicated, sometimes "there is a disconnect—the faculty members are extremely comfortably with the subject material, while teachers are still struggling with it."

One PI observed a mutual respect: "Teachers trust them (faculty), and the mathematicians thought teachers know more than they have expected. They like being around each other." One teacher said, "We found that they are just like us. We enjoy getting to know them as people…I was scared to death of [name of the faculty] in college. But 20 years later, I enjoy working with him." One group noted that the faculty respect them and are not condescending. While the professors they had in college tended to show "one way," here they got to explore "more choices." Another group found the mathematicians to be "real and down-to-earth."

3.4.4 Awareness of the Need to Review and Modify Institutional Practices and Policies

MSP hopes that the involvement of STEM faculty will lead the universities to review and modify policies and create a more conducive environment for faculty engagement. However, only one project stated it as a project goal, and so far none have made any proactive efforts to influence institutional policies on behalf of the projects (Table 3-20).

Table 3-20.—Project efforts to review and modify institutional practices (case study projects)

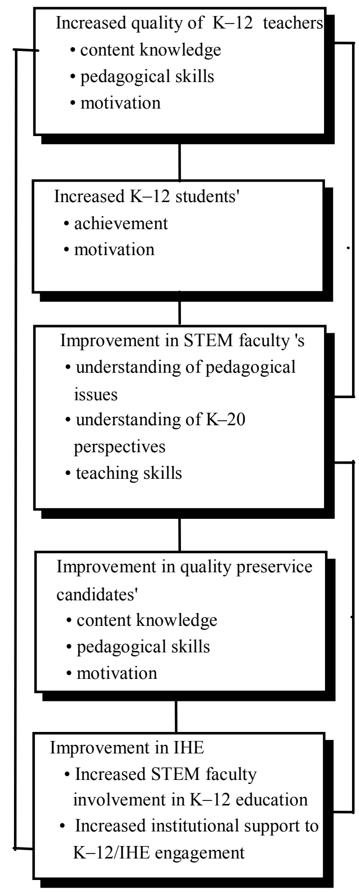
Aspect	P1	P2	P3	P4	P5	P6	P7	P8
State as a goal						X		
Have made efforts								

Data source: Case studies.

When asked about this question, one PI said he wrote a "most poetic" letter of support for a faculty member whose promotion was reviewed, but added, "I am not in the position to address university policies." The project that makes policy change an explicit goal plans to convene a 15-member Council for Math, Science and Education to address the larger issues that plague education reform, systemic environmental problems, and specific issues arising from the project's operation. Potential issues include discussions on reward structures for IHE faculty and K–12 teachers, as well as institutional change and sustainability. All these are related to our research questions. However, this important macro side of the proposal has not yet been addressed.

3.5 Interim Outcomes: What Are the Outcomes of STEM Faculty Involvement?

INTERIM OUTCOMES



Our study hypothesizes that STEM faculty involvement will lead to changes not only at the individual level such as K–12 teachers, K–12 students, preservice students, and STEM faculty themselves, but also changes at the IHE and K–12 institutional levels. While it is still too early to examine these assumptions, we gathered some preliminary evidence from site visits on the perceived changes from different respondents as well as from analyses of extant project data and MIS data. A summary is presented in Table 3-21.

3.5.1 Improvement in Teachers

Case Study Evidence

Self-report perspectives. We asked respondents about their views on the expected impact on teachers from STEM faculty involvement. In general, most STEM faculty members felt that teachers would learn content more than pedagogy. One said that teachers "have to have this" and need to take courses beyond what they teach, and STEM faculty are in a unique position to help teachers to see beyond the range of K–12 mathematics, i.e., the broader picture and issues. Pedagogical influence on teachers would come through content implementation strategies. Some STEM faculty members were skeptical of the pedagogical strategies advocated by the project, although those who have been with one project for 3 years have shown more buy-in on the pedagogical issues. In the best situations, they work with teachers on content, enhancing what they know and helping them to teach in a more student-oriented style.

Table 3-21.—Interim outcomes of STEM faculty involvement (case study projects)

Aspect	P1	P2	P3	P4	P5	P6	P7	P8
Increased quality of K–12 teachers								
▪ Content knowledge	X	X	X	X	X	X	X	X
▪ Pedagogical skills	X	X	X	X	X	X	X	X
▪ Others	X	X					X	X
Increased quality of K–12 students		NV	NV	NV	NV		NV	NV
▪ Achievement						X		
▪ Engagement	X							
Increased quality of preservice students		NV			NV	NV	NA	NA
▪ Achievement								
▪ Engagement			X					
Improvement of STEM faculty								
▪ Understanding of K–12 perspectives	X	X	X	X	X	X	X	X
▪ Pedagogical skills	X	X	X	X		X	X	
Improvement in IHE institution	NV	NV			NV	NV	NV	NV
▪ Increased STEM involvement				X				
▪ Increased institutional support			X					

NA = not applicable. NV = not available.

Data source: Case studies.

A minority of the STEM faculty believe that the bigger impact will be in pedagogy, especially if teachers already have a higher level of content knowledge. One PI who began the project thinking that teachers would benefit primarily in content came to realize that it is teachers' interaction and communication skills that need to be enhanced. Another potential impact is that teachers would have increased confidence in their ability to teach their subject due to working with STEM faculty.

In general, teachers were very positive about their experience and see benefits in both content and pedagogy. "You can't have one without the other," said one teacher. Many teachers viewed STEM faculty as providers of content. They appreciated the depth and breadth of knowledge that STEM faculty offered and saw this knowledge as more extensive than what they normally received from other professional development providers. They generally felt that the content in the summer institute was well-established, although some elementary teachers admitted that the courses are "over their heads." One teacher noted that "learning in this program is giving me a feeling of being 'bulletproof' in the classroom." However, while teachers from some projects felt the content was applicable to their classrooms, teachers from at least one project that provided PD in a multi-grade setting felt that the content would not be transferable to their classrooms.

The majority of teachers agreed that they would become more effective teachers as a result of their participation in an institute and, more specifically, the emphasis on inquiry-based learning. The summer institutes show teachers what they can do in their classrooms rather than just providing pure content. Teachers generally appreciate the effort faculty were making to incorporate best practices into their pedagogy. They spoke highly of the nontraditional approach and its lack of lectures. They like the guided inquiry, questioning strategies, scaffolding of classroom discussions, and the modeled underlying pedagogy—showing, not telling. In addition, the emphasis on classroom application was viewed as a major difference between the MSP summer institute and other professional development teachers had received previously. "The summer institute is more real and others are more general." One teacher mentioned, "Before, I was so ready to do Connected-Math when the school was not. I felt that I was out there by myself…Now the project gives me validation for something I did intuitively." Some teachers who admitted struggling with the content said it was useful to be reminded of what it felt like to be a struggling student, and that this would impact their approach to teaching when they return to the classrooms.

Observation. Observing instruction led by STEM faculty to inservice teachers in the summer provides a firsthand look at the interaction between STEM faculty and teachers that will shed additional light on the impact of their experience.

The majority of the classes were small, with about 15 teachers. Participants sat at small tables. Instructors checked in with the teachers periodically by asking questions and waiting patiently for answers and discussions. By and large, the level of engagement was very high; different solutions were offered and explored, and participants seemed comfortable raising issues and attempting to look at questions from various angles. Problem-based learning was used, and students were frequently encouraged to look at things in different ways or to explore alternative solutions to the same problem. Some lectures were observed. In a few cases, the observers were struck by how remedial the class was.

Not all the sessions went well. In one incident, teachers literally walked out of the class in frustration over a STEM faculty member's instructional approach. This faculty member talked too fast, talked over the heads of teachers, and did little to engage them in their learning. Opportunities for individual or small group work revealed the instructor's lack of appreciation of the time needed to address the problems presented. While some instruction was too fast paced in parts of other lessons, this lesson was a disaster from start to finish. The other team members tried to remedy the situation by inserting a low-stress activity on the day following the incident. However, the IHE faculty member himself saw no problem with his approach. He volunteered considerable information to the observer that indicated he felt the problem rested with others—their lack of knowledge or skill— and that he would not change his practices. It will be interesting to see if he is part of the faculty next summer.

Evidence From Project-Collected Data

Data collected from the projects also provided some preliminary perspectives on impact on teachers in a number of areas. Some of the evidence came from evaluation results conducted by the projects while others were results from Westat's analysis of project data (Appendix D).

Teacher views. Two projects conducted teacher surveys. For one project, teachers (N=160) expressed high level of satisfaction with the summer institute, noting only that there was not enough time for each activity.

Another survey of elementary teachers (N=364) conducted during the school year revealed that teachers who were more involved in the project were more likely to view the project positively, especially those who teach classes with a large percentage of English as second language learners (ESL). However, the extent of project participation is not related to teachers' attitudes and beliefs about mathematics, controlling for other teacher and classroom characteristics.

One project used the course evaluation to gauge teacher feedback. While such feedback is often instructor-specific, we did see some patterns. For example, teachers generally felt that the instructional methods (i.e., hands-on approach, how-to assignments, and step-by-step treatment of problem solving) helped them develop a robust understanding of the subject, the materials were very relevant to their teaching, the instructors were patient and flexible, and they felt challenged by the course. Teachers also offered suggestions for improvement such as a need for more practice and more optional problems, additional assistance for those who lack mathematics backgrounds, greater emphasis on conceptual understanding, and possibly a de-emphasis on problem solving.

Teacher knowledge assessment. Two projects administered pre-post tests during the summer institute to examine changes in teachers' understanding of various subjects. Both projects used the same items for the pretest and the posttest. Results from one project show that teachers who participated in the summer academy for 2 weeks (N=20) had an average pre-post change of 50 percent on a test with nine questions. The pre-post change for those in 3-week programs (N=10) was 30 percent on a test of 25 questions.

The second project administered a pre-post test to 25 teachers to measure and document changes in their understanding of algebraic ideas. The results show statistically significant improvement in overall learning, with an effect size of 0.45. They also made significant gains in all the subcategories tested as well as in two out of four knowledge types (conceptual understanding and pedagogical content knowledge), with effect sizes around 0.6.

Teacher practice. The next logical area to examine is the change in instructional practice. Using factor analysis and multiple regression to analyze data from one project's teacher survey, we found that teachers' participation is not associated with their instructional practices. However, teachers who have longer daily mathematics instruction and whose classrooms have a larger percentage of students in ESL are more likely to use reform instructional practices.

3.5.2 Improvement in Students

Case Study Evidence

Respondents generally felt that it is too early to determine student impact. The majority of projects work with teachers directly, and do not work with students. It is hoped that the effect on teachers will filter down to students. One PI said, "It's still early in the game to make these wild assumptions" that STEM faculty involvement would result in improved K–12 student achievement. He considers this to be a secondary effect. The primary effect is on improving teachers' content knowledge. One school administrator said, "I have to say yes. It's the next logical step. Helping teachers, of course will help students. If you say 'No,' the whole project is down the drain." Some respondents are more hopeful than others; as one faculty member told us, "We won't get involved if we don't know there are student impacts."

One project attributed increasing AP class enrollment and a reduction in the number of students taking remedial courses, as well as participation in Saturday mathematics classes, to the project. Others felt that student knowledge and behavior will improve as a result of the teachers being more effective, but they are not sure that student impacts would be manifest on high-stakes tests, which may not be assessing understanding. There are concerns that the emphasis on memorization of facts on the state assessment is not aligned with the project emphasis on understanding of concepts because teachers will be busy "ensuring that their students know the required facts and not have opportunities to delve deeper into important scientific concepts." However, teachers from one project felt that their PD would help raise student achievement scores because the state assessment is heavy on process. Others expressed concerns about attribution: "It's hard to isolate STEM faculty; they're part of the team." Also, the number of teachers included as a percentage of a district or school may be small, which makes claims of attribution very complex. In addition to MSP, the schools have other programs in place that could impact mathematics test scores.

Regardless of perceptions on student achievement, many respondents were anxious to use state assessment results as validation of the success of the project. One project decided to work directly with students who previously failed the state assessment. Faculty and teachers felt that students benefit in both content and atmosphere and were confident about helping students pass the state exams, but thought the long-term effects were somewhat unclear. However, the model also requires a significant amount of resources. At any given class, one team member and tutor worked with one or two students while another team member was giving instruction. This raises questions about the practicality of the model.

MIS Data

Drawing on data from the Partnership Project Survey, the K–12 District Survey, the IHE Survey, and the IHE Participant Survey of the MIS annual surveys (2003–04) of cohort 1 projects, we explored the baseline relationship between STEM faculty participation and student achievement (Appendix E).

Using two-level hierarchical linear modeling (HLM), we modeled the relationship between student achievement (school-level percent proficient aggregated from grade-level data) and extent of STEM faculty involvement at the project level. The math model drew data from 15 projects and 300 schools, while the science model analyzed data from 8 projects and 147 schools.

We used different specifications to measure the extent of faculty involvement, including 1) total number of STEM faculty participating in the project to measure the overall scale of participation, 2) relative emphasis of STEM faculty involvement (percent of STEM faculty among total IHE participants),

3) intensity of participation (multiplying the number of STEM faculty by the average number of hours spent on the MSP), and 4) faculty involvement in specific types of participation in preservice, inservice, and project management (factor scoring).

Preliminary results suggest STEM faculty involvement, as measured by multiple proxy variables, is independent of baseline student mathematics and science achievement in the schools with which MSP projects are working. However, the percentage of white/Asian students is positively associated with a school's average percent of proficiency.

Project-Collected Data

Analyzing large-scale student and teacher surveys from one project (Appendix D), Westat found that teacher project participation at the baseline is independent of various student outcomes, such as their attitude toward mathematics, perception of the class, perception about their teachers, as well as teacher expectations about their students. However, we found a significant positive association on these various student outcomes with family support.

Another project assessed the attitude and behaviors of students whose teachers attended the summer institute. The baseline data did not generate any evidence about the teacher impacts, but the longitudinal nature of the research design may generate interesting evidence in the years to come.

3.5.3 Improvement in STEM Faculty

Case Study Evidence

According to one co-PI, the STEM faculty have "uniformly gained." We often hear STEM faculty use words such as "most rewarding," "positive," and "invigorating" to describe their project experience. Faculty members from six of the case study projects citied benefits for their own instruction in that the experience made them think about content and exposed them to pedagogy. The general agreement was that they would be making changes in their approaches to teaching based on what they have learned through their MSP experience. A major personal "aha" was the discovery of active teaching strategies as a way of teaching, which has reshaped their ideas about learning. One junior faculty member noted, "I discover new teaching methods which are beneficial to my career. Before, I had no concept of mathematics education." The types of changes STEM faculty have made in their own work include using more questioning, working with groups, making connections with prior knowledge, and setting contextual concepts. However, STEM faculty from two projects did not express the sense that working with teachers would change their own practices.

STEM faculty in all eight projects agreed that the experience helped them think about education and its goals on a broader basis, not just at the university level. Specifically, they learned about the concerns and weaknesses of K–12 teachers, which will help them refine their approaches in the future. Some developed greater appreciation for these teachers.

Other faculty cited the experience of working on course design, interaction with other participants, and research opportunities as beneficial. One junior faculty member told us that working with large groups of teachers has expanded his horizon. "In my own research work, I work with no more than three people."

Project-Collected Data

One project surveyed university faculty (most of whom are STEM faculty) who attended a summer institute with teacher leaders and schools administrators as “co-learners.” Results from daily surveys suggested that faculty were satisfied with the summer institute and felt that they had learned a lot and could apply most of the concepts covered in the institute. Teachers reported more positively than faculty on their gains from the summer institute. The confidence surveys administered at the beginning, middle, and end of the summer institute showed that overall, participants grew significantly, especially between the beginning and end of the institute, in level of confidence on all the items except the one concerning parental involvement. The differences between teachers and faculty are mostly not significant, except that teachers are more confident than faculty in creating changes in student mathematics assessment scores and using state test data to make improvements in mathematics.

3.5.4 Improvement in IHEs

Evidence about improvement in IHEs is sketchy, and it is perhaps too early to expect it to emerge. Faculty reported some effects at the department level, as more faculty members became aware of the importance of K–12 education. The high profile of the participating faculty also helps the recognition, because “people will listen.” In addition, STEM faculty from one project reported that their colleagues refer to project as the “Big Grant” and are awaiting research papers and publications to better judge its influence. One PI added, “Especially when money is behind it, it gives legitimacy.” Many agreed that it is going to be a slow process. Even teacher leaders observed some changes taking place at IHE. “When I was at the university, there were two different worlds and no blending between mathematicians and education faculty. Now it is great to see how they work together.” Another teacher added, “University teachers need to know group work—most of my undergraduate classes were straight lectures. I was excited to see small groups in our mathematics professors’ classes.”

The impact on the nonlead institutions varied. In one case, STEM faculty cited that their institution went from “zero release time to curriculum development,” a situation they described as a “big thrill.” Some faculty mentioned that the project gives some visibility to their institutions. However, community college faculty cited staffing problems in finding replacements in their absences, the need for more technical support to conduct classes, and the need for more release time to do related work. Some also said that STEM faculty from lead institutions do not understand the challenges faced by community colleges in terms of student quality and large class sizes. The difference in laboratory facilities was also emphasized by community college faculties. Activities and labs at the lead IHE could not be translated to the community college preservice classes because the community colleges are equipment-poor.

3.5.5 Improvement in K–12 Districts

Critical elements of change in K–12 districts are leadership and teacher leaders. According to one co-PI, “Where you have good building and superintendent support, you do well. It is harder to effect changes where there are problems.” STEM faculty noted that the building of teacher leadership will have a strong implication on the sustainability of the project.

In one project, teacher leaders praised the project leadership for engaging with superintendents and principals from the start. The project also found a way for some of the poor schools and districts to get much needed resources. The team provided access to what teachers want and need, particularly technology. As a result, teachers received not only their professional development and resources such as geometry sketch pads and new textbooks, but also strong backing and commitment from administrators.

Chapter 4. IMPLICATIONS

In this section, we summarize findings from year 2 of the study. We also discuss implications for our study over the next 2 years.

4.1 Summary of Findings

We group preliminary findings in three general areas as follows:

What is the IHE policy context for STEM faculty involvement? What have the projects done to engage STEM faculty?

- According to the case studies, traditional reward structures and faculty perceptions about the status associated with different types of engagement are still considered major barriers for faculty involvement in most MSP-like endeavors. While the majority of the IHEs recognized service or outreach, such activities are generally considered to be a distant third in priority as compared to research and teaching. This presents a serious institutional problem and a major roadblock to involving faculty in the STEM disciplines. Some institutions specifically discourage junior faculty from participating in these activities so that they do not have to sacrifice time that could otherwise be spent in research. In projects that we visited for the second time, we found little change in terms of tenure and reward policy at the university level. Many respondents felt that the current system will never change, and the most they can hope for is for the deans and chairs to broadcast "there is no reward for doing this, but it is okay for you to do so." It is disturbing that despite the existence of these policies, involvement in such activities is not highly valued in practice. It is a concern that none of the case study institutions have taken steps to modify their policies to create a more supportive environment in which collaborations such as the MSP activities can occur.

- However, a number of strategies are credited with increasing STEM faculty engagement. At the institution level, policies such as elevating the status of outreach in tenure and rewards, giving more weight in the hiring process to faculty applicants who demonstrate interest in teaching and outreach, recognizing research in STEM teaching, and creating a dual appointment infrastructure that allows disciplinary faculty to work half time on disciplinary teaching and research and half time on pre/inservice teacher training are often found to be effective.

