MATH AND SCIENCE PARTNERSHIP PROGRAM EVALUATION (MSP-PE)

Supporting Statement for Continuation of Data Collection

November 8, 2010

National Science Foundation
Division of Undergraduate Education
Math and Science Partnership Program

GLOSSARY OF TERMS AND ABBREVIATIONS

ED	U.S. Department of Education
ED-MSP	Mathematics and Science Partnerships Program administered by the U.S. Department of Education; a counterpart to NSF's MSP Program
Focused and Not-Focused Schools	One of MSP-PE's substudies examines trends for two groups of schools: 1) those schools on which the partnership had focused its activities (focused schools), and 2) those schools in the same district and grade level that had not been the subject of any partnership activity (not-focused schools).
IHE	Institutions of higher education
LEA	Local education agency
MSP-MIS or MIS	Math and Science Partnership (Program's) Management Information System. The MIS is designed to obtain annual data from each MSP Program-funded awardee. The data describe the implementation and progress of the individual awardees.
MSP-PE	Math and Science Partnership Program Evaluation
MSP Program or NSF-MSP	Math and Science Partnership Program administered by the National Science Foundation
Partnerships	Math and Science Partnerships funded by the National Science Foundation under the MSP Program
PD	Professional development
PIs or co-PIs	Principal investigators or co-principal investigators
R&D	Research and development
RETA	Research, Evaluation, and Technical Assistance
RQ	Research question
SEA	State educational agency
STEM (education)	Science, technology, engineering, and mathematics (education)
Substudy	MSP-PE consists of a series of substudies with each substudy covering a different facet (e.g., student achievement) of the MSP Program.

INTRODUCTION TO THE SUPPORTING STATEMENT

This document presents the supporting statement for the continuation of data collection as part of an evaluation of the National Science Foundation's (NSF) Math and Science Partnership (MSP) Program. OMB approved an earlier clearance on June 20, 2006 (OMB No. 3145-0200), and the three years allotted for the original clearance then expired on June 30, 2009. The present document seeks mainly to extend the original clearance so that data collection can restart and then continue through June 2014 (this target date assumes a three-year re-approval that would start in June 2011).

NSF supports research and education in science, technology, engineering, and mathematics (STEM) through extramural awards (grants, contracts, and cooperative agreements) to over 2,000 institutions of higher education (IHEs) and other research and education institutions in all parts of the United States. The awards serve NSF's broader mission, which is to help the United States to: maintain a position of eminence at the global frontier of "fundamental and transformative research" and to sustain a "world class science and engineering workforce"—while also fostering the scientific literacy of all citizens (National Science Board, 2005). The workforce includes not only practicing scientists and engineers but also teachers (and in particular K-12 teachers) of mathematics and science. To support current and future generations, the successful workforce must draw from students who have gained a strong mathematics and science education. The critical nature of K-12 systems arises from their positioning at the beginning of such education.

The Math and Science Partnership Program

Within NSF, the MSP Program is administered by the Directorate for Education and Human Resources (EHR), which is responsible for the continued vitality of the nation's STEM education as well as its improvement. The MSP Program is among many within EHR devoted to this quest, which covers not just K-12 but also undergraduate and graduate education programs.

The MSP program is distinct from other EHR programs in that it fosters *math and science partnerships (partnerships)* between STEM discipline departments and K-12 school districts.[1] The partnerships require extended participation by STEM discipline faculty (faculty having a STEM field as their primary field of research, compared to other faculty who might have been teaching mathematics or science at the IHE level but whose field of research might have been some other field, such as education). One result of this requirement has been the presence in the MSP Program of many Research I and Research II universities, as categorized under the Carnegie Classification system. More often than not, these universities serve as the partnerships' lead organizations.

Awards Made by the MSP Program. The MSP Program began making awards to support the partnerships in 2002. From 2002 to 2004, NSF made five-year awards to 48 partnerships (many later receiving no-cost extensions or supplemental awards that lengthened their awards to six or seven years). From 2006 through 2009 NSF then made

[1]Technically, most school districts cover the preschool grade and are "pre-K-12" systems, and the activities of the MSP Program can include this full grade range. However, for the sake of convenience, the districts are referred to as "K-12" systems throughout this document.

new rounds of awards, adding 32 partnerships. Under the most recent solicitation for proposals (NSF 10-556), NSF made yet another round of awards during the late summer and fall of 2010.

Exhibit 1 summarizes the total number of awards made by the MSP Program through 2009. The exhibit shows that the IHE-K-12 partnerships receive the bulk of the program's funds, but the MSP Program also makes other kinds of awards related to the partnerships. For example, the Research, Evaluation, and Technical Assistance (RETA) awards are devoted to conducting related research, providing technical assistance to the partnerships, or fostering dissemination and communication among the partnerships.

Awardees' Acceptable Educational Activities. For the partnerships, the congressional legislation authorizing the MSP Program (National Science Foundation Authorization Act, P.L. 107-368, 2002) identified a broad range of acceptable educational activities. The flexibility was intended to suit local education conditions, which differ because of the decentralized nature of the U.S. education system for grades K-12: State and local school boards, the latter usually consisting of elected officials, establish each local system's instructional methods and curricula, and the local boards also are responsible for hiring and firing all school personnel, including the K-12 system's superintendent. The acceptable activities could cover K-12, undergraduate, and graduate education as well as inservice training to existing K-12 teachers (see Exhibit 2). Equally important, each partnership was permitted to undertake more than a single activity, and every partnership has done so.

In its solicitations for proposals (e.g., NSF 10-556 as well as earlier solicitations), NSF has defined five key features that are intended to embrace the broad range of acceptable activities. The partnerships are to incorporate all of the features in their work:

1. Being *partnership-driven* (collaboration between IHE and K-12 systems, including significant roles by IHE-STEM disciplinary faculty);

2. Aiming to enhance and sustain the *quality, quantity, and diversity of K-12 teachers of mathematics and/or the sciences*;

3. Ensuring K-12 students' preparation for, access to, and encouragement in succeeding in *challenging courses and curricula*;

4. Using *evidence-based design and outcomes* to contribute new knowledge about teaching and learning in mathematics and science; and

5. Ensuring the *sustainability* of project work, reflected by *comprehensive and coordinated institutional change at both the college/university and the local school district levels*.

Nevertheless, the overall guidance does not specify any particular set of interventions or activities to be implemented by awardees. As a result, the awardees' projects may more closely resemble those in a "field-initiated" research program, reflecting considerable heterogeneity, rather than awards in a centrally-specified and consistently defined intervention from grant to grant. On top of these variations, the awards may cover different grade levels and emphasize different academic subjects within mathematics and science.

