Alternative Approaches to Evaluating STEM Education Partnerships: A Review of Evaluation Methods and Application of an Interorganizational Model

(NSF 02-061 Award #: 0231904)

Final Report

March 31, 2008

Prepared by

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This paper reports on the findings from the National Science Foundation sponsored Research, Evaluation, and Technical Assistance (RETA) project (NSF 02-061 Award #: 0231904): Alternative Approaches to Evaluating STEM Education Partnerships: A Review of Evaluation Methods and Application of an Interorganizational Model. Gordon Kingsley, Principal Investigator, Dara O’Neil & Marion Usselman – Co-Principal Investigators
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Alternative Approaches to Evaluating STEM Education Partnerships
Project Summary Report

Introduction

This report summarizes research conducted under the Research Evaluation and Technical Assistance program associated with the National Science Foundation’s Math Science Partnership Program. The proposal initiating this line of research was entitled “Alternative Approaches to Evaluating STEM Education Partnerships: A Review of Evaluation Methods and Application of an Inter-organizational Model (NSF grant 02-061, Award # 0231904). This work brought together a group of researchers from the School of Public Policy and the Center for Education Integrating Science, Mathematics, and Computing (CEISMC) at Georgia Tech and from the Georgia Tech Research Institute.

The purpose of this summary report is to give an overview of the work that has been accomplished to date and a summary of the major findings in the research. A substantial body of research has been produced which is compiled in the following reports that are associated with this summary:

1. A literature review of the partnership research and evaluation studies.
2. A review of partnership program and evaluation requirements in federal grant programs as evidenced through Notices of Funding Availability (NOFA) announced in the Federal Register, aka, the NOFA study.
3. A report of findings from an electronic policy Delphi panel of experts in STEM partnerships, aka, the Delphi study.
4. A case summary report comparing the results from eight case studies of NSF projects funded through the Systemic Initiative programs and the Math Science Partnership program, aka the Case Summary Study.
5. The individual case study reports.

Purpose of the Project

Drawing from the original project proposal, “this research project is designed to improve understandings of how partnerships influence science, technology, engineering, and mathematics (STEM) educational outcomes. We do so by exploring how the emergence, operation, and, in some cases, dissolution of partnerships influence the process by which STEM educational outcomes are pursued and achieved. We have two research objectives:
Alternative Approaches to Evaluating STEM Education Partnerships

1. To review how partnership performance is evaluated in the STEM educational community and also in a variety of other settings drawn from other policy contexts, industry, and not-for-profits; and

2. To develop and test a model exploring how degrees of embeddedness among partners influence the process by which STEM educational outcomes are pursued and achieved.

The project builds upon models and frameworks associated with inter-organizational studies. This is a literature that has not matured into a solid body of theory. There is a good deal of sharing of terms and concepts between inter-organizational studies and research in collaboration, coordination, alliances, and networks. We defined partnerships as a form of inter-organizational collaboration characterized by voluntary arrangements between organizations, anchored by agreements, to promote the exchange, sharing, or co-development of products and programs designed to stimulate STEM education.

An Evolution of Models Used in the Study of Partnerships

In our proposal we began our investigations by focusing on the following factors:

- **Embeddedness** -- describes the number and types of relationships that organizations have with one another prior to the development of a partnership.

- **Strategic needs** -- describes the types of resource and legitimacy needs confronting individual organizations prior to a partnership and whether there is a congruence or complementarity in these needs.

- **Partnership formation** -- describes the types of agreements regarding the goals, resource allocations, and responsibilities of each party to the partnership. This concept captures the collective intent of the partnership.

- **Partnership operations** -- describe the actual behaviors in which the partners are engaged as they pursue the goals and duties of the partnership.

- **Process outcomes** – these are qualitative and quantitative assessments as to whether the partnership actually achieved the goals and duties of operation. For example, under process outcomes we may observe whether partners were able to implement a common curriculum across schools, marshal resources among partners, bring together the support and talents of universities, parents, businesses, and not-for-profits, or achieve congruence among policies.

- **Performance outcomes** – assesses improvements in the working environments of teachers, enhancements in their ability to engage in STEM education, and assessments of the performance of students on STEM topics.
To do so we started with the following model and hypotheses:

*Partnerships formed on the basis of positive embedded relationships and matched by congruence or complimentarity of strategic needs among the partners are likely to develop more harmonious and efficient partnerships that will be more effective in achieving process and performance outcomes.*

In our research this hypothesis was only partially supported. We do find substantial evidence in the electronic policy Delphi and in the case studies that partnerships characterized by higher levels of embeddedness and congruence of strategic needs amongst partners are more likely to develop more harmonious and efficient partnerships in terms of their operations. However, we do not find that these partnerships are more likely to achieve substantive process and performance outcomes related to science and math education. Partnerships marked by strife and conflict over goals and where the partners had few previous relationships were just as likely to produce innovations in STEM education and changes in teacher practice. The road that they take to these outcomes is bumpier in terms of partner conflict.

We organized our research using a series of models for exploring the inter-organizational relations in a partnership. At the beginning of our research we proposed that our six factors would be observed through the following model (see Table 1):

**Table 1: Initial Partnership Model**

<table>
<thead>
<tr>
<th>Pre-existing Conditions</th>
<th>Partnership Activity</th>
<th>Outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Embeddedness</td>
<td>Partnership Formation</td>
<td>Process Outcomes</td>
</tr>
<tr>
<td>Strategic Needs</td>
<td>Partnership Operations</td>
<td>Performance Outcomes</td>
</tr>
</tbody>
</table>

Rival Explanations
This model proved to be a useful starting place. It gave us a basis for designing a typology of partnerships that was useful in our case selection procedures and case analysis. We were able to group cases according to whether they started with high or low levels of embeddedness and strategic needs congruence. As an example, our eight case studies were initially organized as follows (see Table 2):

**Table 2: Case Studies Organized by Embeddedness and Strategic Needs**

<table>
<thead>
<tr>
<th>Embeddedness</th>
<th>Congruence of Strategic Needs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low</td>
<td>Low</td>
</tr>
<tr>
<td></td>
<td>Alaska SI</td>
</tr>
<tr>
<td></td>
<td>Duke TASC MSP</td>
</tr>
<tr>
<td>High</td>
<td>High</td>
</tr>
<tr>
<td></td>
<td>Appalachia SI</td>
</tr>
<tr>
<td></td>
<td>SCALE MSP</td>
</tr>
<tr>
<td></td>
<td>Appalachia MSP</td>
</tr>
<tr>
<td></td>
<td>Rochester MSP</td>
</tr>
</tbody>
</table>

Ultimately our research team found this framework to be a poor representation for what we were observing across the elements of our research. Early in our research we began to encounter strong influences from policy inducements and more coercive requirements for partnership. In the NOFA study we found numerous requirements for partnership in eligibility requirements, program requirements, and evaluation requirements. In most cases these were simply preferences that the agency was giving to potential applicants. However, there were also a growing number of NOFA announcements that made partnership a condition-in-aid. In the Delphi study and in the case studies we also heard from a minority of respondents who indicated that the only reason they were involved in partnership was because of a policy inducement. There was sufficient evidence of this activity to warrant monitoring the phenomena in a revised model.
A second reason that we abandoned our initial model was that the relationships between the formation and operations boxes were not sufficiently separated in time. We had anticipated that partnerships would have a good deal of ebb and flow in membership so initially aligned formation and operations as events that would be on-going throughout the life of the partnership. In one sense we were correct. In both the Delphi study and in the case studies, we observed instances of membership turnover in partnerships and the need to reconstitute the partnership agreements and working patterns.

However, our original conceptualization does not adequately capture two norms that prevailed in the experience of the majority of the respondents. The norm is that there are periods of formation and operations that overlap but are not on-going throughout the life of the partnership. In most cases partnership formation begins with the writing of the proposal between the actors. There are exceptions to this (as in the Appalachia MSP and Rochester MSP) which are built upon long-standing relationships. But the norm in most projects is a distinctive formation period overlapping with but also followed by a period of operations. A second problem with this model is that it is too static. The norm for partnerships is that the partners move to a shared understanding of each other (whether they like it or not). Partnerships that begin with low levels of embeddedness do not remain in that state. Similarly, partnerships with low levels of strategic needs congruence move, over the life of the project, to higher levels of strategic needs congruence as the partners learn to adapt and build upon the experiences of their collaboration. We get a flavor of this dynamism in the table above with the Appalachia SI beginning in a state of low embeddedness, but by the time the Appalachia MSP is created by many of the same actors, they have a much higher state of embeddedness.

In our initial investigations we came to understand that each of our major concepts was comprised of several factors that are the basis for the variables used in each of our studies. The literature review, Delphi study, and case study summary each provide detailed explorations of these factors. Figure 1 provides our revised model that was used in our analysis of partnerships at a conceptual level but also provides lists of the key factors that we explored in our studies.
We now include policy inducements in the model as a factor influencing participation. Policy inducements in the MSP context are not highly coercive but, rather, range from incentive-based (a condition-in-aid for a grant that organizations can opt to apply for) to mildly coercive (school districts feeling the need to participate in a partnership in an effort to build capacity in response to high stakes testing or teachers participating at the strong encouragement of district officials).

Another important conceptual development to our model is in operations of partnerships. We originally conceptualized the work of partnerships from a program evaluation perspective. In other words, the project leaders would, through their partnership, organize a program that would be delivered to the target audience. Most of our respondents indicated that the “program” was not quite as coordinated and packaged as...
our conceptualization implies. Partnerships engage in a variety of activities, some of
which are tied together and some of which are rather independent. In doing so,
partnerships strived to take advantage of the skill sets available through the collaboration
and privileged innovation in professional or curricular development rather than program
packaging. We came to understand that there is considerable variance in the number of
activities in which partnerships engaged. Some, like the Duke TASC MSP case, were
quite focused in the types of activities offered. Others, like SCALE MSP or the Alaska
RSI, allowed for considerable local innovation in activities anchored by common
strategic and operational goals.

In a similar vein, each activity has distinctive demands on partnering requirements with
some activities requiring high levels of partner engagement and some exhibiting low
levels of partnership. Within a single partnership, there may be considerable variance
across the activities in the need for partnership interactions. We also observed important
linkages across activities in a single case. The Alaska RSI and the Appalachia MSP had
each location working independently but following the same general model. The five
regions in Alaska were further connected as they rotated their phases of work annually,
but each location was dependent on the activities developed in the previous year by
another location.

In the next section of the project summary we move from the conceptual model to
specific findings that have been observed through our model of partnership. The
selection of findings was based upon factors found in evidence across the individual
reports. As such, these represent findings in which evidence was observed in the
distinctive context of each data source.

**Summary of Key Findings**

Partnerships have become a major strategy used by the federal government to generate
transformative change in systems with which public services are provided. In our review
of the NOFA announcements we found partnership as a significant component in federal
grant announcements from the majority of federal departments throughout the 1990s and
into the 2000s. There is also an increasing stridency to the calls for partnership. Historically, there have been numerous announcements that call for partnership but do this primarily in a rhetorical fashion. We observed that the incidence of eligibility, program, and evaluation requirements for partnership, increase among NOFA announcements over time.

Education has made significant use of partnerships over time as well. Partnerships have been called for in creating professional development programs, in building school-community partnerships, and building closer ties to business and professional communities.

What is interesting about this trend is that there is little evidence that demonstrates partnership to be a more efficacious means of delivering public services. The evidence that does exist provides a weak platform for external generalizability. The call for partnership has not been accompanied by corresponding innovations in methods for observing and assessing their performance. In reviewing the evaluation strategies employed by other departments and programs in the U.S. and internationally we find little agreement on the appropriate methods. In part, this is because there is little agreement as to what one should observe when assessing partnership performance. The tendency in the literature is to consider partnership as a form of collaboration and to apply concepts and methods used in the study of dyadic collaboration and generalize this behavior to a larger community of both individual professionals and their organizations.

In the partnerships that we observed, the majority have had a stable core set of actors responsible for the development and growth of the partnership, what we call the administrative network, and considerable going and coming of other organizations participating in the partnership. A key factor in the participation of non-core actors is the degree to which the organizations buy-in to the legitimacy of the partnership program. In the Rochester case we see how legitimacy is associated with the level of commitment to the partnership and how it predicts the overall level of involvement. Those school
districts that suffered from legitimacy problems did not participate (and even backed out of the project), while those that districts that had “blessing from above” were more active.

We note that our study, as most studies of partnership, tend to have an over-representation of survivor partners and have fewer observations from organizations that leave the partnership. We also note that several, but not all, respondents viewed departures as a sign of partnership failure and that departure is often accompanied by strife and conflict.

Another issue limiting the evaluation of partnerships is the tendency to treat all partnerships as if they embody the same phenomena of behavior. We have observed that partnerships exhibit considerable variance in the degree to which they require partners to interact in the pursuit of a goal or outcome. In the Alaska RSI, the partnership was based on the blessings of the tribal Elders, whose commitment to the partnership was an absolutely necessity. Absent the blessing, the partnership would never have gotten off the ground. In contrast, Duke was a business model where the TASC personnel were seen as the suppliers of a source of knowledge. In the Appalachia MSP the working relationships were characterized by more give and take, with the professors at the universities learning about pedagogy from K-12 teachers, and the K-12 teachers learning math/science content from the professors. In the STEM partnerships that we have observed this, variance was associated with the degree to which the target populations, in most cases K-12 teachers, were involved in development and delivery of partnership activities.

Building on this, we observe several classes of this type of engagement. First, in some cases, partnership was simply a pre-condition to activities offered. There may be engagement to design and develop a program of activities, but program delivery is accomplished through a single actor. Second, in some cases the partnership is an integral part of the program being delivered. For example, in the science immersion units developed in the SCALE project, engagement across the partners was required in each phase of the development and delivery of the unit. Even the presentation to the teachers as professional development was done in a collaborative way seeking teacher guidance.
on how the immersion unit might be applied in different classroom contexts. Third, partnering might be episodic, required at different points but not all points, along the value chain of the partnerships plan of action. Fourth, partnership may be required in some, but not all, of the activities developed by a partnership. In this case the managers of a partnership would need to be aware of the portfolio of activities and determine where the partnering behavior of would be of highest value. This type of planning was particularly important in cases where there were critical interaction effects or sequencing of activities in the partnership’s plan of action. As a rule, we found it difficult for partnerships to share information and lessons learned across activities unless the leadership facilitated the discussion or there was a sophisticated knowledge management system to serve as a conduit for information sharing.

One of the key concepts that we set out to examine in this study was the influence of embeddedness upon the formation and operation of partnerships. We found that embeddedness is a significant factor in the life of a partnership. However, there are several important dimensions to this concept. Personal and professional embeddedness, i.e. interactions based on one’s personal life or one’s professional associations, were less likely to contribute to the efficiency and harmony of operations that we predicted. We saw two notable exceptions to this pattern in the Appalachia RSI and the Alaska RSI where strong personal embeddedness was a significant factor in the formation of the partnership. However, project embeddedness, i.e. experience working together on previous projects or activities, tended to give actors greater capacity to reap the types of gains predicted.

We also observe that embeddedness can be both a help and a hindrance to the development of a partnership. Groups of organizations that have a history of working together often can point to the product of previous engagements as evidence of their worthiness for support. But this also means they have a history of engagements that are supported with soft money. Thus, these signs of success may also serve as foreshadowing of what the funding agency is actually going to support. In our observations, partnerships with high levels of embeddedness found it easier to use the
funds to expand activities in which they had previously engaged to new audiences rather than develop innovations in program delivery.

One of the chief advantages of high levels of project embeddedness is that these projects experienced far less conflict or problems in the operation of the partnership. Of the four case studies that we conducted with low levels of embeddedness at the initiation of the partnership, three cases (SCALE, Duke, and Alaska) all reported significant conflict in the relationship or problems with partnering. In two of the cases (SCALE and Alaska) the conflict reached such a pitch that complaints or appeals were made to the NSF program officer. In each of these cases there were fundamental disagreements between the partners regarding how the participating organizations should collaborate. Organizations bring their way of working and engaging with their clients to a partnership. Most of the conflicts that we observed were most strongly associated with fundamental differences in which these ways of working are conducted. Conflict stories were most often personalized and relayed as a failing of an individual or organization. But in most cases the complaint addressed a pattern of work that was difficult or threatening for the partner to address. In each case, after a period of negotiation one partner has felt compelled to assert a way of interaction on the others (usually the PI’s organization makes a decision of this sort).

When conflict has emerged, there were major declines in the mutuality of exchange between partners, a diminished sense that the identity of each partner was enhanced by the partnership, and reduction in the level of trust between organizations. Enormous transaction costs were also associated with these disputes. In all cases the partners devoted considerable time and made good faith efforts to resolve the disagreements that had developed. We also note that conflict is not a predictor of poor performance. Some of the most positive outcomes from partnership were observed in the Alaska and SCALE cases, both of which suffered from high levels of conflict in the developmental years of the project.
Given the high incidence of conflict that emerged amongst low embeddedness cases, NSF may want to consider some process for arbitration of these disputes when they arise. We observed that in many disputes partners, particularly those with experience in winning and implementing grants and contracts, had a difficult time communicating the limits of what their organization could tolerate in their collaboration. Organizations are better at defining plans but less effective at playing out scenarios of their expectations for collaboration. Nor are they effective in articulating threat points in the partnership that might do damage to their strategic needs.

Across our studies we see examples of teachers and professors participating in partnership programs because the collaboration meets their strategic needs. In the Rochester MSP case, the teachers that remained committed to the project expressed their willingness to participate because the program explicitly served their strategic needs.

Successful partnerships also remain sufficiently flexible in operations to meet strategic needs that were not initially identified. An example of this can be found in the Rochester LSC case when the partners discovered that the initial programs did not meet the strategic needs of special education teachers. Rochester then developed programs to meet the needs of these teachers. Another example can be found in the Appalachia MSP case, as the PEP grant program was developed to respond to local strategic needs that were not initially identified and needs that may affect a single district (and not the whole partnership).

Partnerships are often sensitive to key actors. They can be positively affected by the presence of champions who serve as advocates for partnering within their organization and to professional audiences. Champions are particularly important during the formation phase of a partnership. In all of the case studies, champions were crucial in the identification and alignment of potential partners and for “driving the ship” during the proposal period. Similarly, all of our cases illustrate how the presence of strong champion leadership is important throughout the value chain and through to program delivery. In the Appalachia, Jacksonville, SCALE and Alaska cases, more than one
champion emerged during the life cycle of the project. In contrast, turnover in leadership can be damaging to a partnership. In the Rochester and SCALE cases turnover amongst key school district administrators changed the perception of the legitimacy of the partnership and the level of buy-in from the district.

Our research has also found that partnerships are often comprised of a variety of actors not envisioned in the NSF solicitation for these partnerships. One of the goals of the MSP program is to create learning communities amongst K-12 teachers and STEM faculty members from institutions of higher education. We found these in evidence in each of the partnerships. But in several cases these were not the strongest ties that led to the creation of the portfolio of partnership activities. In most of our case studies and in the Delphi studies, the importance of consultants, post doctorate fellows, and research center personnel associated with universities were the key actors. In most of our case studies STEM faculty members reported significant disincentives to participate in partnership activities. This was particularly true for faculty in math and science departments who require a significant research record as a condition for tenure. An exception to this is found in the Duke case which established a new professor of practice tenure track. While STEM faculty members participate in the partnership, there was less evidence of a sustained learning community being generated with the K-12 teachers. In contrast, the level of engagement for university actors supported through soft money grants and contracts is quite high and, in most cases, vital to the life of the partnership. These are the actors who are most likely to sustain relations with K-12 teachers and are most likely to serve as a bridge in nascent learning communities.

In the course of this research we have examined many alternative outcomes and impacts from partnerships used by respondents and also in the research literature. However, we found that from the perspective of achieving a transformation in math and science education, one of the most promising indicators is changes in routine. This is the type of behavior change amongst teachers that groups like the Program Evaluation and Research Bureau in Los Angeles was observing in monitoring the SCALE project. Important aspects of changes in routine include the how well changes align with existing systems of
work and accountability, whether or not changes are sustained over time, and whether changes in routine are accepted as good professional practice by peers and peer institutions.

Many of the activities that were observed in this study represent innovations of practice for both K-12 teachers and STEM faculty. Of the two, the STEM faculty had the lower levels of engagement and the lower demands for changes in routine. Consequently, we heard reports of incorporation of new approaches to teaching and learning in two of our case studies amongst STEM faculty. For K-12 teachers the cases varied significantly in terms of the type of change in routine that the partnership program represented. But there does not seem to be a negative consequence generated by the magnitude of the change. For example, the Alaska and SCALE cases posed significant changes in routine both in the way in which professional development was conducted and the way in which classroom instruction would take place. In both cases, respondents reported good indications of changes in routine by teachers in the classroom.

**Conclusion**

This project has provided an examination of partnership behavior in STEM education. We have reviewed many of the existing approaches to partnership evaluation and found little agreement amongst evaluators on the best practices. Our empirical assessments of STEM partnerships have identified numerous factors that should be observed. We note a temptation amongst professionals to ignore the partnering aspects and proceed to a straightforward program evaluation. However, both our Delphi Study and our case studies demonstrate that, for most sites, the partnership is integral to the program intervention and must be accounted for directly in the evaluation.

This research shows signs of being highly productive. There are two dissertations being generated out of this research; 8 conference papers have been presented which are now in various stages of preparation for consideration by journals; and 12 invited presentations have been made (sponsors include U.S. Department of Education; other NSF programs including Center for Ocean Science Education Excellence and the JSLAMP program;
The National Academy of Sciences; Northwest Educational Research Laboratory; State of Montana Dept. of Education; State of Illinois, Dept. of Education). We also have under development a prospectus for a book about this research project and partnerships in STEM education.
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Education Partnerships:
Defining, Observing, Measuring and Evaluating

January 20, 2006

Prepared by

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In education, practitioners, consultants, evaluators, and researchers are challenged with the need to model and assess the performance of work involving multiple organizations. Partnership, one form of inter-organization relationship, has drawn recent attention largely as a consequence of public policies. The Math Science Partnership (MSP) program of the National Science Foundation (NSF), which provides the context and impetus for this essay, is but one of many federal programs aimed at fostering partnerships as a means of policy implementation and innovation. The need to understand how partnering works, and whether it influences the outcomes of programmatic work, has led to a growing body of evaluation studies and research. This paper reviews this literature in an effort to synthesize the concepts and measures used in the study of partnership. While our focus is primarily on partnerships between K-12 schools and institutions of higher education (IHE) like those in MSP, we have reviewed studies of partnership in other policy domains in order to develop a broader understanding of the topic and to learn from other professional communities.

1. The Policy Context for Math Science Partnerships

The term partnership has been used in recent years to describe a means for leveraging resources, coordinating work and increasing collaboration among various stakeholders in many policy arenas. The increasing use of partnerships by public organizations occurs in the context of budgetary constraints coupled with demands for greater performance and accountability. Rules that encourage the creation of networks of actors spanning sectors and/or levels of government are being included in many programs at the federal level (Hall & O'Toole, 2004). In public education, this trend builds on a long history of reform movements aimed at leveraging networks in the seventies (Cohen and Lorentz, 1977) and building communities in the eighties and nineties (Dufour & Eaker, 1998).
The MSP program developed under Title II of the No Child Left Behind Act of 2001 is an attempt to address problems in accountability in public education and proposes close partnerships between K-12 schools and IHE to create a better learning environment for children.\(^1\) While neither K-12 schools nor IHE need such partnerships to survive, the assumption is that they can both benefit from the interaction. The specific policy tool used to stimulate partnership under MSP is a set of eligibility criteria within the federal grant application. Applicants are required to demonstrate that a substantive partnership between K-12 schools and IHE will be formed to engage in improvements to math and science education. These relationships must include faculty from the Arts and Sciences, faculty with content knowledge in math and/or science. The partnerships should encourage reciprocal learning and adaptation within the K-12 and IHE partners\(^2\).

Compared to regulatory mandates, eligibility criteria for grants are a less forceful tool for promoting transformational change (Salamon, 1995). While K-12 schools face other regulatory sticks (stemming from the No Child Left Behind Act and other state and local mandates) that may stimulate an interest in trying new approaches, it is not clear that the IHE confront similar pressures. Therefore their motivation to participate must come from elsewhere.

This has an important implication for understanding the types of partnerships that develop from grant programs. Our common understanding of partnership is that partners are closely bound to one another, share common goals, share liability and risk, and have a mutual interest in adapting behavior to one another in the pursuit of shared objectives. However, studies have found that organizations tend to require compelling environmental pressures to engage in such potentially invasive relationships (Aldrich, 1999). Absent such pressures we can anticipate a broader range of inter-organization relations appearing under the heading of partnership ranging from high

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\(^1\) MSP is similar to a class of partnerships sponsored by the federal government through grant programs. Other examples, in education include the Manufacturing Extension Partnership sponsored by the National Institutes for Standards and Technology.

\(^2\) The application for a MSP grant under the National Science Foundation’s request for proposals requires specification of a program that is “partnership-driven” where the core partnership is between universities and K-12 institutions. The core partners are to commit to strengthening teaching practices on the university side while K-12 institutions commit to providing an environment in which teachers, administrators and other staff can grow for the long term. Further, the partnership (and its impacts) should last beyond the funding of the MSP.
levels of engagement under collaboration to less interactive behaviors such as coordination (Kamensky & Burlin, 2004).