- At the project level, both extrinsic and intrinsic incentives need to be created. The former may involve providing release time and summer support for faculty, and the latter often include not only constant communication and provision of professional development and administrative support, but also targeted recruitment for STEM faculty who have experience working with K–12 teachers, successful college teachers, and sometimes tenured senior faculty. In addition, it is important to find niches for faculty engagement and not to overextend their responsibilities. However, the discussion of extrinsic incentives needs to move beyond release time and stipends to the structural issues of definitions of scholarly work. Continuing to define the work as "service" does not make sense and perpetuates the general public impression that IHEs are intentionally disengaged from the most pressing needs of our society. One project definition of research from MSP activities as "scholarly" reflects an emerging trend to recognize that teaching and engagement with the serious local and national challenges of mathematics and science in K–12 are discipline-based scholarship activities that require the attention of our best STEM faculty.

- Case studies also provide examples of poor planning and management on the part of the MSP projects. Such behaviors as leaving faculty unclear about their academic year participation, or having their academic year participation not remunerated, could hinder participation and outcomes.

What are the STEM faculty involving in MSP like? To what extent have they been engaged in the MSP projects?

- While many participants have had previous experience in working with the K–12 sector, MIS data show that MSP is the first such experience for 15 percent of the participants. Case studies also suggest that some projects have had many years of experience engaging STEM faculty in K–12 reforms, while for others, the engagements were based on small group or individual initiatives. Despite the documented progress, these data suggest that there may be a small number of faculty who repeatedly involve themselves in such activities, while the majority of their colleagues do not participate.

- MIS data show that 1,084 STEM faculty participated in MSP activities during 2004–05. The 740 STEM faculty who responded to the IHE participant survey represent about 64 percent of the participating IHE faculty. Sixty-one percent of the participating STEM faculty are male and 86 percent are white. Three-fourths have tenure or are in tenure-track positions.

- STEM faculty involvement is both extensive and substantive. Eighty percent of the STEM faculty reported at least 40 hours of involvement, and 41 percent had over 160 hours in a year. These numbers are higher than the extent of involvement reported in last year's report. Seventy-three percent of the STEM faculty involvement was reported in the inservice area, while engagement in preservice and project management was around 40 percent.

- Case studies found a variety of models of STEM faculty participation in providing professional development. Essentially, none of the projects are identical in their approaches and strategies. For example, we found that providing professional development for inservice teachers is the main focus for STEM faculty involvement in seven of the projects; with the exception of one project, STEM faculty work in teams. While teacher leaders serve as team members in seven projects, four projects also involve education faculty; of seven projects involving team efforts, STEM faculty play a leading role in three projects, serve as equal peers in three, and function in a supportive role in one. Two projects see the STEM faculty contribution primarily in providing content, while others envision involvement in pedagogy as well. We also observed that a number of features are more related to the structure of professional development rather than to the particular involvement of STEM faculty.

- STEM faculty are also involved in other areas. In preservice, four projects involved them in teaching preservice content courses, three of which also involved STEM faculty in course and curriculum design. Two projects involved STEM faculty in preservice student recruitment and student mentoring only. Of the four projects where STEM faculty teach content courses for preservice students, three also involved STEM faculty in student mentoring, and two in student recruitment. All eight case study projects involved STEM faculty in project management and joint research, and 31 and 12 percent of faculty reported activities in these areas, respectively.

How do STEM faculty work with other participants in MSP? To what extent does STEM faculty involvement lead to changes at the individual and institutional level?

- Case studies show that disciplinary faculty's working relationships with other players such as education faculty, K–12 teachers, and teacher leaders are critical to the success of MSP projects. In general, the relationship between STEM and education faculty are collegial in some cases and contentious in others, depending as much on personalities as discipline. STEM faculty enjoyed a more collegial relationship with teacher leaders. The quality of collaboration between STEM faculty and K–12 teachers was generally rated high by both groups. A key to the success of these relationships is mutual respect and ongoing communication and dialogue.

- Case studies provide some preliminary evidence regarding the impact of STEM faculty engagement. While many STEM faculty expected to see positive impacts on teacher content knowledge, teachers reported learning from both content and, especially, pedagogy. Data collected from selected projects suggest that teachers were satisfied with the summer institutes. While most of the evidence is self-reported, that positive self-awareness is a necessary condition if students are to learn more. Pre-post assessments indicated statistically significant improvement in overall learning and specific content and pedagogical knowledge by participants. However, multivariate analysis of a large-scale teacher survey showed that that teacher instructional practices are independent of their project participation. Teachers who have longer daily mathematics instruction and whose classrooms have a larger percentage of students in ESL are more likely to use reform instructional practices.

- Respondents were less certain about direct impact on student achievement and generally felt that it is too early to determine it. Many hope that the effect on teachers will filter down to students. Despite concern about state assessments, many are anxious to use state assessment results to validate project success. However, using baseline data from MIS, we found that student achievement at the school level is independent of STEM faculty involvement at the project level. Data from large-scale student and teacher surveys administered by one project did not show any statistically significant relationship between teacher project participation at the baseline and student outcomes, such as their attitude toward mathematics, and perceptions of the class and about their teachers, as well as teachers' expectation about their students.

- Participating STEM faculty often acknowledged learning on their part from the MSP experience in terms of becoming more sensitive about pedagogical issues in their own teaching, understanding K–12 perspectives, and being exposed to team work.

- Although it may be too early for them to emerge, some changes at institutional levels were also noted. At the IHE level, faculty reported an increasing awareness of the importance of K–12 education reflected by the size of the MSP grant and senior status of the participating faculty. Collaboration between STEM and education faculty were also reported. Changes at the K–12 district level were considered to be critical to the sustainability of the project, an issue we will explore in the future.

4.2 Implications for Future Study

Year 3 of the RETA project will have a slightly different focus than years 1 and 2 (see Table 4-1 for a timeline of year 3 study activities). The following is a discussion of a number of changes to be made in site visits, analysis of MIS data, and analysis of project-collected data.

Table 4-1.—Year 3 study activities

Activity	Timeline
Protocol development	May 2006
Site visits to 8 projects	June–November 2006
Analysis of the MIS data	December 2006–February 2007
Dissemination (1–2 conference presentations)	June 2006—March 2007
Year 3 report	January–March 2007

Site visits. A 2-day site visit will be conducted to all eight case study projects. While we will continue to follow development at the IHE level, we will begin investigating the impacts occurring at the K–12 level. During the site visits, the first day will be spent at IHEs interviewing the PI/project director and STEM faculty members, as well as observing preservice classes taught by STEM faculty, where applicable. The focus is to identify models of STEM faculty involvement in other areas (i.e., preservice, curriculum design, project management) beyond the summer institutes. Additional questions will be asked to explore the areas of project finance related to STEM faculty, the extent to which STEM faculty are incorporating new teaching and learning techniques into their own classrooms, possible screening or qualifications for STEM participants in the projects, etc. The second day will be spent at K–12 schools for in-depth interviews of K–12 teachers who have worked with STEM faculty either as teacher leaders or participants in summer institutes. Classroom observations will be used to see the kind of teaching that is occurring. Where possible, we will talk to school administrators.

In year 2, the majority of the site visits were conducted during the summer institutes. The timing allowed us to observe intensive involvement of STEM faculty. However, one of the drawbacks is that the structured professional development did not give us enough time to talk to K–12 teachers and address other topics of interest such as preservice training, course and curriculum design, and potential impact on the institutions. In year 3, we plan to conduct six site visits during the fall semester. We have not yet collected data for two projects, which we will visit during the summer.

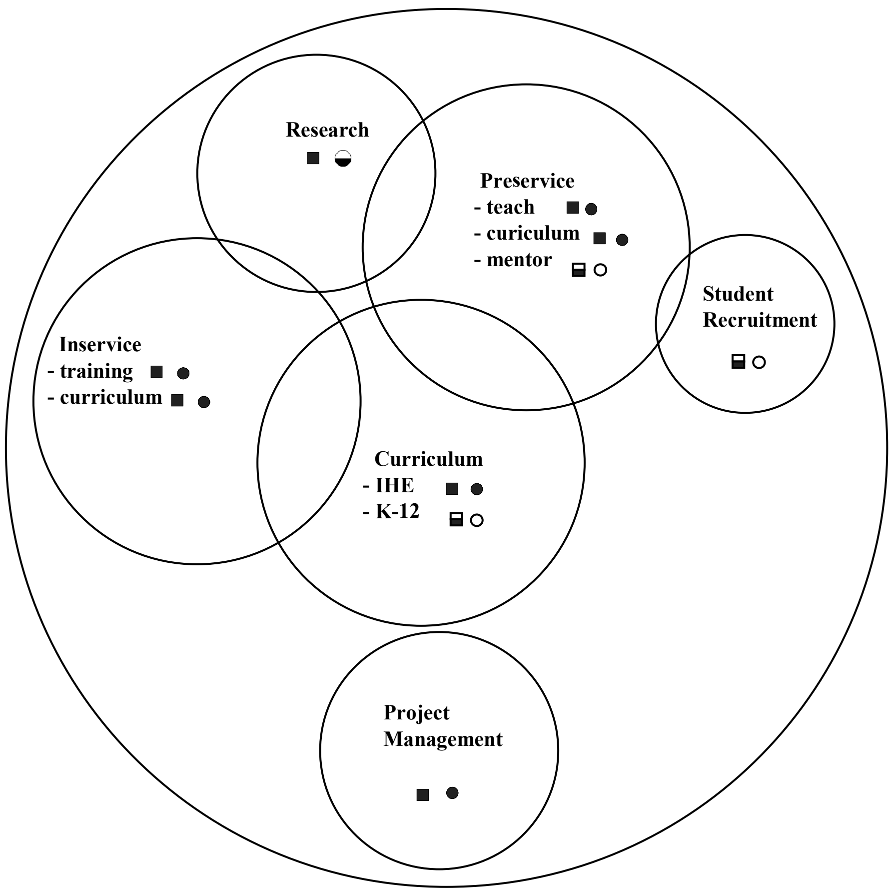
In addition, site visits in year 3 will explore the long-term outcomes of the MSP projects and issues related to sustainability.

Analysis of MIS data. Analysis in year 3 will be both descriptive and causal. Descriptive analyses will continue to look at STEM faculty responses to the IHE participant survey. Correlational analysis will build on the analysis in year 2 by including the longitudinal component of student outcome data from multiple years. In addition, we will explore the relationships of student achievement to STEM faculty involvement, as well as to specific or combinations of practices. Other possible analyses may include compared activities that seem to be more sustaining and/or requiring more collaboration and others that are not.

Analysis of project data. We will continue to follow data collection and analysis efforts from all eight projects. Based on our understanding of the nature of data collection within each project, we will work with selected projects that collect data appropriate for the data analysis plan for this project. Full analyses of project collected data will be conducted in year 4.

Model building. Another planned task is to build models of STEM faculty involvement for each project. The presentation of findings so far has been driven by aspects of STEM faculty involvement. While it highlights patterns across projects, it does not give a holistic picture of how an individual project is engaging STEM faculty. The model for individual project will use a Venn diagram to connect different aspects of STEM faculty involvement in the areas of inservice, preservice, curriculum development, research, student recruitment, and project management. The diagram will visually illustrate 1) what aspects the project addresses, 2) the extent of focus on different aspects, 3) what aspects STEM faculty contribute to, and 4) the extent of STEM faculty contribution. A prototype of the diagram is shown in Exhibit 4-1. The size of the circle reflects the project emphasis on different activities (i.e., inservice, research, curriculum). Within each activity, we distinguish the emphasis between project levels using square and that for the STEM faculty using a circle. The level of emphasis is characterized by the extent of black filling. For example, this particular project has a strong emphasis on inservice both in terms of providing training to teachers and designing related curriculum. STEM faculty are fully involved in both inservice-related activities. In comparison, the project has a moderate emphasis on student recruitment where STEM faculty are not involved in.

Exhibit 4-1.—A prototype Venn diagram for STEM faculty involvement in an individual project



Appendix A. Advisory Panel and Site Visitors

Advisory Panel

Jerry Gaff, Senior Scholar, Association of American Colleges and Universities, Washington, DC

Laurie A. Fathe, Director of Center for Teaching Excellence, George Mason University, Fairfax, VA

David Kaplan (statistical consultant), Professor of Education, University of Delaware, Newark, DE

Alfred Manaster, Professor of Mathematics, University of California, San Diego, San Diego, CA

H. Eugene Rice, Senior Scholar, American Association for Higher Education, Washington, DC

STEM Site Visitors

Alexander Hahn, Professor of Mathematics, University of Notre Dame, Notre Dame, IN

Rhonda Hatcher, Assistant Professor of Mathematics, Texas Christian University, TX

Nancy L. Jestel, Analytical Chemist, GE Plastics, Selkirk, NY

Donald Jones, Professor of Chemistry, McDaniel College, Westminster, MD

Katrina Palmer, Assistant Professor of Mathematical, Appalachian State University, NC

Eric Rawdon, Professor of Mathematics, Duquesne University, PA

Eric J. Sheppard, Dean of Engineering, Hampton University, Hampton, VA

Westat Site Visitors

Joy Frechtling, Joseph McInerney, Joan Michie, Glenn Nyre, John Wells, Xiaodong Zhang

APPENDIX B1. SITE VISIT PROTOCOLS FOR RETA COHORT 1 PROJECTS (2ND TIME)

PI/PD INTERVIEW PROTOCOL

Respondent:	MSP:
Interviewer:	Institution:
Date:	Duration:

I. Interview

Thank you for taking the time to talk to us about your MSP. We spoke to you last year about the extent and impact of STEM faculty involvement in your project. This year, we are primarily interested in changes in STEM faculty engagement. The interview will take about 60 minutes. We won't identify you or your project by name.

STEM faculty involvement and relationships with other players

1. Of the STEM faculty actively engaged in the MSP last year, are there any changes in the extent and type of involvement this year?

2. Have you recruited additional STEM faculty to participate in your MSP? How many? What level and type of activities are they involved in?

3. What is the approximately percentage of participating STEM faculty in relation to the total number of STEM faculty from the recruited departments in your IHE institutions?

4. In the past year, what have you done to engage and support STEM faculty involvement? How does it compare with what you did last year?

5. Does the project have an ongoing process to gather and use data to assess STEM faculty engagement? If yes, what kinds of data are you collecting? How do you use the results?

6. In the past year, have you observed any changes in STEM faculty's working relationships with other project participants (where applicable): a. other STEM faculty; b. education faculty, c. teacher leaders, d. K–12 teachers, and e. pre-service students? If yes, please describe.

7. What is your overall assessment of STEM faculty involvement in your project so far? What are the successful areas? Are there any specific areas that need improvement?

Institutional policies and resources

8. In the past year, have there been any changes in departmental, institutional or state policies and practices regarding tenure and rewards that may affect STEM faculty involvement?

9. (If applicable) Did the project do anything to change these policies and practices? If so, please describle.

10. We want to learn more about the broader context of your project implementation. Are there any other external factors that may affect STEM faculty involvement and your project implementation (i.e. state standards and testing, financial and political context, business/ community involvement)?

Personal expectations about STEM faculty involvement

11. Do you think STEM faculty involvement is resulting in improved teacher content knowledge? What about pedagogical skills? If yes, what is it about STEM faculty involvement that might cause the improvement?

12. Do you think STEM faculty involvement is resulting in improved K–12 student achievement? If yes, what is it about STEM faculty involvement that might cause the improvement?

13. How do STEM faculty perceive their MSP experience personally and professionally in terms of gains and losses?

14. What characteristics in STEM faculty make for productive engagement?

15. Does STEM faculty involvement in MSP have any broader effect on your institution? If yes, what kinds of effects have you noticed?

16. Are there other things you'd like to discuss about STEM faculty?

Thank you.

STEM FACULTY GROUP INTERVIEW PROTOCOL* (NON-LEAD INST)

Respondent:	MSP:
Interviewer:	Institution:
Date:	Duration:

I. Interview

Thank you for taking the time to talk to us. Our research project is supported by National Science Foundation's Math and Science Partnership (MSP), which funds [project name]. We are examining the extent and impact of mathematics and science faculty involvement in MSP, which is the central premise of this national initiative. We are particularly interested in your personal experience on this topic. The interview will take about 60 minutes. It covers three broad sections: background information, your personal experiences with the project, and your institution's policies and relationships with other players.

Background

1. Will you please tell us something about your background (e.g., mathematics or science discipline, rank, years at current institution, primary teaching responsibility, research interest)?

2. How and why did you become involved in the MSP?

3. Please describe any previous experiences you have had working with K–12 teachers and education faculty at higher education institutions? How do they compare with those from the MSP?

Personal experiences with the project

4. What are your responsibilities in the MSP? What is your time commitment to the project?

5. In what areas do you see yourself making contributions? Can you give us a few examples (i.e., curriculum development, professional development for inservice teachers, teaching preservice students, joint research with education faculty, etc.)?

6. What are some of the challenges in your MSP work?

7. Do you think STEM faculty involvement is resulting in improved teacher content knowledge? What about pedagogical skills? If yes, what is it about STEM faculty involvement that might cause the improvement?

8. Do you think STEM faculty involvement is resulting in improved K–12 student achievement? If yes, what is it about STEM faculty involvement that might cause the improvement?

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* Questions in italics are optional in group interview but can be used if there is one respondent.

9. How have you been affected by your participation in MSP personally and professionally in terms of gains and losses? *Can you give us a few examples?*

10. How does STEM faculty involvement in MSP affect your institution? *Can you give us a few examples?*

11. How important do you think STEM faculty involvement is to the success of what is happening at the K–12 level in your project?

12. Do you plan to continue to work with the MSP? If so, what will the work involve?

Institutional policies and relationship with other players

13. Are there any departmental and institutional policies (i.e. tenure and reward) that affect your MSP participation? What else could be done to facilitate your involvement?

14. What are the perceptions of your disciplinary colleagues regarding your MSP involvement? Have you encouraged or discouraged faculty peers to become involved in the MSP project?

15. (If applicable) In what ways do you work with education faculty in the project? What is your assessment of the collaboration so far?

16. (If applicable) In what ways do you work with K–12 teachers in the project? Do you work directly with K–12 staff or through intermediaries? What is your assessment of the collaboration so far?

17. Does the project need to take steps to improve STEM faculty involvement? If yes, do you have any suggestions?

18. Please describe your relationship with the lead institution? Is it what you expected?

19. Do you have any other comments?

Thank you.

STEM FACULTY GROUP INTERVIEW PROTOCOL (LEAD INST)

Respondent:	MSP:
Interviewer:	Institution:
Date:	Duration:

I. Interview

Thank you for taking the time to talk to us. Our research project is supported by National Science Foundation's Math and Science Partnership (MSP), which funds [project name]. Last year, we talked to some of you about the extent and impact of mathematics and science faculty involvement in MSP. This year, we are primarily interested in any changes that may have occurred. The interview will take about 60 minutes.

1. Quick introduction of the STEM faculty who were not interviewed last year (if applicable).

2. In the past year, have there been any changes in your project involvement (i.e. time commitment, type of activities)?

3. In the past year, have there been any changes by the project to support your engagement?

4. In the past year, have there been any changes in departmental and institutional policies and practices that might affect your involvement?

5. What factors facilitate your involvement? What factors hinder your involvement? What can be done to overcome the barriers?

6. How have you been affected by your participation in MSP personally and professionally in terms of gains and losses? *Can you give us a few examples?*

7. Do you think your involvement affects changes in 1) K–12 teachers (content knowledge, and pedagogical skills), 2) K–12 students, 3) your institution, 4) K–12 district? Why and in what ways?

8. How do you assess your working relationship with other project participants 1) STEM faculty, 2) education faculty (if applicable), 3) teacher leaders, 4) other K–12 district personnel?

9. Do you have any other comments?

Thank you.