The MSP Program as an R&D Program. The MSP Program has one other distinctive facet. According to the first sentence in the introduction of its solicitations for proposals, the program considers itself, first and foremost, an R&D program:

> *The MSP Program is a major research and development effort designed to improve K-12 student achievement in mathematics and science* (NSF 09-507).

This designation fits with the fourth of the preceding program features. Awardees are therefore urged to develop new ideas and innovations in mathematics and science education, not just to implement acceptable activities (Yin, Hackett, & Chubin, 2008).

U.S. Department of Education Counterpart Program. NSF's MSP Program has a counterpart program, the "Mathematics and Science Partnerships (ED-MSP)," administered by the U.S. Department of Education (ED) under its own authorizing legislation (No Child Left Behind Act, P.L. 110-103, 2002). A U.S. House Committee report (Committee on Science, 2003) describes the complementarity of the two programs as follows: Whereas the NSF-MSP Program is to fund "innovative programs to develop and establish new models of education reform, thereby remedying the lack of knowledge about math and science research," the ED-MSP Program is aimed at "broadly implementing and disseminating new teaching materials, curricula, and training programs."

The ED-MSP Program focuses on professional development for mathematics and science teachers, to improve their content knowledge and pedagogical skills. In implementing the program, ED first makes formula allocations to the states, which in turn make awards to school districts, for up to a three-year period and ranging from $25,000 to $2.5 million per award. Evaluating the ED-MSP Program falls outside of the scope of the evaluation of the NSF-MSP Program. However, a few local sites have received both

NSF-MSP and ED-MSP awards, and the planned data collection will attend to the nature of the relationships between the NSF and ED awards at these sites.

Summary of Request to OMB. The request for OMB review asks to extend the clearance for three instruments to be administered in face-to-face interviews with the partnerships' staffs, including accessing and reviewing the partnerships' records and documents, under the NSF-MSP Program. One instrument calls for interviews of a partnership's principal investigator and project coordinator; a second calls for interviews of co–principal investigators and partners; and the third calls for interviews of the local partnership evaluator. The three instruments are slightly updated but are essentially the same instruments that were the subject of the original OMB clearance.

Under the original OMB clearance, the original versions of all three instruments were used to collect data from the 48 partnerships awarded from 2002 to 2004. Some of the findings from this data collection are reported in the next section of this introduction.

The proposed data collection will use the slightly revised versions of the instruments to cover 32 additional partnerships, which include the newly-awarded partnerships from 2006-09 as well as a few earlier partnerships receiving Phase II awards.[2]

Tables 1 and 2 at the end of the supporting statement describe the differences between the original clearance and this request.

[2]The earlier partnerships were all eligible to apply for Phase II awards to continue or extend some aspect of their original activities, and six of them received awards between 2006 and 2009.

The Evaluation of the Math and Science Partnership Program

The data to be collected with these field instruments are for the ongoing evaluation of the NSF-MSP Program. This *program evaluation* started in 2004 and is known as the Math and Science Partnership Program Evaluation (MSP-PE).

The purpose of the evaluation has been to assess the progress and accomplishments of the MSP Program as a whole, not focusing on any specific awardee.[3] The program evaluation has been addressing three research questions (RQs):

> RQ1. *How has the MSP Program affected, influenced, or been associated with changes in: a) K-12 student achievement in math and science; b) the K-12 math and science teaching force; and c) other outcomes associated with the program?*
>
> RQ2. *How have STEM disciplinary faculty from institutions of higher education (IHEs) participated in the MSP Program, and what has been their role in the program's achievements?*
>
> RQ3. *What factors or attributes appear to have accelerated or constrained progress in the MSP Program's achievements?*

To address these questions, and to accommodate the diversity of the partnerships' activities within the MSP Program described earlier, the MSP-PE has had to develop a distinctive evaluation design. Precluded by the diversity of acceptable partnership activities has been the use of any singular evaluation design, as might resemble an experimental or quasi-experimental study. Such single designs assume either a single activity undertaken by a single awardee (the conventional "project" evaluation) or the same kind of activity undertaken by multiple awardees (the conventional "program" evaluation).

[3]The individual partnerships are the subject of separate, "local"-level evaluations that perform both formative and summative functions, but only in relation to their specific partnerships.

In the MSP Program, in contrast, each awardee has undertaken multiple activities, and these activities differ widely from awardee to awardee.

Also precluded by the nature of the partnerships' activities has been the use of a theory-based design, typically involving the development and testing of some sort of *logic model* or theory of change (e.g., Kellogg Foundation, 2004). By definition, the partnerships operate in a multi-institutional environment that includes school districts, IHEs (community colleges, 4-year colleges, as well as universities), business and community groups, and other institutional partners (e.g., science centers and museums). Among these institutions is hypothesized a series of pathways whereby support for K-20 mathematics and science education can result in the desired career outcomes, including the ultimate goal of enhancing the STEM workforce in this country (see far right portion of Exhibit 3).

In principle, the logical flow through these pathways could serve as the needed logic model. However, the multi-institutional environment effectively creates an *open system* rather than the closed set of "input-activity-output-outcome-impact" components of any desired logic model. Such a closed set is usually dominated by a single institution or organizational environment. In contrast, evaluations of open systems, rendered as if they were following a logic model, are notoriously difficult to design and implement, if not impossible to conduct. The difficulty lies in the complexity and importance of external conditions in an open system. They cannot easily be tracked, but they can swamp any expectation of an orderly input-activity-output-outcome sequence.

Given the inappropriateness of an experimental (or quasi-experimental) design, as well as the difficulties faced by any theory-based design, NSF defined the needed MSP-PE evaluation as one that would consist of a series of substudies, with each substudy covering a different facet of the MSP Program. To date, and with data collected under the original OMB Clearance (OMB No. 3145-0200), the MSP-PE has completed 39 substudies, of which 19 have been published in peer-reviewed journals.

The substudies have mainly aimed at the first and second of the three research questions. In effect, the initial set of substudies collectively emulates an *outcome-based evaluation* (e.g., Schalock, 1995; Newcomer, 1997; Hatry, Cowan, & Hendricks, 2004); and Morley & Lampkin, 2004). Such a strategy therefore represents a viable means of assessing the MSP Program, in the following sense: by highlighting outcomes, the strategy covers the summative orientation implied by the first research question; and by relying on multiple substudies covering multiple outcomes, the strategy accommodates the diverse nature of the MSP Program. As the MSP-PE progresses into the future, other substudies can now begin to examine the third research question more closely.

Brief Summary of Findings for Five Outcomes

To highlight briefly the findings from the MSP-PE to date, the remainder of this introduction discusses five outcomes from the MSP Program that have been assessed by

one or more of the 39 substudies.[4] Two of the outcomes are related to research question one (RQ1), involving the progress (or not) shown by the MSP Program with regard to: 1) K-12 student achievement trends among students whose teachers participated in the partnerships' professional development and related activities; and 2) changes in teacher content knowledge after the teachers had participated in such activities. A third outcome is related to RQ2: 3) the extent and nature of participation in the MSP Program by IHE-STEM faculty. The fourth outcome deals with: 4) the progress of the MSP Program as an R&D program; and the fifth outcome deals with: 5) the early signs of sustainability of the partnerships' activities beyond the period of formal funding by the MSP Program.