2. Defining Partnership

Studies across several policy domains tend to agree on the elements that motivate the creation and structuring of a partnership. Teisman and Klijn (2002) provide a useful summary of these elements: a) for an individual actor to achieve goals requires activities by other actors; b) the resources and knowledge for achieving goals are distributed across multiple actors; and c) the systems and processes that develop under partnership are complex because they are dependent upon the negotiations of participating actors.³

However, beyond this basic description, research designs in the study of partnering splinter in a variety of directions emphasizing a large array of distinctive units of analysis and models. These differences stem in large part from definitions applied to the term partnership. The wide variety of approaches has led some researchers to view the term as having limited utility. Atkinson (1999) suggests that partnership cannot be defined outside of specific contexts. Burgos (2004) argues in a similar vein that partnership is a floating and empty signifier that varies in meaning between contexts. Unfortunately, the most common approach studies take is to skip the messy business of formally defining partnership all together. However, several studies have taken up the challenge and can be useful to our understanding of school-university partnerships.

In the context of public education, Boyer (1981) give us a starting place, arguing that partnership is the condition of moving beyond organizational collaboration to a point where common problems are agreed upon, mutual rewards are understood, there is leadership, and a project focus. Goodlad (1988) defines partnerships as collaborative events that grow out of networks of professionals (in education) creating platforms for programs, activities, and projects. Partnerships are both a particular structure and a process through which partners can draw on each other’s strengths. Clark furthers this definition by explaining that networks are not a “deliberately designed, collaborative arrangement between different institutions” (1988, p. 37).

³ Teisman and Klijn use the term actor in an inclusive fashion to refer to organizations or interested stakeholders.
Thus he distinguishes networks from partnerships by their deliberate design, goal orientation, and collaborative nature.

Bennett and Krebs (1994) also make a distinction between project-oriented networks [partnerships] and more general collaborative networks with interests in specific policy areas. Collaboration is the most common term used in definitions of partnership to distinguish them from other forms of group interaction. Researchers frequently apply a romantic ideal when defining partnership as consisting of “mutually collaborative arrangements between equal partners working together to meet self-interests while solving common problems” (Sirotnik & Goodlad, 1988a, p. viii). However, partnership definitions anchored in collaboration often will include additional elements.

For example, partnership is described as a platform for programs and activities. Rather than acting as a focused, well-coordinated, organized entity, partnerships often enable a range of programs and activities, many of which are generated or influenced by local interests that have varying levels of affiliation with the core activities of the partnership. Tushnet (1993) finds that a single partnership may serve as a platform for a portfolio of activities with different programmatic foci, distinguishing between professional development, curriculum development and client participation. Firestone and Fisler (2002) and Gross (1988) find that collaborative partnerships are often formed to create a platform for fundraising to support specific programs and activities sanctioned by participants. Sellgren (1990) takes a similar point of view in referring to economic development partnerships as funding schemes formed around infusions of resources into the local network and given organization through a funded project. Partnerships are embedded within the larger policy network that includes state and federal regulations, mandates, and grants.

This view of platforms is distinct from Goodlad’s who tends to see the professional networks as the platform from which partnerships emerge (1988). In Goodlad’s view a successful partnership is likely to have three characteristics “(1) a moderate degree of dissimilarity between or among partners, (2) the potential for mutual satisfaction of self-interests, and (3) sufficient selflessness
on the part of each partner to assure the satisfaction of self-interests by all involved” (Sirotnik, 1988, p. 178).

Some definitions of partnership stress agreement among participants. Brinkerhoff, writing to the international development community, defines partnership in terms of an exchange between partner organizations. She argues that partnership is “a dynamic relationship among diverse actors, based on mutually agreed objectives, pursued through a shared understanding of the most rational division of labor based on the respective competitive advantages of each partner” (2002, p. 14). However, like Goodlad before her, Brinkerhoff also notes that this is an ideal characterization and that actual partnerships rarely mirror the complete definition. Firestone and Fisler (2002) argue that collaborative partnerships are at their core deliberately designed formal agreements between organizations. Harding (1990, p. 110) goes more broadly calling “any action which relies on agreement of actors” a partnership. Thus, the meaning and structure of the partnership is found in the terms and conditions of the agreement.

Another view of partnership is as a venue for interaction. Rose argues that there exists a “third space” that lies between the state or public and the family or individual (Rose, 1999). Within this space there is an opportunity for interaction that is neither coerced by authority nor based solely on personal influence. It is a space based on mutually beneficial alliances in which negotiations can take place to develop goals, set agendas, and to coordinate actions (Whetten, 1981). Sirotnik and Goodlad (1988a) also use the idea of a venue in a series of case studies to describe partnerships in actual and metaphorical terms. The management of the partnership is based in a particular place like a unit within an IHE designed to coordinate interactions with and among schools or other actors. But a venue is also a metaphor for describing how ideas can come together from various sources, be mixed and mingled, and give birth to new initiatives.

Partnership is also defined, as an evolving public governance structure comprised of a network of actors bound by a web of institutional rules, routines, and customs. These structures may be community or place-based (Bloch, Lee, & Peach, 2003) or they may be based on a network structure that links professionals in their patterns of work (Goodlad, 1988, 1991; Human & Provan, 1997, 2000; O’Toole, 1997; Sirotnik & Goodlad, 1988b). Popkewitz (2004) has such
networks in mind when defining partnerships as reform structures that link schools, communities, and, in some cases, IHE. A theme that links all of the previous definitions together is the idea that a particular partnership is a single event that can be pointed to and recognized as a specific interaction.

As an alternative to definitions that describe partnerships from a single perspective with one correct set of characteristics, we might consider the dual nature of such networked arrangements as, for example, they can be viewed from both within and without. Human & Provan (2000), using the analytic tools of social network analysis, find that it is important to consider both “outside-in” and “inside-out” approaches to generating legitimacy among partners. An observer looking from the outside-in will perceive the partnership as a single entity with which funders and other outsiders interact. These outsiders see the partnership as a particular point of contact, potential recipient of funds, and the party to be held accountable for the use of granted resources. The external legitimacy of the partnership is thus based on a notion of it as a singular entity. Alternatively, the partners (individuals and organizations) observe legitimacy from an inside-out perspective. Buy-in (or lack of it) from network members is important to maintaining and thus defining the partnership over time. Members look to the partnership as a venue for dialog in which their concerns and desires must be addressed. Failure to maintain inside-out legitimacy is therefore likely to result in network instability, and eventual dissolution (Human & Provan, 2000)^4.

Many of the distinctions in the concepts and measures, discussed in the following two sections, flow from these differences in the definition of partnership. In the following sections of this work we organize studies according to the most common elements found in partnership models: (a) the relational structure of the partnership, and (b) the behavioral processes followed by partners as they work in concert (or at cross-purposes). The final section of the study examines the methods and measures used to study partnerships.

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^4 Human and Provan (2000) is a follow up study to earlier work on two wood product industry networks (i.e., Human & Provan, 1997). Two approaches to building legitimacy are explored and both work during network formation (they are described as outside-in and inside-out). The authors noted that legitimacy built from the inside out provides a base from which external legitimacy might be built. However, networks that built based on external legitimacy are hollow and are prone to collapse absent internally generated legitimacy, especially when outside funding ends, as was the case in their study.
3. Relational Structures and Partnerships

Partnerships can emerge from a set of professional relationships among educators in the K-12 and IHE communities. Goodlad (1988) argues that these relationships are best understood as a network of education professionals. The network can vary in the size of the geographical domain but in most cases it has a geographical bound. Members of the network may share a common professional interest in improving school performance, but they are not involved in a “deliberately designed collaborative arrangement” (Clark, 1988, p. 37). They are however, the basic infrastructure that might support the formation of goal directed partnerships. This has led Goodlad and others to advocate that professionals and funding agencies pay attention to developing professional networks in order to create a richer auger for the growth of partnerships.

Studies have found that partnerships are more likely to emerge from such professional networks as partner organizations use their relationships as a means for dealing with environmental conditions and mitigating uncertainty (Stearns, Hoffman, Heide, 1987; Provan, 1984). Many authors make similar observations but do not pick up the explicit language of networks. Instead they favor broader descriptions of the environment in terms of common set of interests, broadly envisioned goals and/or policies (Gross, 1988; Le et al., 2004; Popkewitz, 2003; Williams, 2002), a set of problems requiring a response from multiple organizations (Bloch, Lee, & Peach, 2003), or a set of strategic decisions affecting multiple organizations in complementary ways (Teitel, 2003).

When partnerships are created, studies describe a variety of ways in which the resulting programs and activities are controlled and coordinated. For example, Goodlad describes a partnership from a single organizational perspective as if it is a new institutional entity.

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5 Goodlad (1988) provides the most complete discussion of the structural elements associated with school-university partnerships. The partnerships in his examples create new institutions (Professional Development Schools or Centers of Pedagogy) typically based at an IHE. Goodlad’s centers of pedagogy serve as venues for collaboration and learning and for improving teacher training in the Unites States. National Network for Educational Renewal (NNER) sites have impacted K-12 schools (250+) but little impact on IHE has been documented (see Cole et al., 2002 and Cole & Ryan, 2001 for an exception). Under Goodlad’s model, there is a controlling authority typically based at an IHE that would manage contact among K-12 teachers, arts and sciences, and teacher education faculty.

6 Goodlad’s entity orientation is easy to understand as the partnership form he is most often referring to is a professional development school set up as a new organization to manage the three-way connections between schools, arts and science faculty and education faculty.
describes a core group that performs administrative and coordination functions for the partnership labeling it a “governing board” comprised of senior administrators (e.g., deans and school superintendents) from the partner organizations (1988). This board manages the partnership activities and forms the basis for its interactions with those outside of the partnership. Similarly, Firestone and Fisler (2002) refer to a “steering committee” formed by a school principal and the IHE liaison after it was recognized that an inclusive decision process was needed. Gross (1988) explains that to be successful a partnership needs a central focus with firm and substantial time commitments from partners, financial and secretarial support, top level support from senior administrators, set decision-making processes, and links to others in the network. All of these authors view the management of the partnership as something internal, and centralized as if it is something separate from the partnering individuals and organizations. In contrast, Human and Provan (1997, 2000) describe the establishment of an administrative network which serves the function of providing control and coordination. At times the administrative network is comprised of resources drawn from across multiple organizations and at other times within a single partner organization to manage relations between partners (in their case a partnership among numerous wood product manufacturers for economic development purposes).

Variability in control and coordination structures raises the important question: Who benefits from such structures? Human and Provan’s (2000) work points to internal and external legitimacy benefits for networks. In this case the benefits can accrue to the partnership or to the organizations that comprise it. Provan and Milward (1991) point to a distinction between another two kinds of outcomes from network interactions. First there are the impacts to the partner organizations, what are referred to in the MSP program as elements of organizational transformation. The second type refers to impacts on policy goals or to clients as transmitted through programmatic activity.

It may be difficult to understand what partnerships do and what impact they have by looking at or defining them as a single event, organization, or activity. Tushnet (1993) advances the discussion by noting that the underlying set of professional relationships and policy environments are difficult to conceptualize as single a phenomenon. While Tushnet does not
make the argument explicitly, her study suggests that partnerships inhabit various environments by engaging different networks and/or policy environments depending upon the tasks that they pursue. Thus, a partnership that begins with a professional development focus may experience the need to reach into a new community of professional expertise to engage in community development or curriculum development.

In MSP, and other grant-based programs, benefits to a target population or policy goal are the primary focus of the partnered activities. Thus an integrated structure (as seen from the outside-in) that accepts external resources must be able to use them both internally and more importantly pass them through to the programs being delivered by those outside of the highly integrated components of the partnership. When we start to separate administrative functions from programmatic functions and their clients or target populations, thus reducing integration, we have some activities (the programs) that are supported by the structure but not directly connected to all other actors within the network. Taking this just a bit further, when the separated activities are managed by partners and not actors who report directly to the administrative network we no longer have a single homogenous structure to observe but one that clearly has distinct components that potentially operate in very different ways.

This distance can have both positive and negative consequences. Provan & Milward argue networks will be most effective under “structural conditions of centralized integration and direct non fragmented control” (1995, p 23). Further, they argue that networks that are centrally controlled and organized administratively, and loosely connected at the organizational level, will be more effective than organizations that are both centrally controlled and highly integrated at the organizational level. Dual integration they argue leads to excess complexity and to inefficiency (Provan & Milward, 1995). Therefore, when we look at partnerships structure, an increasing network density measure reflecting more interaction or collaboration may not be a good indicator of goal enhancement or partnership quality (White, 2003).

Additionally, in grant based service delivery programs we have clients receiving programmatic services who may never interact with or be aware of the administrative core of the partnership.
A benefit to creating some distance as Firestone and Fisler argue is that the, “professional community ideal is more feasible in subunits of a partnership than for a whole partnership” (2002, p450). Communication among all units within a partnership, especially a very large one, is likely to consume too many resources to be of great benefit, but communication within programs can be used to coordinate and aid implementation. Simon (1962) argued that tightly linked networks are “deviation amplifying” meaning that tight links spread problems to other units faster than more dispersed units. Alternatively, Human & Provan (1997) argue that loose integration coupled with a lack of direct control (a common situation when dealing with affiliated partners) results in a less effective system.

Partnership platforms vary with regard to the amount of central direction that they exert over programs and activities. This is dependent in part on the stimulus that draws financial support. Often partnerships are formed in the hopes of attracting resources (see Firestone and Fisler, 2002 or Gross (1988) for detailed case studies of such endeavors). In other instances there are outside funds for creating the partnership (Teitel, 1996, Tushnet, 1993; Williams, 2002, Le et al, 2004). When the partnership is the fiscal agent for a grant, this enhances (though, as many case studies have demonstrated, it does not ensure) the capacity and apparent legitimacy of the partnership to act in a directive manner with regard to the associated programs and activities (Yin, 2005).

While individual institutions also have a role to play, the MSP concept suggests that the system will produce benefits that the individual organizations are not capable of providing. Therefore, people in “formal boundary spanning roles have special potential” as leaders that can contribute to the formation of and facilitate communication between professional communities (Firestone and Fisler, 2002, p451) and between the administrative core and program elements of a partnership. The role of the boundary spanner is particularly important as they can fill in the gaps, making connections where formal control structures are absent (Burt, 1982).

The preceding discussion has outlined four broad, interrelated categories of actors within partnerships including, the partner organizations and their representatives, the partnership’s administrative core, the programmatic or service implementation network, and the clients or the
intervention’s target population. The discussion has focused on the way various researches have explored the relationship between structural arrangements and impacts to organizations and/or a programs target population. The following discussion will explore the behavior of actors from within these categories.

4. Operational and Behavioral Approaches to Understanding Partnerships

A thorough review of the behavioral approaches to the study of partnership is made difficult because there are so many potential units of analysis. Partnerships have been conceptualized as entity-based, collaborative decision-making institutions (Leach, Pelkey, & Sabatier, 2002; Leach & Pelkey, 2001; Wondolleck & Yaffee, 2000). In essence, the entire partnership serves as the unit of analysis. The work of Tushnet and Human and Provan make clear that there are distinctive groups at work inside partnerships; some focused on coordinating the efforts of the entire partnership, others focused on specific programs and activities. From this perspective groups and teams of actors may provide the best perspective for observing partnerships. And, from the perspective of organization theory, the organizations and their interorganizational relations provide two more points of view (e.g., Thompson, 1967; Whetton, 1981; Provan & Milward, 2001). We limit our focus in this study to behavioral approaches that explore two or more points in time (formation and operation) and two or more general themes (impact of partnering on the partner organizations and the impact of the system of partnered relations on desired education or policy outcomes).

As we learned in the previous section, the relational structures of a partnership that may lead to organizational change or programmatic outcomes can be observed in an aggregate way through the networks of professionals and organizations. Thus, partnerships can be seen broadly as specific engagements that emerge out of loosely coupled networks of professional affiliation (Weick, 1976). They can be viewed as entities that are distinct from the organizations that developed them, may have their own legitimacy, and may pursue goals that differ from those of the parent organizations. However, educators have also thought of networks and partnerships more broadly as interactive learning communities, and thus venues for idea exchange and the
leveraging of information gathered from outside of their regular operational base (Cohen & Lorentz, 1977).

From a learning community perspective we want to observe the relational, knowledge, and resource exchanges within the education community and, in turn, measure their impact on either partner organizations or program goals. However, one cannot assume that the processes and behaviors exhibited by smaller groups will be the same or even similar to behaviors observed and aggregated across an entire network of partnership actors. The partnership literature is silent on this issue. This is largely an artifact of the evaluative nature of the literature, which privileges case study methods and research designs limited to one program or site. Such approaches allow for observations that blend the behaviors of networks, organizations, groups and individuals in a common narrative thereby obscuring their distinctions.

We can also look at partnership as a collection of behaviors, processes, or leveraged routines (Firestone & Fisler, 2002; Tushnet, 1993; Van de Ven, 1976). From this perspective, partnerships are not so much entities as they are collections of actions given a common label to separate the partnered set of activities from those of regular work (Brinkerhoff, 2002). Here we find a significant distinction between the formation of a partnership and its operation (the implementation of partnership programs). Circumstances and motivations that lead to choosing to partner and to choosing specific partners are quite different from those that enhance the coordination, collaboration, and leveraging functions of the partnership when engaging in its program activities. Organizations may enter into partnerships as a consequence of specific political, legal, regulatory, or board directions or in response to a local need, critical event or due to a special circumstance.

Another characteristic common to studies at all levels of analysis is a curious gap in the research between factors influential for the formation of partnership and factors influential in the operations of partnership (Kingsley and Waschak, 2005). The literature on inter-organizational relations (IOR), has focused on the formation of relationships between and among organizations (Aldrich, 1976, 1999; Isett & Provan, 2005; Whetten, 1981). The evaluation literature on
partnerships tends to focus on the operation of partnerships particularly the programs and activities given sanction by the partnership (Tushnet, 1993).

One concept in the study of partnerships that seems to transcend this multiplicity of potential social actors is collaboration. The preponderance of research posits that partnerships are collaborative in nature. However, partnership studies for the most part do not specify what constitutes collaboration or whether the use of the term is distinctive from near neighbors such as cooperation or coordination. A variety of scholars have tried to make sense of these terms by developing continua for classifying and measuring partnerships (Clark, 1999; Clarke, Davis, & Rhodes, 1998; Crawford, 1998; Goldman & Intriligator, 1990; Pirkis, Herman, Schweitzer, Young, & Grigg, 2001). The continua use a variety terms such as “communication”, “contribution”, “coordination”, “cooperation”, and “collaboration” to distinguish levels of relationships among partner organizations (e.g., Taylor-Powell, Rossing, & Geran, 1998, p5.). However, no field of inquiry has developed a standardized set of definitions or measures for these dimensional properties. While there is little agreement between researchers on the precise definitions or ordering for these terms, there is a sense that an ordering exists, that it is based on intensity of interaction among partners, and that more interaction leading toward collaboration and institutional integration is better and results in a more fully functioning partnership.

Below we describe several concepts that have been used in the study of partnerships and other forms of inter-organizational relationships at multiple levels of analysis. We have organized these into factors into two sections: formation factors and implementation factors.

**Formation Factors**

Embeddedness refers to the history of the relationships among the partners and their key agents. Case studies have found that the inter-organizational and/or professional relationships observed in partnerships can be very long-lived exhibiting varying levels of activity and dormancy depending upon whether the partners have been successful in attracting funds (Barber and Borman, 2004; Fendler, 2004; Gross, 1988; Sirotnik and Goodlad, 1988a). It is not uncommon to see reports in the literature where the partnership or the underlying network has had working relationships for decades. While embedded relationships can be positive or negative, Granovetter
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(1992) argues that embedded relationships are the building blocks that allow organizations to work together. In addition, researchers from various fields have also argued that mutual goals are more likely to be met when partnerships and similar forms of IOR’s are built on embedded relationships (Goodlad, 1994; Gulati & Gargiulo, 1999; Sanders & Epstein, 2000).

A second concept that is used is a strategic need, which refers to anything outside of the organization that will enhance its ability to accomplish goals. Burt (1992) argues that organizations enter partnerships for rational reasons (e.g., to gain resources, increase control or coordination, to gain knowledge or expertise). Thus pursuing fulfillment of a strategic need is one motivation for forming a partnership. Goodlad (1988) for example, pointed out the need for better coordination among teachers, colleges of education, and colleges of the arts and sciences and suggested a new inclusive partnership would fulfill that need.

However, Gulati argues, that a purely rational approach to choosing partners is less important than the existing environment and socially embedded set of relationships (Gulati, 1998). In a study of one educational partnership, Borthwick (1995) reported that in the beginning, members sought to focus on long-range goals, and included individuals at all levels in the process. At formation, they also expected that while their goals might evolve over time, they would continue to work together, and that outcomes would ultimately be consistent with their stated vision. Thus, long term interactions based on trust (embeddedness) can be focused on addressing specific problems (strategic needs) in the context of planning and decision-making. Firestone (2005) argues that a partnership formation can be predicted based on an overlap between complimentary strategic needs emerging from a set of embedded relationships. However, coercion or other environmental conditions may also be factors in the formation of some partnerships.

Brinkerhoff (2002) posits two alternative explanatory dimensions for partnership formation: mutuality in exchange, which encompasses ideals of partnering, and enhancement to organizational identity, which provides the motivation for choosing partners. The greater mutuality in exchange achieved in operations, the greater the likelihood of agreeing to partner and thereby potentially achieving a positive outcome. For example in the Borthwick case study
members expected activities to be “mutually beneficial” involving “give and take” (1995, p. 8). And, when partners perceive that their stand-alone identity is being enhanced there is a greater likelihood of continuing operational commitments and a greater likelihood of desired outcomes being achieved. Complementary partnership goals at the formation of the partnership are likely to enhance the likelihood of developing an effective partnership operation.

Implementation Factors
One factor that influences the operations and outcomes of partnerships is the degree of interdependence that actors have among one another in conducting the agreed upon program of work. Education researchers such as Clark (1988) have drawn from Thompson’s (1967) conceptualization of work interdependence. Pooled work refers to low levels of interdependence as each partner contributes work to partnership outcomes independent of one another. Work is sequential when one partner (or even a program) is dependent upon the work of another partner (or another program activity). This work, in turn, may later be an input for another partner or program’s work. Sequential work has a higher level of interdependence than pooled work. The final level is called reciprocal, which refers to a pattern of work that exhibits the highest level of interdependence. The work of each partner (or even program) is shared back and forth with other partners in a collaborative fashion, each depending on the other to make their contributions in order to create a final outcome. The coordination of partnership work becomes more invasive and more costly as the level of interconnectivity increases. Creating standards can provide coordination under pooled interdependence, and planning will suffice for sequential arrangements but mutual adjustment is required for reciprocal working relationships (Clark, 1988).

Mutual adjustment assumes that there is room for actors to make changes in their operations. However, programmatic interventions (like those managed under MSP) are designed, implemented and evaluated with specific tasks and expected outcomes in mind. We can then argue that a successful program is one that is effective as well as efficiently and equitably delivered. The process of implementing a program assumes that the choice of intervention is already made. Therefore, looking at alternatives is not something that would be done at the program level. While it has been found elsewhere that taking opportunities to explore
alternatives in the face of performance based initiatives is often overlooked (Moynihan, 2005), within a broader partnership context, there are opportunities to debate options and make different choices.

Choice making by organizations is broadly discussed under the heading of organizational learning (Argyris, 1999; Isaacs, 1993; Jacobson, 2001; Senge, 1990). Single-loop learning involves measuring a singular linear operational process. Within partnering, it is trying to find a better way to implement the current program. It is comparable to a process of continuous quality improvement. Double-loop learning however, goes a step further and asks why are we implementing the program in the first place? Are we getting the results we expect? We engage in double loop learning when we take an opportunity to look at other options, to make choices and possibly change what we are doing if we are not seeing progress. This type of learning involves an iterative interaction in a venue (like a professional community, e.g., Firestone & Fisler, 2002) where values, goals and options are evaluated and new choices are made based on evidence gained through practical experience.

Norman Webb defines alignment as “the degree to which expectations and assessments are in agreement and serve in conjunction with one another to guide the system toward students learning what they are expected to know and do” (Webb, 1997, p.3). Alignment is also a measure of how expectations of programs, materials or curriculum translate into assessments of desired outcome measures. For example, poor alignment would refer to assessment measures that do not accurately reflect the topics taught in the curriculum. In addition to gauging the alignment of curricula to assessment tests, alignment might also be taken more broadly to include the behavior of the partnership’s individuals, groups, and organizations interacting at varying levels. For example, Provan and Milward (1995) refer to the alignment of services with the needs of clients in a system of healthcare providers. In their study they noted that, in addition to system structure, control mechanisms, environmental conditions, and sufficient resources were important partnership effectiveness.

From a behavioral perspective, partnerships can be conceptualized as actors (by what they do), as processes (by what is done through them), or as venues for action (by what is done within them).
As an entity, partnerships can administratively take action, facilitate action or be the venue for interaction among other actors. As interaction, partnerships are a series of relationships and events that are strung together to impact a desired policy goal. Our choice of perspective and observation point within the partnership structure will impact what we can measure and what meaning we can draw from our observations.