INSERVICE TEACHER (K–12 INSTITUTE PARTICIPANT) GROUP INTERVIEW PROTOCOL

Respondent:	MSP:
Interviewer:	Institution:
Date:	Duration:

I. Interview

Thank you for taking the time to talk to us. The Math and Science Partnership (MSP) is a major research and development effort of the National Science Foundation that is designed to improve K–12 student achievement in mathematics and science. The professional development you are receiving is funded by MSP, as is our research project. We are examining the extent and impact of mathematics and science faculty involvement in MSP, which is the central premise of this national initiative. We are particularly interested in your personal experience with mathematics and science faculty in this project. The discussion will take about 30-45 minutes.

1. Will you please tell us something about your background (e.g., grade level, years of experience, math/science training, reason/motivation to attend the PD selection process, district/project incentive)?

2. Was the session we just observed typical of those being provided by the MSP? In what ways?

3. What did you think about the content presented? (Was it too easy? Over your head?) Is it applicable to the class you will be teaching? In what ways?

4. What did you think about the way the lesson was presented (i.e. pedagogy)? Is it applicable to the class you will be teaching? In what ways?

5. Are mathematics and science faculty different from other professional development providers you've experienced (Is your current professional development different from those you received previously)? In what ways?

6. Are you working with mathematics and science faculty in the MSP in ways other than professional development (e.g., mentoring, course and/or curriculum development)? If yes, please describe.

7. Have you had previous experiences working with mathematics and science faculty under other initiatives or as an undergraduate/graduate student? If yes, what were they and how were they like your MSP experience? How do you compare them with your current experience?

8. To what extent do you think higher education mathematics and science faculty involvement will help you to become a better teacher and improve student achievement?

9. Are there things that might make mathematics and science faculty involvement more useful and meaningful to you as a teacher?

10. Do you have any other comments?

PRESERVICE CANDIDATE GROUP INTERVIEW PROTOCOL

Respondent:	MSP:
Interviewer:	Institution:
Date:	Duration:

I. Interview

Thank you for taking the time to talk to us. The Math and Science Partnership (MSP) is a major research and development effort on the part of the National Science Foundation that is designed to improve K–12 student achievement in mathematics and science, such as the class you are taking and our research project. We are examining the extent and impact of mathematics and science faculty involvement in MSP, which is the central premise of this national initiative. We are particularly interested in your personal experience with mathematics and science faculty in this project. The interview will take about 30-45 minutes.

1. Will you please tell us something about your background (e.g., degree program, year in the program, prior classroom experience)?

2. Was the class/session we just observed typical of this class? In what ways?

3. What did you think about the content that was presented? (Was it too easy? Over your head?) Will you be able to apply it when you are teaching? In what ways?

4. What did you think about the way the lesson presented (i.e., pedagogy)? Will you be able to apply that method of presentation in the classroom in the future? In what ways?

5. Are mathematics and science faculty different from education faculty? In what ways?

6. Are there other MSP activities that you are working on with mathematics and science faculty? If yes, please describe.

7. Have you had previous experiences working with mathematics and science faculty under other initiatives or as an undergraduate/graduate student? If yes, what were they and how were they like your MSP experience? How do you compare them with your current experience?

8. To what extent do you think higher education mathematics and science faculty involvement will help you to become a better teacher and improve student achievement?

9. Are there things that might make mathematics and science faculty more useful and meaningful to you in your preparation to be a teacher?

10. Do you have any other comments?

Thank you.

CLASSROOM OBSERVATION PROTOCOL

Presenter: MSP:

Observer: Location:

Date: Duration:

Background *(Check all apply)*

1. Number of participants

   ☐ 1-10 ☐ 11-25 ☐ 26-50 ☐ 51 or more

2. Types of participants

   ☐ regular classroom teachers ☐ teacher leaders (trainers) ☐ preservice candidates

3. Subject

   ☐ mathematics ☐ science

4. Grade level

   ☐ elementary ☐ middle school ☐ high school

5. Session focus

   ☐ content ☐ pedagogy ☐ instructional materials ☐ Other *(specify)* ____________________

6. Main activities and teaching techniques

   ☐ formal presentation/lecture ☐ collaborative learning

   ☐ class reports ☐ small group work

   ☐ inquiry-based ☐ problem-based learning

Comments

7. What was the specific STEM content of the lesson?

8. To what extent and how effectively did the instructor

   - Present the material clearly?
   - Encourage participants to generate ideas and questions?
   - Provide opportunities for participants to consider classroom applications?

9. How well were participants intellectually engaged? In what ways?

10. Please provide brief comments about other noticeable features.

11. What is your overall impression of the session?

TEACHER LEADERS (K–12 INSTITUTE FACULTY) GROUP INTERVIEW PROTOCOL

Respondent:	MSP:
Interviewer:	Institution:
Date:	Duration:

I. Interview

Thank you for taking the time to talk to us. Our research project is supported by National Science Foundation's Math and Science Partnership (MSP), which funds [project name]. We are examining the extent and impact of mathematics and science faculty involvement in MSP, which is the central premise of this national initiative. We've talked to some of you about your experience in working with STEM faculty last year. This year, we are particularly interested in any changes in your experience. The interview will take about 30-45 minutes.

1. What are your responsibilities in the MSP?

2. In what ways do you work with mathematics and science faculty in the project? Have these changed overtime?

3. What is your assessment of the collaboration so far? Did you encounter any surprises or challenges in that collaboration?

4. Has the project done anything to facilitate the collaboration?

5. What have you learned through the collaboration?

6. Have you been affected by working with STEM faculty in MSP personally and professionally? In what ways?

7. Do you think STEM faculty involvement is resulting in improved teacher content knowledge and pedagogical skills? Why and in what ways? Can you give some examples?

8. Do you think STEM faculty involvement is resulting in improved K–12 student achievement? Why and in what ways? Can you give some examples?

9. Do you have any other comments?

Thank you.

EDUCATION FACULTY GROUP INTERVIEW PROTOCOL

Respondent:	MSP:
Interviewer:	Institution:
Date:	Duration:

I. Interview

Thank you for taking the time to talk to us. Our research project is supported by National Science Foundation's Math and Science Partnership (MSP), which funds [project name]. We are examining the extent and impact of mathematics and science faculty involvement in MSP, which is the central premise of this national initiative. We've talked to some of you about your experience in working with STEM faculty last year. This year, we are particularly interested in any changes in your experience. The interview will take about 30-45 minutes.

1. What are your responsibilities in the MSP?

2. In what ways do you work with mathematics and science faculty in the project? Have these changed overtime?

3. What is your assessment of the collaboration so far? Did you encounter any surprises or challenges in that collaboration?

4. Has the project done anything to facilitate the collaboration?

5. What have you learned through the collaboration?

6. Have you been affected by working with STEM faculty in MSP personally and professionally? In what ways?

7. Do you think STEM faculty involvement is resulting in improved teacher content knowledge and pedagogical skills? Why and in what ways? Can you give some examples?

8. Do you think STEM faculty involvement is resulting in improved K–12 student achievement? Why and in what ways? Can you give some examples?

9. Do you have any other comments?

APPENDIX B2. SITE VISIT PROTOCOL FOR RETA COHORT 2 PROJECTS (IST TIME)

PI/PD INTERVIEW PROTOCOL

Respondent:	MSP:
Interviewer:	Institution:
Date:	Duration:

I. Interview

Thank you for taking the time to talk to us about your MSP. We are interested in the extent and impact of STEM faculty involvement in your project. The interview will take about 60 minutes. It covers four broad sections: background information, the status of STEM faculty engagement in your project, institutional policies and resources, and your personal assessment and expectations about STEM faculty involvement. We won't identify you or your project by name.

Background

1. What is your background in areas related to MSP (i.e., mathematics or science discipline, prior positions, prior experience with NSF)?

STEM faculty involvement and relationships with other players

2. What role do you expect STEM faculty to play in your MSP? How important are they in the project?

3. So far, how many STEM faculty are actively engaged in your MSP? What is your rough estimate of the percentage they represent out of the total number of STEM faculty from the recruited departments? What are the characteristics of participating STEM faculty (mathematics or science disciplines, rank, tenure, etc.)?

4. What is the average time commitment of core participating STEM faculty? What types of activities are they involved in?

5. Do you know if the STEM faculty at any of the institutions in your project participate in any previous K–12 educational reform efforts? If yes, please explain.

6. What have you done to date to gain the cooperation of STEM faculty in your MSP project? What have been the most successful and the least successful approaches?

7. (If applicable) In what ways do STEM faculty work with education faculty?

8. (If applicable) In what ways do STEM faculty work with K–12 teachers (K–12 institute participants) and/or teacher leaders (K–12 institute faculty)?

9. What cultural differences among groups (STEM faculty, education faculty, K–12 teachers) have you observed? How are they affecting the project? Have any activities been carried out or are any activities planned to help bridge these differences?

10. Does the project have an ongoing process to gather and use data to assess STEM faculty engagement? If yes, what kinds of data are you collecting? How do you plan to use the results?

Institutional policies and resources

11. What institutional, departmental, or state policies tend to reward or hinder STEM faculty from participating in educational reform?

12. Are there any other external factors that may affect STEM faculty involvement and your project implementation (i.e. state standards and testing, financial and political context, business/ community involvement)?

Personal expectations about STEM faculty involvement

13. Do you think STEM faculty involvement will result in improved teacher content knowledge? What about pedagogical skills? Why and in what ways?

14. Do you think STEM faculty involvement will lead to improved K–12 student achievement? Why and in what ways?

15. Are there other things you'd like to discuss about STEM faculty?

Thank you.

STEM FACULTY INTERVIEW PROTOCOL

Respondent:	MSP:
Interviewer:	Institution:
Date:	Duration:

I. Interview

Thank you for taking the time to talk to us. Our research project is supported by National Science Foundation's Math and Science Partnership (MSP), which funds [project name]. We are examining the extent and impact of mathematics and science faculty involvement in MSP, which is the central premise of this national initiative. We are particularly interested in your personal experience on this topic. The interview will take about 60 minutes. It covers three broad sections: background information, your personal experiences with the project, and your institution's policies and relationships with other players. We won't identify you or your project by name.

Background

1. [For interviewee whose session is observed] Was the session we observed typical of the sessions you teach? Did it meet your objectives?

2. Will you please tell us something about your background (e.g., mathematics or science discipline, rank, years at current institution, primary teaching responsibility, research interest)?

3. How and why did you become involved in the MSP?

4. Please describe any previous experiences you have had working with K–12 teachers and education faculty at higher education institutions? How do they compare with those from the MSP?

Personal experiences with the project

5. What are your responsibilities in the MSP? What is your time commitment to the project?

6. In what areas do you see yourself making a significant contribution? Can you give us a few examples (i.e., curriculum development, professional development for inservice teachers, joint research with education faculty, etc.)?

7. Do you think STEM faculty involvement will result in improved teacher content knowledge and pedagogical skills? Why and in what ways?

8. Do you think STEM faculty involvement will result in improved K–12 student achievement? Why and in what ways?

9. How important do you think STEM faculty involvement is to what is happening at the K–12 level in your project?

Institutional policies and relationship with other players

10. Are there any departmental and institutional policies that might affect your MSP participation? What else could be done to facilitate your involvement?

11. What do you expect the impact of your MSP participation will be on your tenure or advancement?

12. What are the perceptions of your disciplinary colleagues regarding your MSP involvement? Have you encouraged or discouraged faculty peers to become involved in the MSP project?

13. (If applicable) In what ways do you work with education faculty in the project? What is your assessment of the collaboration so far?

14. In what ways do you work with K–12 teachers in the project? What is your assessment of the collaboration so far?

15. Do you have any other comments?

Thank you.

EDUCATION FACULTY INTERVIEW PROTOCOL

Respondent:	MSP:
Interviewer:	Institution:
Date:	Duration:

I. Interview

Thank you for taking the time to talk to us. Our research project is supported by National Science Foundation's Math and Science Partnership (MSP), which funds [project name]. We are examining the extent and impact of mathematics and science faculty involvement in MSP, which is the central premise of this national initiative. We are particularly interested in your personal experience on this topic. The interview will take about 30-45 minutes. It covers two broad sections: background information, and your own experiences working with mathematics and science faculty in the project. We won't identify you or your project by name.

Background

1. Will you please tell us something about your background (e.g., academic field, rank, years at current institution)?

2. What are your responsibilities in the MSP?

3. Have you had previous experiences in working with mathematics and science faculty at the college/university level? If yes, what were your experiences? How did they compare with those from the MSP?

Personal experiences and perceptions

4. In what ways do you work with mathematics and science faculty in the project?

5. What is your assessment of the collaboration so far? Did you encounter any surprises or challenges?

6. Do you think STEM faculty involvement will result in improved teacher content knowledge and pedagogical skills? Why and in what ways?

7. Do you think STEM faculty involvement will result in improved K–12 student achievement? Why and in what ways?

8. How important do you think mathematics and science faculty involvement is to what is happening at K–12 level in your project?

9. Do you have any other comments?

Thank you.

TEACHER LEADER (K–12 INSTITUTE FACULTY) GROUP INTERVIEW PROTOCOL

Respondent:	MSP:
Interviewer:	Institution:
Date:	Duration:

I. Interview

Thank you for taking the time to talk to us. Our research project is supported by National Science Foundation's Math and Science Partnership (MSP), which funds [project name]. We are examining the extent and impact of mathematics and science faculty involvement in MSP, which is the central premise of this national initiative. We are particularly interested in your personal experience on this topic. The interview will take about 30-45 minutes. It covers two broad sections: background information, and your own experiences working with mathematics and science faculty in the project.

Background

1. Will you please tell us something about your background (e.g., academic field, rank, years at current institution)?

2. What are your responsibilities in the MSP?

3. Have you had previous experiences in working with mathematics and science faculty at the college/university level? If yes, what were your experiences? How did they compare with those from the MSP?

Personal experiences and perceptions

4. In what ways do you work with mathematics and science faculty in the project?

5. What is your assessment of the collaboration so far? Did you encounter any surprises or challenges?

6. Do you think STEM faculty involvement will result in improved teacher content knowledge and pedagogical skills? Why and in what ways?

7. Do you think STEM faculty involvement will result in improved K–12 student achievement? Why and in what ways?

8. How important do you think mathematics and science faculty involvement is to what is happening at the K–12 level in your project?

9. Do you have any other comments?

Thank you.

INSERVICE TEACHER (K–12 INSTITUTE PARTICIPANT) GROUP INTERVIEW PROTOCOL

Respondent:	MSP:
Interviewer:	Institution:
Date:	Duration:

I. Interview

Thank you for taking the time to talk to us. The Math and Science Partnership (MSP) is a major research and development effort of the National Science Foundation that is designed to improve K–12 student achievement in mathematics and science. The professional development you are receiving is funded by MSP, as is our research project. We are examining the extent and impact of mathematics and science faculty involvement in MSP, which is the central premise of this national initiative. We are particularly interested in your personal experience with math and science faculty in this project. The discussion will take about 30-45 minutes.

1. Will you please tell us something about your background (e.g., grade level, years of experience, math/science training, reason/motivation to attend the institute, selection process, district/project incentive)?

2. Was the session we just observed typical of those being provided by the MSP? In what ways?

3. What did you think about the content presented (Was it too easy? Over your head?)? Is it applicable to the class you will be teaching? In what ways?

4. What did you think about the way the lesson was presented (i.e. pedagogy)? Is it applicable to the class you will be teaching? In what ways?

5. Are math and science faculty different from other professional development providers you've experienced (Is your current professional development different from those you received previously)? In what ways?

6. Are you working with mathematics and science faculty in the MSP in ways other than professional development (e.g., mentoring, curriculum development)? If so, how?

7. Have you had previous experiences working with mathematics and science faculty under other initiatives or as an undergraduate/graduate student? If yes, what were they and how were they like your MSP experience? How do you compare them with your current experience?

8. To what extent do you think higher education mathematics and science faculty involvement will help you to become a better teacher and improve student achievement?

9. Are there things that might make mathematics and science faculty involvement more useful and meaningful to you as a teacher?

10. Do you have any other comments?

CLASSROOM OBSERVATION PROTOCOL

Presenter: MSP:

Observer: Location:

Date: Duration:

Background *(Check all apply)*

1. Number of participants

   ☐ 1-10 ☐ 11-25 ☐ 26-50 ☐ 51 or more

2. Types of participants

   ☐ regular classroom teachers ☐ teacher leaders (trainers) ☐ preservice candidates

3. Subject

   ☐ mathematics ☐ science

3. Grade level

   ☐ elementary ☐ middle school ☐ high school

4. Session focus

   ☐ content ☐ pedagogy ☐ instructional materials ☐ Other *(specify)* ____________

5. Main activities and teaching techniques

   ☐ formal presentation/lecture ☐ collaborative learning

   ☐ class reports ☐ small group work

   ☐ inquiry-based ☐ problem-based learning

Comments

6. What was the specific STEM content of the lesson?

7. To what extent and how effectively did the instructor

   - Present the material clearly?
   - Encourage participants to generate ideas and questions?
   - Provide opportunities for participants to consider classroom applications?

8. How well were participants intellectually engaged? In what ways?

9. Please provide brief comments about other noticeable features.

10. What is your overall impression of the session?

DEAN/CHAIR INTERVIEW PROTOCOL*

Respondent: MSP:

Interviewer: Institution:

Date: Duration:

I. Interview

Thank you for taking the time to talk to us about your faculty members' involvement in math and science partnership (MSP). The interview will take about 30 minutes. We are especially interested in your view on faculty engagement in K–12 education reform, and institutional policies and resources. We won't identify you by name.

STEM faculty involvement

1. How many STEM faculty in your school/department are actively engaged in the MSP? What percentage do they represent in relation to the total number of STEM faculty in your school/department? What are their characteristics (mathematics or science disciplines, rank, tenure, etc.)?

2. What types of activities are they involved in?

3. Did the STEM faculty participate in any previous K–12 educational reform efforts? If yes, please explain.

Institutional policies and resources

4. What has your school/department done to encourage STEM faculty to participate in the MSP project?

5. What institutional, departmental, or state policies tend to reward or hinder STEM faculty from participating in K–12 educational reforms?

Personal expectations

6. In what areas do you expect STEM faculty expertise and contributions to be most valuable?

7. In what areas do you expect STEM faculty involvement in MSP will benefit themselves and the university?

8. Are there other things you'd like to discuss about STEM faculty?

Thank you.

* A separate interview will be conducted if the PI is not currently holding a dean or chair position.

OMB # 3145-0199

Expires: 9/30/08

Math and Science Partnership Program

Annual IHE Participant Survey for Comprehensive and Targeted MSPs

Sponsored by the

National Science Foundation

Conducted by

Westat

1650 Research Boulevard

Rockville, Maryland 20850

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Public Burden

Paperwork Reduction Act Notice. The Paperwork Reduction Act of 1995 says we must tell you why we are collecting this information, how we will use it and whether you have to give it to us. The reasons and purpose of this survey are described in the introduction and instructions for this survey and your response is voluntary. Failure to provide full and complete information, however, may reduce the possibility of NSF continuing support for the award or project subject to this monitoring survey. An agency may not conduct or sponsor, and a person is not required to respond to a collection of information unless it displays a valid OMB control number. The OMB control number for this survey is 3145-0199. The estimated average burden associated with this collection of information is 0.75 hours per response, depending on individual circumstances. Comments concerning the accuracy of this burden estimate and suggestions for reducing the burden should be sent to Suzanne Plimpton, Reports Clearance Officer for OMB 3145-0199, NSF/DAAS, 4201Wilson Boulevard, Arlington, VA 22230.

Annual Institution of Higher Education (IHE) Participant Survey For the [INSERT SCHOOL YEAR] School Year

To be completed and submitted by November 18, 2005.