1. K-12 Student Achievement Outcomes. One substudy examined student achievement on state assessment tests in mathematics and science at the elementary, middle, and high school levels (grades 5, 8, and 11), for the four-year period from 2003-04 to 2006-07 (Dimitrov, 2009). The substudy contained three analyses.

The first analysis tested the correlation between achievement trends and school participation in the MSP Program. The findings showed that:

> *The more years that schools met the participation criterion during the four-year period from 2003-04 to 2006-07, the higher were their proficiency scores in 2006-07.*

This correlation was statistically significant at the $p<.01$ level for three of the test combinations (two academic subjects times three grade levels) and therefore suggested a

[4]The discussions of the five outcomes are accompanied by references to the relevant substudies. For a synthesis of these substudies and the five outcomes, including a presentation of the original data from the substudies, see Yin, 2010.

positive relationship between participation in the MSP Program and K-12 student achievement.

The second analysis examined the trends for two groups of schools: those schools on which the partnership had focused its activities (*Focused* schools) and those schools in the same district and grade level that had not been the subject of any partnership activity (*Not-focused* schools). The results showed that:

> *Within partnering school districts, Focused schools had statistically significant and positive achievement trends from 2003-04 to 2006-07 at the $p<.05$ level for all six test combinations (two academic subjects times three grade levels), whereas*
>
> *Within the same partnering districts, the trends for the Not-focused schools were negative at the $p<.05$ level in elementary and middle school mathematics; had no significant changes in middle and high school science; and were positive at the $p<.05$ level in high school mathematics and elementary school science.*

Because the predicted pattern appeared in four of the six combinations of subjects and grade levels, the findings were interpreted as providing further support for a positive relationship between participation in the MSP Program and K-12 student achievement.

The third analysis covered the Focused schools alone. Within these schools, the trends among four subgroups of students showed greater gains for African-American students in comparison to three other groups (Asian American students, White students, and Hispanic students). These results suggested that achievement gaps between the African-American and other subgroups were diminishing during the four years, also a desired educational outcome.

2. K-12 Teacher Content Knowledge. Such knowledge represents one of the important outcomes dealing with teachers of mathematics and science. The evaluation assessed changes in teachers' content knowledge by conducting a synthesis of the annual reports submitted by the partnerships that had provided findings on teachers' content knowledge before and after participating in a partnership's professional development activities (Moyer-Packenham & Westenskow, in press).[5] The synthesis showed that:

> *The vast majority of the reports (covering 63 percent of the teachers in mathematics and 78 percent in science) reported statistically significant gains on tests administered after a partnership's professional development activities, compared to performance on similar tests prior to the activities.*

These results were reinforced by the findings from another substudy which only covered the eight "Institute" awards, finding that six of the eight reported statistically significant gains (Davis, 2009).

3. Involvement in Partnerships' Activities by STEM Discipline Faculty. The evaluation examined the extent of involvement by STEM discipline faculty, who were defined as those faculty having a STEM field as their primary field of research, compared to other faculty who might have been teaching mathematics or science at the IHE level but whose field of research might have been some other field, such as education (Alligood, Moyer-Packenham, & Granfield, 2009).

[5]Unlike the data on K-12 student achievement, the reports did not provide the actual data representing the teachers' original scores, but only gave the partnerships' own findings on teacher content knowledge. Therefore, and again unlike the analysis of the K-12 student achievement data, the cross-awardee analysis of teacher content knowledge consisted of a research synthesis of the partnerships' findings.

Because the purpose of the faculty's involvement was to deepen the partnerships' mathematics and science content, the desired involvement needed to take the form of services provided by the STEM discipline faculty, not just their participation in partnership functions. The relevant services could cover: leading or assisting in the professional development for K-12 teachers; offering programs and courses for preservice teachers; assisting K-12 students with science projects, math nights, and science fairs; and assisting school districts in making curriculum selections or defining district assessments and lesson plans.

Based on a review of data reported by the partnerships and the site visits conducted by the evaluation team, the assessment found that (Moyer-Packenham et al., 2009):

> *Whether categorized by grade span or subject, STEM discipline faculty were more involved in every kind of partnership activity than any other single kind of service provider (including IHE education faculty and K-12 teacher/leaders).*

Of the roughly 900 IHE faculty involved in the MSP Program, 55 percent were STEM discipline faculty and 45 percent were education faculty. These findings support the conclusion that the MSP Program has successfully engaged STEM discipline faculty in its activities. Part of the success may be attributed to the program's requirement that every partnership have a STEM discipline faculty member as its project director. However, to their credit, the partnerships have successfully extended such top leadership to the recruitment of many other STEM discipline faculty into the partnerships' work.

4. Advances as an R&D Program. Because the MSP Program is considered an R&D program, NSF has strongly urged the partnerships to contribute new ideas in mathematics

and science education and not just to deliver educational services. To assess this outcome, the evaluation used a proxy measure: the extent and nature of articles authored by the awardees and that had appeared in peer-reviewed journals (Yin, Hackett, & Chubin, 2008). Such articles were taken as indicators of R&D contributions because each journal, by agreeing to publish a paper through its peer-review process, in effect had vouched for the quality and newness of the ideas in the paper, as well as the soundness of the paper's research methods (Davis & Yin, 2009).

As part of this assessment, the relevant publications had to appear during the life cycle of the awardees, and therefore from 2004 to 2009. Reviewing these publications, the substudy (Davis & Yin, 2009) found that:

> *The 77 awardees reported 304 published works, with 172 or 57 percent of these appearing in 83 peer-reviewed journals*.

Further examination revealed that no small group of awardees dominated the publications and undesirably accounted for the bulk of the publications, as the 172 articles had been produced by 39 (or 51 percent) of 77 awardees. The findings led to the conclusion that the MSP Program has been successfully meeting its objective of serving as an R&D program, especially since the initial search had identified over 628 candidate items (including the 172 articles), and many of these other items took the form of presentations that may appear as additional publications beyond 2009. At the same time, the evaluation was not able to identify any comparative benchmark, from other R&D programs, to help define the expected number of peer-reviewed publications that might emanate from an R&D program.

5. Signs of Sustainability of the Partnerships' Work beyond the Period of Formal Funding by the MSP Program. Truly sustainable partnerships require a symbiotic relationship whereby the partners contribute and derive mutual benefits—e.g., partners must collaborate to produce a joint product that neither can produce alone, and the availability of the product must then benefit all the collaborators (Yin, 2009). The benefits will support a partnership in the long run, independent of external sources of support.