5. Evaluating Outcomes of School-University Partnerships

School-university partnerships have become an important part of the education community. However, the methods used to evaluate these partnerships vary. Few educational partnerships use rigorous scientific-based methods to evaluate specific outcomes of their programs, although that number is increasing. Most favor descriptive case studies, analysis of perceived benefit, or, in a few cases, the continued existence of the programs as methods of evaluation. The reasons for the different evaluation methods, difficulties in evaluating the outcomes of an education partnership, and the lack of consensus on evaluation are each significant to understanding the impetus behind our study.

The literature on Professional Development School (PDS) activities does include scientific-based evaluation methods and clear outcomes. PDS draws from a structured field of research in education: teacher instruction and professionalism. In this field, gender studies and critical theories have been influential in pushing approaches towards empowerment and action/participatory research approaches (Darling-Hammond, 1994), so the collaboration implied in partnering appears conceptualized more broadly within that frame. Wiseman and Knight (2003) identified two evaluation strands of focusing on different outcomes. One proposes change in the instruction practices of teachers as an outcome (Teitel, 1997; Firestone, 2002; Borthwick, 1995). The other strand attempts to pioneer studies that measure improved educational achievement of students as an outcome (e.g. better test scores, lower drop out rates) (Wiseman and Knight, 2000).

There are studies that are based on the Holmes Group Partnership publication (1986) that focus on processes, pre-service and in-service teacher perceptions, and program features such as the
work done by Abdal-Haqq (1998) and Book (1996) studying professional development in schools. The work on partnership formation led to identifying some differences in the ways schools and universities go about their work. It was found that partnership formation increased opportunities for future teachers to be involved in school settings (Shen, 1994; Teitel, 1997; Yerian & Grossman, 1993) and that partnering allowed for more collaborative professional development activities for both teachers and university faculty (Book, 1996).

A second set of articles analyzed the perceived benefits of participation in joint inquiry for school and university faculty. Darling-Hammond (1992) authored one such study that examined the impact on teachers, future teachers, and, to lesser extent, university professors as well as how schools and universities change as a result of their collaboration. Program evaluation literature seems to be drawing more from stakeholder evaluation and the need for formative evaluation more generally (Brinherhoff, Jacobson, Holland; Stevens, 1999). In particular, Stevens (1999) highlights the fact that some of the outcomes used in partnership evaluation may be merely superficial achievements and that most literature on PDS partnerships focus on mature settings, not how the program developed and what it overcame. A common theme is that measuring outcomes is quite complex since outcomes are different for the different partners involved. Additionally, the goals are also different for the different partners.

The literature suggests that partnerships between K-12 and IHE bring changes to the usual operating rules for the actors involved, as K-12 schools and universities have different hierarchies. Two separate studies argue that K-12 and IHE partnerships face obstacles for true collaboration since the organizational cultures of both are very different, resulting in a high potential for conflict. (Stevens, 1999; Sandoval, 2001) This concept helps explain why programs may fail or cease to continue even if both partners are committed to the same goals.

In literature on community and/or urban school partnerships, monetary resources gained through partnership opportunities continue to be used as an outcome measure (Borthwick, Stirling, & Cook, 2000). However, participants tend to identify the benefits of partnering broadly in terms of enhancing the quality of life within a community. Thus, instead of a standards based evaluation, perspective programs implemented through partnerships are deemed effective simply by serving
the community or by providing opportunities to interact. One measure of partnership success, the importance of which is difficult to evaluate, is the continuation of the partnership itself. However, a positive outcome for a partnership can be the continuation of the partnering process. Since desired outcomes are often vaguely identified or difficult to measure, evaluations can become trapped in their reflection upon partnerships. Russell and Flynn (2001) present this recursive argument with a conclusion that the journey is equally important to the destination and that working together becomes an end in itself.

There has been a recent political movement to change from the traditional methods and philosophical approaches used to evaluate STEM programs to instead pursue more experimental methods for evaluation. STEM program evaluation is favoring experimental designs that have the potential to demonstrate causation that can be attributed to programmatic activities. Lawrenz and Huffman (2006) attribute this emphasis on scientific evidence to a larger national educational accountability movement, including the No Child Left Behind Act of 2001. They also argue that recent advances in STEM evaluation go beyond randomized controlled experimentation and include mixed-methods evaluation, multi-site evaluation, and include elements of cultural competency. Methodological pluralism is inherent in STEM educational evaluations according to Lawrenz and Huffman. Although specific “scientific” approaches to evaluation should be considered and clear outcomes need to be measured, these tools are most effective when paired with additional assessments such as participant surveys or case studies that allow evaluators to look at the complexity of a program.

6. Observing and Measuring Partnerships

One of the greatest difficulties in evaluating the impacts of partnerships and programs on desired policy goals is measuring and discerning the partnering impacts as distinct from other environmental factors. It is not uncommon for partners to attempt to seek synergies from the internal operations and innovations of one partner organization. A common form of this is to “piggyback” partnership programs and activities onto existing programs and working relationships within partner organizations. There are distinct advantages to building within existing organizational operations as the barriers to entry for a new program can then be much
lower. However, it also becomes much more difficult to develop measures that distinguish the influence of the partnership program from the normal work patterns of the partner organizations.

It is, therefore, not surprising researchers often avoid the causation question, as authors from several fields have pointed out, by rarely evaluating outcomes (Gulati & Gargiulo, 1999; Kingsley & Melkers, 2000; Provan, & Milward, 2001; Riggin, Grasso, & Westcott, 1992). The links between partnerships and effective programs and between program level activities and desired outcomes are poorly understood. Many studies focus on measures of process because such data is easier and more straightforward to collect. Since conventional wisdom suggests that partnering will have a positive impact on program level goals we might simply look for evidence of partnering and assume that impacts will be positive.

Current approaches to observation are better for establishing whether a partnership exists and the level interaction among the partners, than for serving as a vehicle for measuring actual outcomes from partnership. Among the most common strategies for capturing and conveying the dynamics of partnerships is the narrative case study (Franklin, Bloch, & Popkewitz, 2003; Sandoval, 2001; Sirotnik & Goodlad, 1988a). Case study narratives describing the creation and operation of a partnership skirt many of the unit of analysis problems noted above by treating the entire partnership as a case and describing the interaction between networks, organizations, groups, and professionals within the partnership (see collections of cases by Franklin, Bloch, and Popkewitz, 2004; Bodilly et al, 2004; Sirotnik & Goodlad, 1988a; Tushnet, 1993). Descriptions tend to be practitioner and evaluation oriented, focusing on whether a partnership existed, how it operated, and, if it can be shown, its impact.

Another common approach can be described as a tool-box or checklist aimed at facilitating practice (Ramaley, 2003; Ravid & Handler, 2001). In this approach practitioners identify a series of factors indicative of partnering or desired outcomes and then collect data from participants, teachers, students, or administrators (Borthwick et al., 1999). Once the lists of common characteristics are created, efforts are made to determine whether a factor is present in the current project or not (Borthwick, 1995). This approach is accompanied by a list of criteria organized as a checklist for “good” partnering activity. Thresholds are often suggested so that measures can
be used to see if the project fits a normative definition of successful, equitable, excellent, or efficient. Alternatively, a matrix of criteria can be developed and used across the lifecycle (e.g., during planning, implementation, and assessment) of the intervention so that all factors may be evaluated over time (Kemshall & Ross, 2000).

Expanding on the checklist approach to measuring partnerships is developing a scale for the level of partnering in an intervention. This type of measure will allow for differing levels of engagement that partner organizations may have with one another. The most common approach of this sort is to ask participants of a partnership to rate the level of engagement or satisfaction they have experienced on a five or seven point likert scale. For example, the Center for the Advancement of Collaborative Strategies in Health has developed a web-based likert scale resource for partnership assessment (2006). This tool will develop an index which sums up the number of factors present and is used to create a numeric predictor of whether a partnership will (a) operate and (b) be effective. Likert-based approaches make the implicit assumption that there is a continuum of levels of engagement that is observable. The mean is interpreted as the average level of engagement for the partnership and variance captures distribution of experiences across the partners. These measures assume that respondents have a clear understanding of the meaning of the terms used to differentiate levels on the continuum and that the definitions provided by the research team are internalized and used in responses to the likert scale.

Researchers have conceptualized partnership as an organizational relationship comprised of many tasks and forms of interaction (See for example, the Health Partnership Index built during the Plymouth Study, Halliday, Asthana, & Richardson, 2004). Instead of conceptualizing partnership as the high end of a continuum of engagements (e.g., competition, coordination, collaboration), it is argued that all of these forms of interaction are likely to be present. Likert scales are used to assess the degree to which respondents perceive that different forms of interaction are taking place. From these responses an index is constructed of the level of interactivity occurring in the partnership for different tasks or in different locations. The advantage of this approach is that it avoids making judgments about what kind of interaction is best or ought to be used and focuses on differences that can then be compared.
The evaluation methods discussed so far lack mechanisms to measure the interaction effects of partnering as distinct from the regular operations of the local educational environment. Social network analysis based on the assumption that the structure of networks affects how they work, is an attempt to fill that gap (Burt, 1982; Scott, 2000; Wasserman & Faust, 1994). This method uses relational measures and is supported by analysis tools and formal concepts that allow us to observe and represent the connections and interactions of networks of actors. It can be used when the partnership includes small and large networks of actors (individuals, groups or organizations) and focuses on relational data. Actors are nodes; ties between actors are edges or links. Here the intention is to describe the social structure of the partnership or the partnership within a larger community in terms of the density of the ties and the centrality of various actors (Brandes, Kenis, & Wagner, 1999). Density refers to the number of links between actors while the number of connections passing through a certain node determines its centrality. Ties can be considered strong or weak based on the density of the connections (Granovetter, 1973). This approach is just beginning to be used in education partnership studies. However, networks studies and organizational chart approaches tell us only so much. They show us how and through whom partners interact and therefore where to look for partnering impacts but do not help us to measure them.

Game Theory has the potential for helping us test certain assumptions about partnership formation and operation and about potential outcome advantages. This method has not been applied in studies of education partnerships. However, the approach has shown promise in other policy domains (McQuaid, 2000). There is a long history of games being used to study cooperation, competition, and coalition building (Ford, Wells, & Bailey, 2004; Nash, 1951, 1953; Roth, 1979; Sandler, 1999). Games seek to explain whether actors partner or defect and focus on incentive compatibility. They can also be used to explain how networks expand through contact with others as in disease models (Schroeder & Rojas, 2002). Potoski and Prakash (2004) point out the effectiveness from a game theory standpoint of repeated face-to-face interactions on increasing trust among partners while Langbein (2002) found that rulemaking was more responsive to stakeholders when negotiated in a collaborative venue but that the results may be

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8 Relational data include, for example, frequency of contact between actors, length of association, intensity of interactions, and the centrality of an actor with respect to a set of interactions with others.
more unequal than conventionally written rules. Such inequality is predicted by game theory to improve as extended interactions [games] occur (Axelrod, 1984). Using game theory, Cooper used simulations to show that fixed partnerships enable coordination for efficient outcomes but will breakdown if they will lead to inefficient outcomes (Cooper & Wallace, 2000).

7. Implications for Practice and Research

Studies of partnership have tended to concentrate upon identifying the complicated relational structures amongst actors and in describing processes and behaviors found in the work performed under the auspices of a partnership. This body of research and evaluation has identified numerous cases of partnership in which the participants were able to identify the ways in which their work together had fundamentally influenced the capacity of actors to engage in education (or, for studies in other policy domains, achieve policy objectives). By conducting several comparative case studies, researchers have identified behaviors that seem to contribute to successful and unsuccessful outcomes.

With less frequency studies have attempted to relate the relational structures and behavioral processes associated with partnerships to measures of the outcomes of partnership work. A more common approach has been to use success or failure in outcomes as a basis of case selection. In reviewing the body of the case literature there are several different ways in which partnership are thought to have positive outcomes.

Diffusion Hypothesis: By stimulating learning in a sufficient number of members in a target group you increase the likelihood that the programs and activities created by the partnership will be adopted and reinforced by the group. This can be further enhanced if the target group feels that the “treatment” that they are receiving has been adapted to the needs of their working environment. Thus, the greater the interactivity of the target with the administrative and/or operational network the greater the likelihood of adoption and use (for example, by making the target school special it was expected that lessons learned would be spread throughout the school
system see Firestone & Fisler, 2002; for an example of how a negotiated process can lead to the
dispersion of ideas though a system see Allexsaht-Snider, Deegan, & White, 1995).

New Resource Hypothesis: the partnership brings a unique collection of resources for the target
group that represents a new input to their way of thinking. For MSP’s this is embodied in the
form of requiring that Arts and Sciences faculty must be a part of the outreach to the target
groups (for example see Goodlad, 1988, 1991, 1994; Clark, 1988, 1999; Teitel, 1997;
Osguthorpe, 1996; Gross, 1988; Cole & Ryan, 2001; Borthwick, 1995; Borthwick, Beverly,
Burnett, Nauman, Patay, & Pistorio, 1999; Borthwick, Stirling, & Cook, 2000; And for an
example of a top-down combined with a bottom-up approach to allocating and designing reform
see Ross, Sanders, Wright, Stringfield, Wang, & Alberg, 2001; and for a more general discussion
of outside-in and inside-out concepts see Human & Provan, 2000).

Alignment Hypothesis: Schools are complex institutions that have several layers of
administration that contribute to the working requirements and the incentives in which target
groups operate. A key issue is whether the program or activity being delivered is in conflict or
alignment with existing administrative procedures, incentives and assessments. If they are not,
then does the program engage the levels of administration that are responsible for the alignment
of procedures, rules, and incentives so that alignment can be achieved? This is particularly
important when specific client services are to be supplied (for example in combining networks of
healthcare providers see Provan & Milward, 1995; and in education on the alignment of
language on instructional terms and cultural differences see Sandoval, 2001).

Learning Community Hypothesis: The existing system for educating and training math and
science teachers at the K-12 and IHE levels needs to have greater alignment of values and
approach to pedagogy. This will be best observed through indications that K-12 schools,
districts, and IHEs are in better communication with one another at a strategic level, that math
and science education at the K-12 level values content more, and that IHE values outreach to
schools and pedagogy more (this is often accomplished by creating new venues for interaction
like schools of pedagogy or professional development institutes; see for example Goodlad, 1988,
1991, 1994; Clark, 1988, 1999; Teitel, 1997; Osguthorpe, 1996; for creating venues for
community problem solving see Leach, & Pelkey, 2001; Lasker & Weiss, 2003; and in business on learning organizations see Overmeer, 1997).

However, most case studies do not discuss the interaction effects of the relational structure of the partnership with the behaviors and processes observed. This seems to be an artifact of the dual organizational nature of educational partnerships funded through grant programs. In most cases there seems to be a core partnership group which then encourages and influences the work of small work groups or teams focused on specific programs and activities (Tushnet, 1993). But most studies of partnership tend to acknowledge the existence of the core partnership and focus on the work of the programmatic groups to assess whether outcomes are being achieved. This provides a poor understanding of how relational structures and behavioral processes interact to create outcomes.

The development of concepts distinguishing between a partnerships administrative core and the network service providers (Human and Provan, 1997; Provan and Milward, 2001) provides a useful language to discuss the interaction between the partnership and programs and may provide a more formal way of approaching Tushnet’s conceptualization of platforms. Such an approach provides a foundation for exploring key questions of partnership performance: Who is expected to coordinate the various programs being delivered to the target groups or population and at what level? Is the partnership a decision-making or controlling entity responsible for some integration of programs? How is the target population for partnership programs supposed to put it all together after being exposed to the individual programs activities?

We can hypothesize that partnerships that assist the target groups in integration of programs are more likely to achieve outcomes (and even impacts). However, there is a temptation for the organization that has the bulk of the resources to dictate the terms of the partnership. This will be observed in the amount of the monies distributed and in the effectiveness of the principal funded partner to export their operational rules and procedures onto partner organizations. Negative behaviors of this sort are likely to hinder the effective operation of the partnership, as there will be an absence in the mutuality of the exchange.
With MSP, the process of implementing a program assumes that the choice of program is already made, as is the case with grant-based educational partnerships. Therefore, venues for looking at alternative programs are not something that would necessarily be needed in this context.

However, within in a broader partnership context there is an opportunity to debate options and make choices. It has been found elsewhere that taking opportunities to explore alternatives in the face of performance based initiatives is often overlooked but can be beneficial (Moynihan, 2005). While we make note of the strong normative assumption that there exists a collaborative advantage to highly integrated partnerships, (Huxham, 1996) we must not discount the importance of coordinating activities and of leveraging local advantages.
Alternative Approaches to Evaluating STEM Education Partnerships

References


Alternative Approaches to Evaluating STEM Education Partnerships


Alternative Approaches to Evaluating STEM Education Partnerships:
A Review of Evaluation Methods and Application of an Interorganizational Model

(NSF 02-061 Award #: 0231904)

Exploring Federal Government Use of Partnerships

March 31, 2008

Prepared by

Jeff Jones

Georgia Institute of Technology

This paper reports on the findings from the National Science Foundation sponsored Research, Evaluation, and Technical Assistance (RETA) project (NSF 02-061 Award #: 0231904): Alternative Approaches to Evaluating STEM Education Partnerships: A Review of Evaluation Methods and Application of an Interorganizational Model. Gordon Kingsley, Principal Investigator, Dara O’Neil & Marion Usselman – Co-Principal Investigators
Alternative Approaches to Evaluating STEM Education Partnerships
Alternative Approaches to Evaluating STEM Education Partnerships

Exploring Federal Government Use of Partnerships

Why Are We Interested in Partnerships?

Recently, members of both the government and private sectors have come to value the expertise and experience that collaboration brings to their endeavors. The phrase “public-private partnership” has even become a buzzword and is ubiquitous in the contemporary public sector. Our study, with its focus on understanding how partnering influences educational outcomes in science, technology, engineering, and mathematics, is no exception to this phenomenon. We have studied policy ventures in which partnering is being stimulated for a specific reason—to achieve a policy-related goal. Many federally-funded arrangements exist in which parties receiving federal funding are asked to work together using their own particular strengths and skill sets to generate results for the sponsoring federal agency. Such arrangements have a host of advantages: they prevent duplication of effort and encourage more efficient use of resources and human capital; they open communication and encourage collaboration among stakeholders and community members; and they often provide a field lab for testing new innovations. Understanding how partnerships generally fit into the universe of federally-sponsored programs can help us better understand how our study fits into the larger picture of federally funded public-private collaboration.

Why Evaluate Partnerships?

In order to get the most value from the process of working in partnership, sponsors and participants need to understand which methods and practices lead to success and which lead to dysfunction. To gain this understanding, sponsors must develop evaluation methods and metrics to discern whether partnerships are delivering the results that are important to them—the particular policy outcomes they are seeking to achieve and the kinds of behavior they are trying to encourage. Evaluations of partnership practice are usually performed at the end of a project when participants share lessons learned. However, it may also be beneficial to perform them while a project is still ongoing in
order to determine whether goals are being met and to more reliably capture information, enhance productive practices, and correct problems. Evaluations provide the security of accountability for all members of the partnership, and evaluative reports can serve as knowledge-sharing tools for partners by increasing their awareness of how goals are being pursued and relationships are working. In the best situation, a good partnership evaluation report will not only help enhance the effectiveness of the partnership it evaluates, but it will also provide a resource for future policy actors working toward similar goals or pursuing similar collaborative relationships.

Searching the Federal Register

In order to develop a general idea of how the practice of partnering has been developed and emphasized by federal agencies over the past decade, we turned to the Notices of Funding Availability (NOFAs) published in the Government Printing Office’s Federal Register. NOFA are published by federal agencies and departments who wish to make funds available to parties outside their organization to pursue specific endeavors—usually research or economic development—related to the public welfare. For example, the Department of Commerce has published NOFAs advertising financial assistance for research projects aimed at improving the stock of Chesapeake Bay fisheries. Since 1988, the Office of Management and Budget has required that public notice be made of all federal awards. The Office of the Federal Register has tracked such notices and archived them in its online database. Although the Federal Register does not account for all federal program grants available during the years we searched, it contains enough historical information to enable us to develop an idea of how partnering is being practiced among federal agencies’ sponsored programs.

We pulled from the Federal Register all NOFAs published between 1993 and 2005, and searched among these for notices that included a specific focus on partnering. We searched specifically for notices whose language included at least one of the following words:

• “partnership”
Alternative Approaches to Evaluating STEM Education Partnerships

- “collaboration”
- “coordination”
- “cooperation”
- “network”
- “systemic”
- “coalition”
- “consortium”

Our search returned 1,154 results published by 25 federal departments and agencies; 846 of these included partnership language.

**Chart 1—Percentage of NOFA With Partnering Requirements, 1993-2005**

As the figure above illustrates, the percentage of NOFA published between 1993 and 2005 that include partnerships fluctuates but remains above 50%, with partnering requirements increasing in incidence between 1994 and 1998 and declining from 1999 to 2001, after which they again rise slightly. Likewise, the total number of NOFA that included partnership requirements rose slightly between 1996 and 2002 and peaked dramatically at 140 in 2003 before declining to 78 in 2004.

**Identifying Partnership Trends through NOFAs**
Not all NOFAs invited partnership activity in the same way. Some included existing partnerships as a criterion for funding eligibility; others required that the proposed program include the use of a partnership to achieve its goals; and others made rhetorical mention of partnerships as a valued or desired tool or outcome but did not specifically require their inclusion in the program.

Following the general typology of their partnership language, NOFA were coded for “eligibility criteria,” “program criteria,” or “rhetorical mention” according to their use of partnership language. A notice coded positively for eligibility would stipulate that funding applications come from parties in partnership or include clear partnership or coordination requirements as a condition of aid disbursement. A notice coded positively for program criteria would require active cooperation between partners during the execution of the program being sponsored (note that the cooperation must be between the grantee and another party other than the grantor agency). A notice would be coded positively for rhetoric if it made mention of partnering or cooperation but did not explicitly require partnering for funding eligibility or define how partnering should be used in pursuit of programmatic goals. These three criteria were not mutually exclusive—a NOFA could be coded positively for all three criteria or for none.

**Table 1—Partnership Criteria Frequency by Year, 1993-2005**

<table>
<thead>
<tr>
<th>Year</th>
<th>Eligibility Criteria</th>
<th>Program Criteria</th>
<th>Rhetorical Mention</th>
<th>All Partnership Language</th>
<th>Partnership Language as % of Total NOFAs</th>
<th>Total NOFAs</th>
</tr>
</thead>
<tbody>
<tr>
<td>1993</td>
<td>4</td>
<td>10</td>
<td>24</td>
<td>41</td>
<td>63%</td>
<td>65</td>
</tr>
<tr>
<td>1994</td>
<td>7</td>
<td>9</td>
<td>30</td>
<td>45</td>
<td>52%</td>
<td>86</td>
</tr>
<tr>
<td>1995</td>
<td>9</td>
<td>14</td>
<td>40</td>
<td>60</td>
<td>84%</td>
<td>71</td>
</tr>
<tr>
<td>1996</td>
<td>13</td>
<td>13</td>
<td>32</td>
<td>48</td>
<td>66%</td>
<td>73</td>
</tr>
<tr>
<td>1997</td>
<td>13</td>
<td>15</td>
<td>38</td>
<td>61</td>
<td>68%</td>
<td>90</td>
</tr>
<tr>
<td>1998</td>
<td>6</td>
<td>15</td>
<td>48</td>
<td>66</td>
<td>72%</td>
<td>92</td>
</tr>
</tbody>
</table>
Table 1 illustrates that the annual number of NOFAs posted to the Federal Register increased almost linearly from 1997-2003 before nearly halving in 2004. This steep reduction in the number of NOFAs published coincides with the popularization of “SuperNOFAs” that included multiple notices of funding within individual publications in place of individual NOFAs for each individually sponsored program. Additionally, in late 2003 federal agencies became required to post all their competitive grant opportunities on the newly-formed Grants.gov website, thus making the practice of publishing in the federal register redundant. The overall incidence of partnership language in NOFAs remained fairly constant between 61% and 73% for all years except 1994 in which partnership language was unusually low at 52%, and the following year, 1995, in which partnership language was unusually high at 84%. Likewise, the relative frequency of the types of partnerships to each other remained essentially the same, with eligibility criteria being by far the most rare in most years, and rhetorical use of partnering language remaining quite high.

**Chart 2—NOFA Coded for Eligibility, Program, and Rhetorical Criteria**
The chart above illustrates the frequency with which the 1154 NOFAs were coded positively for having each of our three types of partnership language. Of 846 NOFAs with partnership language between 1993 and 2005, 88 used partnering as a requirement for funding eligibility; 200 incorporated partnering into the program requirements; and 558 made rhetorical references to partnering as a tool for programmatic goal achievement or as a desirable outcome.

We can infer that the agencies posting to the federal register were interested in the idea of partnering and understood that partnerships could be a valuable tool to accomplish programmatic goals. However, they were much less aggressive about actually defining what partnerships look like or how partnerships should function in the context of policy work.

Identifying Departmental Trends through NOFAs

From 1993 to 2005, the highest frequency of partnership was found among NOFAs published by the Departments of Health and Human Services, Housing and Urban Development, and Commerce followed distantly by the Departments of Agriculture, Labor, Transportation, the Treasury, and Justice. Other agencies that published low numbers of partnership-relevant NOFAs from 1993-2005 included the departments of Defense, Energy, State, the Interior, Veterans’ Affairs, the Federal Emergency
Management Agency, the Environmental Protection Agency, the Social Security Administration, and the National Science Foundation.