The National Science Foundation (NSF) is collecting annual information about each of its Math and Science Partnership (MSP) projects. The purpose is to assess the overall implementation of the MSP program and to monitor the progress of individual MSP grants.

This form is designed to obtain information from ***each*** STEM and education faculty member and administrator who has participated in the MSP program. For the purposes of this collection, this includes any faculty member or administrator who was (1) directly supported by the MSP grant, and/or (2) directly participated in the development or implementation of MSP-related activities.

If you have any questions about the MSP Management Information System, please contact:

Robyn Bell
1-800-937-8281, ext. 2908
MSPMIS@westat.com

We estimate that it will take approximately 45 minutes of your time to complete this survey.

Thank you in advance for completing this survey.

INSTRUCTIONS FOR COMPLETING THE SURVEY

Faculty support and expertise are at the nucleus of the MSP enterprise as it seeks to improve teacher quality and to increase student achievement in mathematics and science throughout the United States. We have constructed this survey to give you the flexibility to respond in general and in detail relative to your level of involvement.

Neither NSF nor the Federal Government will maintain names or contact information associated with this survey. However, this information is held by the awardee institution.

Please answer the following questions with the most appropriate response. You may cut and paste text into this system.

It is recommended that you review the Primer (which can be accessed electronically by clicking on "Help" in the menu on the top of the page) before beginning the survey. The Primer provides general instructions and navigation information.

As you are completing the survey, please click the Save & Continue button after you respond to each item/set of items. Once an item or item set is saved, you may use the **Question Guide** to return to an item and revise your response. If you exit the system without saving, you will lose any unsaved data.

When you are ready to submit your data to NSF, please click the Submit button at the end of the form. You will no longer have access to this survey after a Final Submit has been made.

1. **Identification (ID) Number:** pre-filled

2. **Institution of Higher Education (IHE) Name:** pre-filled

3. **Primary IHE Department:** __________________

4. **Secondary IHE Department:** *(if applicable)* __________________

5. **Gender:** *(Check one response)*

   ❒ Male
   ❒ Female

6. **Which of the following categories describes your ethnicity?** *(Check one response)*

   ❒ Hispanic or Latino[1]
   ❒ Not Hispanic or Latino

7. **Which of the following categories describes your race?** *(Check one or more)*

   ❒ American Indian or Alaska Native[2]
   ❒ Asian[3]
   ❒ Black or African American[4]
   ❒ Native Hawaiian or Other Pacific Islander[5]
   ❒ White[6]

---

[1] Hispanic or Latino: A person of Cuban, Mexican, Puerto Rican, South or Central American, or other Spanish culture or origin, regardless of race.

[2] American Indian or Alaska Native: A person having origins in any of the original peoples of North and South America (including Central America), and who maintains tribal affiliation or community attachment.

[3] Asian: A person having origins in any of the original peoples of the Far East, Southeast Asia, or the Indian subcontinent including, for example, Cambodia, China, India, Japan, Korea, Malaysia, Pakistan, the Philippine Islands, Thailand, and Vietnam.

[4] Black or African American: A person having origins in any of the black racial groups of Africa.

[5] Native Hawaiian or Other Pacific Islander: A person having origins in any of the original peoples of Hawaii, Guam, Samoa, or other Pacific islands.

[6] White: A person having origins in any of the original peoples of Europe, the Middle East, or North Africa.

8. Use the list below to identify your primary fields of *research* and *instruction* during the [INSERT SCHOOL YEAR] school year:

Fields of Research and Instruction	**Primary Field of *Research*** *(Check one)*	**Primary Field of *Instruction*** *(Check one)*
Astronomy		
Atmospheric Sciences		
Biological Sciences		
Chemistry		
Computer Science		
Education *(specify area of education - from drop-down menu)*[7]		
Engineering		
Geosciences		
Mathematical Sciences		
Ocean Sciences		
Physics		
Not Applicable (e.g., IHE administrators with no primary research or instructional responsibilities)		
Other (specify): ______________________________		

[7] Drop-down menu will include the following options: Science, Technology, Engineering and Mathematics (STEM) Education, Early Childhood Education, Elementary Education, Middle Childhood Education, Secondary Education, Special Education, Distance Learning, Educational/Instructional Media Design, Educational Leadership and Administration, Curriculum and Instruction, Counseling and Guidance, Educational Assessment, Evaluation, and Research, Educational Psychology, Social and Philosophical Foundations of Education, and Other.

9. **What is your tenure status?** *(Check one response)*

- ❐ Tenured
- ❐ On tenure track
- ❐ Not on tenure track
- ❐ Not applicable to my position/at my institution

10. **Which of the following best describes your title or faculty rank during the [INSERT SCHOOL YEAR] school year?** *(Check one response)*

- ❐ Professor
- ❐ Associate Professor
- ❐ Assistant Professor
- ❐ Instructor
- ❐ Lecturer
- ❐ Adjunct Faculty
- ❐ Administrator with instructional and/or research responsibilities (e.g., deans, department chairs)
- ❐ Administrator with no instructional or research responsibilities (e.g., director of research center)
- ❐ Other (specify): ________________________________
- ❐ Not applicable at this institution
- ❐ Not applicable for my position

11. **Was the [INSERT SCHOOL YEAR] school year the first time you had been involved in efforts to reform or enhance K–12 instructional practices?** *(Check one response)*

- ❐ Yes
- ❐ No

12. **Which of the following areas of activities were you involved in during the [INSERT SCHOOL YEAR] school year? Click on an activity area to preview the definition and list of example activities.** *(You must select at least one of the following options. Check all that apply)*

- ❐ Pre-service
- ❐ In-service
- ❐ Management and/or Other MSP-related activities

13. **Estimate the number of hours you spent on your institution's MSP during the [INSERT SCHOOL YEAR] school year?** *(Check one response)*

- ❐ Less than 20 hours
- ❐ 20-40 hours
- ❐ 41-80 hours
- ❐ 81-160 hours
- ❐ 161-200 hours
- ❐ More than 200 hours

Note: For each area of activity that is checked for item 12, the respondent will be prompted to complete a corresponding item set (Q14a-c); however, the system will generate an abbreviated version of the survey and prompt the respondent to skip Q14a-c if the respondent checks "Less than 20 hours" or "20-40 hours" for item 13.

14a. Using the table below, identify the MSP Pre-service Activities that you participated in during the [INSERT SCHOOL YEAR] school year:

Pre-service Activities	**Did you participate in this activity during the [INSERT SCHOOL YEAR] school year?**	**Narrative**[8]
a) Participate in pre-service recruitment activities (e.g., encourage teaching as a career by speaking at STEM/minority undergraduate clubs, participating in high school career fairs, providing teaching assistant positions for STEM undergraduates)	Yes/No	
b) Provide pre-service students with experience in K–12 classroom settings before formal student teaching (e.g., an internship experience; teaching at a summer STEM camp; shadowing; tutoring)	Yes/No	
c) Provide pre-service students with opportunities to participate in local school district in-service activities (e.g., in-service summer institutes or ongoing LEA professional development)	Yes/No	
d) Teach or co-teach a pre-service STEM content course	Yes/No	
e) Involve K–12 master teachers in pre-service program (e.g., co-teach with a K–12 master teacher)	Yes/No	
f) Design pre-service STEM courses specifically for elementary/middle/high school teacher certification programs **Courses were designed for:** *(check all that apply)* ❑ Elementary school certification ❑ Middle school certification ❑ High school certification	Yes/No	
g) Develop an innovation as part of a traditional pre-service course	Yes/No	
h) Develop/revise pre-service courses to align with national, state and/or local standards	Yes/No	
i) Participate in efforts to link the pre-service process to national teacher certification activities (e.g., the National Board Certification process)	Yes/No	
j) Mentor pre-service students	Yes/No	
k) Other (specify):		

[8] Note: After completing the Yes/No column, the respondent will be prompted to: **Provide a brief description (i.e., 2-3 sentences) of your role in each activity listed below.** The primer will provide an example of an appropriate response.

14b. Using the table below, identify the MSP In-service (K–12) Activities that you participated in during the [INSERT SCHOOL YEAR] school year:

In-service (K–12) Activities	**Did you participate in this activity during the [INSERT SCHOOL YEAR] school year?**	**Narrative**[9]
a) Align K–12 mathematics and science curricula to other courses/standards (e.g., align to state standards; align to IHE expectations)	Yes/No	
b) Conduct a review of K–12 course curricula (e.g., update curricula based on current research; review curricula for content accuracy)	Yes/No	
c) Conduct workshops/institutes/courses with K–12 teachers that increase general content and/or pedagogical knowledge (e.g., teach at a summer science institute; conduct a workshop on cognitive science and its impact on instruction)	Yes/No	
d) Conduct targeted workshops/institutes/courses with K–12 teachers (e.g., teach at a summer science institute that is specifically linked to the curriculum/text used at partner schools)	Yes/No	
e) Design STEM courses specifically for elementary/middle/high school teacher certification programs **Courses were designed for:** *(check all that apply)* ❑ Elementary school certification ❑ Middle school certification ❑ High school certification	Yes/No	
f) Support adjunct positions for K–12 master teachers at your IHE	Yes/No	
g) Establish/provide externship opportunities for K–12 teachers	Yes/No	
h) Remain "on call" for classroom teachers (e.g., communicate with K–12 teachers via email or telephone to clarify a concept or content issue)	Yes/No	
i) Mentor a K–12 teacher in a shared discipline	Yes/No	
j) Establish/provide STEM learning communities/study groups (e.g., lesson study groups; discipline dialogues)	Yes/No	
k) Provide traditional STEM courses at alternative venues (e.g., students take credit bearing courses at a local science museum or university)	Yes/No	
l) Develop/re-design traditional STEM units or courses for in-depth immersion in a single topic (e.g., restructure school schedules and classroom time to allow for concentration on a single topic)	Yes/No	

[9] Note: After completing the Yes/No column, the respondent will be prompted to: **Provide a brief description (i.e., 2-3 sentences) of your role in each activity listed below.** The primer will provide an example of an appropriate response.

m) Help K–12 schools utilize computer-communications technology for challenging course delivery (e.g., teach an Advanced Placement (AP) course via video-conferencing)	Yes/No	
n) Help K–12 teachers utilize technology for course content innovation (e.g., mathematical modeling; online science experiments; access to digital images on online libraries)	Yes/No	
o) Participate in activities that motivate K–12 student participation in challenging mathematics and science courses (e.g., present a hands-on event at a K–12 school; take part in a "Meet the Scientist" night)	Yes/No	
p) Work one-on-one with K–12 students (e.g., to encourage students who have an interest in STEM disciplines)	Yes/No	
q) Participate in activities that encourage high school students to enroll in IHE courses (e.g., create a system that allows students to enroll in an IHE course and earn both high school and college credits)	Yes/No	
r) Other (specify):		

14c. Using the table below, identify the Management and other MSP-related Activities that you participated in during the [INSERT SCHOOL YEAR] school year:

Management and Other MSP-related Activities	**Did you participate in this activity during the [INSERT SCHOOL YEAR] school year?**	**Narrative[10]**
a) Serve as a member of the partnership management structure (e.g., help develop a strategic plan, participate in monthly MSP management meetings)	Yes/No	
b) Help develop joint databases or facilitate data sharing between K–12 and IHE partners	Yes/No	
c) Help create formal links between all MSP core partners (e.g., establish connections between high school STEM departments and corresponding disciplinary fields at your IHE)	Yes/No	
d) Help align teacher certification program requirements among partner IHEs (e.g., adopt a common course numbering or sequencing system)	Yes/No	
e) Participate in the development of policies to reward IHE disciplinary faculty for their involvement in K–12 education (e.g., policies and incentives in support of promotion or tenure)	Yes/No	
f) Conduct research on teaching and learning in math and science (e.g., effective practices for pre-service and in-service education programs)	Yes/No	
g) Enlist support from STEM industry/business personnel who work in disciplinary fields related to your own	Yes/No	
h) Attend National MSP conferences (e.g., NSF required conferences)	Yes/No	
i) Work on project-related evaluation activities or with RETA projects	Yes/No	
j) Other (specify):		

[10] Note: After completing the Yes/No column, the respondent will be prompted to: **Provide a brief description (i.e., 2-3 sentences) of your role in each activity listed below.** The primer will provide an example of an appropriate response.

15. Please briefly describe (i.e., one paragraph) your most significant contribution(s) to your own MSP project during the [INSERT SCHOOL YEAR] school year.

____
____
____
____

16. Please briefly describe (i.e., one paragraph) any knowledge or experience that you have gained through your participation in MSP—and how this knowledge influenced your instruction or research during the [INSERT SCHOOL YEAR] school year.

____
____
____
____

17. Did you receive any MSP-sponsored professional development during the [INSERT SCHOOL YEAR] school year to provide you with the skills needed to perform your MSP responsibilities (e.g., working with K–12 teachers)?

❒ Yes[11]
❒ No

Thank you for your observations and participation in the MSP review process.

[11] If respondent says yes, respondent will be asked: **Please briefly describe (i.e., one paragraph) these professional development activities, including (1) who provided these professional development activities, (2) the topics covered by these professional development activities, and (3) your assessment of whether these professional development activities improved your ability to perform your Institute responsibilities.**

OMB # 3145-0199

Expires: X/XX/XX

Math and Science Partnership Program

Annual Institution of Higher Education (IHE) Survey for Comprehensive and Targeted MSPs

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Public Burden

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Annual Institution of Higher Education (IHE) Survey

For the [INSERT SCHOOL YEAR] School Year

The National Science Foundation (NSF) is conducting a survey of its Math and Science Partnership (MSP) projects. The purpose is to assess the overall implementation of the MSP program and to monitor the progress of individual MSP grants. This survey has been designed to collect information about each Institution of Higher Education (IHE) that is serving as a lead, core or supporting partner in the Math and Science Partnership (MSP) Program.

INSTRUCTIONS FOR COMPLETING THE SURVEY

It is recommended that you review the **Primer** (which can be accessed electronically by clicking on "Help" in the menu on the top of the page) before beginning the survey. The Primer provides general instructions and navigation information.

As you are completing the survey, please click the Save & Continue button after you respond to each item. Once an item or section is saved, you may use the menu below or the Question Guide to return to an item and revise your response. If you exit the system without saving, you will lose any unsaved data.

To print and view completed sections of this survey, click on "Reports" in the menu on the top of the page.

Please complete each of the following sections as they pertain to the following Institution of Higher Education (IHE) by November 12, 2004: [INSERT NAME OF IHE]

Contact Information	IHE Participants in the MSP	MSP-supported Pre-service Courses
Report Status: **Not Complete**		

If you have any questions about how to respond to a particular item you should contact your principal investigator. Questions about how to navigate the system should be referred to:

Robyn Bell
1-800-937-8281, ext. 2908
mspmis@westat.com
Westat
1550 Research Boulevard
Rockville, Maryland 20850

Contact Information

This section obtains information on the individual who should be contacted for any follow-up questions about this submission.

1. Provide the following contact information for the individual primarily responsible for completing this survey:

Name: ______________________________

Title: ______________________________

Street address: ______________________________

City: ______________________________

State: ______________________________

Zip code: ______________________________

Phone number: ______________________________

Fax number: ______________________________

E-mail: ______________________________

IHE Participants in the MSP

This section is designed to obtain information on the number of individuals at *your* IHE that participated in your MSP during the [INSERT SCHOOL YEAR] school year.

1. Indicate the number of IHE individuals who:

- **Were involved in the <u>development</u> and/or <u>delivery</u> of MSP activities during the [INSERT SCHOOL YEAR] school year** *(e.g., IHE education faculty who revised a pre-service course to align with state standards, IHE STEM faculty who presented at a professional development seminar).*

- **Were <u>recipients</u> of MSP activities during the [INSERT SCHOOL YEAR] school year** *(e.g., IHE STEM faculty who <u>received</u> professional development, pre-service students who enrolled in/completed an MSP-revised pre-service course)*

NOTE—individuals who developed/delivered MSP activities and were also recipients of MSP activities should be counted under both columns. However, no individual should be counted more than once in each column.

Enter an "X" in all cells where information is not currently available.

	Number of IHE individuals involved in the <u>development</u> and/or <u>delivery</u> of MSP activities	**Number of IHE individuals who were <u>recipients</u> of MSP activities**
IHE STEM faculty *(tenure track)*		
IHE STEM faculty *(non-tenure track)*		
IHE education faculty *(tenure track)*		
IHE education faculty *(non-tenure track)*		
IHE administrators with or without instructional/research responsibilities (e.g., deans, department chairs)		
K–12 teachers in residence		
MSP liaisons/coordinators		
STEM undergraduate students		
Pre-service undergraduate and alternative certification students		
Graduate students (including doctoral candidates)		
Postdoctoral students		
Other (specify):		

MSP-supported Pre-service Courses

This section obtains information about <u>each</u> MSP-supported pre-service undergraduate or graduate course/seminar that was developed or offered at your IHE during the [INSERT SCHOOL YEAR] school year. For the purpose of this collection, MSP-supported refers to the following types of contributions:

- MSP funds were used to develop a **new** pre-service course/seminar
- MSP funds were used to **modify** or **enhance** a pre-existing pre-service course/seminar

To add an MSP-supported course, click on the *Add Course* button below.

To provide information on a course listed below, click on the link in the matrix (in the column titled *Name of Course/Seminar*)

Name of Course/Seminar	Number of Course/Seminar	Department	Information Complete?
(from Item 1)	(from item 2)	(from item 3)	(yes or no)

1. **Provide the name of the MSP-supported undergraduate or graduate course/seminar:**

2. **Provide the number (e.g., MATH210) of the MSP-supported undergraduate or graduate course/seminar:**

3. **Provide the department for the MSP-supported undergraduate or graduate course/seminar:**

4. **What was the nature of MSP's contribution to this course during the [INSERT SCHOOL YEAR] school year?** *(Check all that apply for the* **[INSERT SCHOOL YEAR]** *school year)*

- ❐ A new course/seminar was developed using MSP funds
- ❐ A pre-existing course/seminar was modified or enhanced using MSP funds
- ❐ Other *(specify):* ____

5. **What subject matter does this course cover?** *(check* <u>*all*</u> *that apply)*

- ❒ Astronomy
- ❒ Atmospheric Sciences
- ❒ Biological Sciences
- ❒ Chemistry
- ❒ Computer Science
- ❒ Education *(specify area of education)* ______________________
- ❒ Engineering
- ❒ Geosciences
- ❒ Mathematical Sciences
- ❒ Ocean Sciences
- ❒ Physics
- ❒ Other (*specify*): ______________________________________

6. **What was the level for this course?** *(check* <u>*one*</u> *response)*

- ❑ Undergraduate
- ❑ Graduate

7. **Provide a brief description (i.e., 250 words or less) of the purpose and scope/content of this course:**

8. **Were any pre-service students enrolled in this course during the [INSERT SCHOOL YEAR] school year?** *(check* <u>*one*</u> *response)*

- ❒ Yes *(complete Q9)*
- ❒ No, course still under development *(end of section)*
- ❒ No, course was fully developed, but not offered during the **[INSERT SCHOOL YEAR]** school year *(end of section)*
- ❒ No, other (specify): ____ *(end of section)*

9. How many students took this course/seminar during the [INSERT SCHOOL YEAR] school year? *(Provide this information for all students who were enrolled in all sections of this course during the [INSERT SCHOOL YEAR] school year.)*

Enter an "X" in all cells where information is not currently available.