A review of the partnerships' activities revealed that most of the activities benefited either the IHE or K-12 partner, but not both. For instance, when STEM faculty assist K-12 teachers and students, the STEM faculty do not necessarily derive any particular benefit in relation to their STEM careers. Conversely, when preservice teachers enroll in an IHE partner's courses and programs, the partnering district does not necessarily derive any predictable benefit, because the preservice graduates may become employed anywhere, and not necessarily at the partnering district.

The review did uncover two kinds of activities that may produce mutual benefits and therefore hold promise as the basis for sustained partnership. The first kind involves changes in IHE tenure and promotion rules—to recognize IHE faculty for their participation in K-12 education activities (e.g., Kutal, Rich, Hessinger, & Miller, 2009). The desirability of this type of initiative for fostering partnerships is well-known, but only a small number of partnerships have taken such steps, and the desired changes are likely to follow an uncertain path that also takes a long time to occur. First, the rules may pertain to some academic departments but not others. Second, even after favorable rules are in place,

the changes then need to be translated into concrete actions in reviewing the work and advancement of an individual faculty member.

The second kind of activity has received less recognition, possibly because it has not been frequently found in the partnerships between IHE-STEM faculty and K-12 systems that predated the MSP Program. Yet, within the MSP Program, the activity has been widespread. It involves STEM faculty designing, modifying, or enhancing courses in STEM departments (Yin, 2009):

> *From 2003-04 to 2005-06, the partnerships in the MSP Program had offered 257 courses by STEM discipline departments at 57 IHEs.*

This second kind of activity differs from the conventional preservice activity in that existing K-12 teachers, not just preservice and undergraduate students, may enroll in the courses (see Exhibit 4 for examples among the partnerships). Yet, the courses also differ from the conventional inservice activities that usually take place in workshops, summer institutes, or at school sites—but outside of the formal IHE curriculum.

From a sustainability perspective, to the extent that a large number of existing K-12 teachers enroll in the courses, the activity appears to offer the desired mutual benefits. The IHEs and STEM faculty benefit from the increased enrollment in their programs, and the K-12 districts and their teachers benefit from the more intense lessons in mathematics and science than might occur in the traditional professional development workshops or summer

institutes,[6] and local school districts may divert their professional development funds toward the enrollment in these courses. Many of the teachers also become candidates for advanced degrees. The IHE courses for existing K-12 teachers may therefore become self-sustaining and the basis for lasting IHE (STEM)-K-12 district partnerships.[7]

[6]The assumption about this favorable comparison about the intensity and quality of the lessons is based on the fact that formal course offerings at a university require departmental review that serves as a quality control measure not present in the offering of off-site K-12 workshops and institutes—see Shapiro et al., 2006, p. 7).

[7]The most desirable situation would be where a local university (or group of collaborating universities) offered an array of courses meeting the substantive needs of the local K-12 teachers, and where the K-12 district(s) then restricted professional development options (and limited the use of their resources), at least in mathematics and science, to the university courses. Barring the intermittent cutbacks in districts' professional development budgets, the local resources would then support the arrangement on a sustaining basis.

A. JUSTIFICATION

A.1. Circumstances Requiring the Collection of Data

The information collection for which OMB clearance is being sought is part of a program evaluation of the National Science Foundation's (NSF) Math and Science Partnership (MSP) Program. The Program is one of 11 programs authorized under the NSF Authorization Act of 2002 (P.L. 107-368, December 19, 2002) and is administered by NSF's Directorate for Education and Human Resources' (EHR). EHR prepared and competed a Statement of Work (SOW) for the program evaluation. COSMOS Corporation, teamed with scholars at George Mason University and Vanderbilt University,[8] was awarded the evaluation contract.

The program evaluation started in 2004 and collected data on the MSP Program's initial set of partnership awards, collecting site visit data from 48 partnerships. The data collection used instruments and procedures approved under OMB No. 3145-0200 (June 20, 2006 and expiring on June 30, 2009). Since that time, the MSP Program has made 32 additional partnership awards, covering 26 new partnerships and the Phase II work of 6 of the earlier partnerships. Site visits are to be made to these 32 additional awards, and the clearance requested in this package covers the instruments and procedures related to this new set of site visits.

[8]Two of the scholars at the two universities subsequently re-located to Utah State University and Brown University but are still part of the evaluation team.

The MSP Program is recognized as an important research and development effort at NSF for integrating the work of higher education, especially that of STEM disciplinary faculty, in support of the development, implementation, and sustaining of partnerships among institutions of higher education (IHEs), K-12 schools and school systems, and other important stakeholders.

The evaluation addresses three primary questions. Other questions may arise during the course of the evaluation, and therefore the evaluation will include but is not limited to these questions. The three main questions all are found in the original Statement of Work used by NSF in commissioning the MSP Program Evaluation (MSP-PE):

> RQ1. *How has the MSP Program affected, influenced, or been associated with changes in: a) K-12 student achievement in math and science; b) the K-12 math and science teaching force; and c) other outcomes associated with the program?*
>
> RQ2. *How have STEM disciplinary faculty from institutions of higher education (IHEs) participated in the MSP Program, and what has been their role in the program's achievements?*
>
> RQ3. *What factors or attributes appear to have accelerated or constrained progress in the MSP Program's achievements?*

NSF started the program evaluation in 2004, making an award to a team of evaluators led by COSMOS Corporation, an external contractor. Some of the evaluation's findings from this earlier period have been described in the introduction to this supporting statement.

The information from the program evaluation already has provided and should continue to provide an understanding of the MSP Program's outcomes. The contractor's

earlier reports to NSF included informal periodic reporting, formal quarterly and annual reports, and separate substudies. NSF used the analyses to make mid-course modifications in support of the MSP Program, to prepare and publish its own reports, and to respond to requests from Committees of Visitors, Congress, and the Office of Management and Budget, particularly as related to the Government Performance and Results Act (GPRA) and the Program Effectiveness Rating Tool (PART).

A.2. Purposes and Uses of the Data

The primary purpose for this information is program evaluation. The program evaluation will answer the research questions enumerated in A.1. The evaluation's major purpose is to provide summative assessments of the outcomes of the MSP Program. These include the program's contributions to K-12 student achievement; to the strengthening (e.g., quantity, quality, and diversity) of the K-12 teaching force; and to other outcomes such as the role and participation by IHE STEM faculty in the program's activities. The evaluation also will assess the program's role and contributions as an R&D program as well as the prospects for the sustainability of the partnerships.

Besides providing summative assessments, the evaluation aims to contribute to the identification of the processes that influence or interfere with the outcomes of the features studied, including the conditions that account for the demonstrated quality and innovativeness of the program.