As the tables below indicate, three federal agencies in particular showed a much higher incidence of NOFA posting than did the rest of the higher-frequency agencies—the departments of Commerce (n=227), Health and Human Services (n=310), and Housing and Urban Development (n=263). Table 2 shows the total number of NOFAs posted by the agencies with the highest number of publications between 1993-2005, broken down according to the number of NOFAs in which the three types of partnering criteria were used.

Table 2—Partnership Criteria Frequency for Selected Agencies, 1993-2005

<table>
<thead>
<tr>
<th>Agency</th>
<th>Eligibility Criteria</th>
<th>Program Criteria</th>
<th>Rhetorical Mention</th>
<th>Total NOFAs 1993-2005</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dept. of Agriculture</td>
<td>0</td>
<td>2</td>
<td>34</td>
<td>66</td>
</tr>
<tr>
<td>Dept. of Commerce</td>
<td>7</td>
<td>43</td>
<td>119</td>
<td>227</td>
</tr>
<tr>
<td>Dept. of Health and Human Services</td>
<td>25</td>
<td>68</td>
<td>148</td>
<td>310</td>
</tr>
<tr>
<td>Dept. of Housing and Urban Devel.</td>
<td>30</td>
<td>25</td>
<td>129</td>
<td>263</td>
</tr>
<tr>
<td>Dept. of Justice</td>
<td>6</td>
<td>7</td>
<td>12</td>
<td>29</td>
</tr>
<tr>
<td>Dept. of Labor</td>
<td>6</td>
<td>22</td>
<td>30</td>
<td>53</td>
</tr>
<tr>
<td>Dept. of Transportation</td>
<td>5</td>
<td>6</td>
<td>2</td>
<td>11</td>
</tr>
<tr>
<td>Dept. of the Treasury</td>
<td>0</td>
<td>0</td>
<td>7</td>
<td>36</td>
</tr>
<tr>
<td>Total NOFA</td>
<td>74</td>
<td>44</td>
<td>502</td>
<td>1154</td>
</tr>
</tbody>
</table>

Table 3 is useful for comparing the kinds of partnership language favored by each federal agency and the degree to which they are favored. While a relatively small percentage of most agencies’ NOFAs made partnership a requirement for applying for funding, the Department of Transportation required partnership as a condition of funding 45% of the
Partnership in general was ubiquitous among notices posted by the DOT. The Table 3 is useful for comparing the kinds of partnership language favored by each federal agency and the degree to which they are favored. While a relatively small percentage of most agencies’ NOFAs made partnership a requirement for applying for funding, the Department of Transportation required partnership as a condition of funding 45% of the time. Along the same lines, the Department of Transportation (DOT) had 54% of their NOFAs include partnership requirements as part of their program requirements. Partnership in general was ubiquitous among notices posted by the DOT. The Table 3 is useful for comparing the kinds of partnership language favored by each federal agency and the degree to which they are favored. While a relatively small percentage of most agencies’ NOFAs made partnership a requirement for applying for funding, the Department of Transportation required partnership as a condition of funding 45% of the time. Along the same lines, the Department of Transportation (DOT) had 54% of their NOFAs include partnership requirements as part of their program requirements. Partnership in general was ubiquitous among notices posted by the DOT. The Departments of Justice and the Treasury show much lower rates of partnering language than their federal counterparts. The department of Labor leads in terms of percentage of NOFAs with partnering language and shows a very high focus on program criteria at 41%. The Departments of Transportation, Labor, and Housing and Urban Development seem to be leading the way in the use of eligibility criteria for program funding. Likewise, Transportation, Labor, Health and Human Services, and Commerce stand...
above the other agencies in terms of the degree to which they have integrated partnerships into their sponsored programs.

**Partnership Evaluation in Practice**

**Identifying Partnership Evaluations**

Our study focuses on how the STEM education community evaluates partnership performance. To put our research into context, we wish to understand how federal agencies evaluate the practice of collaboration in the programs they sponsor. What kinds of methods and measurements do sponsor agencies use to evaluate existing or completed partnerships and to direct future partnership formation?

In order to get a sense of how partnership evaluation is practiced, we used a two-pronged approach. First, we conducted online searches of the websites of the specific federal agencies that showed up most frequently as sponsors of NOFAs in the federal register. Next we conducted a general web search of all “.gov” websites. From these searches we obtained a sample of 45 federal program reports and websites—many of which turned up in both searches—that made reference to the use of partner relationships or partnering practices as part of their activities. If these programs had been present in the NOFA data set, they would all have been coded positively for partnership eligibility criteria, program criteria, or both. The federal agencies represented by programs in our sample included the Departments of Agriculture, Commerce, Energy, Education, the Interior, Labor, Health and Human Services, Housing and Urban Development, Transportation, Veterans’ Affairs, NASA, the National Institutes of Health, the National Institute of Standards and Technology, the Social Security Administration, the Government Printing Office, and the Environmental Protection Agency.

The Department of Health and Human Services (HHS) was represented most frequently with seven out of 45 results. Likewise, the Department of Commerce sponsored 6 programs in our sample. The Departments of the Interior and of Housing and Urban
Development (HUD) had four each. These results roughly correspond to what we would expect from the departments of Commerce, HUD, and HHS, which were most frequently represented among the NOFAs from the Federal Register.

**Policies on Partnership**

Agencies evaluate their programs and collaborations based on their expectations of the outcomes. Almost all of the agencies represented in our sample expressed in their evaluations a policy or perspective on the usefulness of working in partnership and what they hoped it would help them achieve. Most held at least some of the following assumptions: that partnering would increase knowledge-sharing and innovation; that it would reduce waste and duplication of effort; that it would expand their ability to involve the community and respond to stakeholder concerns; that it would allow participating organizations to specialize according to their strengths; and that it would improve the quality of programmatic outcomes. All the materials that mentioned partnership referred to it positively as a useful tool and encouraged it as desirable behavior.

**Elements of Partnership Evaluation**

We coded the sample for a number of key attributes related to evaluation:

- **sponsoring federal agency**: chosen so we could observe trends across agencies should any emerge;
- **formative or summative perspective on the partnership being evaluated**: to observe how partnership evaluation is practiced at different intervals on the timeline of partnership activity;
- **qualitative and quantitative evaluation criteria**: to observe how sponsoring agencies expected partnership performance to be measured;
- **references to more than two partners participating in the program**: to observe trends in the breadth of partnership activity;
- **primary evaluative focus on partnering as opposed to programmatic**
achievements: to note that the materials being coded were in fact substantively engaged in the kind of evaluation we were interested in— that is, evaluation of the practice of collaboration; and

- presence of a stated policy or perspective on how partnership would contribute to program goals: because partnership success will be evaluated based on what is expected of the partnership to begin with.

Chart 3—Percentage of Programs Using Selected Partnership Evaluation Methods

Chart 3 illustrates the extent to which our selected methods were employed by the programs in our sample. 51.1% of the sample represented formative material; that is, material that provided suggestions and requirements for forming, and later evaluating, a new partnership. Likewise, 48.9% represented summative material, which evaluated the performance of partnerships who were in the process of or who had already completed work on their policy goals. 91.1% used or advised using qualitative measurements to evaluate and form partnerships compared to 62.2% using quantitative methods. This does not necessarily mean, however, that quantitative evaluation methods are used less frequently than qualitative methods. In formative cases, the instructions for evaluating a partnership are written in such a way as to necessitate some qualitative analysis; however, they can be answered quantitatively as well at the discretion of the evaluator.
57.8% of our samples referred to the presence of more than one public or private organization partnering with the sponsoring federal agency. Interestingly, of the 45 examples in our sample, only 44% of them focused primarily on evaluating how their partnerships worked in practice as opposed to focusing on how the partnerships achieved their goals.

Few patterns were evident among the individual agencies apart from their primary focus—or lack thereof—on partnerships as opposed to programs and their references to partnerships with greater than two parties. Most agencies referred to multi-party partnerships at least half of the time; however, only two out of seven Health and Human Services programs and one of three EPA programs did so. Health and Human Services, along with Labor and Transportation, had the highest percentage of reports with a high primary focus on partnership—71.4%, 100%, and 100% respectively. Only the National Institutes of Health and Standards and Technology had no evaluations primarily focused on partnership.

**Partnership Evaluations vs. Program Evaluations**

One recurring issue that emerged in the process of surveying the evaluation materials was the often vague definition and function of a “partnership evaluation” as opposed to a “program evaluation.” Our study regards partnership evaluations as analyses of the function and structure of relationships among partners. On the contrary, program evaluations refer to summations of how well a program achieves its goals. Although achievement of desired outcomes does matter in partnership evaluations, it matters in the context of helping the observer understand the workings of the partner relationship.

There seems to be confusion in the application of the language at the agency level, as “partnership” is frequently used as a synonym for “program.” Use of the term “partnership” in this way does not fit with the typology of partnering as a tool to enhance programmatic achievement—a contributor to, but separate from, the programmatic end in
itself. Frequently in our survey materials, individuals and agencies who believed they were evaluating a partnership were actually evaluating the program in which the partnership was embedded. Although there may have been attention given to what the partnership accomplished for the program, there was often little or no substantive attention given to how the functioning of the partnership contributed to program accomplishments. Groups which evaluated partnerships after the fact would talk about the ways in which the partnership succeeded or failed in its goals but not how it worked organizationally toward those ends or how certain practices led to specific results. They might include some basic discussion about the involvement of partnership in accomplishing goals but nothing truly substantive or methodological. Such reports might mention that partners attended meetings, that they engaged in “hard work,” or that they “worked together,” points which are either redundant or too vague to be useful in defining actual methods and practices.

The usefulness of evaluations that focus overwhelmingly on program outcomes is limited because although they may explain what actions were taken and which goals were met, they fail to address the causal organizational factors that influenced their own programmatic success or failure or to provide similar insight for future collaborators seeking to replicate their successes and avoid their mistakes.

**Frameworks for Forming and Evaluating Partnerships**

Formative partnership evaluations give direction to organizations wishing to form partnerships in order to achieve a specific goal. Federal agencies encourage organizations to pursue partnerships by offering funding for the achievement of specific, measurable programmatic goals. In a best-case scenario, the partnering experience will be so positive that partners will wish to engage in further collaboration or will at least have a set of best practices to pass on to future program participants. To help partner organizations have the best experience and return the best results possible, agencies offer them formative models and evaluation frameworks. Even though their programmatic goals have already been formalized by their grant proposals, many partners compose a
memorandum of understanding prior to beginning their activity in order to organize and communicate their expectations of the partner relationship.

Formative frameworks and models encourage parties to consider such concepts as program and partnership goals, timelines, budgets, available resources, capabilities, roles, missions of individual partners, existing relationships between the partners themselves, and relationships between the partners and stakeholder communities prior to partnership formation. They encourage partnership managers to think methodically about their pursuits and to practice in-process evaluation and benchmarking. However, few formative frameworks direct evaluators to use particular methods of measurement such as surveys or statistical analysis; rather, they generally instruct partners about what information to report and leave it to the partners to decide how that information should be gathered and analyzed.

Our partnership evaluation survey revealed the following information about formative evaluations: 95.7% of the evaluations surveyed had a focus on qualitative data compared to 65.2% with a focus on quantitative. 78.3% focused primarily on the functions of partner relationships as opposed programmatic outcomes, while only 52.2% clearly expressed an expectation that partnering would take place between the federal agency and more than one additional party. The following case examples illustrate common methods and values connected to partnership formation in federally sponsored programs.

Example: HUD Neighborhood Networks: Partnership Development and Maintenance

In 1995, the Department of Housing and Urban Development created the Neighborhood Networks Consortium, a network of national and local partnerships whose purpose is “to encourage property owners to establish multiservice community learning centers in HUD insured and assisted properties” (Barnd et al. 2002). This program has been included in HUD-sponsored NOFAs archived in the Federal Register as late as 2005. Neighborhood Networks Centers serve their stakeholder communities by “improv[ing] computer access; advanc[ing] literacy; prepar[ing] residents to take advantage of employment
opportunities; [and providing] access to healthcare information and other social services” (ibid.). Regional Neighborhood Network Coordinators are permanently on staff with HUD to facilitate partnering for the creation of new centers. Partners include local housing managers, local and national non-profits, and even federal agencies such as the Departments of Labor and Education.

We obtained a copy of the partnership evaluation framework developed for Neighborhood Networks partners and presented at the Department of Housing and Urban Development’s 2002 Regional Technical Assistance Workshop. The advice HUD gives to its Neighborhood Networks partners is largely behavioral and somewhat procedural. It focuses on creating and sustaining productivity through healthy partner relationships. The language of the framework is relational rather than metric. HUD encourages new partners to do the following:

- Bring benefits to all partners
- Communicate
- Establish one-to-one relationships
- Actively involve residents and community members
- Hold joint activities
- Be patient
- Keep momentum
- Help each other

Additionally, HUD encourages its partners to actively seek additional parties to bring into the partnership, believing that a larger partnership network corresponds with a more responsive program and is well-attuned to the interests and climate of the stakeholder community.

**Example: Evaluating Heart Disease and Stroke Prevention Partnerships**

In September of 2005 at the Building and Enhancing Public Health Capacity conference hosted by Cardiovascular Health Practitioner’s Institute, Dr. Jan C. Jernigan of the
Division for Heart Disease and Stroke Prevention at the CDC, along with partners from Northrop Grumman IT, gave a presentation entitled, “Evaluating Heart Disease and Stroke Prevention Partnerships”. This presentation is available on the CDC website. Dr. Jernigan and her colleagues presented a tool they had developed to assist organizations participating in partnership activities related to the prevention of heart disease and stroke. Their partnering tool consists of a formative framework that helps partnership managers set up their partnerships and then evaluate their performance based on three key facets that determine achievement: capacity, operations, and effectiveness. ‘Capacity’ criteria include the following: skills and expertise of members; sectors represented; links to constituencies; leadership; group decision making; and conflict management (Jernigan et al. 2005). ‘Operations’ criteria include member participation; planning; structure and procedures; communications; consensus building; development of financial resources; and outreach efforts. Finally, ‘effectiveness’ criteria are defined as sphere of influence; expansion/spread; system change; and sustainability.

Dr. Jernigan et al. advise evaluating a partnership both at its inception (formation) and during its lifetime (maintenance/institutionalization), checking to ensure that the overall partnership is achieving its goals and that all partners are participating appropriately. They suggest that evaluations should be used for quality improvement, measurement of impact, and assessment of whether to continue, expand, or terminate partnerships. Likewise, their framework encourages tailoring an evaluation to its audience. Evaluators should consider who will be using their evaluation (e.g. the funding agency, other health professionals, or other federal agencies) and for what purpose the evaluation will be used (e.g. quality and impact assessment, determination of future direction of the project). Their suggestions are somewhat vague in that they lack any specific methods for measurement; however, they do provide suggestions for the organization as well as pacing of the evaluation process. They encourage managers to perform periodic self-assessments and for participant interviews and surveys to measure their success relative to prescribed effectiveness inventories and checklists. As in other formative evaluations we explored, Jernigan et al. leave the choice of metrics up to the individual evaluation team. Their partnership evaluation example is noteworthy because it can be used to
seamlessly incorporate program evaluation and partnering practice evaluation through its examination of themes that are common to both.

**Example: Partnerships at the Department of the Interior**

The Department of the Interior (DOI), which made limited use of the Federal Register to publish NOFAs through 2002, manages its own website devoted to all partnering activities in its sponsored programs. The DOI sponsors a broad range of partnership-inclusive programs that deal with conservation and preservation of natural resources; settling land management issues; and encouraging the development of environmentally-friendly technologies. Their website features a series of formative instructions intended to provide guidance to managers seeking an answer to the question, “what are the keys to creating and managing successful partnerships?” The DOI’s framework focuses on understanding the behavior of partner organizations and managing the dynamics of the partner relationship through the following formative and evaluative activities:

- Focus on an important need
- Adopt a shared vision
- Understand each partner’s mission and organizational culture
- Negotiate a formal agreement that outlines the specifics
- Ensure the partnership is wholly owned by each partner organization
- Diversity the resource base for the partnership
- Monitor and evaluate work being accomplished under the partnership
- Recognize and celebrate accomplishments

Key features to note about the DOI’s approach are its encouragement of partners to develop a formal agreement—including elucidation of roles and responsibilities, mutual interests, identification of resources, and projection of achievement timelines—before their work begins. Also notable is its instruction that partners monitor and evaluate their work not only after their collaborative work is completed, but also while it is in process. The agency makes note that “the best way to evaluate how well your center worked…is to do a self evaluation. It is important to note measurable outcomes.” The DOI goes on
to suggest the following outcomes as suitable examples by which centers participating in sponsored partnerships may measure their success:

- Jobs created through partnerships
- Shared programs create through partnerships
- Residents who benefited from a partner’s service
- Community relationships built between the center and stakeholders
- Various types of organizations with which the center is affiliated

The department encourages evaluators to inventory their achievements and make note of which collaborative relationships were most productive and why. The DOI believes its evaluation criteria will provide partners with “a built-in framework for accountability.”

**Evaluating and Maintaining Existing Partnerships**

Summative evaluation occurs at different times. It may occur once, or at various instances throughout the course of a program or partnership, as well as after the program’s or partnership’s completion. Likewise, different sets of partners working on various program goals will evaluate their activities differently. Some partners will make use of a specific set of focused questions to track partnership progress. Frequently, however, the results that are published are more general “lessons learned” types of evaluations and are less tightly focused on specific measurements. In terms of usefulness, neither method is clearly preferable. Evaluators working with no framework at all may end up being too general and vague in their evaluations. On the other hand, operating too tightly around a rubric may cause them to miss key points that are not perceived as directly germane to any of the pre-selected evaluation criteria. Many evaluations, including a handful of those from our survey, seek to strike a medium between the two approaches through the use of descriptive case studies. In the examples used in our survey of partnership evaluations, results from the summative partnership evaluations were generally consistent with the suggestions we saw in the formative evaluations.
Our partnership evaluation survey revealed the following information about the summative evaluations it included: 100% of the evaluations included qualitative data, and 73.9% included quantitative data as well; only 21.7% focused primarily on the functions of partner relationships as opposed programmatic outcomes; likewise, 82.6% clearly expressed an expectation that partnering would take place between the federal agency and more than one additional party.

Example: ‘Public/Private Partnerships: Engines for Innovation in Transportation’ at the Department of Transportation

The Volpe Center, a part of the Department of Transportation’s Research and Innovative Technology Administration, is “an innovative fee-for-service organization [whose] work is performed primarily for the DOT as well as other federal agencies and state, local, and international entities” (National Science and Technology Council, 2000). Its work includes assisting its clients—federal governments, state governments, local governments, industry, and academia—with technology research and development, strategic policy planning analysis, and implementation related to innovation in transportation. The “Engines for Innovation in Transportation” report was published by the Volpe Center in 1998 as summation of a series of case studies on successful partnership programs sponsored by the DOT and other major agencies for the purpose of showcasing specific examples of successful transportation technology development partnerships and improving institutional knowledge of partnering methods that yield positive returns in innovation in the transportation sector. The report does not identify any specific values or criteria by which partnerships are judged; rather, it observes the workings of each case study partnership and identifies as valuable those practices which have made each partnership successful or exemplary. Even though the Volpe Center is a fee-for-service program rather than a grant program, this report is valuable for the way in which it makes the link between federal partnering practices and program outcomes. It includes explanations not only of how partners worked together, but also about how their activities achieved results.
Example: Crash Injury Research and Engineering Network (CIREN)

The CIREN program, created in 1996, represents a partnership between the federal government, motor vehicle manufacturers, and major research hospitals. Its primary purpose is to improve automobile safety by studying causation of injuries in actual car crashes. The CIREN partners have done well integrating common partnership values—communication, sustainable progress—into the network’s basic structure. The NTSC praises CIREN for its long-term goals and its strong focus on basic research, which have driven the program since its inception and may be a factor in helping the partnership keep its momentum. Additionally, CIREN has set up “explicit institutional structures and channels of communication” to help partners coordinate with each other and share complex information about their activities. Thus, the DOT report is concerned with seeing that the “process” of partnering for research does not get lost in the “practice” of the research itself.

Example: Clean Cities Initiative

The Clean Cities initiative, sponsored by the Office of Transportation Technologies at the Department of Energy (DOE), was originally conceived to help federal agencies respond to legislation passed in the mid and late 1990s which requires agencies to meet certain standards of reducing the environmental impact of their motor vehicle use. It is now a voluntary program that coordinates more than 3,500 public and private partner organizations and 74 local Clean Cities coalitions nationwide. Clean Cities provides a valuable catalyst for action for its local partners seeking information; research and program implementation assistance; and advice on best practices. Because of the voluntary nature of the program and the fact that Clean Cities partners design and drive their own initiatives, an observer will note a wide diversity among the level of impact that program membership makes among partners. Some local partnerships are strong and active, while others have done very little since formalizing their relationships with the DOE. This phenomenon emphasizes the importance of strong motivation—both internal and external—to successful partnership implementation.
Example: Next-Generation High-Speed Rail Program (NGHSR)

The NGHSR is a large network of partnerships in industry, academia, and the federal government (including the DOT) working on the research and future domestic implementation of “commercially feasible high speed intercity passenger rail transportation.” Federal grants are not available through the NGHSR itself, although participants do compete for publicly sponsored grants for their funding. According to this report, the NGHSR program is remarkable because it represents a partnership in which all participants have made equal financial contributions to the endeavor, thereby ensuring that all parties are well-motivated toward the completion of their technology development and implementation goals. The program, therefore, provides “an excellent example of federal government, state government, and private sector railroads and supply organizations moving forward to address common interests.” The program has also developed a sophisticated communication infrastructure and protocols, indicating its high valuation of information sharing and consultation among partners.

Example: The Fraunhofer Society in America

The Fraunhofer-Gesellschaft (Fraunhofer Society) is a German non-profit advanced technology development organization with partners in academic centers throughout the United States. The NTSC report praises the Fraunhofer Society and its US partners as an excellent example of the best features of partnership as a practice: the synthesis of the strengths and experience of all participants to achieve a whole that is greater than the sum of its parts. The Society also receives praise for its role as a lead coordinator for the research and technology community in Germany where its endeavors have precipitated economic development after the implementation of some of the advanced technologies it has helped to develop.

The NTSC notes that the Society’s model has key advantages as a research-focused partnership. It relies heavily on university faculty and students who provide not only a cost-effective, highly-skilled pool of research labor, but who also have access to
university facilities and resources. Additionally, it has excelled at unifying partners traditionally motivated by different things in pursuit of common efforts that hold benefits for all. Because of its success in its endeavors, the Fraunhofer Society has drawn attention from private companies seeking collaboration because of the perceived benefits of partnering with the Society.

Example: Partnerships for Reform: Changing Teacher Preparation Through the Title II HEA Partnership Program Final Report

This report was produced by the American Institutes for Research and by SRI International for the Department of Education’s Office of Planning, Evaluation and Policy Development, Policy and Program Studies Service. Its purpose was to evaluate the effectiveness of the collaboration among members of the Department of Education’s Teacher Quality Engagement Grants Program’s partnership program. The partnership grants program was created by Congress in 1998 “to support accountability for teacher preparation and to improve the work of teacher-preparation programs” (American Institutes for Research and SRI International, 2006). There was hope that the program collaborators, “66 colleges and universities, 28 community colleges, 179 school districts, and 821 elementary schools in more than 25 different states,” collectively engaged in partnership from 1999-2005, would achieve the program’s goal of improving K-12 teacher training programs for public educators. The partnership evaluation report, mandated by a 1998 amendment to the Higher Education Act of 1965 that created the grants program, represents a synthesis of survey data from the partners and secondary sources of school achievement data and teacher assessments and does well at linking partnership practices with programmatic goals. Although the evaluation report is structured around a summation of the partners’ performance on their program goals, it refers to specific partnership goals and methods of measuring quality of collaboration.

The Department of Education defined its key values for the program as partnership authenticity, partner relations, leadership, accountability, and recognition and elimination of barriers. The agency hoped to see these values translated into the following practices:
“sharing a mission and goals; developing and expanding partner roles and strengthening relationships over the duration; developing and expanding leadership roles; assuming shared accountability; and recognizing [and] working to eliminate cultural barriers.” To measure attainment of these partnership goals, auditors used a series of four evaluation questions:

- **Evaluation Question 1**: Did partnerships fulfill the program mandate, encouraging colleges and universities to partner with and address the teacher-preparation needs of high-need districts?
- **Evaluation Question 2**: Did partnerships undertake activities designed to improve the academic content knowledge of new or veteran teachers?
- **Evaluation Question 3**: Were changes in the student teacher internship component associated with partnership efforts to improve teacher preparation?
- **Evaluation Question 4**: Did partnership initiatives address the accountability concerns about teacher preparation?

To respond to these questions, the American Institutes for Research, SRI International, and the Department of Education’s Office of Planning, Evaluation, and Policy Development collected and analyzed data on a cohort of 25 partnerships that received grants in 1999. They collected both qualitative and quantitative data through case studies of individual programs and through focus groups; interviews and surveys of project directors college and university faculty; and secondary school teachers and administrators. The authors also used benchmarks established by the Department of Education’s 2001 Targeted Literature Review to measure partnership and program performance. The evaluation concludes that in most cases program participants were able to fulfill partnership goals, though incompletely.