		Total number of students enrolled in all sections of the course during the [INSERT SCHOOL YEAR] school year
Total		
Gender		
Male		
Female		
Not Reported		
Race/Ethnicity		
Hispanic or Latino	Race Not Reported[1]	
	American Indian or Alaska Native	
	Asian	
	Black or African American	
	Native Hawaiian or Other Pacific Islander	
	White	
	More than One Race Reported	
	SUB-TOTAL: Hispanic or Latino	*(auto total)*
NOT Hispanic or Latino OR Ethnicity NOT Reported[2]	American Indian or Alaska Native	
	Asian	
	Black or African American	
	Native Hawaiian or Other Pacific Islander	
	White	
	More than One Race Reported	
	SUB-TOTAL: Non-Hispanic or Latino	*(auto total)*
Neither Race nor Ethnicity Reported[3]		

[1] Use "*Race Not Reported*" to provide information about Hispanic or Latino students for whom race is not reported or unknown.

[2] Use *"NOT Hispanic or Latino OR Ethnicity NOT Reported"* to provide race information for those students (1) that are not Hispanic or Latino, or (2) for whom ethnicity is not reported or unknown.

[3] Use *"Neither Race nor Ethnicity Reported"* for those students for whom both race and ethnicity are unknown.

OMB # 3145-0199

Expires: 9/30/08

Math and Science Partnership Program

Annual K–12 District Survey for Comprehensive and Targeted MSPs

Sponsored by the

National Science Foundation

Conducted by

Westat

1650 Research Boulevard

Rockville, Maryland 20850

Privacy Notice

Information from this monitoring system will be retained by the National Science Foundation, a federal agency, and will be an integral part of its Privacy Act System of Records in accordance with the Privacy Act of 1974 and maintained in the Education and Training System of Records 63 Fed. Reg. 264, 272 (January 5, 1998). These are confidential files accessible only to appropriate National Science Foundation (NSF) officials, their staffs, and their contractors responsible for monitoring, assessing, and evaluating NSF programs. Only data in highly aggregated form, or data explicitly requested as "for general use," will be made available to anyone outside of the National Science Foundation for research purposes. Data submitted will be used in accordance with criteria established by NSF for monitoring research and education grants, and in response to Public Law 99-383 and 42 USC 1885c.

Public Burden

Paperwork Reduction Act Notice. The Paperwork Reduction Act of 1995 says we must tell you why we are collecting this information, how we will use it and whether you have to give it to us. The reasons and purpose of this survey are described in the introduction and instructions for this survey and your response is voluntary. Failure to provide full and complete information, however, may reduce the possibility of NSF continuing support for the award or project subject to this monitoring survey. An agency may not conduct or sponsor, and a person is not required to respond to a collection of information unless it displays a valid OMB control number. The OMB control number for this survey is 3145-0199. The estimated average burden associated with this collection of information is 62 hours per response, depending on individual circumstances. Comments concerning the accuracy of this burden estimate and suggestions for reducing the burden should be sent to Suzanne Plimpton, Reports Clearance Officer for OMB 3145-0199, NSF/DAAS, 4201Wilson Boulevard, Arlington, VA 22230.

Annual K–12 District Survey

The National Science Foundation (NSF) is conducting a survey of its Math and Science Partnership (MSP) projects. The purpose is to assess the overall implementation of the MSP program and to monitor the progress of individual MSP grants.

This survey has been designed to collect information about each K–12 school district that is serving as a lead, core or supporting partner in the Math and Science Partnership (MSP) Program. It may be completed by the PI or someone designated by the PI to complete individual sections (e.g., K–12 school district representatives, a project evaluator).

Instructions for Completing the Survey

It is recommended that you review the **Primer** (which can be accessed electronically by clicking on 'Help' in the menu on the top of the page) before beginning the survey. The Primer provides general instructions and navigation information.

As you are completing the survey, please click the "Save & Continue" button after you respond to each item. Once an item or section is saved, you may use the menu below or the Question Guides to return to an item and revise your response. If you exit the system without saving, you will lose any unsaved data.

Do not leave any cell in a table blank. There are two ways to indicate that some or all of the information on a given table is currently not available:

- For some tables in this survey, there is a checkbox to indicate that your project is unable to provide ANY of the requested information for the ENTIRE table. Checking this box will allow you to skip the entire item.
- On all tables, enter an "X" in each cell where information is not currently available (e.g., the number of students taking an assessment cannot be disaggregated by race). Use an "X" when some, but not all information on a table is obtainable. Only enter "0" when it is the actual number that you wish to report for a given cell (e.g., to report that there are no Asian math teachers at the school).

Please complete and submit each of the following sections as they pertain to the following K–12 school district by November 18, 2005: [Insert Name of School District]

Contact Information	District-level Information for the [INSERT SCHOOL YEAR] School Year	School-level Information
Report Status: **Not Complete**		

If you have any questions about how to respond to a particular item you should contact your principal investigator. Questions about how to navigate the system should be referred to:

Robyn Bell
1-800-937-8281, ext. 2908
mspmis@westat.com
Westat
1550 Research Boulevard
Rockville, Maryland 20850

Contact Information

This section obtains information on the individual who should be contacted for any follow-up questions about this submission.

2. Provide the following contact information for the individual primarily responsible for completing this survey:

Name: ______________________________
Title: ______________________________
Street address: ______________________________
City: ______________________________
State: ______________________________
Zip code: ______________________________
Phone number: ______________________________
Fax number: ______________________________
E-mail: ______________________________

District-level Information

This section obtains information on the number of individuals in each K–12 school district that participated in your MSP during the [INSERT SCHOOL YEAR] school year and information on the number of K–12 teachers and administrators in your K–12 school district that received professional development.

1. Indicate the number of K–12 participants in your district who were involved in the <u>development</u> and/or <u>delivery</u> of MSP activities during the [INSERT SCHOOL YEAR] school year:

❒ Check this box if you cannot provide ANY of the information on this ENTIRE table, then click on the *Save & Continue* button below.[1]

If ANY information on this table is available, complete as many cells as possible and type an "X" in each cell for which information is unavailable.

NOTE—Count only those K–12 participants who were involved in the development and/or delivery of MSP activities, such as:

- *Co-teaching a pre-service course at a partner IHE*
- *Revising challenging course curricula to align with state standards*
- *Presenting at a summer institute*

*Do **NOT** count K–12 participants who were <u>recipients</u> of an MSP activity, such as:*

- *Guidance counselors who received professional development*
- *New K–12 teachers who took part in an induction program*
- *K–12 administrators who attended a weekend seminar*

*Do **NOT** double count participants—e.g., if a guidance counselor is also a teacher, do not count that individual twice—classify that individual based on his or her primary role.*

	Number
Teachers	
Principals, vice principals and assistant principals	
Instructional coordinators and supervisors (e.g., curriculum specialists)	
Guidance counselors	
District-level administrators/staff	
Other (specify):	

[1] **Note:** Question is complete if checked.

2. **Provide the following information about the amount of MSP-supported professional development received by K–12 teachers and school-level administrators in your district *during the [INSERT SCHOOL YEAR] school year*.**

❒ Check this box if you cannot provide ANY of the information on this ENTIRE table, then click on the *Save & Continue* button below.[2]

If ANY information on this table is available, complete as many cells as possible and type an "X" in each cell for which information is unavailable.

NOTE—assign only one classification for teachers that provide instruction in both math and science and/or more than one school level—do not report on any individual teacher more than once.

		Elementary School[3]	Middle School		High School	
			Math	Science	Math	Science
Total number of K–12 teachers participating in MSP-supported professional development during the [INSERT SCHOOL YEAR] school year						
Number of K–12 teachers receiving:	1-20 hours					
	21-40 hours					
	41-80 hours					
	81-120 hours					
	121-160 hours					
	161 or more hours					
Total number of school-level administrators participating in MSP-supported professional development during the [INSERT SCHOOL YEAR] school year						
Number of school-level administrators receiving:	1-20 hours					
	21-40 hours					
	41-80 hours					
	81-120 hours					
	121-160 hours					
	161 or more hours					

[2] **Note:** Question is complete if checked.

[3] For elementary schools, this includes regular classroom teachers who teach math, science and a variety of other subjects. It can also include math and science resource teachers and special education teachers. Do not include specialized teachers (e.g., art, music, physical education) who do not teach math or science as part of their regular assignments.

3. **Provide the following information about the amount of MSP-supported professional development received by K–12 teachers and school-level administrators in your district *since the beginning* of your MSP.**

❒ Check this box if you cannot provide ANY of the information on this ENTIRE table, then click on the *Save & Continue* button below.[4]

If ANY information on this table is available, complete as many cells as possible and type an “X” in each cell for which information is unavailable.

NOTE—assign only one classification for teachers that provide instruction in both math and science and/or more than one school level—do not report on any individual teacher more than once.

		Elementary School[5]	Middle School		High School	
			Math	Science	Math	Science
Total number of K–12 teachers participating in MSP-supported professional development *since the beginning of your MSP*						
Number of K–12 teachers receiving:	1-20 hours					
	21-40 hours					
	41-80 hours					
	81-120 hours					
	121-160 hours					
	161 or more hours					
Total number of school-level administrators participating in MSP-supported professional development *since the beginning of your MSP*						
Number of school-level administrators receiving:	1-20 hours					
	21-40 hours					
	41-80 hours					
	81-120 hours					
	121-160 hours					
	161 or more hours					

[4] **Note:** Question is complete if checked.

[5] For elementary schools, this includes regular classroom teachers who teach math, science and a variety of other subjects. It can also include math and science resource teachers and special education teachers. Do not include specialized teachers (e.g., art, music, physical education) who do not teach math or science as part of their regular assignments.

School-level Information

This section obtains key information (i.e., school name, NCES ID, etc.) on ALL K–12 schools that are participating in your MSP. Additional information about teacher and student characteristics, course enrollment and student achievement data will be collected for those schools that have participated extensively in your MSP.

For the purposes of this collection, a participating school is any school in this district that has worked with your MSP in ANY CAPACITY since funding began. In completing this section, please include ALL participating schools.

NOTE—this section contains several skip patterns, i.e., there may be one or more items that you are not required to complete for a given school. These items will be marked with an "X" in the question guide

Do not leave any cell in a table blank. There are two ways to indicate that some or all of the information on a given table is currently not available:

- For some tables in this section, there is a checkbox to indicate that your project is unable to provide ANY of the requested information for the ENTIRE table. Checking this box will allow you to skip the entire item.

- On all tables, enter an "X" in each cell where information is not currently available (e.g., the number of students taking an assessment cannot be disaggregated by race). Use an "X" when some, but not all information on a table is obtainable. Only enter "0" when it is the actual number that you wish to report for a given cell (e.g., to report that there are no Asian math teachers at the school).

Provide the following information for *each* school that has worked with your MSP in ANY CAPACITY:

a. School Name:

b. NCES School ID:

c. School Level: *(check the one that best applies to this school)*

- ❑ Elementary
- ❑ Middle
- ❑ High
- ❑ Ungraded

d. Grade Levels at this school: *(check all that apply)*[6]

❑ Pre-K	❑ 7
❑ K	❑ 8
❑ 1	❑ 9
❑ 2	❑ 10
❑ 3	❑ 11
❑ 4	❑ 12
❑ 5	❑ Other *(specify):* ______________________
❑ 6	

Grade Levels targeted at this school by MSP: *(check all that apply)*

❑ Pre-K	❑ 7
❑ K	❑ 8
❑ 1	❑ 9
❑ 2	❑ 10
❑ 3	❑ 11
❑ 4	❑ 12
❑ 5	❑ Other *(specify):* ______________________
❑ 6	

[6] Respondents will be asked to provide information for the grade levels at the school that are equal to or greater than the grade levels targeted by the MSP (e.g., if a K–8 school is targeting grades 6-8, the respondent would provide information for grades 6-8. If a 9-12 school is targeting grades 9 and 10, the respondent would provide information for grades 9-12). If respondent selects grades in the "targeted" table that are not selected in the "at school" table, respondent will receive an error message. The targeted grades are a subset of the grade levels at the school.

If Elementary or Ungraded is selected in Qc AND any combination of Pre-K through 6 in Qd, then SKIP Qe and f OR if Middle or High is selected in Qc AND any combination of 6-12 in Qd, then SKIP Qe and f.

e. Does this school have self-contained classroom teachers (i.e., teachers who provide instruction to one group of students in many or all subject areas)?

Note—do NOT select yes if the only teachers who teach more than one subject at this school are special education teachers.

- ❑ Yes
- ❑ No

f. Does this school have teachers who only teach math or science?

- ❑ Yes
- ❑ No

A. Which of the following conditions apply to this school? *(check all that apply)*

For the purposes of this collection, the term "targeted" refers to those teachers and students who are expected to be directly impacted by your MSP. For example, if your project is focusing on mathematics in grades 7 and 8, you would determine if 30 percent or more of a school's 7th and 8th grade mathematics teachers had participated in 30 or more hours of MSP-sponsored activities in the previous school year (as opposed to 30 percent of all teachers at the school).

- ❑ 30 percent or more of targeted teachers participated in 30 or more hours of MSP-sponsored activities during the **[INSERT SCHOOL YEAR]** school year.
- ❑ 30 percent or more of targeted students were engaged in a challenging mathematics or science curriculum that was initiated or revised with MSP support during the **[INSERT SCHOOL YEAR]** school year.
- ❑ 30 percent or more of targeted students participated in a MSP-supported academic enrichment activity during the **[INSERT SCHOOL YEAR]** school year.
- ❑ None of the above conditions apply to this school for the **[INSERT SCHOOL YEAR]** school year. ***(If this response option is selected SKIP questions 1-7[7])***

NOTE—the column headings for Q1 and 2 will be determined by your responses to Qc-f and your project's subject focus (math only, science only or math and science).

[7] Respondents will complete questions 1-7 if one of the other three response option were selected in a previous collection year.

1. **Provide the following information about the TOTAL number of teachers in [NAME OF SCHOOL] at the beginning of the [INSERT SCHOOL YEAR] school year:**

Enter an "X" in ALL cells where information is currently not available.

NOTE—DO NOT report on any individual teacher more than once in a given row.

		Self-contained Classroom Teachers[8]	Math Teachers	Science Teachers
Total				
Gender				
Male				
Female				
Not Reported				
Race/Ethnicity				
Hispanic or Latino	Race Not Reported[9]			
	American Indian or Alaska Native			
	Asian			
	Black or African American			
	Native Hawaiian or Other Pacific Islander			
	White			
	More than One Race Reported			
	SUB-TOTAL: Hispanic or Latino	*(auto total)*	*(auto total)*	*(auto total)*
NOT Hispanic or Latino OR Ethnicity NOT Reported[10]	American Indian or Alaska Native			
	Asian			
	Black or African American			
	Native Hawaiian or Other Pacific Islander			
	White			
	More than One Race Reported			
	SUB-TOTAL: Non-Hispanic or Latino	*(auto total)*	*(auto total)*	*(auto total)*
Neither Race nor Ethnicity Reported[11]				

[8] For elementary schools (and some middle schools), this includes regular classroom teachers who teach math, science and a variety of other subjects. It can also include math and science resource teachers and special education teachers. Do not include specialized teachers (e.g., art, music, physical education) who do not teach math or science as part of their regular assignments.

[9] Use "*Race Not Reported*" to provide information about Hispanic or Latino teachers for whom race is not reported or unknown.

[10] Use *"NOT Hispanic or Latino OR Ethnicity NOT Reported"* to provide race information for those teachers (1) who are not Hispanic or Latino, or (2) for whom ethnicity is not reported or unknown.

[11] Use *"Neither Race nor Ethnicity Reported"* for those teachers for whom both race and ethnicity are unknown.

2. **Using the definition for "participating teachers" below, provide the following information about the number of teachers in [NAME OF SCHOOL] that actively participated in your MSP during the [INSERT SCHOOL YEAR] school year:**

Enter an "X" in ALL cells where information is currently not available.

NOTE—DO NOT report on any individual teacher more than once in a given row.

Definition for participating teachers: Those teachers who have participated in 30 or more hours of MSP-sponsored activities during a given school year. Examples include teachers who (1) developed or delivered a MSP-sponsored activity to K–12 students or other teachers, (2) participated in a MSP-sponsored effort to revise mathematics or science curriculum, (3) received MSP-sponsored professional development, and/or (4) took part in MSP-related learning communities.

		Self-contained Classroom Teachers[12]	Math Teachers	Science Teachers
Total				
Gender				
Male				
Female				
Not Reported				
Race/Ethnicity				
Hispanic or Latino	Race Not Reported[13]			
	American Indian or Alaska Native			
	Asian			
	Black or African American			
	Native Hawaiian or Other Pacific Islander			
	White			
	More than One Race Reported			
	SUB-TOTAL: Hispanic or Latino	*(auto total)*	*(auto total)*	*(auto total)*
NOT Hispanic or Latino OR Ethnicity NOT Reported[14]	American Indian or Alaska Native			
	Asian			
	Black or African American			
	Native Hawaiian or Other Pacific Islander			
	White			
	More than One Race Reported			
	SUB-TOTAL: Non-Hispanic or Latino	*(auto total)*	*(auto total)*	*(auto total)*
Neither Race nor Ethnicity Reported[15]				

[12] For elementary schools (and some middle schools), this includes regular classroom teachers who teach math, science and a variety of other subjects. It can also include math and science resource teachers and special education teachers. Do not include specialized teachers (e.g., art, music, physical education) who do not teach math or science as part of their regular assignments.

[13] Use "*Race Not Reported*" to provide information about Hispanic or Latino teachers for whom race is not reported or unknown.

[14] Use *"NOT Hispanic or Latino OR Ethnicity NOT Reported"* to provide race information for those teachers (1) who are not Hispanic or Latino, or (2) for whom ethnicity is not reported or unknown.

[15] Use *"Neither Race nor Ethnicity Reported"* for those teachers for whom both race and ethnicity are unknown.

3. Provide the following information about student enrollment for <u>each</u> grade at [NAME OF SCHOOL] in the beginning of the [INSERT SCHOOL YEAR] school year.

To provide information on a grade level, click on the link in the matrix (in the column titled *Grade Level*).

Grade Level	**Information Complete**
Pre-Kindergarten	(yes or no)
Kindergarten	
1st Grade	
2nd Grade	
3rd Grade	
4th Grade	
5th Grade	
6th Grade	
7th Grade	
8th Grade	
9th Grade	
10th Grade	
11th Grade	
12th Grade	
Other	

If you have entered information on all grade levels (indicated by a checkmark in the *Information Complete* column) proceed to the next question by clicking on the *Save & Continue* button below.

3 (continued). Provide the following information about the total number of students at this grade level that were enrolled in [NAME OF SCHOOL] at the beginning of the [INSERT SCHOOL YEAR] school year:

Enter an "X" in ALL cells where information is currently not available.

*NOTE—provide information about **all** students in the school-regardless of whether those students or their teachers participated in the MSP during the previous school year.*

Grade Level: (from matrix)

		Total Number of Students *(at the beginning of the [INSERT SCHOOL YEAR] school year)*
Total		
Gender		
Male		
Female		
Not Reported		
Race/Ethnicity		
Hispanic or Latino	Race Not Reported[16]	
	American Indian or Alaska Native	
	Asian	
	Black or African American	
	Native Hawaiian or Other Pacific Islander	
	White	
	More than One Race Reported	
	SUB-TOTAL: Hispanic or Latino	*(auto total)*
NOT Hispanic or Latino OR Ethnicity NOT Reported[17]	American Indian or Alaska Native	
	Asian	
	Black or African American	
	Native Hawaiian or Other Pacific Islander	
	White	
	More than One Race Reported	
	SUB-TOTAL: Non-Hispanic or Latino	*(auto total)*
Neither Race nor Ethnicity Reported[18]		
Students participating in the National School Lunch Program[19]		
Special Education Students		
Limited English Proficiency Students		

[16] Use "*Race Not Reported"* to provide information about Hispanic or Latino students for whom race is not reported or unknown.