A.3. Use of Information Technology To Reduce Burden

The evaluation will collect only the minimum information necessary for addressing the evaluation questions. The data collection procedures minimize respondent burden and will use reporting formats that are best suited for the type of information to be gathered. In compliance with OMB directives, paper data collection instruments in this evaluation will be supplemented with an electronic version as an option.

A.4. Efforts to Identify Duplication

The MSP-PE evaluation does not duplicate other NSF efforts. For example, project data on program funding are drawn from the NSF administrative database called the FastLane Project Reports system (OMB Control Number 3145-0058). Project monitoring data for the MSP Program are gathered via the Program's Monitoring Surveys cleared under OMB 3145-0199 and have been made available to the COSMOS team. Data from these collections are used to pre-fill items, where possible, to further minimize the overall response burden.

Neither the FastLane nor Monitoring Surveys involves site visits to the partnerships. To the extent possible, the evaluation will use the data from these preceding sources and pre-fill or delete items from its own site visit instruments as appropriate, to avoid redundancy and reduce burden on respondents. Similarly, no other national databases capture completely the information sought by this evaluation.

A.5. Impacts on Small Businesses

No small businesses are known to be partners of any of the MSP Program's partnerships. Therefore, no data will be collected from any small business organizations.

A.6. Consequences of Not Collecting the Information

If the information is not collected, NSF will not have independent, external documentation of the outcomes of the MSP Program and thus will not be able to meet its accountability requirements. Moreover, NSF will be unable to comply fully with the congressional mandate that the Foundation evaluate its MSP Program.

A.7. Special Circumstances Justifying Inconsistencies with Guidelines in 5 CFR 1320.6

The data collections will comply with 5 CFR 1320.6.

A.8. Consultation Outside the Agency

Federal Register Notice. A 60-day notice to solicit public comments was published in the Federal Register on July 7, 2009 (see Appendix A). Only one comment was received, but it had no substantive content and also did not address issues of cost or hour burden.

Consultation Outside of the Agency. Consultations on the research progress have occurred throughout the evaluation work and will continue to take place as the evaluation progresses. In particular, the evaluation team has engaged a small group of experts who have not been involved in the data collection and who have and will continue to provide their expert opinions. The purpose of such consultation is to ensure the technical soundness of the evaluation and the relevance of its findings, as well as to verify the

importance, relevance, and accessibility of the information sought in the evaluation. The members of the expert group represent the nation's leading researchers and scholars in mathematics and science education as well as the broader field of evaluation. During the earlier phase of the program evaluation, the group included:

- ***Robert Boruch, Ph.D.,*** is University Trustee Chair Professor in the Graduate School of Education and the Statistics Department of Wharton School at the University of Pennsylvania, the Co-Director of the Center for Research and Evaluation of Social Policy (CRESP), and the Co-Director of the Policy Research, Evaluation, and Measurement Program (PREM).
- ***Sharon Johnson Lewis*** is the Director of Research for the Council of the Great City Schools. In that role, Ms. Lewis has been responsible for developing and maintaining a research program that articulates the status, needs, attributes, operations, and challenges of urban public schools and the children whom they serve.
- ***Douglas Osheroff, Ph.D.,*** is the J.G. Jackson and C.J. Wood Professor of Physics in the School of Humanities and Sciences and the Gerhard Casper University Fellow in Undergraduate Education at Stanford University.
- ***Charles S. Reichardt, Ph.D.,*** is Professor of Psychology at the University of Denver. A self-described methodologist and statistician, Dr. Reichardt's research focuses on the logic and practice of causal inference in both laboratory and field settings.
- ***Warren Simmons, Ph.D.,*** directs the Annenberg Institute for School Reform at Brown University. The Institute was established in 1993 to generate, share, and act on knowledge that improves conditions and outcomes in American schools, particularly in urban areas and in schools serving disadvantaged students.
- ***Mary Lee Smith, Ph.D.,*** is the Regents' Professor in Arizona State University's Division of Educational Leadership and Policy Studies. At ASU, Dr. Smith worked with Gene V. Glass as he developed meta-analysis methodology and published with him a book and numerous scholarly articles about the effects of psychotherapy (one of the most often-cited studies in psychology).
- ***Philip Uri Treisman, Ph.D.,*** is Professor of Mathematics at the University of Texas at Austin and Executive Director of the Charles A. Dana Center. Dr. Treisman has received numerous honors and awards for his efforts to strengthen American education.

- ***Alan Tucker, Ph.D.,*** is Director of Undergraduate Studies and the Distinguished Teaching Professor of Applied Mathematics and Statistics Department at SUNY-Stony Brook. His current professional service includes: Chair of the MAA Education Council; Chair of the MAA Metropolitan New York section; lead author on the 1994 MAA evaluation, *Assessing the Calculus Reform Movement*; Director of the MAA project, *Case Studies in Exemplary Undergraduate Mathematics Programs;* as well as membership on a dozen MAA, AMS and NRC committees.

All of these individuals will be asked to serve in a similar capacity in relation to the new data collection. If any of them are unable to serve, comparable replacements will be found.

In addition, the partnership awardees from whom the site visit data are to be collected have had explicit knowledge of the planned data collection. These awardees were required, as part of their conditions of award, to collaborate with the evaluation's data collection.

A.9. Payments or Gifts to Respondents

No payments or gifts will be provided to respondents.

A.10. Assurance of Confidentiality

Respondents will be advised that any information on specific individuals will be maintained in accordance with the Privacy Act of 1974. Data collected are available to NSF officials and staff and other contractors hired to manage the data and data collection software. Data are processed according to Federal and state privacy statutes. Detailed procedures for making information available to various categories of users are specified in the Education and Training System of Records (63 Fed. Reg. 264, 272, January 5, 1998). That system limits access to personally identifiable information to authorized users. 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. The information requested may be disclosed to qualified researchers and contractors in

order to coordinate programs and to a Federal agency, court or party in a court, or Federal administrative proceeding, if the government is a party. Confidentiality issues are addressed in the cover letter announcing the evaluation and its site visits to the partnerships (see Appendix B).

A.11. Questions of a Sensitive Nature

In some cases, the instruments request information from respondents including their name and title. These data are collected in order to monitor the site visit procedures and to check for consistent data collection across the partnerships. Any individualized data that are collected are provided only to the evaluation staff who are conducting the studies, using the data as authorized by NSF. Any public reporting of data is in aggregate form.

A.12. Estimates of Hour Burden

This evaluation includes site visit instruments and the review of field documents and other records maintained by the partnerships being evaluated. By covering a census of the MSP Program's partnerships, the result will be a comprehensive description of the range and variety of the partnerships supported by the MSP Program. Such a descriptive profile complements the more numeric profile cumulated through the program's management information system (MSP-MIS) and inquires more intensely about key claimed linkages, e.g., the relationship between the partnerships' activities and expectations about K-12 student performance (see the probe for Q. A1b in Appendix C).