**Walking Back: From Funding to Evaluation**

After looking at the funding of partnerships and the partnership evaluation process, we were curious to see if we could walk back a particular program from the initial funding notice through to the post-funding evaluation of the partnership. This exercise is helpful
for a number of reasons. The emergence of a clean line of concern from funding to evaluation would suggest that a particular agency is cognizant of the challenges that partnerships bring. On the other hand, inconsistency between what aspects of the partnership are stressed during formation, and then again during the evaluation period, might suggest a change in partnership strategy for a particular agency or a maturation of the agencies understanding of partnerships over time.

In conducting the walk back, the process was quite simple and began with the identification of the partnership evaluation efforts of federal agencies conducted in the previous section of this paper. In some instances, the evaluation materials identified are specific to a particular program, as was the case with the HUD Neighborhood Networks evaluation materials. In this instance, searches were conducted within the Federal Register and the Code of Federal Regulations in an effort to identify the initial funding notice for the program. Once both the initial funding, and the later evaluations are clearly identified, we begin to look at the emphases within each phase to identify common concerns or inconsistencies in agency focus.

In other cases, the partnership evaluation methods are provided on an agency-wide basis, and are not narrowly aimed at a specific program. Often, these evaluation materials will discuss specific programs, but discuss them within the context of other programs. In these cases, efforts were made to identify key partnerships that were funded by the agency and then discussed in some way. While this type of walk back is not as strong as the previous example, it still offers a keen insight into the focus of individual agencies and its change over time.

As we will see in the lack of fully successful “walk backs,” the process is a daunting one and rarely leads to the clear conclusions we hope to draw. For one, as we pointed out in the previous section, there is somewhat of a dearth in firm quantifiable partnership evaluations being done amongst federal agencies. In many instances, what has been identified as a partnership evaluation is little more than technical assistance and best practices information to be utilized by future partnerships. In other instances, the
Evaluation is little more than a case study that describes the partnership in question without really getting to the evaluative meat of the issue. In either instance, the exercise is still of merit by offering a small glimpse into what aspects of partnerships, if any at all, an agency or subagency focuses on.

**Example: HUD Neighborhood Networks: Partnership Development and Maintenance**

As discussed in more detail in the previous section, the Housing and Urban Development agency (HUD) provides some partnership evaluation methods aimed specifically at their Neighborhood Network program. This program funds partnerships for community learning centers located on HUD property and represents a very large grant program with partnerships throughout the country. In their partnership evaluation materials, HUD encourages self evaluation, and suggests that partnerships look at outcomes in order to measure partnership success. Among suggested outcome measures are jobs created through partnership; shared programs created through partnership; residents benefited from a partner’s service; community relationships built; and the types of organizations affiliated through partnership. In addition to these measures, the HUD materials offer a lot of guidance on partnership formation and on sustainability.

In walking back the Neighborhood Network program from the evaluation to the initial funding, we were unable to identify any NOFA for the program that directly explained the eligibility and program requirements for funding, but we were able to identify NOFA that directed applicants to the HUD office that awards and administers the Neighborhood Network grants ([http://www.hud.gov/offices/hsg/mfh/nnw/nwindex.cfm](http://www.hud.gov/offices/hsg/mfh/nnw/nwindex.cfm)). In addition to the typical application instructions, this site offered technical assistance on the gains to be made by establishing consortia, discussions of past private/public partnerships, the advantages of partnering, and guidance on what makes a successful partnership. Amongst this guidance, the HUD office encourages applicants to draw partners from more than one source, ensure that all partners benefit from the program, and attract additional partners to participate by staying active in the community, keeping a reliable staff, and providing a solid financial base.
In doing the walk back for the Neighborhood Network program is it easy to see that HUD is fairly consistent in their focus from funding through evaluation. In both phases, the agency stressed the importance of partner diversity in the success of a program and encouraged applicants and participants to continue to identify the measurable benefits for all partners.

**Example: Partnerships at the Department of the Interior**

The Department of the Interior adopts an agency-wide approach to its partnership evaluation assistance, offering best practice information on how to form and maintain partnerships in a general way that is not specific to any particular program or grant. During the walk back process, a number of DOI programs that utilized partnership language were identified, but none of them offered more than a rhetorical use of the partnership language in their funding announcements. For example, in their NOFA for the Alternative Transportation in Parks and Public Lands Program in 2006 (71 FR 70583), the agency asserts, “the proposed planning projects will be evaluated based upon…[the involvement of] partnerships and funding from other sources.”

The lack of a clear and concise focus of concern for DOI suggests that they have yet to develop a common understanding of how partnerships operate and what aspects of a partnership make it successful or prone to failure.

**Summary**

Our foray into the practice of federally-sponsored partnership programs indicates that although partnering language is ubiquitous among federal agencies, each agency—even each office within each agency—may have its own set of methods by which it evaluates partnership activity. This lack of standardization can be helpful or confounding. Although there is no formally standardized federal method of evaluation, agencies currently have the flexibility of defining their standards based on their own values and
Alternative Approaches to Evaluating STEM Education Partnerships

evaluation criteria. An incredibly varied universe of program diversity exists beneath the aegis of the federal government, but, in fact, many of the key values that inform partnering practices have proven to be remarkably similar. Partnership evaluation as a discipline is difficult to clearly define and very difficult to meaningfully quantify. This should not be surprising, because although partnership processes may be carefully defined, partnerships themselves are not machines but are based in human relationships. Many of the skills that are necessary to sustain a good friendship are necessary for a good partnership as well: patience, communication, respect, a good mix of talents and traits, and a common vision or goal.

The lack of standardization and the general obfuscation of the elements that go into a successful partnership are also seen in the brief “walk backs” conducted. The aim of this process was to identify the focus of individual agencies at both the funding and evaluation stage to see if agencies were consistent in their foci. As discovered, this process is often easier said than done, and results are mixed across the board. In the case of the Neighborhood Network program, HUD was consistent in their foci from funding through to evaluation and stressed partnership diversity and outcome-driven partnerships. In the case of the Department of Interior, there was little to no consistency in focus, as the agency often meandered from funding to evaluation without a clear agenda.
Alternative Approaches to Evaluating STEM Education Partnerships

Bibliography


Alternative Approaches to Evaluating STEM Education Partnerships:
A Review of Evaluation Methods and Application of an Interorganizational Model

(NSF 02-061 Award #: 0231904)

Georgia Institute of Technology Electronic-Policy Delphi:
Summary of Findings

December 30, 2007

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This paper reports on the findings from the National Science Foundation sponsored Research, Evaluation, and Technical Assistance (RETA) project (NSF 02-061 Award #: 0231904): Alternative Approaches to Evaluating STEM Education Partnerships: A Review of Evaluation Methods and Application of an Interorganizational Model. Gordon Kingsley, Principal Investigator, Dara O’Neil, & Marion Usselman – Co-Principal Investigators
Alternative Approaches to Evaluating STEM Education Partnerships
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Abstract:

In recent years federal agencies like the National Science Foundation (NSF) and the U.S. Department of Education (DoE) have emphasized partnering between universities and the K-12 community to improve student academic achievement, particularly in the fields of science, technology, engineering, and mathematics (STEM). After a number of years of involving higher education institutions in targeted and systemic K-12 reform, NSF and the DoE developed a set of grant-based inducements to promote new university-K-12 “partnerships” to drive more intense and sustainable relationships. Using survey data from a 32-member electronic-Policy Delphi panel, this paper presents an evaluative model of partnership to be used during the case study phase of our continuing research.
Executive Summary
Georgia Institute of Technology Electronic-Policy Delphi:
Summary of Findings

In this research we develop a model of education partnerships for improving the evaluation of programs implemented through partnerships. We built on our review of the literature to develop a model of education partnerships, beginning with the impacts two important variables have on the formation, operation and outcomes derived from these partnerships: embeddedness (Granovetter, 1985) and the alignment of organizational strategic needs (Whetten, 1981). Embeddedness refers to the history of relationships among actors in a network, while Organizational strategic needs refers to anything outside of the organization that is required to enhance an organization’s ability to accomplish goals. In the course of our research we expanded our model to include two additional variables: Environment and Rules and Inducements. We were forced to include considerations of the environment in our partnership model because differences in local conditions make direct comparisons difficult without controlling for them (e.g., Some projects or partnerships will do better simply because the local conditions are better). Similarly, the partnerships we are observing are formed to deliver specific programs in response to or in accordance with a set of rules and inducements developed by the funding agency.

The data for this study comes from a modified electronic policy Delphi panel of 32 experts in STEM school-university partnerships. Quantitative and qualitative analysis was used to analyze and categorize responses to a series of scaled and open-ended questions that asked the respondents about their partnership experiences. The electronic policy Delphi was initiated in 2004 and data collection was completed April 7, 2005. The panel study was designed to serve as a model building exercise: modeling alternative conceptualizations and alternative methods for the evaluation of STEM education partnerships. As such, the electronic policy Delphi is used as a tool for examining the ways in which STEM professionals conceptualize partnership and the range of behaviors that their organizations engage in under the rubric of partnership.

There were four rounds to the electronic policy Delphi. The first round was based upon the personal experience of the respondents with working in partnerships aimed at addressing STEM education. In the second round respondents were presented with key concepts drawn from the literature on partnerships, and asked their assessment of the applicability of the concept to their experience. The third round required that the respondents make judgments about partnerships in reaction to a set of mock proposals for funding. The final round was used to focus upon discrepancies that had emerged in responses between the rounds, and to explore the outcomes and impacts from STEM partnerships.
During the course of this research we have come to conceptualize the STEM partnership as a label we place on a relational event\textsuperscript{1} that is initiated by a federal policy inducement comprised of a set of inter-organizational collaborations aimed at enhancing the performance of participating partners in generating desired policy outcomes. A policy inducement is any program that provides funds for specified actions of activities but has requirements for qualification\textsuperscript{2}. These requirements are intended to fund specific activities or to induce behaviors desired by policy-makers in the grant recipients. For example, in the case of NSF-MSP, the requirement for higher education institutions to partner with local K-12 schools can be defined as a “Policy Inducement to Partner” (PIP). The policy inducement is the initiating condition for the formation of a partnership.

However, our results have pointed to an evolutionary aspect to partnering, leading us to reconceptualize partnership formation from a single event to a process of entry and exit that occurs over time. While the beginning of this process can be bounded by the partnership’s initiating factors, evaluation is likely to be improved by: 1) observing the degree to which partnership is a policy-induced activity (and understanding the alignment of these inducements, 2) observing that partnership, and the level of commitment by members, is poorly understood when evaluated as a single independent event, but is better understood in the context of a set of ongoing activities and relationships amongst partners, and 3) observing the alignment between organizational and partnership operating structures and goals as a driver towards achieving desired outcomes.

\textsuperscript{1} This follows to Goodlad’s ideas about collaborative events providing a platform for coordinating programs, activities, and longer-term projects (1988).

\textsuperscript{2} This is in contrast to rules, laws or mandates that require specific actions whether an organization is prepared, willing or able to comply.
A review of new federal policy initiatives shows that the goal of creating partnerships is increasingly an important component of federal grant programs. These programs often include specific partnering requirements that link actors together in what are assumed to be new or different ways. How these new relationships form and precisely what impacts they have on policy goals is poorly understood. This report is intended to improve our ability to make sense out of the complex set of relationships contained under the heading of partnering, by providing a model that can be used in evaluating the impacts of partnerships on policy goals.

In our research on improving the evaluation of education partnerships, we started by looking at the impact of two important variables: embeddedness (Granovetter, 1985) and the alignment of organizational strategic needs (Whetten, 1981). Embeddedness refers to the history of relationships among actors in a network. Those actors with long and positive histories of interaction are more likely to have lower transaction costs, be more effective in the conveyance of particular types of knowledge (complex, tacit or expert knowledge) (Powell and Grodal, 2005), have a greater understanding of each other’s operations, as well as greater trust that something of value will be created and that there will be no malfeasance in the carrying out of activities. Organizational strategic needs refers to anything outside of the organization that is required to enhance an organization’s ability to accomplish goals. For example, Burt (1992) argues that organizations act rationally when they choose to enter partnerships (e.g., to gain resources, increase control or coordination, to gain knowledge or expertise, or to enhance their reputation). Thus pursuing fulfillment of a strategic need is one motivation for forming a partnership. Goodlad (1988) for example, pointed out the need for better coordination among...
Alternative Approaches to Evaluating STEM Education Partnerships

teachers, colleges of education, and colleges of the arts and sciences, and suggested a new inclusive partnership would fulfill that need. Also, Brinkerhoff (2002) posited two needs-based dimensions leading to partnership formation: mutuality in exchange, fair trades of complimentary resources, and enhancement to organizational identity, which can make is easier for an organization to acquire resources from other additional sources. Thus, the greater the likelihood of mutuality in exchange achievable through partnered operations, the greater the likelihood of agreeing to partner.

In other work, we reviewed a variety of literature on the formation and operation of partnerships and the impacts they have on desired policy outcomes (Waschak & Kingslsey, 2008)\(^5\). This literature suggests that higher levels of embeddedness and more closely aligned strategic needs among organizations would positively impact partnership formation, operation and outcomes. In the initial model developed for this research, embeddedness and strategic needs alignment were hypothesized to be the primary factors shaping the formation of a partnership. The variance in these two factors in conjunction with the experience of organizations throughout partnership operations was then hypothesized to explain the variance in a partnership’s impact on programmatic outcomes.

However, our results have pointed to an evolutionary aspect to partnering, leading us to reconceptualize partnership formation from a single event to a process of entry and exit that occurs over time. While the beginning of this process can be bounded by the initiating factors, evaluation is likely to be improved by the following: 1) observing the degree to which partnership is a policy-induced activity (and understanding the alignment of these inducements, 2) observing that partnership, and the level of commitment by members, is poorly understood when evaluated as a single independent event, but is better understood in the context of a set of ongoing activities and relationships amongst

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partners, and 3) observing the relationship between a partnership’s operating structures and goals as a driver towards achieving desired outcomes.

The data for this study comes from a modified electronic policy Delphi panel of 32 experts in science, technology, engineering, and mathematics (STEM) school-university education partnerships. Quantitative and qualitative analysis was used to analyze and categorize responses to a series of scaled and open-ended questions that asked the respondents about their partnership experiences. The electronic policy Delphi was initiated in 2004 and data collection was completed April 7, 2005. The panel study was designed to serve as a model building exercise: modeling alternative conceptualizations and alternative methods for the evaluation of STEM education partnerships. Our modified electronic policy Delphi is based on the Rand Corporation's paper and pencil Delphi (expert consensus building and forecasting) method initially developed and refined in the 1950's and 1960's (Dalkey, 1969) and later modified and applied for use in developing policy (Turoff, 1970; Turoff & Hiltz 1982; Rayens, 2000).

Background

Federal involvement in local education can take the form of laws, rules or mandates that require local school districts to act in prescribed ways regardless of their ability to act. In recent years, federal policy has increasingly added grant-based inducements as a motivation to those willing and able to take specified actions. Federal agencies like the National Science Foundation (NSF) and the U.S. Department of Education (DoE) have emphasized the inherent responsibility universities have in assisting the K-12 community in improving student academic achievement, particularly in the fields of science, technology, engineering, and mathematics (STEM). After a number of years of involving higher education in various ways in targeted programs (in which specific activities were funded) and systemic K-12 reform (in which the funded activities were intended as catalysts for change), NSF and the DoE developed grant-based inducements to promote university-K-12 “partnerships” to drive more intense and sustainable relationships.

The study of partnering has a long history in a variety of literatures covering both the
private and public sectors. In the private sector management literature, partnering is a form of inter-organization relations (IOR). Partnerships link organizations in mutually beneficial, goal-based relationships. In an influential work, Oliver identified six distinctive determinants of IOR’s including necessity, asymmetry, reciprocity, efficiency, stability and legitimacy (1990). Private sector organizations partner when they need each other, or when they can gain a competitive advantage by working together (Pfeffer and Salancik, 1978). They are more likely to engage in partnered relationships when there is a need for resource exchange, knowledge or technical expertise the partner can provide, or a need for collaboration to secure strategic positions within a field of organizations. Additionally, they will choose partners that enhance or compliment their organizational reputations.

Alternatively, in the public management literature the term partnership has been closely linked to various reform agendas. Partnership is often seen as an all-purpose remedy within these reform movements (Osborne, 2000; Teisman & Klijn, 2002). Teisman and Klijn summarize three key features of partnership for public management reform: a) actions by other actors are required for an individual actor to achieve desired goals; b) the resources and knowledge for achieving goals are distributed across multiple actors; and c) the systems and processes that develop under partnership are complex because they are dependent upon the negotiations of participating actors (2002). While partnering is a resource intense activity, it is seen as a necessary bridge toward improving public management. In addition, there is a strong flavor of program evaluation associated with partnerships in this literature as public agencies, like public schools, are subject to intense accountability standards.

Not surprisingly, the education literature on school-university partnership is more closely related to the uses found in the public rather than the private sector. In this literature, relatively little attention is given to the factors that drive the creation of partnerships. Rather partnership is offered as a potential remedy for a whole class of public education problems. For example, underperformance of students is often linked to a lack of content knowledge and confidence on the part of teachers that might be remedied by creating
Alternative Approaches to Evaluating STEM Education Partnerships

links to higher education side experts. Thus partnerships between universities and schools are born. The education literature focuses on program implementation and the outcomes associated with partnering (Goodlad 1988; 1994).

The program requirements of the Math and Science Partnership (MSP) program (NSF 02-061), under the “No Child Left Behind Act of 2001”, mandate the creation of partnerships that are goal based, encourage the use of evidence and scientific research to develop and improve programs, and drive “institutional change” while promoting partnership “sustainability.” That the MSP should be “partnership driven” suggests that a thing called partnership drives the initiative, and that it lies between (as a bridge) or includes universities and K-12 institutions. We might expect this new partnering entity to have boundaries (things on the inside and on the outside), aspirations or goals, and a tendency to strive for continued sustainable existence. However, models of partnership in the education community tend to be descriptive of programs being promoted or evaluated and not of the entity that facilitates that programmatic activity.

Goodlad describes partnerships as collaborative events that grow out of linked networks of professionals, creating a platform for programs, activities, and longer-term projects (1988). Conceptualizing partnerships as collaborative events leads to the assumption that they will have a unique beginning and lifecycle. However, Firestone and Fisler found that partnerships might simply be platforms for fundraising activities supporting programs and activities sanctioned by participants (2002). Their perspective shifts Goodlad’s

6 The MSP program has five key features: Partnership-Driven - Partnerships between universities and K-12 institutions are required. Teacher Quality, Quantity and Diversity - The projects are intended to enhance the quality, number and diversity of math and science teachers. Challenging Courses and Curricula - The projects are intended to provide courses and curricula that improve the math and science understanding of students while teaching a range of problem solving and analytical skills. Evidence-Based Design and Outcomes - Programs are to be designed based on the best current research and link evaluation with indicators of partnership success. Institutional Change and Sustainability - The core partners are to commit to strengthening teaching practices on the university side while K-12 institutions commit to providing an environment in which teachers, administrators and other staff can grow for the long term. Further, the partnership (and its impacts) should last beyond the funding of the MSP.
collaborative event to a more sustained quasi-organizational form that might last beyond any single event. Alternatively, Tushnet examined the work of partnerships through the programmatic foci, distinguishing between professional development, curriculum development, and client participation as ways of classifying partnership activities (1993). Tushnet’s focus suggests that partnerships are defined by what they do rather than how they do it. However, in this work, we make a distinction between programmatic activity (what gets done) and partnering (the interpersonal and interorganizational links that help get it done). Therefore, because we separate the two, we can focus on how the partnering aspects of STEM interventions impact programmatic outcomes.

In an attempt to bridge the partnership literature in both the public and private sectors, our focus has been on developing a better understanding of motivations to partner (a theme drawn from the private sector research) and on the kinds and quality of relationships that develop (themes drawn from the public sector research). Researchers from different fields have argued that mutual goals are more likely to be met when partnerships are built on embedded relationships (Goodlad 1994; Gulati and Gargiulo 1999; Sanders and Epstein 2000). Drawing from Granovetter’s work on the impacts of social structure, we developed a model of the partnership process that combined embedded relationships and organizational strategic needs as the drivers of partnering (Granovetter, 1973; 1985; 2005). Partnership formation was hypothesized to be a product of embedded relationships among individuals and organizations coupled with an overarching strategic need or set of needs. Richer networks of embedded relationships and greater alignment of strategic needs are hypothesized to improve partnering and programmatic outcomes. The panel exercise was designed to identify and explore the various aspects of embedded relationships and organizational strategic needs that impact partnering and partnership outcomes. We assumed that this model was complete and that no other critical variables existed. However, as this e-Delphi exercise was intended to build a model of partnership to be used in further research we planned to test the hypothesis that the model was complete in to course of conducting the panel.
Our initial model of partnership captured the *preexisting conditions, partnership activities, and outcomes* aspects of a partnered intervention along with a pathway for *rival explanations*. Under *preexisting conditions*, embeddedness refers to the number, quality (including level of trust) and types of relationships that organizations have with one another prior to the development of a partnership. Strategic needs are the resource, knowledge, coordination and legitimacy needs confronting individual organizations prior to partnership formation.

Partnership activities refer to the two phases of activities that develop as organizations engage in partnership: formation and operation. These phases were designed to describe the process of partnership as a lifecycle. Partnership formation includes developing agreements about goals, resource allocations, and responsibilities of each party to the partnership. We describe the actual behaviors in which the partners engage as they pursue their programmatic goals and duties as partnership *operations*.

The final phase describes two types of partnership *outcomes* we can try to measure. First, we define *process outcomes* as the qualitative and quantitative assessments that measure
whether the partnership actually achieved the goals and duties of operation (e.g., under process outcomes we might observe partner interactions, whether partners were able to work together, marshal resources among partners, bring together the support and talents of universities, parents, businesses and not-for-profits, or achieve congruence among policies). Measures of process answer the questions “what happened and how or how well?” *Performance outcomes* are the assessments of changes in measures included in the policy goals that drove the formation of the partnership (e.g., changes in test scores, improvements in teacher content knowledge or pedagogy, organizational transformation). Measures of performance answer the questions “were policy or organizational goals met?”

In this model, embeddedness and strategic needs are thought to affect formation and operation of partnerships (our four concepts from which we develop independent variables). This model also suggests that all of the partnership outputs and outcomes (our two concepts from which we develop dependent variables) are mediated by the experience and activities associated with partnership formation. We do not find much exploration or support in the partnership literature for the proposition that embeddedness or strategic needs alignment have independent impacts upon outputs and outcomes that are not mediated by the behavior of partners at the formation stage.

It seems unlikely that partners might not react and behave independently over the life of a partnership, or that the formation experience would be such a strong modifier of the behavior of work partners under the rubric of the partnership. Thus, rival pathways are a necessary component of this logic model allowing us to regularly test and account for any other possible explanations for the impacts we identify for our panel.

**Research Methods**

*The GA Tech Modified Electronic Policy Delphi*

The electronic Delphi or ‘expert panel’ portion of the Georgia Tech RETA project was initiated in 2004 and data collection was completed April 7, 2005. The panel study was designed to serve as a model building exercise: modeling alternative conceptualizations
Alternative Approaches to Evaluating STEM Education Partnerships

and alternative methods for the evaluation of STEM education partnerships. Our modified electronic Delphi is based on the Rand Corporation's paper and pencil Delphi method developed by Dalkey and Helmer and refined through the 1950's and 1960's (Dalkey, 1969). The method involves an iterative survey of experts with the intention of developing a better understanding or consensus on problems, approaches, or future trends. In recent times the computer and internet have been used to facilitate the Delphi method (Turoff and Hiltz 1982).

This computerized approach has been used in many ways beyond the traditional structure of consensus seeking Delphi protocols. For example, a policy Delphi is not used to look for consensus but to develop pro and con arguments about specific policy issues and their potential resolutions (Turoff 1970). This technique allows a diverse panel of experts to contribute elements to a composite model of a complex situation or process. Our exercise in model building with the Delphi method takes a similar but slightly different approach, as we started with a model developed from the literature and then began testing the components and looking for missing elements and interactions.

**Participant Selection**

The sample frame for this study was 300 Science and Technology Education and Math (STEM) education partnership professionals drawn from three sources: online searches of PI’s working on STEM education partnerships, nominations (both of self and others) in response to presentations of our partnership research, and lists of attendees to educational conferences on STEM partnerships. To be eligible, nominees had to have experience running multiple partnerships that linked universities with K-12 schools for the purpose of improving math and or science education. This group of professionals generated a total of 133 nominees as prospective panelists.

The potential panelists were contacted by telephone and e-mail over the summer of 2004 to determine their availability and willingness to participate in the project. Telephone interviews were conducted of each potential panelist to gather demographic and background information. As the sample was put together for the purpose of modeling
partnerships and evaluation, we screened for people with experience with a number of partnerships or projects from a variety of backgrounds. Following the interviews, the 32 final panelists were selected based on their level of experience, diversity, and availability.

Table 1. Sample Frame Used in this Research

<table>
<thead>
<tr>
<th>Population of MSP Professionals</th>
<th>Potential nominators</th>
<th>Nominees</th>
<th>Panel</th>
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<tr>
<td>Total population unknown</td>
<td>Approximately 300</td>
<td>121</td>
<td>32</td>
</tr>
<tr>
<td>Chosen from 3 sources:</td>
<td>Nominated</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Contacted by e-mail</td>
<td>Given a 30 minute pre-screening interview</td>
<td>Participated in 2-4 rounds of the panel</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>30-31 panelists participated in every round</td>
</tr>
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</table>

The final panel consisted of thirteen women and nineteen men from nineteen states. Nineteen of the panelists were affiliated with public or private colleges and universities, six represented public K-12 institutions, and seven of the panelists were from other kinds of education organizations. There were twenty-eight Caucasians, one African American, two Native Americans, and one Hispanic on the panel. They averaged 12.7 years of experience with STEM education, and half have worked as K-12 classroom teachers. Most of the panelists have graduate degrees, and about half hold Doctorates. Initially we were concerned about the limited ethnic diversity of the panelists. However, after additional assessment of the source lists and nominations, we found that our panelists were representative of individuals charged with organizing federally funded education partnerships. While the panel consisted of 32 participants, only 30-31 of them participated in any given round.