[17] Use *"NOT Hispanic or Latino OR Ethnicity NOT Reported"* to provide race information for those students (1) who are not Hispanic or Latino, or (2) for whom ethnicity is not reported or unknown.

[18] Use *"Neither Race nor Ethnicity Reported"* for those students for whom both race and ethnicity are unknown.

[19] Students receiving free or reduced price lunch.

4. **Check *one* of the following:** [20]

- ❑ Level 1 math *is not currently being offered* at this school to students prior to and/or during the 8th grade.[21]

- ❑ Level 1 math is currently offered at this school to students prior to and/or during the 8th grade—and information on student enrollment AND completion *can be provided at this time*.[22]

- ❑ Level 1 math is currently offered at this school to students prior to and/or during the 8th grade—but information on student enrollment AND completion *will not be available until a later date*.[23]

- ❑ Level 1 math is currently offered at this school to students prior to and/or during the 8th grade—but information on student enrollment AND completion *cannot be made available to NSF*.[24]

---

[20] This question will only be required for schools with an 8th grade in projects that are designed to address math.

[21] **Note:** Question 4 is complete if checked.

[22] **Note:** Respondent completes Question 4a table if checked.

[23] **Note:** Respondent is asked follow-up question if checked: **"When can this data be reported?"** Respondents are given a drop down menu for month and year.

[24] **Note:** Question 4 is complete if checked. In a warning message, respondent is prompted to explain WHY data cannot be made available to NSF in the generic text box for the K–12 District Survey.

4a. Provide student enrollment and completion data for the Level 1 math courses offered in [NAME OF SCHOOL]:[25]

Enter an “X” in ALL cells where information is currently not available.

NOTE—includes students enrolled in the following courses Algebra 1; Elementary Algebra; Beginning Algebra; Unified Math 1; Integrated Math 1; Algebra 1B (second year of two-year sequence for Algebra 1); Math B.

		Number of 8th grade students enrolled in a Level 1 math course prior to or during the [INSERT SCHOOL YEAR] school year	Number of 8th grade students who passed/received credit for a Level 1 math course prior to or during the [INSERT SCHOOL YEAR] school year
Total			
Gender			
Male			
Female			
Not Reported			
Race/Ethnicity			
Hispanic or Latino	Race Not Reported[26]		
	American Indian or Alaska Native		
	Asian		
	Black or African American		
	Native Hawaiian or Other Pacific Islander		
	White		
	More than One Race Reported		
	SUB-TOTAL: Hispanic or Latino	*(auto total)*	*(auto total)*
NOT Hispanic or Latino OR Ethnicity NOT Reported[27]	American Indian or Alaska Native		
	Asian		
	Black or African American		
	Native Hawaiian or Other Pacific Islander		
	White		
	More than One Race Reported		
	SUB-TOTAL: Non-Hispanic or Latino	*(auto total)*	*(auto total)*
Neither Race nor Ethnicity Reported[28]			

[25] This question will only be required for schools with an 8th grade in projects that are designed to address math.

[26] Use “*Race Not Reported*” to provide information about Hispanic or Latino students for whom race is not reported or unknown.

[27] Use *“NOT Hispanic or Latino OR Ethnicity NOT Reported”* to provide race information for those students (1) who are not Hispanic or Latino, or (2) for whom ethnicity is not reported or unknown.

[28] Use *“Neither Race nor Ethnicity Reported”* for those students for whom both race and ethnicity are unknown.

5. Provide student enrollment and completion data for <u>each</u> of the following *science* courses offered in [NAME OF SCHOOL][29] during the [INSERT SCHOOL YEAR] school year:

To provide information on a course type, click on the link in the matrix.

For courses that are not offered, click on the link and indicate *course not offered* on the next screen.

Course Type	Common Course Names	Information Complete?
Biology 1st Year	Biology I; General; College Preparation; Regents; Introductory; BSCS I	(yes or no)
Chemistry 1st Year	Chemistry I; General; Introductory; Regents	
Physics 1st Year	Physics I; General; Regents; Introductory	
Earth Science	Earth Science; Earth-Space Science; Regents Earth Science; Space Science; Aerospace Science	
Integrated Science	SS&C; Project 2061; Integrated Science 9, 10; Unified; Comprehensive Ideas of Investigations in Science; Life/Physical Science; Earth/Life/ Physical Science; Coordinated Science.	
AP/IB Biology	Advanced Placement and International Baccalaureate exams	
AP Chemistry	Advanced Placement and International Baccalaureate exams	
AP Physics	Advanced Placement and International Baccalaureate exams	

[29] This information will only be required for high schools in projects that are designed to address science.

5. Check *one* of the following:

- ❑ [INSERT COURSE NAME] *is not currently being offered* at this school.[30]
- ❑ [INSERT COURSE NAME] is currently offered at this school and information on student enrollment AND completion *can be provided at this time*.[31]
- ❑ [INSERT COURSE NAME] is currently offered at this school, but information on student enrollment AND completion *will not be available until a later date*.[32]
- ❑ [INSERT COURSE NAME] is currently offered at this school, but information on student enrollment AND completion *cannot be made available to NSF*.[33]

[30] **Note:** Question 5 is complete for this course if checked.

[31] **Note:** Respondent completes Question 5a table if checked.

[32] **Note:** Respondent is asked follow-up question if checked: **"When can this data be reported?"** Respondents are given a drop down menu for month and year.

[33] **Note:** Question 5 is complete for this course if checked. In a warning message, prompt respondent to explain WHY data cannot be made available to NSF in the generic text box for the K–12 District Survey.

5a. Course Type: (from matrix)

Enter an "X" in ALL cells where information is currently not available.

NOTE—students who completed multiple courses in a given category should be counted as many times as applicable.

		Number of students enrolled in this course at any time during the [INSERT SCHOOL YEAR] school year	Number of enrolled students who passed/received credit for this course during the [INSERT SCHOOL YEAR] school year
Total			
Gender			
Male			
Female			
Not Reported			
Race/Ethnicity			
Hispanic or Latino	Race Not Reported[34]		
	American Indian or Alaska Native		
	Asian		
	Black or African American		
	Native Hawaiian or Other Pacific Islander		
	White		
	More than One Race Reported		
	SUB-TOTAL: Hispanic or Latino	*(auto total)*	*(auto total)*
NOT Hispanic or Latino OR Ethnicity NOT Reported[35]	American Indian or Alaska Native		
	Asian		
	Black or African American		
	Native Hawaiian or Other Pacific Islander		
	White		
	More than One Race Reported		
	SUB-TOTAL: Non-Hispanic or Latino	*(auto total)*	*(auto total)*
Neither Race nor Ethnicity Reported[36]			

[34] Use "*Race Not Reported*" to provide information about Hispanic or Latino students for whom race is not reported or unknown.

[35] Use *"NOT Hispanic or Latino OR Ethnicity NOT Reported"* to provide race information for those students (1) who are not Hispanic or Latino, or (2) for whom ethnicity is not reported or unknown.

[36] Use *"Neither Race nor Ethnicity Reported"* for those students for whom both race and ethnicity are unknown.

6. Provide student enrollment and completion data for <u>each</u> of the following *math* courses offered in [NAME OF SCHOOL][37] during the [INSERT SCHOOL YEAR] school year:

To provide information on a course type, click on the link in the matrix.

For courses that are not offered, click on the link and indicate *course not offered* on the next screen.

Course Type	Common Course Names	Information Complete?
Level 1 Mathematics	Algebra 1; Elementary; Beginning; Unified Math 1; Integrated Math 1; Algebra 1B (second year of two-year sequence for Algebra 1); Math B	(yes or no)
Level 2 Mathematics	Geometry; Plane Geometry; Integrated Math 2; Unified Math II; Math C	
Level 3 Mathematics	Algebra 2; Intermediate Algebra; Algebra and Trigonometry; Advanced Algebra; Algebra and Analytic Geometry; Integrated Math 3; Unified Math III	
Level 4 Mathematics	Trigonometry; College Algebra; Algebra 3; Pre-calculus; Analytic/Advanced Geometry; Trigonometry and Analytic/Solid Geometry; Advanced Math Topics; Introduction to College Math; Number Theory; Math IV; College Preparation Senior. Math; Elementary Functions; Finite Math; Math Analysis; Numerical Analysis; Discrete Math; Probability; Statistics	
Level 5 Mathematics	Calculus and Analytic Geometry; Calculus; Abstract Algebra; Differential Equations; Multivariate Calculus; Linear Algebra; Theory of Equations; and Vectors/Matrix Algebra	
AP Calculus (AB)		
AP Calculus (BC)		
AP Statistics		

[37] This information will only be required for high schools in projects that are designed to address math.

6. Check *one* of the following:

- ❑ [INSERT COURSE NAME] *is not currently being offered* at this school.[38]

- ❑ [INSERT COURSE NAME] is currently offered at this school and information on student enrollment AND completion *can be provided at this time*.[39]

- ❑ [INSERT COURSE NAME] is currently offered at this school, but information on student enrollment AND completion *will not be available until a later date*.[40]

- ❑ [INSERT COURSE NAME] is currently offered at this school, but information on student enrollment AND completion *cannot be made available to NSF*.[41]

[38] **Note:** Question 6 is complete for this course if checked.

[39] **Note:** Respondent completes Question 6a table if checked.

[40] **Note:** Respondent is asked follow-up question if checked: **"When can this data be reported?"** Respondents are given a drop down menu for month and year.

[41] **Note:** Question 6 is complete for this course if checked. In a warning message, prompt respondent to explain WHY data cannot be made available to NSF in the generic text box for the K–12 District Survey.

6a. Course Type: (from matrix)

Enter an "X" in ALL cells where information is currently not available.

NOTE—students who completed multiple courses in a given category should be counted as many times as applicable.

		Number of students enrolled in this course at any time during the [INSERT SCHOOL YEAR] school year	Number of enrolled students who passed/received credit for this course during the [INSERT SCHOOL YEAR] school year
Total			
Gender			
Male			
Female			
Not Reported			
Race/Ethnicity			
Hispanic or Latino	Race Not Reported[42]		
	American Indian or Alaska Native		
	Asian		
	Black or African American		
	Native Hawaiian or Other Pacific Islander		
	White		
	More than One Race Reported		
	SUB-TOTAL: Hispanic or Latino	*(auto total)*	*(auto total)*
NOT Hispanic or Latino OR Ethnicity NOT Reported[43]	American Indian or Alaska Native		
	Asian		
	Black or African American		
	Native Hawaiian or Other Pacific Islander		
	White		
	More than One Race Reported		
	SUB-TOTAL: Non-Hispanic or Latino	*(auto total)*	*(auto total)*
Neither Race nor Ethnicity Reported[44]			

[42] Use "*Race Not Reported*" to provide information about Hispanic or Latino students for whom race is not reported or unknown.

[43] Use *"NOT Hispanic or Latino OR Ethnicity NOT Reported"* to provide race information for those students (1) who are not Hispanic or Latino, or (2) for whom ethnicity is not reported or unknown.

[44] Use *"Neither Race nor Ethnicity Reported"* for those students for whom both race and ethnicity are unknown.

7. Provide student achievement data on all statewide math and science accountability assessments administered at [NAME OF SCHOOL] during the [INSERT SCHOOL YEAR] school year.

NOTE—MSP projects with a Math Only or Science Only focus are still required to report on all math AND science assessments administered at this school.

Only report on those accountability assessments that report percentage of students scoring at, above or below a criterion (this includes assessments reporting a Pass/Fail score).

To add an assessment, click on the *Add Assessment* button below.

To provide or update information on an assessment, click on the link in the matrix (in the column titled *Assessment Name*).

Assessment Name	Subject	Grade Level	Information Complete
(from Q7a)	(from Q7b)	(from Q7c)	(yes or no)

If there are no statewide accountability assessments to report for this school, please click the submit button to the right.

7a. **Assessment Name:**

7b. **What subject area does this assessment cover?** (*Check one response)*

- ❑ Mathematics
- ❑ Science

7c. **What grade level does this assessment primarily cover?** (*Check one response)*

- ❑ Drop-down menu determined by response to Qd

7d. **What type of assessment is this?** (*Check one response)*

- ❑ End-of-course exam[45]
- ❑ Grade-level accountability assessment
- ❑ Other (*specify*): ______________________________________

7e. **Has this assessment been changed in the previous 12 months in such a manner that would preclude comparisons with assessment data from previous years?**

- ❑ No
- ❑ Yes[46]

7f. **Can information about the students taking this assessment (i.e., number of students taking assessment, number of students scoring above proficient, number of students scoring below proficient) be provided at this time?** *(Check one response)*

- ❑ Yes, information about students taking this assessment can be provided at this time.[47]
- ❑ No, information about students taking this assessment can not be provided at this time, but will be available at a later date.[48]
- ❑ No, information about students taking this assessment cannot be made available to NSF.[49]

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[45] If checked, respondent will be asked: **"You reported that the primary grade level this assessment covers is grade [INSERT GRADE LEVEL FROM 7c]. If you can not report this assessment by grade level, check all additional grade levels of the students taking this assessment. If you can report for each grade level separately or if students from only one grade took this assessment, please click the *Save & Continue* button below."**

[46] If yes, respondent will be asked: **"Please describe any changes that have been made to this assessment in the previous 12 months that preclude comparisons with assessment data from previous years."**

[47] Respondent completes Question 7g table if checked.

[48] Respondent is asked follow-up question if checked: **"When can this data be reported?"** Respondents are given a drop down menu for month and year.

[49] Question 7 is complete if checked. In a warning message, respondent is prompted to explain WHY data cannot be made available to NSF in the generic text box for the K–12 District Survey.

7g. Provide the following information about the number of students who took this assessment at [NAME OF SCHOOL] during the [INSERT SCHOOL YEAR] school year:

If some information is available, complete as many cells as possible and use an "X" to indicate that information is not available for a given cell.

		Number of students at this grade level taking assessment during the [INSERT SCHOOL YEAR] school year	Number of students taking assessment scoring *at or above* proficient level	Number of students taking assessment scoring *below* proficient level
Total				
Gender				
Male				
Female				
Not Reported				
Race/Ethnicity				
Hispanic or Latino	Race Not Reported[50]			
	American Indian or Alaska Native			
	Asian			
	Black or African American			
	Native Hawaiian or Other Pacific Islander			
	White			
	More than One Race Reported			
	SUB-TOTAL: Hispanic or Latino	*(auto total)*	*(auto total)*	*(auto total)*
NOT Hispanic or Latino OR Ethnicity NOT Reported[51]	American Indian or Alaska Native			
	Asian			
	Black or African American			
	Native Hawaiian or Other Pacific Islander			
	White			
	More than One Race Reported			
	SUB-TOTAL: Non-Hispanic or Latino	*(auto total)*	*(auto total)*	*(auto total)*
Neither Race nor Ethnicity Reported[52]				
Special Education Students				
Limited English Proficiency Students				

[50] Use "*Race Not Reported"* to provide information about Hispanic or Latino students for whom race is not reported or unknown.

[51] Use *"NOT Hispanic or Latino OR Ethnicity NOT Reported"* to provide race information for those students (1) who are not Hispanic or Latino, or (2) for whom ethnicity is not reported or unknown.

[52] Use *"Neither Race nor Ethnicity Reported"* for those students for whom both race and ethnicity are unknown.

APPENDIX D. ANALYSIS OF PROJECT-COLLECTED DATA

In this appendix, we present some preliminary results of project-collected data. Our intention is to examine data with regard to 1) STEM faculty participation, 2) measures of changes for inservice and preservice teachers as a result of working with STEM faculty, and 3) measures of changes from students as direct and indirect results of STEM faculty involvement. We will use those data to address questions about the effects of STEM faculty involvement. Our analysis approach depends on, and is tailored to, data collected from each project. In all cases, we try to be as rigorous as possible. Since these are the first 2 years of data collected in all projects, our purpose is to become familiar with the data that will be generated from the projects by first exploring the baseline.

Projects 2–4 are from RETA cohort 1, and projects 5 and 8 are from RETA cohort 2. Data from project 2 allowed some correctional modeling similar to what we proposed, and were consequently analyzed by Westat. Data from other projects were primarily analyzed by the projects and were synthesized by Westat. Each analysis presents the guiding research questions, a description of the data, the methodologies, and the results. Data from projects 1, 6, and 7 were not made available to us by the time of analysis, some of which are due to the change of evaluators.

Project 2

Questions

Although no data were collected from STEM faculty, data that were gathered present us an opportunity to examine the relationships among teacher involvement with the MSP project, teacher outcomes (i.e., attitudes, instructional practices), and student outcomes (i.e., attitudes). If there is significant association between project participation and various outcomes, and STEM faculty play a major role in the project, one can infer that STEM faculty may contribute to the association. As a result, the research questions are 1) What is the relationship between teacher project participation and their attitudes toward mathematics, instructional practices, and the project? 2) Is there any relationship between teacher project participation and their students' attitude toward mathematics?

Data

Project 2 conducted comprehensive surveys of all elementary and secondary teachers and students in 12 participating districts. The data we analyzed are from elementary teachers (N=364) and students (N=1,286). The student survey was developed to assess students' attitudes, interest, utility, and anxiety toward mathematics. Additional scales were constructed to assess student motivation and goal orientation, teacher expectations, traditional and reform teaching/learning activities, and parental involvement. The content for measurement scales were informed by NAEP, the University of Michigan's MSP-Motivation Assessment Program, and the evaluators' prior development and use of scales. The teacher survey was to assess teacher beliefs, attitudes, and instructional practices; teacher and classroom background; professional development activities; and specific involvement with the MSP project. The instrument came from the Learning Mathematics for Teaching project at the University of Michigan.

Methodologies

Our analyses involve two steps. The first step builds scales for various constructs. The item-scale relationships for two surveys were clearly mapped out by the project evaluator. However, in order to apply to the models of our research, we needed to collapse some of these constructs. For example, in the student survey, we combined separate scales for attitudes, values-interest, values-utility, anxiety, academic self-efficacy, mastery goal orientation, performance approach, and performance avoidance into "attitudes." Similar scales were built to represent teacher attitudes, teacher instructional practices, teacher project participation, student perception of teacher, student family support, etc. Confirmatory factor analysis demonstrated a moderate model-data fit[1] (Tables D-1, D-2). Once the scales were built, we calculated standardized factor scores for each factor based on the loadings. The advantage of using scale scores is that they represent the construct more accurately and holistically than using selected observed variables. In addition, we recoded or collapsed the categories of a few variables.[2]

Table D-1.—Factor scales for elementary student survey (project 2)

Factor	Items in survey	Original scales	Fit index		
			CFI	RMSEA	WRMR
Math attitude	A1a-A1s, B1a-B1j	Attitudes (Ala-h), Values-interest (A1i-k), Values-utility (A1p-s), Anxiety (A1l-o), Academic self-efficacy (B1a-e), Mastery goal orientation (b1f-j), performance approach (B1f-j)	.78	.13	.09
Class perception	B2a-B2g		.96	.09	.04
Teacher perception	B3a-B3l	Teacher negative expectations (B3a-c), positive exp (B3d-f), class exp (B3g-i), teacher standards (B3j-l)	.94	.16	.07
Teacher expectation	B4a-B4s	Reform strategies (B4a-k), traditional strategies (B4l-s)	.79	.07	.07
Family support	C7a-C7h		.84	.10	.07

Table D-2.—Factor scales for elementary teacher survey (project 2)

Factor	Items in survey	Fit index		
		CFI	RMSEA	WRMR
Mathematics attitude	A1-A25	.43	.14	.12
Instructional practice	B9A-B9M, B10A-B10S	.46	.19	.14
Project attitude	D1-D7	.96	.14	.06

The second step is to explore the relationship between teacher project participation and various teacher and student outcomes. We used ordinary linear regression (OLS) to address effects on teachers and hierarchical linear model (HLM) to answer questions about students. HLM was selected to model the nesting structure between teacher and students. Teacher survey and student survey were linked by the last name of the teacher.