The MSP-PE site visit instruments contain a set of open-ended questions, to be used in the field, both in interviewing respondents and examining documents and archival

evidence. A distinctive part of the instruments is reflected by questions asking for copies of the partnerships' own data. Overall, the instruments follow established procedures for collecting field-based evidence in a systematic manner (Yin, 2009). To present these questions and collect responses in the most efficacious manner, site visit team members need to have been trained and prepared adequately regarding the various topics of inquiry, and such training and preparation will be a formal part of the data collection procedures.

The three MSP-PE site visit instruments (see Appendix C) include: 1) interviews with the lead partnership staff (principal investigator and project coordinator), 2) interviews with other partnering staff (co-principal investigators and partners), and 3) interviews with the partnership evaluator. A description of the site visit procedures, site visit training, and site visit reporting is provided in Appendix D. Among other items, the procedures identify the persons to be interviewed and the amount of time estimated for the interviews. In turn, these estimates become the basis for estimating the burden rates and costs of the data collection, as discussed next.

A.12.1 Number of Respondents, Frequency of Responses, and Annual Hour Burden

The total number of respondents is 352. The frequency of responses is one time only. The estimated total response burden is 960 person-hours. The data collection occurs over a three-year period, therefore the annual number of respondents and person hours would be the preceding estimates divided by three: 117.3 and 320.

Respondents include principal investigators, project coordinators, co-principal investigators, other partners, and partnership evaluators. A total of 32 partnerships will be site visited over a three-year period, and an estimated 11 respondents for each partnership will be asked to provide information. The burden was calculated using the total number of partnerships to be covered, the number of interviewees per partnership, and the number of interview hours per interviewee (see Exhibit 5).

A.12.2. Hour Burden Estimates by Each Form and Aggregate Hour Burdens

The requested clearance covers three site visit instruments or forms. The first instrument requires 448 burden hours; the second 256; and the third 256. Across all instruments, the total burden is 960 person hours (see Exhibit 6).

A.12.3 Estimate of Cost to Respondents for Hour Burdens

The total cost to the respondents is estimated to be $43,456. Over a three-year period, the annualized cost is estimated to be $14,485.

The following estimated hourly wage rates (in constant dollars as of 2008-09), which were found in the U.S. Department of Education's National Center for Educational Statistics Integrated Postsecondary Education Data System and the U.S. Department of Labor's Bureau of Labor Statistics, were used to create an estimate of the various respondents' wages: principal investigator and project coordinator—$49/hr.; co-principal investigators and partners—$49/hr.; and partnership evaluator—$35/hr. The calculations are shown in Exhibit 7.

A.13. Estimate of Total Capital and Startup Costs and of Operation, Maintenance, and Purchase Costs to Respondents or Recordkeepers

There is no overall annual cost burden to respondents or recordkeepers that results from the evaluation other than the time spent responding to questions in the site visit instruments that are attached to this request.

It is usual and customary for individuals involved in K-12 and postsecondary education activities in the United States to keep descriptive records. The information being requested is, in part, from records that are maintained as part of normal educational practice. Furthermore, the respondents are active participants in programs or projects funded by NSF. In order to be funded by NSF, institutions must follow the instructions in the NSF Grant Proposal Guide (GPG) that is cleared under OMB 3145-0058. The GPG requires that all applicants submit requests for NSF funding and that all active NSF awardees do administrative reporting via FastLane, an Internet-based forms system. Thus, the primary respondents to the data collection tasks for this evaluation make use of standard office equipment (e.g., computers), Internet connectivity that is already required as a startup cost and maintenance cost under OMB 3145-0058, and free software (e.g., Netscape or Microsoft Explorer) to respond.

A.14. Estimates of Total Costs to the Federal Government

The estimated total cost to the government of all data collection, analysis, and reporting activities for this evaluation is $1,238,797. The estimated costs are shown in Exhibit 8.

A.15. Changes or Adjustments

Not applicable.

A.16. Plans for Tabulation and Publication

A team of evaluators led by COSMOS Corporation is conducting this third-party evaluation of the MSP Program on behalf of NSF and will only publish results after NSF completes a review of the document proposed to be published. In short, all products of the collections are the property of NSF. After the products are delivered, NSF determines how the quality of the products can be improved to merit later publication. For NSF's own publications, it is often only after seeing the quality of the information delivered by the evaluation that NSF decides the format (raw or analytical) and manner (in the NSF-numbered product Online Document System (ODS) or simply a page of the NSF Web site) in which to publish. NSF classifies its formal publications as reports, not statistical reports. Presentations of data and project-related information will be made at relevant venues such as meetings of the principal investigators and at national conferences.

Before the conclusion of the evaluation, both NSF and the partnerships may use preliminary data to improve management and performance. For example, data generated by this evaluation may appear as inputs to other internal and external NSF reports (e.g., the GPRA Annual Performance Plan). At this time, NSF has not set a timeline for publishing interim reports from this evaluation. As a general matter, and as with many agencies, NSF is reducing its reliance on formal (i.e., traditional) publication methods and publication formats.

A.17. Approval to Not Display Expiration Date

Not applicable.

A.18. Exceptions To Item 19 of OMB Form 83-I

Not applicable.

Exhibit 1

SUMMARY OF MSP PROGRAM AWARDS ($ in millions)

Type of Award	Cohorts 1-3 2002-04			Cohorts 4-6 2006-09			TOTAL Cohorts 1-6 2002-09		
	Awardees	Awards	Amount	Awardees	Awards	Amount	Awardees	Awards	Amount
Partnerships:									
Comprehensive	12	13	282.4	0	0	0	12	13	282.4
Targeted	28	29	228.6	11	11	55.3	39	40	283.8
Institute	8	8	44.2	15	15	64.7	23	23	108.9
Phase II	0	0	0	6	6	12.5	6	6	12.5
Subtotal	**48**	**50**	**555.1**	**32**	**32**	**132.5**	**80**	**82**	**687.6**
Related Awards:									
Research, Evaluation, and Technical Assistance (RETAs)	29	35	60.3	12	14	16.6	41	49	76.9
Innovation through Institutional Integrity (I3)	0	0	0	2	2	1.4	2	2	1.4
Start (Planning Awardees)	0	0	0	19	19	5.5	19	19	5.5
Other Awards (e.g., workshops and conferences)	8	8	13.3	13	13	12.5	13	21	25.8
Subtotal	**37**	**43**	**73.6**	**46**	**48**	**36.0**	**83**	**91**	**109.6**
GRAND TOTAL	**85**	**93**	**628.6**	**78**	**80**	**168.5**	**163**	**173**	**797.2**

Source: National Science Foundation, "Awards Database: Program Information," downloaded from NSF's Web site on April 26, 2010. The MSP-PE is the source for the number of awardees, which is tracked because several awardees may have received more than one award.