The intention of this portion of our study was to develop a range of possible models of partnership for further research. Thus, we make no claims that all partnerships, or for that

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7 We did note the lack of racial and ethnic diversity among the experts who had organized and managed the federally funded programs we were studying. The source of this lack of diversity requires further investigation that is outside of the scope of this study.
matter all MSP’s, are represented by this panel. In addition, since completing the data collection we identified an unanticipated source of bias in our sample. By using experience as our first selection criteria we created a panel made up of very experienced professionals many of whom have initiated their own MSP’s. Since the panelists all have a great deal of experience, they also tend to be senior level persons in their respective organizations. Thus, one early hypothesis we considered testing, that partnerships formed from the top-down (driven by senior level decision-making administrators) would differ from partnerships that were initiated from the bottom up (driven by passionate practitioners from the field), could not be fully explored.

Figure 2. The Online Survey Instrument Allowed Scaled and Narrative Responses

The Delphi Panel Survey

About the Rounds
1. Descriptive
2. Judging Concepts
3. Evaluation
4. Resolving Differences

Our e-Delphi Panel
- 32 Participants 19 Men &13 Women
- 29 - W, 1 - AAm, 2 - NAm
- 19 States, 19 - IHE, 13- K-12 / Other

HERO e-Delphi Penn State  http://hero.geog.psu.edu/

About the Survey
The e-Delphi panel consisted of four “rounds” of surveys conducted online; each round was intended to take the panelists about four hours to complete. Panelists were compensated for their time. The surveys were administered on the Internet over a period
of about six months during the fall of 2004 and winter of 2005 using Pennsylvania State University’s HERO e-Delphi system⁹. Panelists were given passwords and login instructions, start and stop times, and a direct point of contact (by cell phone or email) to help answer any questions.

Each round of the study called upon the respondents to approach the topic of STEM partnerships from a different perspective in order to test for internal conceptual consistency on themes and variables. In round one, the respondents were encouraged to be in a descriptive mode as they discussed their personal history and general experience of working with STEM partnerships. In round two, respondents were encouraged to be in a conceptual-judgment mode as they were asked to react to key factors identified in the research literature and in round one (exploring our initial model) as critical elements in the formation and successful operation of partnerships.

In round two we shifted to a more open-ended survey format to allow participants to explain their answers in more detail. We did this to because we were getting unexpected results to our more structured questions. In round three, respondents were encouraged to be in a judgment-evaluation mode as they were asked to offer peer review assessments of proposals for forming STEM partnerships as if they were on a National Science Foundation review panel. We did this to test for consistency in their responses. In round four, we pursued three objectives. First we revisited issues from earlier rounds in which we had found disagreement. Next we asked additional questions that the panelists expressed an interest in pursuing. And finally, we explored questions about evaluation and learning within partnerships and from partnered activities.

Analysis and Validation

Our research has been centered on the development of a logic model of the partnership process (our approach to logic models builds from Yin, 2003). In this study a formal logic model was developed from the literature prior to our initial data collection. The initial model was modified after the first round of data collection to include boxes for

⁹ http://hero.geogpsu.edu/
rules / inducements and environmental variables. The expanded model will be introduced as a part of the presentation of our results. The coding procedure started with assembling the data according to the final expanded logic model and then proceeded to identification of variables from the data that are consistent or inconsistent with each category.

We initially used Microsoft Access to assemble and organize the data after collecting it from the online survey system. We then used the QSR-NVivo computer program as a tool to further organize and analyze the qualitative data, as the program allowed for several unique approaches to structuring data and testing relationships. We structured and did our analysis of the quantitative data using Microsoft Excel and STATA. The qualitative data were combined with the quantitative survey data (based on Likert questions asked during each round) as appropriate. Questions in each round were designed to address the major conceptual elements of linkages between concepts. Each theme coupled open-ended and Likert scale items for comparison.

Our results were validated in two ways. First by triangulating the existing literature with our quantitative and qualitative data we were able to compare our initial hypotheses drawn from the literature with the structured (confirmatory) Likert scale items and the open ended (explanatory and exploratory) questions. Second, in each of the first three rounds of the panel we asked questions from a different perspective (experience, judgment, evaluative) so that we could explore how their responses might or might not shift with their perspective. The final round of the survey was used to help us understand why shifting perspective in some cases changed a respondent’s reporting of the importance of a particular variable.
Table 2. Themes Explored in Questions by Round and Type

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<th>Concept</th>
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Results

Defining Partnership

The starting point for this study was to explore the meaning of the term partnership. We wanted to make sure that we had a common understanding of the core meaning of the term among our panelists before we started asking them about how partnerships work. It was anticipated that there would be differences in the focus of the partnerships (e.g., content area, service population), but we wanted to nail down the boundaries and scope of the thing we are calling a partnership. Our initial model was developed assuming that a thing called partnership would form among partners (between organizations) within the set of existing embedded relationships, around a specific strategic need or needs. This was important because we wanted to capture with our logic model the range of partnership structures, activities, interactions, and processes that explain the contribution of partnering to desired outcomes. However, we were made aware of an important problem when we read the responses to the question that asked the panelists to define a partnership in the context of the MSP program. We found that the members of our panel had different understandings about what constituted a partnership. Further, the overwhelming majority (93%) did not define partnerships as a thing so much as set of agreements or as a process.

Our Delphi panel gave us four conceptually different definitions of partnership. These differences are important because when we asked the panel about partnership formation we had certain expectations about what exactly was being formed. Our logic model of the partnership process assumes that a thing called a partnership is being formed and could therefore be clearly described and measured. In addition it was expected that the partnership would take on a life of its own at least in part measuring its success by its ability to continue and grow. Given the research literature, we expected that all members of our Delphi panel held similar entity-based, highly collaborative conceptualizations of partnership in which memberships, boundaries, and formal and informal organizing structures designed to achieve specific functions, played a major role. However, this was not the case.
Our panel did not describe clear boundaries (who was in or out), a definitive scale (partnerships might include individuals, single schools or whole districts with little distinction), or well-defined routines and procedures for their partnerships. Only two of the panelists viewed partnership in a highly structured, entity-based way, and their organizations were specifically set up as bridging organizations and service providers \((n=2/31)\)\(^{10}\). The breakdown of our collaborative entity-based assumption has two important implications. First, our initial model implies that some sort of partnership entity forms, operates, and generates outcomes. For example, in the business world a partnership is a joining of two corporate entities in a way that allows them to pursue specific goals. If MSP partnerships are not conceptualized as collaborative entities that perform a linking / bridging function between organizations, then we need to ask what exactly are they? And second, our choice of appropriate measures of partnership success will differ by how we ultimately define partnership.

About one third of our panelists described an agreement-based conceptualization of partnership with predetermined goals aimed at improving STEM education \((n=9/31)\). Similarly, Firestone and Fisler, citing Goodlad, (1988), state that “the term partnership implies several meanings and may suggest ultimate outcomes to be achieved, but its core definition points to a deliberately designed and formalized agreement [or set of agreements] between different kinds of organizations, without specifying purposes” (2002). From their perspective, a partnership is a goal-focused agreement. Agreements do not necessarily require further collaboration after the agreement is made. The implication of this is clear. Our partners might be doing all of their collaboration prior to engaging in what we believed to be partnered activity. In addition, while any agreement would have to be structured, how it was bounded could differ as appropriate. The important elements of a successful MSP should thus be found in the delivery of agreed upon activities or programs to teachers, school administrators and students according to the terms and conditions of the agreement without additional interactions.

\(^{10}\) The panel was made up of 32 members however, one member did not participate in round one.
A third group, nearly two-thirds of the panelists, related a process-based conceptualization of partnership in which relationships are built up over time to enhance levels of trust and cooperation (n=20/31). Brinkerhoff described partnership as “a dynamic relationship among diverse actors, based on mutually agreed objectives, pursued through a shared understanding of the most rational division of labor based on the respective competitive advantages of each Partner” (2002, p. 14). Partnership success could thus be seen as the continuation of, and adherence to, some process. The scope and structure of the partnering would be set within weak boundaries that are continually varying as new partners move into or out of the process.

Table 3. Framework of Partnership Types

<table>
<thead>
<tr>
<th>Measures of Success</th>
<th>Entity Agreement</th>
<th>Process</th>
<th>Venue</th>
</tr>
</thead>
<tbody>
<tr>
<td>Growth &amp; Sustainability</td>
<td>Adherence to Terms &amp; Conditions</td>
<td>Adherence to the Chosen Process</td>
<td>Community Building &amp; Communication</td>
</tr>
<tr>
<td>Bounded &amp; Structured</td>
<td>Bounded &amp; Variability in Structure</td>
<td>Variability in Boundaries Structured process</td>
<td>Loosely Bounded Loosely Structured</td>
</tr>
</tbody>
</table>

Measuring partnership formation and operations from this process view requires that a great deal of attention be paid to patterns of communication and the forms of reciprocity that develop between partners. For example, Brinkerhoff posits two explanatory dimensions; mutuality, which encompasses ideals of partnership; and, enhancement to organizational identity, which provides the motivation for choosing partners (2002). Collaboration and goal setting, and activities are an integral part of the partnership process. The advantage of this conceptualization of partnership is that the success of the partnering could be measured by the continuation of the process. However, this type of successful partnership tells us little about whether the partnership is having a positive impact on desired policy or programmatic goals. With the majority of our panel partnering from this perspective, it will not be surprising, as we explain later, that they
have difficulty articulating a clear connection between their partnership activities and improvements in outcomes.

A final, minority view was of partnerships as a venue or opportunity for people from diverse backgrounds to come together and interact (n=1/31). The venue concept is drawn from Rose who argues that there exists a “third space” that lies between the state or public and the family or individual (Rose, 1999). It exists whether it is acted on or not. Within this bridging space there is an opportunity for interaction that is neither coerced by authority nor based solely on personal influence. It is a space based on mutually beneficial alliances in which collaboration and negotiation can take place to develop goals, set agendas, and to coordinate actions (Whetten, 1981). From this venue-based perspective specific goals or activities are less important than the potential value added of the collaboration.

Figure 4. Examples of Four Conceptual Definitions of Partnership from the Delphi Panel

| Entity Based |
| "An independent non-profit whose mission is to enhance the capacity of people, companies and organizations to develop and apply science and technology and compete responsibly in the global marketplace.” |

| Venue Based |
| “A partnership provides the opportunity to bring together individuals often with diverse multiple expertise and with similar interests to address issues of importance to the partners in their endeavor to enhance STEM initiatives” |

| Process Based |
| “Partnership means the networking between education (or a particular level or discipline of education) and another entity, such as government or industry, in order to enhance the value of one or both partners and/or provide information between partners.” |

| “Working together in an organized way to reach mutual goals which would be hard or impossible to reach by yourself.” |
"Partnership is a collaborative working relationship in which each partner respects the expertise of the other. The partners plan together and work together to achieve mutual goals, sharing information and decision-making responsibilities."

**Agreement Based**

“A partnership is an agreement made by individuals on behalf of their respective organizations, to define joint goals that will likely improve science/math teaching and learning in the region and to commit resources toward reaching the common goal."

“A mutual agreement among partners to achieve specific goals. Each organization has identified clear roles of responsibility and is accountable for carrying out these activities and responsibilities.”

The venue-based conceptualization is a place-based view of what Sirotnik and Goodlad describe as a seemingly unattainable ideal partnership consisting of “mutually collaborative arrangements between equal partners working to meet self-interests while solving common problems” (1988). Community building and ongoing communication are the measures of a successful venue-based partnership. Such a partnership would have no clear boundaries as participants would come and go, interacting within the partnership venue as needed. It would have little in the way of clearly established structure, as again the shape and scope of the partnership would change as participants became active when there was something of interest to them taking place within the venue. That the venue would continue to exist might also be considered a measure of success. However, if a venue continued to exist over time it would ultimately require some form of institutional support thus becoming a kind of loosely structured entity.

Our panel did not, and we do not, view these categories as mutually exclusive types. Through their definitions, our respondents provided their dominant discourse for conceptualizing partnership. However, when the distinctions among these were pointed out, panelists were, for example, still able to discuss questions about process even if their base definition was agreement or entity-based. These variations in the conceptualization of partnership have led us to explore partnership from additional perspectives. And, more basically, they have suggested to us that our panelists do not share a common language or perspective when discussing partnership. In their responses they may shift from one
conceptualization to another with little warning. Therefore, we needed to be careful about making conclusions and needed to repeatedly check and recheck our ideas and conclusions about partnership variables as the rounds of e-Delphi panel progressed.

Given the apparent ambiguity surrounding the term partnership within our panel, and the apparent breakdown of some of our entity-based assumptions, there was some discussion about how to proceed. However, because the relationships that were being organized in education (e.g., response to the MSP funding) are being labeled partnerships and have many of the characteristics of entities we decided to continue our exploration of partnership from the perspective of our interorganizational model. Something that our panel identified as a partnership was being formed. Therefore, whatever the specific conceptualization of what a partnership is as an ideal, our panelists could still describe the process by which it got started and operated. And, by exploring their ideas about the process of partnership, we might explore the ways in which partnerships impact STEM education.

**Testing Our Initial Model**

This qualitative research was designed to develop a model (or set of models) of partnership that included explanatory elements drawn from our expert panel that could be tested in the set of case studies that would follow. Our focus has been on improving our understanding of why organizations choose to work together, and what impacts these relationships have on STEM education. Our initial model focused on embedded relationships (the network of connections between organizations) and organizational strategic needs.

**Embeddedness**

Granovetter has argued that while relationships can be positive or negative, partnerships are built from on set of positive embedded relationships (Granovetter, 1992). Therefore, in the first round of the Delphi study we asked a series of Likert and open-ended questions about the importance of a variety of embeddedness variables to the formation of the panelists’ previous and current partnerships to see what impact those relationships
had on the partnerships. Following Granovetter, we expected that having a prior relationship with potential partners would be a key element in the final choice of partners.

Table 4. Time Required to Establish Effective Working Relationships

<table>
<thead>
<tr>
<th>How much time does it take to establish effective working relationships between organizations within a partnership, who have never worked together in the past?</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 - 6 Months</td>
<td>5</td>
</tr>
<tr>
<td>6 - 12 Months</td>
<td>6</td>
</tr>
<tr>
<td>1-2 Years</td>
<td>16</td>
</tr>
<tr>
<td>2+ Years</td>
<td>4</td>
</tr>
<tr>
<td>Missing response</td>
<td>1</td>
</tr>
<tr>
<td>Total</td>
<td>32</td>
</tr>
</tbody>
</table>

Our panel reported that it typically took one to two years to develop effective working relationships (n=16/32). The difficulty in establishing these relationships reduced the likelihood that they would choose partners with whom they had never previously worked. The length of previous acquaintance of individuals within the partnering organizations can be classified into those who report having had a previous working experience; those who report a close relationship (e.g., friendship or PhD advisor-student) prior to working on the current partnership; those that report an indirect knowledge of one another but no previous relationship (e.g. by reputation, through working in the same field); and those who mention not having any prior relationship with the current partners.

Communication was one of the key factors that slowed partnered implementation across IHE–K-12 boundaries. One panelist said the “the sense of urgency across the two cultures is different.” While another said, “they speak different languages – literally.” One of the difficulties in establishing good working relationship is the difference between their

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11 This difficulty in forming totally new relationships and the panel’s reporting that they are less likely to work with people they have never previously worked with gave us an early indication that the partnered relationships within the MSP program are not new but are a continuation or reconstitution of previously established working relationships.
respective institutional schedules. University faculty have more flexibility in their schedules while teachers and K-12 administrators are getting ready for work at “5am and are dead tired by 2pm.” Also, the institutional calendars are usually different and the participants at a partner organization may be on a school break when needed.

Figure 4. Examples of Reported Relationships Prior to the Current Partnership

**Previous working experience**

“three to six years with Education, Mathematics, and Science Faculty, 10 years with FDOE administrators, all professional or administrative relationships”

**Previous indirect knowledge**

“Having a track record and reputation for effective partnering is critical when a partnership has to be put together in response to opportunities that arise (i.e. not planned on strategically).... Basically using lessons learned.”

“I had met several of the key people from other organizations over the prior 2 or 3 years, but did not have close connections with them”

“The partnership consisted of a faculty member for C... College and Mathematics and Science Alliance (MMSA) and secondarily the Maine Department of Education. I knew the person at C... College and the people at the Maine Department of Education. The faculty at C... I had known for about one year and did not know very well (Acquaintance), but we worked together on the proposal. The staff at the MMSA knew each other for several years, (Professional working relationship). I knew the people at the Maine DOE for one year (Professional working relationship). The school that joined the partnership joined based on their low student performance in mathematics.”

**Previous closer acquaintance (e.g. friendship, PhD advisor–student, etc.)**

“Over twenty five years, he was a former student and a teaching professional as well as a fellow chairman. He and I are joint members of three professional mathematics organization. Both have been very active in promoting mathematics education in math departments in Texas colleges and universities.”

"My former doctoral student, with whom I’d had a close working relationship, led the involvement by Rowan University. When the project began (1993), we had known each other for about 20 years, though we had not been in touch continuously throughout that time. I’d had professional relationships with individuals at other important partner groups (Merck & Co., the NJ Dept. of Education, the NJ Dept. of Higher Education,
other universities, some of the school districts) that went back for eight years, but few of
these were really close."

“I had a personal friendship with one of the five key individuals for 4 years prior to the
partnership. He was a mathematician at the same institution in which I am a math
educator.”

“I have had a personal and working relationship with faculty members from Auburn
University for approximately ten years. I did not know the leaders from T... University
nor did I know the project director before becoming a part of the grant writing team. As
AASA district four president I knew all the local school superintendents.”

No prior relationship with the other partners

“For the C... grant, none of us knew the university people before writing the proposal”

“The Metro Atlanta P-16 Council (partnership) was formed at the start of the P-16
initiative in Georgia. Governor Zell Miller had just started the Georgia P-16 Council…
The University System of Georgia had decided to give seed funding to any of the teacher
preparation institutions to start localP-16 councils. I had not previously known people
from most of the partner organizations.”

"I had worked with... (the PI) for 6 months in another capacity before being asked to
come to W... to help create the partnership... persuaded me to come to W... We
continued communicating with the partners during the time between submission and
funding... virtually every person involved in the project was new to me.”

Several of our panel’s responses led to questions about the importance embedded
relationships have on partnering. For example, one of our panelists reported that he
personally was brought on “to help create the partnership” even though he had no
established record of working with any of the partners and “virtually every person
involved in the project was new to me.” However, most of our panel stated that they had
known or known of the other partners prior to engaging in their current project. Many of
our panelists described knowing people loosely but having not worked with them, needed
time (most commonly 1-2 years) to establish a good working relationship. One might
expect partners with a prior working relationship to get off faster and to be more
productive in early years. Therefore, it is important to parse embedded relationships into
those including and not including prior working relationships.
To further this example of how important interpersonal relationships are in STEM education, the general solution proposed by several panelists for dealing with such problems within the partnership was to work toward a peer relationship between the two groups so that each is equally invested in the work and could contribute their share. Even though higher education faculty may possess the needed content knowledge, curriculum expertise, or knowledge of how to use new resources they argue, K-12 practitioners must still be seen as contributors and made to feel important to the process.

We found that other measures of embeddedness like trust, a potential partner’s reputation, and open communication were indeed important to the formation of a partnership. The overwhelming consensus on relational issues was that K-12 and higher education practitioners must work together in mutual respect for the partnership to succeed (again we find interpersonal language). However, one of the most common points raised was that the higher education faculty are perceived to act with an air of superiority and often fail to involve the K-12 participant’s and teachers in the decision-making process creating a negative atmosphere. Interestingly enough, one panelist dismissed longstanding relationships altogether as a helpful element in building collaboration, even as another pointed out that both higher education and K-12 need to work on communication and collaboration from the start. For example, one particular panelist reported that merely the prestige of some individual university faculty members or other prestigious education partners intimidated others from contributing to or even participating in the STEM partnership.

When asked what made a particular intervention the best, twenty-five percent of our panel (n=7/32) responded from an organizational perspective. The panelists cited connections to “prestigious labs,” sponsorship by NSF, cross-organization work-groups, and the creation of broad links “among scientists and educators,” as the reasons a particular intervention stood out. However, the overwhelming majority of our panel reported from an individual perspective (n=25/32) saying for example “it is the people I have worked with,” “I have been learning a tremendous amount,” “Worked on something I cared deeply about.” That so much of their description of the positive aspects of
partnership come from an individual perspective suggests that, for these experts, partnering is much more interpersonal than it is interorganizational.

**Trust**

Embedded relationships are assumed to have a direct positive relationship to the levels of trust achieved in a partnership, and are noted as an important condition for their successful formation. Our panel overwhelmingly reported that mutual trust was critical or very important (n=30/31). Higher levels of trust develop over time and do not occur automatically when organizations decide to partner. People with long-term relationships generally have higher levels of trust whether the relationship is based in work or not. However, because long-term nonworking relationships may contribute to higher levels of trust they may shorten the time it takes to develop good working relationships and thus may contribute to improved partnering. In addition, several respondents mentioned trust and mutual respect as key factors in how they chose their partners, (n=6/32) and this contributed to the operational success of their partnership. Among these responses, trust was specifically linked to the frequency and length of the interactions among the partners and to establishing good communication among the partners. However, embeddedness does not cause trust but, trust and embeddedness may covary, and trust may be associated with longer-term relationships.

Figure 5. Examples of Responses Related to Trust

> “Time is not the only aspect, frequency and length of interactions matter just as much. It is a matter of establishing mutual trust and respect. If partners meet once a month it takes a lot longer than if they meet twice a week.”

> "Mutual respect, trust, and a shared mission. These are always the deciding factors in any partnerships."

> “We require trust and competence when we develop partnerships. All other factors, while important, can always be worked out if a problem arises. We have always been successful by following this rule.”

> “An important factor in providing an MSP project with evaluation assistance is developing a relationship of trust and respect. Many MSP projects are skeptical about
the degree to which our project can help them improve their evaluation activities. Reasons for the skepticism include concern about time away from their project activities (transaction costs), concern about what we do with information they share about their project, and willingness to admit that they have weaknesses. Many issues related to these concerns are related to trust and respect and it can result in ineffectual project evaluation.”

Strategic Needs

The second of the critical variables in our initial model of partnership was strategic needs at an organizational level. Following Burt (1992), who argued that organizations enter partnerships for rational reasons (e.g., to gain resources, increase control or coordination, to gain knowledge or expertise, to gain legitimacy), we initially hypothesized that greater alignment of goals and complementarity of strategic needs would increase the likelihood of partnering and would improve outcomes. When asked what they needed from partners, our panel mentioned opportunities to acquire new finances, developing a new curriculum, professional development, knowledge, and various other resources as necessary to accomplishing the goals at hand.

For example, the majority of the panel reported that most of their partnered work was supported by federal monies (n=19/31). Just under half of the panel said they had formed their partnership in response to conditions of a federal grant (n=14/31). When directly asked if their organization would partner if the work were not covered by external funds, two-thirds said yes (n=22/31). Only nine of the panelists stated that their organization would not be involved in partnering without all of the money coming from outside sources. For most of the panel, partnership was not about chasing money.

As alternatives to finances (new external grants), our panel reported responding to locally specific education needs (n=29/31), the need to address the achievement gap, changing technology, and to locally important environmental issues (e.g., ethnic diversity, poverty). However, the most frequently mentioned needs that emerged from the panelists’ responses pointed to common goals, a shared vision, and commitment (none of
which are organizationally strategic) as the real keys to reaching success rather than any specific resource.

Because having a mutual goal was the only perceived need that rose to the level of critical importance among our panel we needed to rethink needs as a driver of partnership formation. The implication here is that needs do not really drive people to partner but, rather, that they partner with people who have similar goals. This evidence supports Gulati’s argument that a purely rational approach to choosing partners is less important than the existing environment and socially embedded set of relationships (Gulati, 1998).

Our panel told us that good partners are first and foremost advocates for STEM education. Their experience is a distant second in importance. Further, the diplomas of potential partners do not matter, and surprisingly, the involvement or support of local community groups also rated low on a scale of requirements of good potential partners.

Nearly half of all responses on the subject of needs concluded that a common foundation in which all partners’ interests and contributions overlap is absolutely necessary. By far, the overarching theme that materialized around the needs of partners was that unity of vision, goals, and values among the partners is essential in pursuit of a goal. Several panelists even stressed the importance of establishing a set of core principles of the partnered intervention from the beginning so that all parties involved were clear about the purpose and intent of the partnership. Others mentioned that a common passion, enthusiasm, and commitment from within the partnership were all important.