[1] Given the exploratory nature of this task, we took a more liberal standard regarding the fit indices here. Because survey items in the following years will be changed, we will use a more stringent fit standard in our final analysis.

[2] Extent of participation (D8) was collapsed from 8 categories to 4 (1=not involved at all and not directly involved, 2=involved in extensive discussions about project with colleagues, 3=involved in implementing aspects of project in my school, and 4=school teacher leader and district teacher leader. Teacher education was collapsed from 8 categories to 5; teacher race was recoded into a dummy variable (white vs. others).

Teacher model

Y(teacher outcomes)=A+B1(teacher participation)+B2(teacher characteristics)
+B3(classroom characteristics)+E

- Teacher outcomes (factors): math attitude, instructional practice, project attitude
- Teacher participation: extent of project involvement, project PD participation
- Teacher characteristics: education, gender, race
- Classroom characteristics: daily length of math class, % free-reduced lunch, % ESL students, % African American

Student model[3]

Level 1: student level
Y(student outcomes)=P0+P1(student characteristics)+E

- Student outcomes: math attitude, class perception, teacher perception, teacher expectation
- Student characteristics: race, gender, free-reduced lunch status, family support

Level 2: teacher/classroom level
P0=B00+B01(teacher participation)+B02(teacher characteristics)
+B03(classroom characteristics)+R0

- Teacher participation: extent of project involvement, project PD participation
- Teacher characteristics: math attitude, instructional practice, education, race
- Classroom characteristics: daily length of math class, % free-reduced lunch, % ESL students

Results

Teacher model. Table D-3 shows no statistically significant relationship between teacher participation in the project and their attitudes and beliefs about mathematics, controlling for teacher and classroom characteristics at the .10 level.

Table D-3.—Regression results for the teacher model (project 2)

Variable	Math attitude		Instructional practice		Project attitude	
	Coeff	P-value	Coeff	P-value	Coeff	P-value
Intercept	52.91	.00	46.97	.00	45.19	.00
Extent of project involvement (D8)	-1.27	.22	-.53	.63	**5.27**	**.00**
Project PD participation (C7)	.41	.48	.72	.25	.28	.61
Teacher education (C4)	-.67	.17	-.64	.18	.02	.97
Teacher gender (C9)	.77	.59	1.48	.31	-.61	.67
Teacher race (C10)	-1.41	.27	**-2.43**	**.06**	-.44	.72
Daily length of math class (C3)	.35	.42	**.83**	**.06**	-.24	.58
% free-reduced lunch in class (C6.1)	-.33	.37	-.00	.99	-.35	.34
% ESL students (C6.3)	.60	.21	**1.61**	**.00**	**1.14**	**.02**
% African American students (C6.5)	-.45	.42	-.59	.30	.02	.97

[3] Data for this model represent 35 teachers with 405 students. Missing data at level 2 were imputed by using the mean.

Similarly, project participation is not associated with self-reported teacher instructional practices. However, teachers who have longer daily mathematics instruction (p=.06) and whose classrooms have a larger percentage of students in ESL (p=.00) are more likely to use reform instructional practices. On the other hand, nonwhite teachers are less likely to adopt reform teaching practices (p=.06).

Finally, teachers who are more involved in the project are more likely to view the project positively (p=.00). Those who teach classes with a larger percentage of ESL students are more likely to have positive views about the project (p=.02).

Student model. Baseline data (Table D-4) show that students' mathematics attitude is not related to teacher project involvement or professional development participation. However, students who have higher level of family support tend to have more positive attitudes toward mathematics (p=.00).

Student perception of the class is not associated with teacher professional development participation or project involvement. Again, students who received more family support have more positive attitudes toward the class (p=.00).

Student perception of their teachers is not related to teacher project involvement or participation in professional development. While family support is positively associated with student perception about teachers (p=.07), students' free-reduced-lunch (FRL) eligibility (p=.01), their classroom percentage of FRL (p=.05), as well as the length of daily mathematics instruction (p=.10) are negatively related to students' perception of their teachers.

Similarly, teacher expectation of students is not affected by teacher project involvement or participation in professional development. Students who have more family support tend to feel a higher level of expectation from their teachers (p=.00), and teachers who have longer daily mathematics instruction seem to have lower expectation of their students (p=.08).

Table D-4.—HLM results for the student model (project 2)

Variable	Math attitude		Class perception		Teacher perception		Teacher expectation	
	Coef	P	Coef	P	Coef	P	Coef	P
Intercept	.25	.29	.01	.96	.29	.25	.25	.37
Level 1 (student)								
Gender (SC1)	.07	.41	.06	.45	-.01	.90	.04	.55
Minority status (SC2)	-.12	.18	-.14	.11	.07	.45	-.10	.18
Free-reduced lunch status (SC3)	-.10	.26	.00	.96	**-.24**	**.01**	-.00	.96
Family support (SC7a-h)	**.23**	**.00**	**.25**	**.00**	**.10**	**.07**	**.15**	**.00**
Level 2 (teacher/classroom)								
Teacher project involvement (TD8)	-.15	.33	-.22	.20	-.05	.77	.13	.49
Teacher project PD participation (TD7)	-.04	.45	-.09	.12	-.02	.75	.05	.45
Teacher math attitude	.02	.76	-.04	.50	-.02	.74	.01	.83
Teacher instructional practice	-.03	.67	.01	.86	-.02	.77	.00	.99
Daily length of math class (TC3)	-.02	.62	-.00	.99	**-.06**	**.10**	**-.08**	**.08**
% free-reduced lunch in class (TC6.1)	-.02	.57	.01	.89	**-.07**	**.05**	.03	.47
% ESL in class (TC6.3)	-.09	.41	-.13	.27	.08	.47	-.01	.92
Teacher education (TC4)	.00	.93	.07	.16	.03	.55	.01	.85
Teacher race (TC10)	-.01	.95	.11	.41	.08	.54	-.15	.28

Project 3

Questions

Year 1 data from project 3 are primarily for formative evaluation and are not amenable to be used for our model. However, we can examine the data in a more descriptive fashion to address the following questions: 1) To what extent were faculty members satisfied with different aspects of the summer academies? 2) Were teachers satisfied with the summer academies? To what extent did their perceptions change as a result of them? 3) What is the effect of the summer academies on teacher pre/post content knowledge?

Data

In year 1, project 3 collected three types of data around the time when summer academies were provided: 1) survey of facilitators[4] was designed to learn about the planning, implementation, and effects of the summer academies; 2) survey of participants (teachers) regards the satisfaction and perceived changes as a result of the experience; and 3) pre-post test of participants was designed to test teachers' change of knowing content, using PET, a physics PD curriculum assessment designed by Fred Goldberg and associates of San Diego State University. Surveys of facilitators and teachers are anonymous and were done by the external evaluators, while the PET test was conducted by the internal evaluator. In the absence of IDs and necessary linkages among data sources, we could only analyze the data separately.

Methodologies

The methodologies used are entirely descriptive. We simply present the statistics provided by the project's internal and external evaluators.

Results

Overall, facilitators (N=15) were satisfied with the planning and implementation of the summer academy. There appears to be concern on the time provided for planning (Table D-5). They generally felt that the summer academies had positive impacts on teachers and themselves.

[4] Most of the facilitators are STEM faculty, but a few are teacher leaders and IHE administrators. The survey did not distinguish their roles.

Table D-5.—Descriptive statistics for facilitator's survey (project 3)

Item	Mean (scale of 1-5)
Preplanning	
Time provided for planning	3.58
Decision-making	3.95
Resources available	4.21
Your level of contribution to summer academy planning	3.89
The focus for this year's academy	4.05
Interaction with other summer academy planners	4.32
Organization of design teams	4.30
Communication within design teams	4.05
Decision making within design teams	3.95
Interaction with design team members	4.20
Implementation	
Your day-to-day role	4.35
Your interactions with co-workers	4.26
Time expectations	3.7
Support staff	4.9
Facilities and resources	4.1
Communication	4.11
Responsiveness of management to your needs as a facilitator, etc.	4.58
Organization	4.2
Daily schedule	3.75
Evaluation	4.18
Impact	
The academy provided a high level of professional development experience for K–12 teachers	4.42
The participants' academy experience will **not** have a strong impact on their practice	1.00
My academy experience will have a significant impact on my work	4.00
I gained important new insight into how people learn	4.05
I did **not** gain important new insight into K–12 education	1.58
I had high expectations of the summer academy	4.26
I feel my expectations were met	4.05
I do **not** want to participate in the summer academy next year	1.53
I have a clear understanding of the goals of this year's academy	4.21
I believe the academy goals were met	3.89
I have had sufficient opportunity to express my opinions	3.95
I do **not** feel that my opinions and comments have been listened to	1.79

Teachers (N=160) expressed high levels of satisfaction with the summer academies, with the exception of the teacher-principal session (Table D-6). They also felt there was not enough time for each activity.

Table D-6.—Descriptive statistics for teachers' survey end of week 2 (project 3)

Item	Mean (scale of 1-4)
Overall satisfaction	
Your science immersion experience	3.56
Homework assignments	3.21
Discussions of readings	3.16
The teacher-principal session	2.54
Opportunities to learn from your peers	3.72
The personal action planning sessions	3.07
Social activities	3.66
Special interest session	3.42
Activities	Mean (scale of 1-5)
Activities were worthwhile	4.36
Enough time for each activity	3.35
Learned a lot	4.58
Personal connections were useful	4.36
Overall experience was good	4.36

On average, teachers' understanding of various subjects and issues prior to the summer academy varied from unclear to somewhat clear; they became clear to very clear on these aspects after the academy. The changes represents about 20 percent on a scale of 1-5 with "1" indicating "very unclear" and "5" as "very clear" (Table D-7).

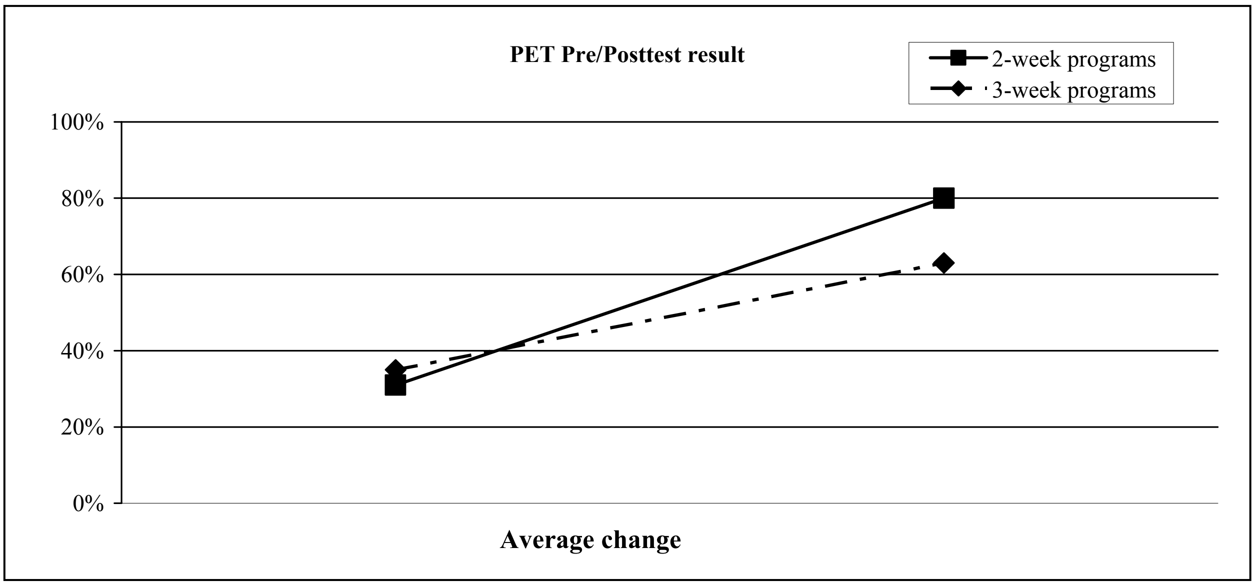
Table D-7.—Descriptive statistics for teachers' report of before and after changes (project 3)

My understanding of	Before (scale of 1-5)	After (scale of 1-5)	Difference
What a professional learning community is	3.70	4.42	0.73
The physical sciences	3.22	4.18	0.96
Science content relevant to my classroom	3.62	4.24	0.62
The essential components of a quality science class	3.47	4.44	0.97
The relationship between the state learning requirements and my instructional materials	3.50	4.20	0.71
What other science teachers do in their classrooms	2.96	3.92	0.95
My own learning process	3.76	4.44	0.68
How students learn science	3.56	4.45	0.90
How to help students construct their understandings	3.32	4.34	1.01
How to elicit students' thinking	3.31	4.25	0.94
My own professional needs as a science educator	3.33	4.19	0.86
The goals of the project	2.82	4.25	1.43
My responsibilities as a teacher leader	2.61	3.83	1.22
The support I need from the project in order to carry out my responsibilities as a teacher leader	2.60	3.64	1.03
The support and resources I can access through the project	2.46	3.83	1.36

PET results (Table D-8) from a sample of participants show that for teachers who participated in the summer academy for 2 weeks (N=20), their average pre-post change was 50 percent on a test with nine questions. The pre/post change for those in 3-week academies (N=10) was 30 percent on a test with 25 questions.

Table D-8.—Descriptive statistics for teachers' pre-post content knowledge test (project 2)

Length of academy	Mean	Std dev	Mean	Std dev
2 weeks	Pre (score out of 9)		Post (score out of 9)	
	2.6	0.63	7.16	0.43
3 weeks	Pre (score out of 25)		Post (score out of 25)	
	8.6	1.02	16	1.4



Project 4

Questions

The data from project 4 are primarily for formative purposes. Their abilities to address our research questions are limited. However, we can still look at the differential responses between teacher leaders and STEM faculty about their summer institute experiences. Research questions include 1) To what extent did participants learn and could apply the concepts covered in the summer workshop? Are there any differential effects on teachers, school administrators, and university faculty? 2) How did participant confidence levels change throughout the summer institute? Are there any differences among the type of participants?

Data

Two types of data were provided. The first are from 14 daily feedback surveys on different subjects addressed during project 3-week summer institutes. The second are confident feedback surveys administered at three points in time during the summer institutes. Respondents included all team participants (i.e., teacher leaders, school administrators, STEM faculty members) who attended the institutes as "co-learners" and will be providing inservice training for district teachers next year. Survey respondents were anonymous and only identified by their positions. Consequently, we cannot track anyone's response over time.

Methodologies

We produced descriptive frequencies for two data sets. Then, we performed a one-way ANOVA to examine the differences in responses among participants. Due to the small number of participants (N=53[5]), we collapsed the participant type variable into three: teachers (mathematics teacher, science teacher— N=18), administrators (school administrator, social worker/guidance counselor, technology teacher— N=19), and university faculty (N=13).

Results

Table D-9 shows the frequencies of the daily survey and confidence feedback survey. Data from daily surveys suggested that participants are satisfied with the summer institute. They feel that they have learned a lot and could apply most of the concepts covered in the institute. F-tests show significant group differences in response to a number of concepts. Further post hoc investigation reveals that most of the differences are between teachers and university faculty, with teachers reporting more positively on their gains from the summer institute.

The confidence surveys administered at the beginning, middle, and end of the summer institute suggest that participants show significant growth, especially between the beginning and end of the institute (T3 v T1), in level of confidence on eight of the nine items queried. The exception was involving parents in mathematics (Table D-10). The differences among positions are largely not significant, except that teachers are more confident than faculty in creating changes in student mathematics assessment scores and using state test data to make improvements in mathematics.

Table D-9.—Descriptive statistics of daily feedback survey (project 4)

Date of workshop	Workshop topic	Concept	n	Today I LEARNED: A lot	I could APPLY this in my teaching: A lot
07/06/04	**Barriers to learning**	Barriers students face	53	61%	57%*
		Successful strategies	53	46	47
		Ways to engage students in learning	53	49	52
		Importance of intrinsic motivation	53	75	69
		Supports for engaging students	53	58	56
07/07/04	**Math in Context (MiC)**	The role of context	43	100	95
		Multiple strategies	43	100*	95
		MiC pedagogy	43	100	52
		Philosophy of MiC	43	100	97
		Using groups in MiC	43	100*	97*

[5] The number of respondents for the daily survey varied from 53 to 19.

Table D-9.—Descriptive statistics of daily feedback survey (project 4)—continued

Date of workshop	Workshop topic	Concept	n	Today I LEARNED: A lot	I could APPLY this in my teaching: A lot
07/08/04	**Math in Context (MiC)**	Ratio	41	50	63
		Proportion	41	51	61
		Scaling	41	53	97
07/09/04	**Math in Context (MiC)**	Understanding fractions	42	74	74*
		Changing fractions to percents	42	83	76
		Solving proportions	42	77	77
		Scale factors	42	71	72
07/12/04	**Math in Context (MiC)**	Recursive formulas	35	68	81
		Direct Formulas	35	76	85*
		Distributive property	35	80	85
07/13/04	**Math in Context (MiC)**	Patterns	38	83	85
		Linear equations	38	80	85
		Substitution principle	38	72	78
		Direct formulas for an arithmetic sequence	38	81	85
07/14/04	**Research for Instructional Improvement (TERC)**	Research supporting high quality mathematics teaching and learning	41	82	77
		Connection between research and practice	41	79	76
		Challenges of the curriculum improvement process	41	85	82*
		Assessing district's current state	41	71	68
		Setting future goals for district	41	76	78
07/16/04	**TI Calculator**	TI-73 Explorer capabilities	38	94*	91*
		Integrating the TI-73 Explorer into class activities to enhance student learning	38	94*	91*
		Using the TI-73 Explorer to become familiar with appropriate key strokes on the calculator	38	92*	91*

Table D-9.—Descriptive statistics of daily feedback survey (project 4)—continued

Date of workshop	Workshop topic	Concept	n	Today I LEARNED: A lot	I could APPLY this in my teaching: A lot
07/19/04	**Connected Math (CMP)**	The CMP Launch-Explore-Summarize Method	39	76%	71%
		Benefit to students from creating similar figures	39	87	83
		Relationship of scale factors and areas	39	89	89
		Benefit to students from exploring properties of shapes	39	84	81
		General concepts regarding Geometry and Measurement strand	39	81	79
07/20/04	**Connected Math (CMP)**	Activities related to Covering and Surrounding	38	89	82
		Relationships among area and perimeter	38	94	88
		Activities related to Filling and Wrapping	38	91	90
		Relationships among volume and surface area	38	97	97
		Using Filling & Wrapping Modules in M, S, and T contexts	38	93	93
07/21/04	**Connected Math (CMP)**	Symmetry	19	95	94
		Symmetry transformations	19	100	94
		Using an analytic understanding of symmetry	19	94	94
		Activities related to Kaleidoscopes	19	95	88
		Using Kaleidoscopes, Hubcaps, & Mirrors Module in M, S, and T contexts	19	100	94
07/22/04	**Connected Math (CMP)**	Establishing relationships among the length of a side of a square, square roots, and irrational numbers	28	96	79
		Exploring areas of figures drawn on a dot grid	28	93	79
		Activities related to Looking for Pythagoras	28	96	79

Table D-9.—Descriptive statistics of daily feedback survey (project 4)—continued

Date of workshop	Workshop topic	Concept	N	Today I LEARNED: A lot	I could APPLY this in my teaching: A lot
07/23/04	**IMaST**	IMaST Instructional Model	28	87%	83%
		Identifying patterns	35	71	73
		Integrating math, science, and tech	35	97*	93*
		Equivalent ratios	35	74	77
07/27/04	**Language and Literacy**	Developing and Promoting Literacy	38	39	52

*As show in F-tests, there were significant group differences in responses to items concerning this concept.
NOTE: Responses that were rated 4 or 5 on a 5-point scale were interpreted as "a lot."