Exhibit 2

RELEVANT ACTIVITIES FOR MATH AND SCIENCE PARTNERSHIPS (MSPs)

(A) recruiting and preparing students for math and science education careers;
(B) offering PD to strengthen the capabilities of math and science teachers;
(C) offering innovative preservice and inservice programs on using technology;
(D) developing distance learning programs;
(E) developing a cadre of master teachers to promote reform and improvement in schools;

(F) offering preparatory and certification programs for existing STEM professionals to start teaching careers;
(G) developing tools to evaluate activities conducted under this subsection;
(H) developing or adapting curricular materials incorporating contemporary research on the science of learning;
(I) developing initiatives to increase quantity, quality, and diversity of K-12 math and science teachers;
(J) using STEM professionals in private businesses to help recruit and train math and science teachers;

(K) developing and offering math and science enrichment programs (e.g., afterschool and summer);
(L) providing research opportunities for students and teachers; and
(M) bringing STEM professionals into K-12 classrooms.

Source: *National Science Foundation Authorization Act of 2002* (P.L.107-368).

Exhibit 3

THE PARTNERSHIPS' ACTIVITIES WITHIN A K-20 FRAMEWORK

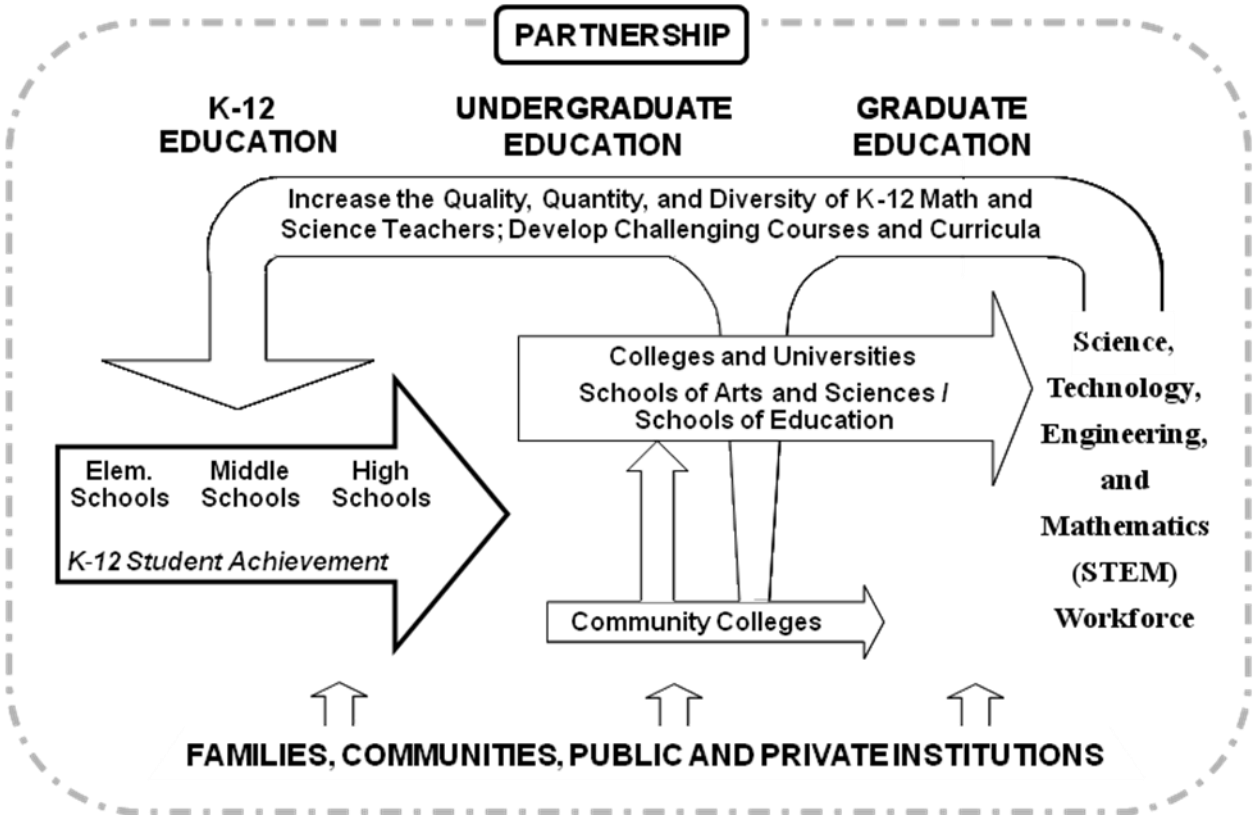

Exhibit 4

STEM COURSES OFFERED TO K-12 TEACHERS: EIGHT ILLUSTRATIVE MATH AND SCIENCE PARTNERSHIPS

Partnership 1:

At one of the partnering IHEs, faculty in the mathematics, science, and education departments developed 11 new math and 10 new science graduate-level courses for existing middle grade teachers of math and science. STEM faculty taught those courses, which can lead to a master's degree offered by the College of Arts and Sciences with a specialization in mathematics and science for middle school teachers (grades 6th-8th). In 2007-08, 98 teachers from the partnering district participated.

Partnership 2:

The partnership supported existing K-12 teachers to take graduate-level mathematics courses. The faculty teams also formed workgroups to review and approve new curricula for elementary and secondary mathematics education at one partnering IHE and revised one new course in mathematics elementary education at a second IHE.

Partnership 3:

The partnership initiated a fellows program for existing teachers to participate in a master's of mathematics for teaching program or to earn a certificate of advanced graduate study. Enrolling in 2004, the first cohort included 14 existing teachers, of whom 8 were to graduate in the fall of 2008.

Partnership 4:

Design teams, primarily composed of faculty from the partnering IHE, developed new courses on various mathematics topics. Four of the courses became part of a new minor, and existing middle school teachers were eligible to enroll. By the summer of 2006, 53 teachers had enrolled, with 41 completing at least two courses. In addition, by 2006-07, 341 existing teachers had taken other graduate courses at the IHE.

Partnership 5:

The partnership has supported its five IHE partners in collaboratively developing a common science education course sequence. At one of the partnering IHEs, 25 undergraduate students and 27 existing K-12 teachers were the latest cohort of students enrolled in the course sequence.

Partnership 6:

The partnership helped one of its partnering IHEs to offer five courses. The courses can lead to a mathematics endorsement, and 17 existing K-12 teachers enrolled in them during the spring of 2007. The partnership also supported other IHE faculty to redesign science and mathematics courses, to encourage students to pursue teaching careers.