Instead of addressing partnership strategic needs in a more objective, resource economic, or organizationally strategic manner, most responses described the needs of their organization conceptually, as a desire to work together, share benefits, have mutual respect, and a “sense of ownership” that often followed a discussion of commonality.\(^{12}\)

\(^{12}\) It is interesting to note that when our panel discussed their partnered relationships, they spoke from an interpersonal perspective; yet when asked in a similar open-ended fashion what they needed from partners, they stuck to detailing what their organizations needed. This seems to indicate that for our panel, the relationships are personal but the work is organizational.
The overwhelming consensus on the need for a common vision and goals among partners suggests that any lack of these would be a serious constraint to effective partnering.

The need to have such a common vision prior to partnering is evidence of and implies a programmatic mentality among our panelists. A common vision means that the characterization of the problem, the choice among several potential alternative solutions, and some plan for implementation is likely to have been established prior to the formation of the funded STEM partnership. This evidence aligns nicely with an ongoing process of developing funding proposals that are specifically tailored in advance and bounded by the requirements of a particular funding program. However, if we define partnership formation as beginning at the start of a funding cycle (and thus potentially bounding our partnership evaluation efforts in the same way) we leave out theoretically important and beneficial elements of the collaborative partnership processes. Much of the value of collaboration is gained from discussing various components of a problem, developing a consensus on the character and importance of a problem, developing options, making decisions, and then implementing, evaluating, and reconstituting consensus so that further improvements can be made.\footnote{There is an important theoretical question here about when the STEM partnership forms. If specific funding streams are intended to drive partnership formation and if we consider the work needed to develop an acceptable proposal, it is possible that the opportunity for funding drives the formation of as many or more partnerships as does receiving funding. However, the operation of these partnerships may be delayed until a source of funds is successfully secured or they may quickly dissolve if alternative funding is not found.}

Figure 6. Examples of Responses Related to Organizational / Partnership Goal Alignment

| “Partnerships are not all organizational. Partnerships among organizations REQUIRE strong administrative commitment. Partnerships among individuals require a vision” |
| “The partnership must help the organization advance it goals. Working in partnership in some respects is harder than just doing your own thing - especially in the short run. Having to work across multiple institutions and develop understandings of the cultures and contexts in each is hard and slow work. To establish a commitment to do that hard work, the partnership must have a clear and valued benefit to all partners.” |
“The single most critical component is having mutual goals among potential partners. Having a clear picture is not necessary, but the concepts are agreed to and there is trust that the partners can achieve common goals by an ongoing participation by all partners. This does not mean always at the beginning, but trust that common goals will be agreed to. So that revisiting the goals at the beginning to key and making revisions due to the realities of the context. Also once up a running revisit the goals at least annually and make adjustments through involving all the partners is very important to a successful partnership.”

“Agreement that a partnership is needed. Trust between different interests. Leadership of respected individuals. A clear and open process. A shared vision of what might be achieved. Time to build the partnership. The development of compatible ways of working, and flexibility. Applying research to solving problems. Good communication, perhaps aided by a facilitator. Collaborative decision-making, with a commitment to achieving consensus. Effective organizational management.”

Once the common vision was established, themes that ran throughout the discussion highlighted time and funding as major needs as well. Before the partnership has formed around a common goal and mission, issues of time and money hinder individual organizations from achieving their own set of goals, and this leads them to collaborate with other like-minded organizations. Less frequent but also common responses along this vein included a need for communication, specific expertise, good data, networking, better use and understanding of technology, and professional development to bring individuals together.

When asked about the needs in their communities to which their home institutions responded, our panel reported several that related directly to education. For example, they reported the need to “strengthen the education system especially in science and math,” “provide professional development to teachers,” and to “redesign AP biology.” However, about half of the panelists said they were responding to broader community needs in “high minority, high poverty, low educational attainment” regions. Their interventions were set in an environment in which local needs were high even as resources were constrained. Also a quarter of our panel reported responding to direct political pressure from outside of their home organizations.
Rivals to Our Initial Model

In addition to goal alignment and other organizational strategic needs of the partners, our panelists reported that their organizations were responding to other non-organizational factors that were driving their decision to partner and with whom to partner. For example, high poverty in their local areas was cited as driver of or constraint on their STEM activities. However poverty is not limited to or controlled by the partnering organizations. That such a critical constraint was outside of our initial model argued for an expansion of our model to include broader environmental conditions. Our initial hypothesis that embedded relations and organizational strategic needs were the two primary drivers of partnering was shown to be incomplete.

When asked about the operational success of a partnership, our panel cited having a passionate individual championing the project as the most significant factor (n=30/31). Key personnel interactions were cited as more important to the success of the partnerships, than were the interactions of top executives. However, as we read the narrative responses, we began to realize that the presence of a passionate individual was also an important factor in the formation of partnerships. This presented a rival to our initial hypothesis that partnering was an organizational phenomena driven by organizational strategic needs and embedded relationships. The importance of key individuals strongly suggested that evaluating partnerships requires at least one additional unit of analysis to capture the range of behaviors we were observing.

Also, there was a tone of coordinated activity but little description of collaborative interactions. Due to the importance of individuals and the coordination of other small groups, we decided to expand our model from a single organizational unit of analysis to one that considers additional units of analysis. We also recognized that our original model lacked any way to control for the environmental context of STEM partnerships. Therefore, we decided to expand our model to explore in more detail the impact environmental conditions have on the formation and operation of STEM partnerships. We also decided to add a separate environmental variable to specifically capture how the
rules and inducements placed on partners (generally the requirements of the funding agencies) impact partnering and outcomes.

Figure 7. Final Evaluation Model of Partnership

Expanding Our Model

In the initial rounds of our survey, our panel reported a number of factors that were important to the formation and operation of their partnerships that fell outside of the bounds of our initial model. The primary motivation for expanding our model of partnership was the complexity of the reported interactions (requiring additional units of analysis), the lack of a terminal point to the lifecycle of a partnership (our original model failed to capture the possibility of breakups and reconstitutions of the relationship), and the lack of an obvious place to explore the effects of environmental conditions including the rules imposed on the partners by funding agencies and the impact policy inducements
on partnering. While the expansion of the logic model increases the scope of our project, our growing understanding of the complexity of STEM partnerships and the variety of actors involved made it necessary.

While initially our research focused on organizational interactions (thus an organizational unit of analysis), our decision to explore additional potential units of analysis in this study is well supported in the literature. Provan and Milward's analytical approach explored individual, agency, and network level impacts on outcomes (K. G. Provan & Milward, 1995). And, a broad application of Yin’s work suggests looking at individuals, organizations and their network relationships (intermediate units), and the environmental conditions (total system) (2003). Therefore, the need for incorporating multiple units of analysis in our understanding of partnerships was not completely unexpected.

For example, in the first round of the study we learned that our panelists would often speak from a number of perspectives when describing their partnership experiences. Sometimes they spoke from the perspective of their individual experience or the experience within workgroups. Other times they spoke for their organizations. In later rounds we attempted to be more explicit in tailoring the questions to these distinctive points of view and establishing alternative units of analysis that might be used in evaluations of partnerships. In order to capture these differences and to be more systematic in our later analysis of the impacts of education partnerships we developed a set of interaction effects that include individual, work-group, organizational, partnership, and policy components.

We observed respondents providing information at five possible levels of analysis. Potential units of analysis open to partnership evaluations include the individual, work-group, organization, interorganizational partnership, and policy network. In our expanded model, we have only one unit of analysis (the individual respondent). However, the goal of our analysis is to identify models of partnership behavior that may inform evaluations. To this end, we have attempted to note when respondents were changing their frame of reference between these different levels of analysis. By individual, we are referring to individual participants within a partnership without regard
for their organizational affiliation. Work-groups can be either subunits of their home institutions, or they can be task-oriented groups that can implement partnership activities outside of any specific organizational boundaries or jurisdiction. The organizational level of analysis (our starting point) refers to the partnered parent organizations. These organizations may be more or less connected with or committed to the partnered activities. The partnership refers to the decision-making core of the partnership. This core may reside separate from, wholly, or partially within one of the parent organizations. The policy level of analysis refers to the set of actors including those outside of either organization that may have an impact on the formation, operation or outcomes derived from the partnering. The policy network context gives us a place to model the impact, for example, that various funding strategies or sets of requirements have on partnering. We expect that the more detailed logic model will provide a better context for detailed discussions of the impacts and interactions of partnering.

Responses from the panel also led us to the realization that our model needed to capture partnership’s entire lifecycle. We wondered if our panel would see the dissolution of their partnership as a failure or as merely the cessation of a completed project. Alternatively, if we see the process of applying for funding as a part of partnership formation, the failure to receive funding might contribute to the failure to form or dissolution of a partnership.

We have included a number of arrows indicating hypothetical feedback mechanisms within the partnering process. Formation and operation are hypothesized to be impacted by embedded relationships, strategic needs, environmental conditions, and the specifics of the rules and inducement that lead to the partnership. The connection between formation and operation is recursive. As a partnership evolves or changes in response to adding or losing members, the process of formation repeats. The model assumes that the operations of the partners would be modified in reaction to learning from measures of process. Performance outcomes are hypothesized to be enhanced by better measures of
performance. The rival pathway in the model exists so that we can account for impacts that cannot be accounted for by partnering\textsuperscript{14}.

In the previous discussion about strategic needs, we found that some of the needs our STEM partnerships react to are external to the organizations. The inclusion of environmental variables allows us to account for the context in which the partnerships operate.

\textit{Environment}

Our exploration of organizational strategic needs led to the addition of environmental variables. We made a further distinction between general environmental factors and variables associated with externally imposed policies, rules, and inducements. Collectively these variables permit a capacity for observing partnered relationships tailored to the specific local conditions. Factors associated with the generic environment tend to be descriptive of the educational challenge confronting professionals. Many of the respondents reported that these factors are also a major motivation for the formation and participation in partnerships.

Several members of our panel reported working in districts that have high poverty rates and that the prevalence of poverty among their students impacted their work. Environmental concerns might also be \textit{geographic scale} of the partnership. Our panel reported a wide variety of geographic scales within their most recent partnership (local community, n=1; a single city or county, n=3; region, n=10; state and larger, n=18). The \textit{geographic scale} of a partnered intervention is a critical consideration when evaluating the impact of partnering particularly with regards to implementation strategies.

A third element of environment has to do with the previous attempts at addressing local education problems. While \textit{embeddedness} captures the history of organizations working together, we found that it is also important to understand the nature of \textit{previous}

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\textsuperscript{14} Throughout this research we have been on the lookout for evidence that partnerships have no effect, thus falsifying the assumption that there is some value added generated by partnerships.
interventions. These can act as an anchor shaping the starting points for most partnerships. A history of failed (or successful) interventions can impact ongoing and future work. Therefore, controlling for what came before is important (recall that several of our panelists reported working on a series of interventions that lasted as long as 30 years and averaged close to ten). In a similar vein, the collection of other activities related to education must be controlled for as they may add to or detract from a program's success. We need to measure the impact of partnering with respect to a particular intervention while controlling for other activity. In this we refer to the regular work of the organizations as distinct to the work of individual partner organizations related to a particular partnered intervention.

A final environmental factor from a partnership perspective is the standard operating procedures of the participating organizations. Normal work patterns refer to the routines and content knowledge that education organizations would normally engage in absent the partnership or the external funding. These regular procedures may be leveraged or can inhibit partnering. Understanding normal work patterns provides a baseline for assessing the nature of the intervention being offered by the partnership. For example, our panel reported no consensus on how well their home organizations handled disputes among partners (indicating that several had troubles), while most said that there were clearly established procedures for getting paid (n=19/30). The difference in the extent of overlap between regular, ongoing work with standardized procedures and the newly constituted partnered work (in which standard processes and procedures must be negotiated and developed) must be accounted for when evaluating the impact of the current intervention.

External Policies, Rules and Inducements
The need to specifically account for the impact of the rules and inducements partners operate under, while not initially obvious, became so when our panel started telling us about the internal and external control of their projects. We would ask, for example, who they chose as partners, and they would tell us. Then when we explored why they choose specific partners, they would sometimes tell us not that the partner was needed, but that they were responding to “various requirements” from government or other funding
agencies. Alternatively, within their partnered relationships, issues of control and fairness were reported to impact the operation and effectiveness of their partnered work.

Our panel reported responding to both funding agencies and to governments. The response to funding agencies seemed milder as many of the panelists had experience with federal agencies and with partnership requirements that applied only to grant participants, and with state and local level block grants that gave them a source of funding with fewer strings. Neither of these seemed to place such a burden on the participants that they could be classified as drivers of behavior (except for writing the proposal, reporting, and basic accounting). For example one panelist said, “Federal policies are more like exaggerated mandates that can be subverted locally.” Another said, “I don’t see much influence by federal policy. I believe that we are encouraged to do this [partner] because it is more cost effective.” Another panelist clearly stated that they partner because “NSF programs (& other federal programs) specifically require partnership, or collaboration).

However, federal government laws (e.g., NCLB), rules, and mandates (especially those without funding) drew a bit of fire because “the policy environment constantly changes.” Clearly the panel reported responding to federal laws, “school districts are responding to” NCLB. A common theme was that, “NCLB has a significant effect on the kinds of things that school districts are interested in.” Clearly, this broader environmental context extends beyond the partnering organizations and its effects need to be factored into our analysis on partnering.

*Internal Controls*

Institutional support is an important variable. For example, nearly half of our panel reported that is was critical to the success of their work (n=12/31), while the rest rated such support as at least important. However, the support from home institutions can vary widely and can differ by institutional type.

We asked a series of questions related to power and control within the partnered relationships and among the partners. In these questions we wanted to explore our panels’
Alternative Approaches to Evaluating STEM Education Partnerships

experiences with other individuals and organizations involved in partnerships. We initially anticipated a difference, hypothesizing that typically one organization might be the more controlling or that a single individual would be both a driving force and in charge. However, our panel was split with about half reporting more centralized control and disproportionate power \((n=17/32)\), while most of the rest reported an equal sharing of control and balanced levels of power \((n=10/32)\). Interestingly, this broke out along a gender and minority basis. Women and minorities were more likely to report power being shared and less centralized decision-making. While men were more likely to report that power was concentrated and that decision-making was centralized. We also noted that older panelists were more likely to report more centralized power and control.

Two main themes that emerge from the dialogue as common denominators to power issues among partners are the structural management of the partnership and the status or prestige of the individuals involved. Nearly every complaint or bit of praise from the panelists touched on one or both of these themes when addressing the power situation and its effects on their partnership. While there were the reported differences in opinion among the panel’s responses based on variables such as gender, race, or occupational affiliation, the overall message was that management and relationships are the key elements behind power struggles.

Panelists who addressed organization and management of the partnership as a reason for power issues raised several different but overlapping concerns: external facilitation, unilateral decision-making and control, top-down management, and unequal distribution and recognition of the work. The common story that materialized from these concerns was one in which the partnership began with the intent of equal contribution from all involved but ended up with one partner dominating the planning and decision-making processes and receiving more of the credit for the work or accomplishments.

However, most of the panel reported that the work of their organization was done as agreed and only slightly less enthusiastically reported the same about their partners. Also, there was no consensus over whether legal contracting improved performance. Several
panelists acknowledged turf battles as a reason for resentment, distrust, a lack of communication, and in one instance, the ultimate failure of the partnership. Specifically, money-handling decisions were referenced various times as having a negative impact on the partnering environment, in large part because it is difficult to establish trust and an equitable partnership when one institution “is seen as holding the purse strings.” How money is handled by partner organizations is a critical factor in our case analysis of partnerships.

**Connecting Partnership to Outcomes**

Changes in an intervention driven outcome measure, (e.g., improved student test scores) are difficult to trace back to a specific education program. Environmental noise makes drawing a clear line of causation close to impossible. Therefore, it is difficult to determine what effect programs have or to determine if an intervention developed and implemented within a partnership is different from or in any way better (or worse) than one developed by an expert in isolation. However, to help us sort out the varying impacts generated by different partnered and non-partnered arrangements we make the distinction between process-based outcomes and performance–based outcomes. By *process*, we are referring to our panels reporting of how (or if) they did their work, and by *performance*, we are referring to conventional performance measures of changes in educational outcomes (e.g., test scores), numbers of clients impacted (e.g., teachers receiving PD), or whether specific benchmarks were met.

By its nature, a partnership asks participants to step out of their normal patterns of work. However, not all partnership participants are stepping beyond their normal activities. It is not uncommon for partnerships to be populated by professional development personnel or members of soft money organizations such as research centers and consulting organizations whose work is aimed at bridging their institution with resources available in the environment of the organization.

Thus when one looks at the work of a partnership, it cannot be assumed that all change is institutional or transformational. These are slippery terms but hold at their core some
fundamental shift in the way that partnership actors interact with their professional networks. Beije and Groenewegens’ (1992) study of networks in the private sector amongst commercial actors makes a useful distinction between transformational and transactional network activities and outcomes. Human and Provan (1997, p386) applied this approach to their study of small manufacturing networks. They define transformational outcomes as “changes in the ways the managers of network firms think, act, or both.” In contrast, transactional outcomes “are enhanced resource acquisition or gains in performance.”

The concept of transformational outcomes translates well to the setting of STEM partnerships. To win a grant award from NSF or the Department of Education, proposals have presented the case that actors entering into a STEM partnership will be drawn into efforts to expand their professional networks, learn new approaches to teaching, enhance their content knowledge of the subject matter that they teach, adopt new curricula, and that there is some hope that the institutional relationships will be sustained. Transformational outcomes imply a change in the normal patterns of work by individual participants and their home organization.

The concept of transactional outcomes does not translate as well to an education since the types of relationships and values among actors and organizations are of a different nature. We use the term programmatic outcomes to describe the types of marginal improvements in the work of participants and their organizations. Programmatic outcomes imply not only a gain in the performance or quality of a given activity, but also a continuity of the normal activities carried out by the participating professionals and their organizations.

Process Outcomes

In our model, measures of process have their root in the operational capacity of the parent organizations and how partnering impacts their ability to accomplish desired goals. Much of the benefit of partnering is assumed to be in greater communication, collaboration on projects, and learning (Goodlad, 1988; 1994; Brinkerhoff, 2002; ). However, the improved coordination or leveraging of resources might also be significant.
contributors to or benefits of partnering. Our panel had little trouble telling us what they
did but they had much more difficulty telling us how partnering improved their work.

In the second round of our survey we spent some time exploring the typical work patterns
of STEM partners. The majority of the panel participants reported reciprocal working
relationships in which they passed work back and forth as needed (n=21/32), which
argues for the presence of collaboration. However, they spend a lot of time talking about
programs but little about what they or their organizations add to the work. They did not
link the partnership process directly to improvements in programs or outcomes. And
while two thirds of the panel described partnership as a process, they did not specifically
talk about their organization’s role in goal setting or decision-making.

Also, they did not report clear stories about learning to drive organizational changes, yet
they claimed regular interaction and learning. When asked in an open-ended format “how
long had you know someone from your partner organization,” twenty percent of our
panel reported that all of the relationships in their current work were new. However, for
most of our panel the relationships go back for many years. They had worked with the
same people on several different projects one after another (with emphasis on the
individual people). This has led us to conclude that longest of the embedded professional
relationships are more interpersonal than interorganizational.

Changes in Organizational Capacity
The question of how changes in organizational capacity impact the work of a partnership
over time is key to understanding its development and stability. With that in mind, we
focused on five main themes to help guide our analysis: resource exchange, the impact of
outside funding, training, turnover, and connectivity (or collaboration). Some panelists
explained the process of exchanging resources, expertise, and support between K-12
educators and higher education faculty. However, many panelists discussed changes in
capacity as more of a broad concept than as a specific improvement or loss; their natural
inclination was to use the idea of improved capacity in general support of partnership
activity.

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The most common themes among the panelists’ responses addressed the general overlap of the exchange of new resources and knowledge among partners. Several individuals specifically pointed to the assumed model of higher education faculty and K-12 teachers in which university-level educators bring the content knowledge, expertise, and research literature to the table while K-12 educators contribute their pedagogical experience and direct perspective of the classroom (n=6/32). This model presumes that each group has specific resources to share with the other, and the result is a better approach to teaching and the learning environment. One panelist used the picture of a Venn diagram to explain that the overlapping product of two organizations entering into a partnership as “a mutual value and productivity between them,” such that one is “magnified, enhanced, or transformed” by the other. However, beyond these words were few specifics of precisely what or how things changed.

Another substantial theme that emerged from the responses described the effects of turnover on partnership capacity and sustainability. Interestingly, there were diverse opinions about the impact of turnover. Some contended that its effects were significantly harmful upon the future success of the partnership (as key people were lost or those with specific skills were hard to replace) (n=6/32); others took a middle stance by saying that it had the potential for good and bad (too much and you were lost but some turnover refreshed the partnership) (n=9/32); and the remaining believed it to have no effect if the partnership was sound (n=17/32). None of our panelists were willing to argue that any turnover is wholly detrimental to a partnership, but it was, rather, a complicating factor that must be handled carefully. Specifically, a handful of individuals brought up trust and reputation as potential problems with turnover, as many organizations work years to build up these two values within their institutions and among their partners (n=4/32). For this reason, the overriding idea was that turnover, if handled properly through good training and leadership, could result in an improvement in capacity.

The discussion on training and connectivity was slightly more limited, but the comments were substantial in their application to capacity change. Many panelists brought up
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networking and community ties as important improvements to capacity, such as the building of “education-business bridges,” greater leverage with larger numbers, and a better political cooperation (n=17/32). One individual commented that the partnership of two school districts directly influenced its positive networking with the local government and universities because the two districts had shown their focus on the improving the community as a whole.

When the panel was asked if their interactions with partner organizations changed their approach to working on programmatic activities, the answers were varied in detail but most had said yes (n=28/32). Interestingly, only four of the panelists did not believe that their interactions with partner organizations had in any way changed their approach to working on programmatic activities. Of these four respondents, all were from IHE.

Of the thirty-two people interviewed for this project, twenty-nine gave a positive response to the following statement about partnerships: “Partnership is not a silver bullet.” Of the dissenters, one declared that the best hope for building the capacity of low performing schools lies within the schools themselves, and these schools should not depend on other institutions to change their curriculum. Another argued that the university should not be held responsible for the success of underachieving student populations.

Partnership as a Lifecycle

Partnerships can be conceived of as having a specific lifecycle (formation, operation, and eventual dissolution). When asked in an open-ended fashion about the lifecycle of their partnership, the most common response among the panel referred to the funding cycle of their interventions (n=17/32). They thought of their partnerships as beginning and ending with the funding. However, those who had very longstanding relationships did not see a linear lifecycle as a useful concept because, “in most cases where the grant has come to an end, other funding has been secured,” or they saw their partnership as cyclical bursts of energy that eventually leveled off to be followed by periods of rejuvenation.
The panel identified the “start-up” phase as the most important. The people involved meet one another and tend to agree on common goals and decide the different types of resources they will need in order to complete their agenda. During this phase the members of the partnership “tend to behave independently.” However, it is during this stage that partners develop plans and secure funding. Once operations begin, there is more of a feeling of teamwork because these people have grown to trust one another, and they have witnessed each member’s commitment to making the partnership a successful one. For many of our panelists, partnership dissolution never occurs as the transition into the next funding stream. However, for some the end of the finding means the end of the partnering (n=5/32).

**Performance Outcomes**

Our panel reported the most likely beneficiaries of their partnered work would be teachers. The majority of our panel considered only improving teacher content knowledge and teaching skill as very likely (n=17/32). Improvements aimed directly at students (as well as teacher retention or IHE faculty) were beyond the scope of most of their interventions, so it is not surprising that their claims are less certain.
Table 5. Outcomes From Partnerships

<table>
<thead>
<tr>
<th>6. What is the likelihood that projects you have worked on within your partnerships will have substantial and lasting impacts on:</th>
<th>Very likely</th>
<th>Somewhat likely</th>
<th>Neither likely nor unlikely</th>
<th>Somewhat unlikely</th>
<th>Very unlikely</th>
<th>Not applicable</th>
<th>Missing response</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>6.a Improving student achievement in low performing schools</td>
<td>10</td>
<td>17</td>
<td>2</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>2</td>
<td>32</td>
</tr>
<tr>
<td>6.b Closing the achievement gap</td>
<td>7</td>
<td>17</td>
<td>4</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>2</td>
<td>32</td>
</tr>
<tr>
<td>6.c Improving student retention</td>
<td>5</td>
<td>12</td>
<td>6</td>
<td>1</td>
<td>1</td>
<td>5</td>
<td>2</td>
<td>32</td>
</tr>
<tr>
<td>6.d Improving teacher content knowledge</td>
<td>17</td>
<td>12</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>2</td>
<td>32</td>
</tr>
<tr>
<td>6.e Improving teacher pedagogy</td>
<td>15</td>
<td>12</td>
<td>2</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>2</td>
<td>32</td>
</tr>
<tr>
<td>6.f Improving teacher retention</td>
<td>2</td>
<td>12</td>
<td>11</td>
<td>2</td>
<td>1</td>
<td>2</td>
<td>2</td>
<td>32</td>
</tr>
<tr>
<td>6.g Creating a learning community of STEM professionals between K-12 and IHE institutions</td>
<td>9</td>
<td>9</td>
<td>6</td>
<td>5</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>32</td>
</tr>
<tr>
<td>6.h Improving IHE faculty pedagogy</td>
<td>6</td>
<td>9</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>32</td>
</tr>
</tbody>
</table>
It is not at all clear that what impact the interactions, collaboration, and mechanisms for decision-making and coordination within a partnered intervention have or could have on the performance of individual students. There was a great deal of difficulty by the panel in describing how any programmatic intervention delivered a specific outcome. Several of the panelists reported on the constraints imposed by the greater complexity of working within a partnership, including the additional time it took for planning and decision-making, coordinating activity, unclear lines of authority, and difficulties with shared control.