Table D-10.—Descriptive statistics of confidence survey (project 4)

Survey item	Mean (scale of 1-10)		
	T1	T2	T3
Integrate math into science and technology	6.83	7.64	8.55**
Improve math pedagogy	6.89	8.65**	8.59**
Create change so students score higher on math assessments	6.83	7.62	8.05**
Share what I have learned in the workshops with others	7.33	7.94	8.59**
Help make math more meaningful to students	7.51	8.29	8.69**
Involve parents in math	5.55	5.65	6.21
Identify "good" math problems	6.78	7.53	8.23**
Use state test data to make improvements in math	6.67	7.30	8.08**
Import additional math-related curricular materials into my course	7.30	8.09	8.69**

** Indicates that the mean difference of the time period is statistically significant from T1 at .01 level.

Project 5

Questions

The main objective of this analysis was to determine whether teachers who were enrolled in the algebraic ideas content course significantly increased their knowledge and skills after using the program.

Data

Twenty-five teachers attended the algebraic ideas content course series. The participants completed a pretest and a posttest that were designed to measure and document changes in a teacher's understanding of algebraic ideas.

Methodologies

Descriptive statistics and charts are used to summarize the participants' scores on the pretest and the posttest (Table D-11). *T*-test for matched groups (paired *t*-tests) were conducted to determine whether students' knowledge and skills related to algebraic ideas increased, decreased, or stayed the same from the pretest to the posttest. The statistical tests were conducted for each knowledge type and subcategory, as well as for the overall scores on the tests. All tests were conducted at the 0.05 significance level. Since it is hypothesized that participants' knowledge and skills will improve after enrollment in the course, one-tailed tests were performed in all cases. Next, effect sizes were computed in each case. Effect sizes are indicators of the degree by which group means differ. Thus, they give an idea of the size of the treatment effect (P-values cannot be used to infer this effect). For these analyses, Cohen's d statistic was used to compute effect size. Values of .2, .5, and .8 are generally considered small, medium, and large effect sizes.

Table D-11.—Pretest-posttest comparisons of assessment results (project 5)

Assessment item	Max score	Pretest		Posttest		Sig	ES
		Mean	SD	Mean	SD		
Overall score	40	20.76	8.54	24.4	7.63	0.00	0.45
Knowledge type							
Memorized/Factual Knowledge	10	6.84	2.08	7.2	1.71	0.13	0.19
Conceptual Understanding	10	5.68	2.58	7.12	2.09	0.00	0.61
Reasoning/Problem Solving	10	5.72	2.48	6.08	2.08	0.12	0.16
Pedagogical Content Knowledge	10	2.52	2.16	4.0	2.83	0.00	0.59
Subcategory							
Patterns, Functions, Relations	20	11.48	4.21	12.84	4.03	0.03	0.33
Expressions and Formulas	9	4.24	2.19	5.12	1.69	0.01	0.45
Equations and Inequalities	11	5.04	3.02	6.44	3.02	0.00	0.46

Results

The group of participants who attended the algebraic ideas course showed medium but significant improvement in overall learning. They also made significant gains in all the subcategories tested as well as in two out of four knowledge types (conceptual understanding and pedagogical content knowledge). The fairly large effect sizes associated with the conceptual understanding and pedagogical content knowledge are indicative of substantial gains made in these two areas.

Project 8

Questions

In year 1, both internal evaluators and external evaluators were involved in evaluation activities related to STEM faculty involvement. Internal evaluators were interested in finding out the reaction of summer institute participants to the courses taught by STEM faculty. The external evaluators focused on assessing the baseline attitudes and behaviors in and outside the classroom of students taught by summer institute participants.

Data

The internal evaluators collected classroom evaluations of three courses (chemistry, physics, and mathematics) and five sessions taught during summer 2005. The external evaluators administered the Discovery Student Questionnaire (N=901) to one of the classes taught by each teacher participant. Items on the questionnaire requested demographic information about respondents; others assessed K–12 students' attitudes or behaviors in and outside the classroom. The behavioral questions were Likert-scale items with rating categories ranging from Almost Never = 1 to Very Often = 5 for the frequency scales (student classroom behaviors, teacher classroom behaviors, peer involvement in science classes, and parental involvement in student's science studies). The attitudinal items also had a 5-point Likert scale, ranging from Strongly Disagree = 1 to Strongly Agree = 5. Students of teacher participants who taught grades 6–8 also completed the Discovery Inquiry Test (DIT).

Methodologies

Classroom evaluations were analyzed descriptively. Common patterns were discussed under "highlights" (strengths) and "area for discussion" (weakness). Ample quotes were included to support pattern statement.

Simple frequencies were calculated to describe the demographic characteristics of the students. Data from the student questionnaire were first analyzed with factor analysis, and results suggested that the measurement scale could be strengthened by removing three items from the analysis. These items were eliminated.

Reliability coefficients were calculated for each subscale (Cronbach's Alpha). Following these steps a Rasch analysis was conducted in order to compute a linear subscale measure for each respondent on each subscale. The Rasch subscale measures were computed using the Winsteps program of Linacre (2005) for the five subscales (student, teacher, friends, home, and attitude). Respondent measures for each subscale ranged from 0 to 100. For the subscales that required a frequency rating from respondents, a measure of 0 signifies a response to all subscale items with the category Almost Never. A measure of 100 identifies a student selecting a response of Almost Always for all subscale items.

Results

Results from the course evaluations are too lengthy to present. Here, we highlighted several major patterns. For example, teachers generally felt that the instructional methods (i.e., hands-on approach, how-to assignments, and step-by-step treatment of problem solving) helped them develop a robust understanding of the subject, the materials were very relevant to their teaching, the instructors were patient and flexible, and the course was challenging. Teachers also offered suggestions for improvement, including a need for more practice and more optional problems, additional assistance for those who lack mathematics background, and a greater emphasis on conceptual understanding, possibly involving a de-emphasis on problem solving.

For the student survey data, *t*-tests were used to compare student responses for the five subscales and the Discovery Inquiry Test as a functions of grade level, gender, and race (white vs. nonwhite). In addition, multiple regression was used to calculate the correlations among demographic variables (student descriptive category and gender) for each grade (5–8). Results, displayed in Table D-12, show changes from grades 5–6 to grades 7–9. Significant differences were observed between nonwhite and white students' measures on the DIT. Students who had a positive attitude toward science scored significantly higher on the DIT, compared with students with less positive attitudes. For students in grades 5 and 6, only 8 percent and 5 percent of the variance was explained by the seven variables, but R2 coefficients increase to 20 percent in grade 7 and 34 percent in grade 8.

Table D-12.—Standardized coefficient estimates (B) on the Discovery Inquiry Test (project 8)

Variable	5th grade	6th grade	7th grade	8th grade
Female	0.10	-0.23	-0.02	-0.09
Male	0.03	0.01	0.23*	0.27
What I do in class	0.30	0.02	-0.09	-0.17
What my teacher does in class	0.05	0.04	0.08	0.04
What my friends do	-0.21	-0.01	-0.11	0.17
At least one adult at home	-0.31	-0.05	-0.09	-0.13
My attitude toward science	0.13	0.20	0.43	0.37
Adj R^2	0.09	0.05	0.21	0.34

* Significant at the .05 level.

APPENDIX E. ANALYSIS OF STEM FACULTY INVOLVEMENT AND STUDENT ACHIEVEMENT FROM MIS DATA

In this appendix, we explore the baseline relationship between STEM faculty participation and student achievement. The data we used were drawn from the Partnership Project Survey, the K–12 District Survey, the IHE Survey, and the IHE Participant Survey of the MIS annual surveys (2003–04) of cohort 1 projects.

We used a two-level hierarchical linear modeling (HLM) to model the relationship between student achievement and STEM faculty participation. The model reflects a nesting structure whereby schools are nested with project in which all participating IHEs are working together.[1]

The results from the unconditional model (Table E-1) show that level 2 variances are larger than those at the level 1, which confirms the need to use a 2-level HLM.

Table E-1.—Unconditional models

Variance component	Outcome	
	Math	Science
Amount variance at Level 1	241.769	274.821
Amount variance at Level 2	473.931	687.353
Total amount variance	715.700	962.174
Percent variance at Level 1	33.8	28.6
Percent variance at Level 2	66.2	71.4

At level 1, we modeled school-level student achievement (i.e., percent proficient aggregated from grade-level data) as a function of student characteristics (i.e., percent white or Asian). Level 2 models student achievement as a function of project-level variables such as STEM faculty participation and project type (i.e., Comprehensive or Targeted). We used four types of variables to quantify STEM faculty participation for each project; each variable captures different aspects of participation.

- The first variable, total number of STEM faculty participating in the project, measures the overall scale of participation.
- The second variable, percent of STEM faculty among total IHE participants, reflects the relative emphasis of STEM faculty involvement.
- The third is a derived variable that attempts to measure the intensity of participation by multiplying the number of STEM faculty by the average number of hours (categorical) each spent on the MSP.
- The last variable incorporates several factor composite scores. Faculty involvement is a complex concept that requires multiple questions in order to capture the different dimensions it entails. The MIS survey asks additional information about specific types of participation in preservice, inservice, and project management if respondents reported engagement in these areas and if their overall MSP involvement in the last academic year was over 40 hours. Factor analysis was used to statistically

[1] We also explored a three-level HLM whereby schools are nested with IHEs, which in turn are nested with the project. The difference between the two-level and the three-level specifications are that the two-level model assumes IHEs are working together, while the three-level assumes that each IHE works with a group of schools separately. By and large, the results are similar. Because the two-level model reflects a more common patterns of interaction between an IHE and K–12 schools, we decided to report only results from the two-level models. In addition, the two-level model allows future exploration of change in student achievement.

verify whether these items belong to the constructs we had in mind. These procedures are both theory driven and data driven. Since survey items are categorical variables, polychoric correlation matrixes were analyzed with the weighted least square method. All of the scales constructed in this study demonstrated a good model-data fit. The responses from the items under the same construct were then used to build composite scores by taking into account the factor loading of the item to the construct. The raw factor scores were standardized with a mean of 0 and standard deviation of 1. We compiled both total score and three factor scores for each individual and then averaged the individual scores to the project (Table E-2).

Table E-2.—Scale structure for STEM faculty involvement (all projects)

Scale	Scale item	Standardized factor loading	Model-data fit
Preservice activity	Participate in preservice recruitment activities	0.93	Item reliability = 0.37 RMSEA = 0.00 CFI = 1.00 RMR = 0.01 GFI = 0.957 AGFI = 0.932
	Provide preservice students with experience in K–12 classroom settings before formal student teaching	0.94	
	Provide preservice students with opportunities to participate in local school district inservice activities	0.94	
	Teach or co-teach a preservice STEM content course	0.93	
	Involve K–12 master teachers in preservice program	0.94	
	Design preservice STEM courses specifically for elementary/middle/high school teacher certification programs	0.94	
	Develop an innovation as part of a traditional preservice course	0.94	
	Develop/revise preservice courses to align with national, state, and/or local standards	0.94	
	Participate in efforts to link the preservice process to national teacher certification activities	0.97	
	Mentor preservice students	0.94	
Inservice activity	Align K–12 mathematics and science curricula to other courses/standards	0.93	Item reliability = 0.62 RMSEA = 0.00 CFI = 1.00 RMR = 0.28 GFI = 0.354 AGFI = 0.170
	Conduct a review of K–12 course curricula (e.g., update curricula based on current research; review curricula for content accuracy)	0.94	
	Conduct workshops/institutes/courses with K–12 teachers that increase general content and/or pedagogical knowledge	0.94	
	Conduct targeted workshops/institutes/courses with K–12 teachers	0.93	
	Design STEM courses specifically for elementary/middle/high school teacher certification programs	0.94	
	Support adjunct positions for K–12 master teachers at your IHE	0.94	
	Establish/provide externship opportunities for K–12 teachers	0.94	
	Remain on call for classroom teachers	0.94	
	Mentor a K–12 teacher in a shared discipline	0.96	
	Establish/provide STEM learning communities/study groups	0.93	
	Provide traditional STEM courses at alternative venues	0.42	
	Develop/redesign traditional STEM units or courses for indepth immersion in a single topic	0.43	
	Help K–12 schools utilize computer-communications technology for challenging course delivery	0.37	
	Help K–12 teachers utilize technology for course content innovation	0.42	
	Participate in activities that motivate K–12 student participation in challenging mathematics and science courses	0.35	
	Work one on one with K–12 students	0.40	
	Participate in activities that encourage high school students to enroll in IHE courses	0.47	

Table E-2.—Scale structure for STEM faculty involvement—continued

Scale	Scale item	Standardized factor loading	Model-data fit
Management activity	Serve as a member of the partnership management structure	0.93	Item reliability = 0.59 RMSEA = 0.00 CFI = 1.00 RMR = 0.01 GFI = 0.96 AGFI = 0.94
	Help develop joint databases or facilitate data sharing between K–12 and IHE partners	0.94	
	Help create formal links between all MSP core partners	0.94	
	Help align teacher certification program requirements among partner IHEs	0.93	
	Participate in the development of policies to reward IHE disciplinary faculty for their involvement in K–12 education	0.94	
	Conduct research on teaching and learning in math and science	0.94	
	Enlist support from STEM industry/business personnel who work in disciplinary fields related to your own	0.94	
	Attend national MSP conferences	0.94	
	Work on project-related evaluation activities or with RETA projects	0.96	
MSP activity	Including all items above		Item reliability = 0.77

Because of different definitions of STEM faculty participation, four models are used to estimate the relationship with student achievement.

Mathematics and science achievement were modeled separately. The math model includes data from targeted projects in mathematics or Comprehensive projects with a mathematics component. Similarly, the science model includes data from those projects providing science intervention. Because science was not tested in many states, the number of projects for the science model is smaller than the mathematics model. The models are specified as follows:

Level 1 model: school
$Y(\text{percent proficient})=P_0+P_1(\text{percent white/Asian})+E$

Level 2 model: project
$P_0=B_{00}+B_{01}(\text{STEM participation})+B_{02}(\text{Project type})+R_0$
$P_1=B_{10}$

Table E-3 provides the descriptive statistics of the data. The math model includes 300 schools and 15 projects, whereas the science model involves 147 schools and 8 projects. In the math model, schools have an average proficiency rate of 53 percent and a student population that is 34 percent white/Asian. An average of 16 STEM faculty members participated in each MSP project, and they represent 42 percent of the total IHE faculty participants. STEM intensity is a scaled variable that cannot be interpreted substantively. In the science model, schools have an average proficiency rate of 48 percent and a student population that is 25 percent white/Asian. An average of 30 STEM faculty members participated in each MSP project, and they represent 37 percent of the total IHE faculty participants.

Table E-3.—Descriptive statistics

Variable	Mean	SD	Min	Max
Math model				
Level 1 (school=300)				
Percent proficient	53.10	23.98	0.04	100
Percent white/Asian	34.29	37.23	0	100
Level 2 (project=15)				
STEM participation				
▪ Total STEM faculty	15.80	15.81	1	45
▪ Percent STEM faculty of IHE participant	41.96	23.72	6.9	100
▪ Number STEM faculty x average hour (categorical)	65.47	65.47	6	193.5
▪ Total participation (factor)	0.21	0.43	-0.36	1.03
▪ Preservice participation (factor)	0.08	0.46	-0.73	0.88
▪ Inservice participation (factor)	0.22	0.43	-0.35	0.88
▪ Project management participation (factor)	0.06	0.54	-0.76	1.1
Project type (1=Targeted, 0=Comprehensive)	0.67	0.49	0	1
Science model				
Level 1 (school=147)				
Percent proficient	47.91	28.64	0	93.71
Percent white/Asian	24.83	33.09	0	100
Level 2 (project=8)				
STEM participation				
▪ Total STEM faculty	29.75	14.08	5	45
▪ Percent STEM faculty of IHE participant	37.40	14.80	22.22	66.67
▪ Number STEM faculty x average hour (categorical)	116.41	59.72	20.71	193.50
▪ Total participation (factor)	-0.05	0.38	-0.46	0.67
▪ Preservice participation (factor)	-0.02	0.38	-0.46	0.64
▪ Inservice participation (factor)	-0.05	0.41	-0.37	0.88
▪ Project management participation (factor)	-0.00	0.36	-0.47	0.51
Project type(1=Targeted, 0=Comprehensive)	0.38	0.52	0	1

Tables E-4 through E-7 present the results of the HLM models for mathematics and science separately. They suggest that STEM faculty involvement, as measured by multiple proxy variables, is not significantly related to student mathematics and science achievement in the schools engaged in the MSP projects. However, percent white/Asian students is positively associated with school average percent of proficiency. It appears that for each additional 10 percent white/Asian students in a school, its proficiency rates increase by 2.3 percent in mathematics and 4 percent in science. The variance component statistics suggest that the level 2 predictors (project-level variation) explain the majority of the variance of both mathematics and science achievement rates.

Table E-4.—HLM results for math models 1–3

Variable	Model 1. IV=Total STEM faculty		Model 2: IV=Percent STEM faculty		Model 3: IV=# STEM x avg hours	
	Coeff	P	Coeff	P	Coeff	P
Intercept (P00)	40.29	.00	41.63	.00	46.68	.00
STEM involvement (P01)	.07	.81	.03	.89	-.03	.7
Project type (P02)	3.8	.69	1.46	.87	-1.16	.91
Minority (P10)	.23	.00	.23	.00	.23	.00

Table E-5.—HLM results for math model 4

Variable	Model 4	
	Coeff	P
Intercept (P00)	39.83	.00
Total participation (P01)	-5669.26	.56
Preservice Part (P02)	1714.47	.56
Inservice part (P03)	4874.45	.56
Management Part (P04)	353.19	.57
Project type (P05)	9.91	.47
Minority (P10)	.22	.00

Table E-6.—HLM results for science models 1–3

Variable	Model 1: IV=Total STEM faculty		Model 2: IV=Percent STEM faculty		Model 3: IV=# STEM x avg hours	
	Coeff	P	Coeff	P	Coeff	P
Intercept (P00)	26.74	.22	20.56	.42	36.29	.09
STEM involvement (P01)	.37	.47	.58	.36	.02	.89
Project type (P02)	-8.93	.44	-22.03	.29	-10.75	.37
Minority (P10)	.4	.01	.4	.01	.4	.01

Table E-7.—HLM results for science model 4

Variable	Model 4	
	Coeff	P
Intercept (P00)	40.87	.14
Total participation (P01)	-16959.54	.47
Preservice Part (P02)	5089.79	.47
Inservice part (P03)	14609.52	.47
Management Part (P04)	1058.28	.47
Project type (P05)	-19.31	.57
Minority (P10)	.38	.00

The results from these models are preliminary for a number of reasons. First, they show baseline evidence rather than change of student achievement with STEM faculty involvement, which is really what we are interested in seeing. As multiple years of student achievement data become available, we can model this relationship. In addition, future analyses will include data from cohorts 2 and 3. Second, our quantifications of STEM faculty involvement are somewhat restricted by the type of data available. Nevertheless, the analyses above have provided us with familiarity with various sources of data from the MIS collection and pointed out aspects we should attend to in future analyses.