Partnership 7:

The partnership supported the provision of mathematics methods courses co-taught by IHE faculty and district coaches. In 2005-06, eight K-12 teachers enrolled, to gain a higher level of mathematics knowledge and to move toward a credential to meet *No Child Left Behind* requirements.

Partnership 8:

The partnership supported four of its IHE partners to create new or redesigned undergraduate science courses. Both existing and aspiring science teachers have enrolled in these courses.

Source: MSP's Annual Reports; and MSP-PE Site Visits, 2006-08 (Yin, 2009).

Exhibit 5

CALCULATIONS USED TO ESTIMATE BURDEN

Respondent Type	Total No. of Respondents Across Partnerships	Burden Hours per Respondent	Person Hours	
			Total	Annual
- Lead Partnership Staff	32 x 2 staff = 64	7 hrs.	448 (64 x 7=448)	149.3
- Other Partnering Staff	32 x 8 staff = 256	1 hr.	256 (256 x1=256)	85.3
- Partnership Evaluator	32 x 1 staff = 32	8 hrs.	256 (32 x 8=256)	85.3
Total	352 (32 partnerships x11 staff =352)		960	319.9

Exhibit 6

ESTIMATED BURDEN HOURS FOR MSP-PE SITE VISIT INSTRUMENTS

Respondent Type	No. of Respondents at Each Partnership	Total No. of Respondents Across Partnerships	Burden Hours per Respondent	Person Hours	
				Total	Annual
- Lead Partnership Staff	2	64 (32 x 2=64)	7 hrs.	448 (64 x 7=448)	149.3
- Other Partnering Staff	8	256 (8x32=256)	1 hr.	256 (256 x1=256)	85.3
- Partnership Evaluator	1	32 (1x32=32)	8 hrs.	256 (32 x 8=256)	85.3
Total	11	352 (32x11=352)		960	319.9

Exhibit 7

ESTIMATED COST TO RESPONDENTS

Respondent Type	Total No. of Respondents	Burden Hours per Respondent	Average Hourly Rate	Total Cost
- Lead Partnership Staff	64 (2x32)	7 hrs	$ 49/hr	$ 21,952 (64 x 7 x $49)
- Other Partnering Staff	256 (8x32)	1 hr	$ 49/hr	$ 12,544 (256 x 1 x $49)
- Partnership Evaluator	32 (1x32)	8 hrs	$ 35/hr	$ 8,960 (32 x 8 x $35)
Total				$ 43,456

Exhibit 8

TOTAL COSTS TO THE FEDERAL GOVERNMENT FOR THE DATA COLLECTION

Personnel	$473,263
Other Direct Costs	
Travel and Per Diem	$133,920
Communication and Supplies	$15,000
Indirect Costs	
Fringe Benefits	$179,840
Overhead	$360,839
Fee	$75,935
TOTAL COST	$1,238,797

Table 1

Differences Between June 2006 Clearance and November 2010 Extension (INTRODUCTORY TEXT, SAMPLE, AND BURDEN)

	Introductory Text	Time Period Covered by the Clearance	No. of Site Visits	Description of Partnerships to be Site Visited	No. of Respondents at each Site Visit	No. of Annual and Total Respondents	Annual and Total Response Burden	Annual and Total Cost to All Respondents	Costs to the Gov't for the Data Collection
Original OMB Clearance OMB: 3145-022 Exp. Date: 6/30/09	Updated and Revised as of June 2005	June 2006 to June 2009	48 over a 3-year period	48 Cohort **1-3** Partnerships	18 Respondents per Partnership: PI and Coordinator (n=2) Co-PI/Advisors/ Partners (n=15) Evaluator (n=1)	288 Annual Respondents 288 x 3 yrs. = 864 Total Respondents	608 Annual Person-hours 608 x 3 yrs. = 1,824 Total Hours	$6,720 $6,720 x 3 yrs. = $20,160	$2,244,256
Request for Extension of Original Clearance (11/8/10)	Updated and Revised as of June 2010	June 2011 to June 2014	32 over a 3-year period	32 Cohort **4-6** Partnerships	11 Respondents per Partnership: PI and Coordinator (n=2) Co-PI/Advisors/ Partners (n=8) Evaluator (n=1)	117.3 Annual Respondents 117.3 x 3 yrs. = 352 Total Respondents	320 Annual Person-hours 320 x 3 yrs. = 960 Total Hours	$14,485 $14,485 x 3 yrs.= $43,456 Reflects a 41% hourly rate increase compared to earlier rates, for each of the respondent classes (per the U.S. Bureau of Labor Statistics, 2009 data)	$1,238,797

Table 2

Differences Between June 2006 Clearance and November 2010 Extension (SITE VISIT INSTRUMENT)

	SECTION OF THE SITE VISIT INSTRUMENT						
	A. Partnerships	**B. Evidence-based Design and Outcomes**	**C. Teacher Quality, Quantity, and Diversity**	**D. Challenging Courses and Curricula**	**E. Role of IHE Disciplinary Faculty**	**F. Explanations Regarding the Partnerships's Work (old Section title: Rival Explanations)**	**G. Background Information on "Discovery" and its Processes**
Substantive Changes (New, Deleted, or Replaced Questions)	1. Insert new q. 1a ("Partners") 2. Replace q. 2b ("Extent of Sharing") with q. 2b ("Creation and Maintenance") 3. Insert new probe for new q. 2b 4. Replace q. 4c ("Formal Evaluation") with new 4c ("Explanation of Partnership Processes") 5. Insert new q. 5c ("Family and Parental Involvement")	1. Replace q. 2c ("Data Sharing with MSP–PE") with new q. 2c ("Review of Data") 2. Replace q. 3 ("Formal Presentations and Publications") with new q. 3 ("Evaluation Management")	1. Replace q. 2a ("Teacher Quality, Quantity, and Diversity Activities") with new q. 2a ("In-depth Description of Two Main Activities"), including the addition of the new Exhibit B. 2. Addition of an illustrative example to q. 1b. 3. Insert new q. 2f ("Implementation Outcomes")	1. Addition of an illustrative example to q. 1b. 2. Replace 2a ("Course and Curriculum Activities") with new q. 2a ("In-depth Description of Main Activity"). 3. Insert new q. 2c ("Instructional Practices") 4. Insert new q. 2f ("Implementation Outcomes")	1. Addition of an illustrative example to q. 1b. 2. Insert new q. 2f ("Implementation Outcomes")	1. Insert new q. 1 (" Building and Maintaining a Math and Science Partnership") 2. Replace 3 original questions on rival explanations with 2 new, re-worded questions on rival explanations	Section G Deleted
Minor Copyedits	• Minor edits to correct verb tense, voice, and punctuation; and • Change in terminology as follows: *partnership* (instead of MSP); *partnership activities* (instead of MSP projects); and *evaluation activities* (instead of data collection activities).						

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