Changes in an intervention-driven outcome measure, (e.g., improved student test scores) are difficult to trace back to a specific education program even without the addition of partnering to the mix. Environmental noise makes drawing a clear line of causation extremely difficult. Therefore, it is difficult to determine what effect they have or to determine if an intervention developed and implemented within a partnership is different from or in any way better (or worse) than one developed by an expert in isolation.

**Reconceptualizing Partnership**

During the course of this research we have come to conceptualize the STEM partnership as a label we place on a *relational event*\(^{15}\) that is initiated by a federal *policy inducement* comprised of a set of inter-organizational collaborations aimed at enhancing the performance of participating partners in generating desired policy outcomes. A policy inducement is any program that provides funds for specified activities but has requirements for qualification\(^{16}\). These requirements are intended to fund specific activities or to induce behaviors desired by policy-makers in the grant recipients. For example, in the case of NSF-MSP, the requirement for higher education institutions to partner with local K-12 schools can be defined as a “Policy Inducement to Partner” (PIP). The policy inducement is the initiating condition for the partnership.

\(^{15}\) This follows to Goodlad’s ideas about collaborative events providing a platform for coordinating programs, activities, and longer-term projects (1988).

\(^{16}\) This is in contrast to rules, laws or mandates that require specific actions whether an organization is prepared, willing or able to comply.
A relational event is a set of interactions between collaborators whose intent is to achieve shared or complementary goals. This set of interactions includes the different types of actors and relationships that come together in making a partnership function: the interactions between STEM professionals (from both higher education and K-12) and students (from both higher education and K-12); the interactions of individual STEM professionals working together; the interactions of organizations in aligning rules and procedures; and the interactions of policies at the federal, state, and local levels. Inclusion of all of these relationships and actors in a single set makes a relational event a very messy concept because it mixes together multiple units of analysis and multiple modes of relationships. However, when human beings relate their experience in working with partnerships they blend these elements together easily in a narrative describing the relational event. Thus, we have developed the concept of a relational event to capture the richness of the narrative that we have observed.

In recent years, federal STEM grant programs like NSF-MSP have begun to require prospective participants to develop partnerships. Thus, one can think of a grant program as a catalyst for stimulating both a relational event (i.e., a policy inducement to partner), and for the STEM educational outcomes desired by policy-makers. The announcement of the grant program in the form of a request for proposals (RFP) is made to a larger institutional field comprised of K-12 institutions, those elements of higher education interested in STEM education at the K-12 level, and other interested groups from the business, non-profit, and governmental communities.

The funding agency designs a policy inducement that identifies the boundaries of the types of institutions that are likely to be called upon to participate. The RFP may stimulate interactions between potential collaborators, drawing people from the various organizations together to discuss the opportunity. At times, these interactions will culminate in sufficient agreement among the participants to produce a completed proposal for submission to the sponsoring agency. This proposal is, in essence, a blueprint of the relational event in which the potential partners are likely to engage. If the proposal is successful, the resources provided by the sponsoring agency are used to enact
the planned relational and have the potential to drive transformation of the organizational relationships.

Organizational transformation can be seen as an institutional change resulting from a “jolt” to the system though a breakdown in current institutional arrangements coupled with the development of new innovations and theories, which then spread to partnered organizations to be re-institutionalized in some new form (Meyer et al., 1990). For example, the National Science Foundation has provided a jolt to the education system through the MSP program. The use of partnerships as a policy tool implies that they are believed to provide an added value to educational programs. However, our panel had a hard time describing a complete network of connections from partnership formation to program outcomes. These networks change with the task at hand and evolve as new members join and others drop out.

The frameworks and models that have been developed to study inter-organizational relations and networks are rarely used to argue that partnerships are a necessary or sufficient condition to stimulate improved outcomes. While many STEM education programs seek to link partnership efforts to positive outcome variables such as increased student achievement, researchers and evaluators from several fields have noted that studies of inter-organizational relations (such as partnerships) rarely address outcomes (Gulati & Gargiulo, 1999; Kingsley & Melkers, 2000; Provan & Milward, 2001). It is far more common for partnership studies to try and explain the reasons for the formation and structure of relationship rather than subsequent outcomes and impacts to the partner organizations (Oliver, 1990) or to simply assert that there are positive benefits to partnering and then provide evidence to show that a good partnership was created. However, the professional wisdom of sponsoring agencies, built up over years of programs stimulating cooperative relationships between STEM educational organizations, has led to current grant requirements that include policy inducements to partner as a means for improving the chances of achieving desired performance outcomes. This is an instance where praxis has run ahead of our theoretical understanding of the utility of partnerships.
Panel participants reported reciprocal relationships (n=21/32), which argues for the presence of collaboration, but failed to link various stages of the partnership process. However, they do talk about the extent to which their collaborative activities extend down to programmatic activities. They are able to answer questions about how work is done and whether they are collaborating in the delivery of a program or just in the planning of the program. Our panelists could make distinctions in formation activity, but would then take formation and leap to outcomes without a clear description of the partnering operations in between. Two-thirds of the panel described partnership as a process but then do not talk about the process of goal setting or decision-making, which seems to imply that those administrative tasks fall outside of the partnership. They do not report clear stories about learning driving changes, yet they claim interaction and learning.

Evaluations focus on programmatic goals. However, evaluations described at the program level miss questions that capture the potential value added or costs generated by partnering interactions. Collaboration can be a resource intense activity but its benefits are assumed. There are perhaps pockets of collaboration embedded within coordinated activities that might add value to a program that need to be more fully examined.

**Conclusions**

Our original assumption, that partnership formation is a single interorganizational event, failed on two points. The first is that partnered relations are created in a broader context. While the beginning and ending dates of policy induced interventions such as an MSP grant offer a convenient starting point for bounding evaluation efforts this new push must be understood in light of a broader set of ongoing relationships at multiple units of analysis (e.g., organizational, programmatic and individual) and in its particular context. The new intervention may add to ongoing efforts, may shift effort in new directions, or may create resistance to current trends. In order to understand the impact of a partnered intervention we need to know how it relates to other environmental factors.
The second point is we needed to recognize the evolutionary nature of interpersonal and interorganizational relationships. As interventions are implemented new actors may be added or dropped as needs or interests change. Thus, a partnership even between just two organizations will not form in total at a given point in time in a particular way. The relationship will develop and change given the needs or interests of the partner organizations, personnel, or changes in programmatic or policy goals. It seems logical when evaluating the effect of a specific program to try to isolate the activity during its lifespan and to then try to measure its impact. However, the logical application of a linear lifecycle model when evaluating the impact of partnered activities ignores the broader local context, history and possible futures that both drive and are impacted by the new grant-induced partnered activity.

As we continue our discussion it is important to point out once more the distinction we have previously made between programmatic activity (the set of interventions in a particular time and place) and the partnership (the interpersonal and interorganizational links that facilitate implementation). This distinction leads us to a change in evaluating education programs conducted through partnerships from simply what they accomplish (program evaluation) to how the ties between individual actors and organizations impact desired outcomes (partnership evaluation). Our expanded model improves our ability to explore partnering by providing a structure to guide our analysis.

Our initial models focused on the impact preexisting conditions have on organizations and organizational interactions as the primary predictors of partnering. While we found organizational effects, we needed to consider the effects of context at differing levels of analysis. For example, our panel made the distinction between relationships based in prior work (at both organizational and individual levels) and interpersonal relationships (at an individual level) that were based on acquaintance or friendship.

For example, a partnership champion (an individual level phenomenon), alignment of federal, state and local school policies (a policy level phenomenon), and community need
(a policy level phenomenon) were frequently the cause for effective communication across organizations and aligning organizational incentives (IOR level of analysis), and the willingness of professionals to be creative in designing and mobilizing professional development activities (a workgroup level phenomenon), and a reason for teacher adoption of new content knowledge and techniques (an individual level phenomenon).

The most important finding from the Delphi panel thus far, that partnering does not fit neatly into a simple linear logic model, has resulted in the breakdown of our entity-based assumptions about policy-induced partnerships. This has led us to develop a model of the partnership process that does not begin with an entity embodied as a partnership at the center of the evaluative model. If MSP partnerships are more like sets of processes and agreements than they are like venues and entities we need to model and explore the partnership phenomena in ways allow for more flexibility than our original logic model. Borrowing some ideas from social network analysis we envision partnerships as a set of actors and activities with certain attributes that are in some way connected. For evaluation, the connectivity among organizational and individuals can be bounded by a funding cycle however by ignoring the context and previous connectivity it is likely that what is driving results will be less well understood. The evolution of our model toward one that included more contextual variables was driven by our interaction with the members of our panel.

Our initial exploration of organizational strategic needs quickly exposed the necessity of considering the needs of partners more broadly and at additional levels of analysis. In particular, our panel reported the importance of strong individual leadership and the contributions of passionate individuals to their work. Simply observing STEM partnerships from an interorganizational perspective is likely to miss important elements that contribute to the success (or failure) of partnered activity. The results of our study have suggested that much of the partnering in the STEM community is more interpersonal and less and organizational phenomena. We have been led to ask how much of the home organization is really involved in these partnered interventions. Therefore,
we expanded the units of analysis in our model to include interpersonal and larger work groups. In the future, this model should be a useful guide for evaluating partnerships.

Our work with our Delphi panel has suggested six key themes for future research that will be incorporated into our case studies.

• Interviewee Background – Our electronic Delphi panel selection process was geared toward people whit a great deal of experience. Therefore our results are biased toward senior level or long-term p'education practitioners. Our case study protocols will be designed to broaden the number of perspectives by specifically interviewing people with a range of experience levels.

• Partnership Background – A significant finding of from this research strongly suggests that previous partnership experiences matter and are carried forward in future partnership work. Some organizations operate in a serial fashion shifting from grant to grant. How newly forming groups determine work patterns may impact outcomes. Also the level of experience with similar projects of the personnel working on a project is likely to have a role in the successful implementation of programs.

• Level of Embeddedness – The connectivity that exists among Partner organizations and individual has been show to be important to partnership operations. In future work we will need to explore how these relationships impact programmatic and transformational outcomes. In particular it will be important to make distinctions between organizational and interpersonal (professional) prior working relationships.

• Strategic Needs – When asked about the needs they were reacting to, our panel reported a wide range of responses that went far beyond organizational strategic needs. Therefore it will be important to fully explore what needs education partners are responding to. We also need to explore whether or not policy
inducements actually drive behavior (alternatively we can test to see if educators are acting opportunistically responding to inducements that align with their needs).

- Partnership Administration – One element of partnership that requires detailed case analysis is how partnerships are administered and how that administration fits into, conflicts with or complements the administration of the partner organizations. The results of this study may suggest that partnership administration can impact outcomes however, a more detailed analysis is required.

- Measuring Outcomes – Our panel had some difficulty connecting their partnership to the work they did and to the outcomes that were produced. Determining how important the partnership is to generating outcomes will be a key element in our case analyses.

Our results have pointed to an evolutionary aspect to partnering, leading us to reconceptualize partnership formation from a single event to a process of entry and exit that occurs over time. While the beginning of this process can be bounded by the partnership’s initiating factors, evaluation is likely to be improved by: 1) observing the degree to which partnership is a policy-induced activity (and understanding the alignment of these inducements, 2) observing that partnership, and the level of commitment by members, is poorly understood when evaluated as a single independent event, but is better understood in the context of a set of ongoing activities and relationships amongst partners, and 3) observing the alignment between organizational and partnership operating structures and goals as a driver towards achieving desired outcomes.
Alternative Approaches to Evaluating STEM Education Partnerships

References


### Appendix 1 - Quantitative Data Summary Tables

#### Round 1

<table>
<thead>
<tr>
<th>3a. How Important are the Following for the Development of Partnerships?</th>
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## Alternative Approaches to Evaluating STEM Education Partnerships

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### Alternative Approaches to Evaluating STEM Education Partnerships

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## Alternative Approaches to Evaluating STEM Education Partnerships

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<th>21d All Work by Other Organizations was Done as Agreed</th>
<th>Strongly Agree</th>
<th>Agree</th>
<th>Neither</th>
<th>Disagree</th>
<th>Strongly Disagree</th>
<th>No Opinion</th>
<th>Missing response</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>17</td>
<td>2</td>
<td>4</td>
<td>2</td>
<td>1</td>
<td>2</td>
<td>32</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>21e It Was Easy to get payments for Expenses</th>
<th>Strongly Agree</th>
<th>Agree</th>
<th>Neither</th>
<th>Disagree</th>
<th>Strongly Disagree</th>
<th>No Opinion</th>
<th>Missing response</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>7</td>
<td>12</td>
<td>4</td>
<td>2</td>
<td>2</td>
<td>3</td>
<td>2</td>
<td>32</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>21f Organizations Handled Individual-Level Personality Disputes Well</th>
<th>Strongly Agree</th>
<th>Agree</th>
<th>Neither</th>
<th>Disagree</th>
<th>Strongly Disagree</th>
<th>No Opinion</th>
<th>Missing response</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>7</td>
<td>4</td>
<td>6</td>
<td>4</td>
<td>6</td>
<td>2</td>
<td>32</td>
<td></td>
</tr>
</tbody>
</table>
### ROUND 2

9. In Round 1, a significant number of panelists indicated that external grants and funds are the most important precondition for entering into partnerships. Please indicate the degree to which you agree or disagree with the following statements:

<table>
<thead>
<tr>
<th>Statement</th>
<th>Strongly agree</th>
<th>Somewhat agree</th>
<th>Neither agree nor disagree</th>
<th>Somewhat disagree</th>
<th>Strongly disagree</th>
<th>No opinion</th>
<th>Missing response</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>9.a My organization won’t enter into partnerships unless the entire effort is covered by external funds</td>
<td>2</td>
<td>7</td>
<td>3</td>
<td>8</td>
<td>11</td>
<td>0</td>
<td>1</td>
<td>32</td>
</tr>
<tr>
<td>9.b Most partnerships are formed because they are required by the sponsor as a condition of the grant</td>
<td>3</td>
<td>11</td>
<td>7</td>
<td>5</td>
<td>4</td>
<td>1</td>
<td>1</td>
<td>32</td>
</tr>
<tr>
<td>9.c Most of our partnerships are sponsored by federal monies</td>
<td>5</td>
<td>14</td>
<td>4</td>
<td>6</td>
<td>2</td>
<td>0</td>
<td>1</td>
<td>32</td>
</tr>
<tr>
<td>9.d It is difficult to attract partners unless we have funds to offer in exchange for their participation</td>
<td>8</td>
<td>16</td>
<td>2</td>
<td>5</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>32</td>
</tr>
<tr>
<td>9.e If there were no external grants, my organization would not be interested in participating in partnerships</td>
<td>1</td>
<td>6</td>
<td>1</td>
<td>12</td>
<td>10</td>
<td>1</td>
<td>1</td>
<td>32</td>
</tr>
<tr>
<td>9.f The STEM education objectives that our partnership pursues were significantly altered by conditions set by external sponsors.</td>
<td>3</td>
<td>8</td>
<td>6</td>
<td>5</td>
<td>8</td>
<td>1</td>
<td>1</td>
<td>32</td>
</tr>
</tbody>
</table>
10. In your most recent partnership, what percentage of the cost of your organization was covered by external grants? Please include all costs including personnel time, programs, and administration.

<table>
<thead>
<tr>
<th>Percentage</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-25%</td>
<td>5</td>
</tr>
<tr>
<td>25-50%</td>
<td>2</td>
</tr>
<tr>
<td>50-75%</td>
<td>11</td>
</tr>
<tr>
<td>75-100%</td>
<td>13</td>
</tr>
<tr>
<td>No opinion</td>
<td>0</td>
</tr>
<tr>
<td>Missing response</td>
<td>1</td>
</tr>
<tr>
<td>Total</td>
<td>32</td>
</tr>
</tbody>
</table>

10.a Do you agree that your partner organizations had a similar degree of coverage?

<table>
<thead>
<tr>
<th>Agreement</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strongly agree</td>
<td>5</td>
</tr>
<tr>
<td>Somewhat agree</td>
<td>13</td>
</tr>
<tr>
<td>Neither agree nor disagree</td>
<td>1</td>
</tr>
<tr>
<td>Somewhat disagree</td>
<td>6</td>
</tr>
<tr>
<td>Strongly disagree</td>
<td>0</td>
</tr>
<tr>
<td>No opinion</td>
<td>6</td>
</tr>
<tr>
<td>Missing response</td>
<td>1</td>
</tr>
<tr>
<td>Total</td>
<td>32</td>
</tr>
</tbody>
</table>
### Alternative Approaches to Evaluating STEM Education Partnerships

**12. Please indicate the degree to which you agree or disagree with the following statements:**

<table>
<thead>
<tr>
<th></th>
<th>Strongly agree</th>
<th>Somewhat agree</th>
<th>Neither agree nor disagree</th>
<th>Somewhat disagree</th>
<th>Strongly disagree</th>
<th>No opinion</th>
<th>Missing response</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>12.a</td>
<td>For partnerships to be effective the primary point of contact within each organization needs to be of the same (or at least very similar) rank in their home organization.</td>
<td>5</td>
<td>13</td>
<td>8</td>
<td>4</td>
<td>1</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>12.b</td>
<td>For partnerships to be effective we need to have several individuals at various levels within each organization who occupy key functional roles critical to the delivery of partnership objectives.</td>
<td>13</td>
<td>15</td>
<td>1</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>12.c</td>
<td>For partnerships to be effective we need to have several individuals in other organizations who are knowledgeable of and sympathetic to our goals.</td>
<td>8</td>
<td>19</td>
<td>3</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>12.d</td>
<td>For partnerships to be effective the majority of partners should be geographically near one another.</td>
<td>1</td>
<td>12</td>
<td>5</td>
<td>5</td>
<td>8</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>12.e</td>
<td>For STEM partnerships to be effective the partners should be drawn from across the public, private, and non-profit sectors.</td>
<td>4</td>
<td>8</td>
<td>8</td>
<td>6</td>
<td>4</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>12.f</td>
<td>Partnerships are most effective when a single person is responsible for decisions.</td>
<td>2</td>
<td>4</td>
<td>5</td>
<td>4</td>
<td>16</td>
<td>0</td>
<td>1</td>
</tr>
</tbody>
</table>
14. In Round 1 the majority of panelists reported experiencing too many meetings, ineffective strategic planning exercises, and contrived social gatherings. This has led us to explore the transaction costs associated with partnering. By transaction costs we mean those costs that partners might incur through interacting with one another and/or are associated with acquiring resources and services used for pursuing partnership goals. Please indicate the degree to which you agree (or disagree) that the following factors contribute to high levels of transaction costs for partner organizations.

<table>
<thead>
<tr>
<th>Factor</th>
<th>Strongly agree</th>
<th>Somewhat agree</th>
<th>Neither agree nor disagree</th>
<th>Somewhat disagree</th>
<th>Strongly disagree</th>
<th>No opinion</th>
<th>Missing response</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>14.a Regular meetings</td>
<td>4</td>
<td>16</td>
<td>3</td>
<td>5</td>
<td>3</td>
<td>0</td>
<td>1</td>
<td>32</td>
</tr>
<tr>
<td>14.b Coordinating across large numbers of partners</td>
<td>9</td>
<td>14</td>
<td>4</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>32</td>
</tr>
<tr>
<td>14.c Low levels of agreement among partners</td>
<td>12</td>
<td>7</td>
<td>7</td>
<td>0</td>
<td>2</td>
<td>3</td>
<td>1</td>
<td>32</td>
</tr>
<tr>
<td>14.d Complementary goals among partners regarding STEM education</td>
<td>0</td>
<td>5</td>
<td>9</td>
<td>11</td>
<td>4</td>
<td>2</td>
<td>1</td>
<td>32</td>
</tr>
<tr>
<td>14.e The use of formal agreements such as contracts</td>
<td>2</td>
<td>8</td>
<td>7</td>
<td>10</td>
<td>3</td>
<td>1</td>
<td>1</td>
<td>32</td>
</tr>
<tr>
<td>14.f Partnership goals that include improving student scores on standardized tests</td>
<td>5</td>
<td>12</td>
<td>7</td>
<td>5</td>
<td>2</td>
<td>0</td>
<td>1</td>
<td>32</td>
</tr>
<tr>
<td>14.g Mandates from public policies</td>
<td>1</td>
<td>17</td>
<td>6</td>
<td>1</td>
<td>2</td>
<td>4</td>
<td>1</td>
<td>32</td>
</tr>
<tr>
<td>14.h</td>
<td>Rules and requirements from external sponsors</td>
<td>6</td>
<td>14</td>
<td>6</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>14.i</td>
<td>Partnership goals that target challenging populations of students</td>
<td>2</td>
<td>11</td>
<td>6</td>
<td>10</td>
<td>2</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>14.j</td>
<td>Partnership goals that target challenging populations of teachers</td>
<td>2</td>
<td>14</td>
<td>3</td>
<td>8</td>
<td>4</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>14.k</td>
<td>Coordinating programs across a geographically dispersed partnership</td>
<td>12</td>
<td>11</td>
<td>5</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>14.l</td>
<td>Coordinating partners drawn from the public, private, and non-profit sectors</td>
<td>1</td>
<td>16</td>
<td>6</td>
<td>1</td>
<td>3</td>
<td>4</td>
<td>1</td>
</tr>
<tr>
<td>14.m</td>
<td>Few professionals with good partnership skills</td>
<td>10</td>
<td>12</td>
<td>5</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>14.n</td>
<td>Low levels of trust among partners</td>
<td>12</td>
<td>11</td>
<td>4</td>
<td>0</td>
<td>3</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>14.o</td>
<td>Turnover in partnership personnel</td>
<td>11</td>
<td>11</td>
<td>7</td>
<td>0</td>
<td>2</td>
<td>0</td>
<td>1</td>
</tr>
</tbody>
</table>
19. For the following, please select the response that best characterizes your interactions with partner organizations.

<table>
<thead>
<tr>
<th></th>
<th>Daily</th>
<th>Weekly</th>
<th>Monthly</th>
<th>Semi-Annually</th>
<th>No Regular meeting pattern</th>
<th>Missing response</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>19.a</strong> The typical frequency of your personal interactions with individual representatives of partner organizations</td>
<td>4</td>
<td>14</td>
<td>7</td>
<td>2</td>
<td>4</td>
<td>1</td>
<td>32</td>
</tr>
<tr>
<td><strong>19.b</strong> The typical frequency of a colleague from my organization interacting with individual representatives of partner organizations</td>
<td>6</td>
<td>16</td>
<td>5</td>
<td>0</td>
<td>4</td>
<td>1</td>
<td>32</td>
</tr>
<tr>
<td><strong>19.c</strong> The typical frequency of meetings in which all partner organizations are supposed to send a representative</td>
<td>0</td>
<td>1</td>
<td>19</td>
<td>9</td>
<td>2</td>
<td>1</td>
<td>32</td>
</tr>
</tbody>
</table>
### 19.d In my work with partnerships I find myself working mostly with:

<table>
<thead>
<tr>
<th>Males</th>
<th>Females</th>
<th>Both Equally</th>
<th>Missing response</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>8</td>
<td>21</td>
<td>1</td>
<td>32</td>
</tr>
</tbody>
</table>

### 19.e Which of the following best describes your personal interactions with other individuals in your latest or current partnership?

<table>
<thead>
<tr>
<th>Interaction Type</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>My interactions with individuals within the partnership almost always refer to partnering activities and almost never refer to my regular work.</td>
<td>11</td>
</tr>
<tr>
<td>My interactions with individuals within the partnership rarely refer to partnering activities and usually refer to my regular work.</td>
<td>16</td>
</tr>
<tr>
<td>My interactions with individuals within the partnership rarely refer to partnering activities and usually refer to my regular work.</td>
<td>2</td>
</tr>
<tr>
<td>My interactions with individuals within the partnership almost never refer to partnering activities and almost always refer to my regular work.</td>
<td>1</td>
</tr>
<tr>
<td>Missing response</td>
<td>2</td>
</tr>
<tr>
<td>Total</td>
<td>32</td>
</tr>
</tbody>
</table>

### 23. In your experience which of the following descriptions of work patterns best characterizes the work you have observed being performed by most partnerships?

<table>
<thead>
<tr>
<th>Work Pattern</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pooled</td>
<td>4</td>
</tr>
<tr>
<td>Sequential</td>
<td>0</td>
</tr>
<tr>
<td>Reciprocal</td>
<td>21</td>
</tr>
<tr>
<td>Other</td>
<td>6</td>
</tr>
<tr>
<td>Missing response</td>
<td>1</td>
</tr>
<tr>
<td>Total</td>
<td>32</td>
</tr>
</tbody>
</table>
25. Responses to Round 1 questions raised a question in the minds of the research team as to whether there might not be a distinction between partnership outcomes and program outcomes. The following questions are designed to help us understand whether panelists think there is a difference. Your current organization supports partnership through the following institutional commitments:

<table>
<thead>
<tr>
<th></th>
<th>Strongly agree</th>
<th>Somewhat agree</th>
<th>Neither agree nor disagree</th>
<th>Somewhat disagree</th>
<th>Strongly disagree</th>
<th>No opinion</th>
<th>Missing response</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>25.a Devoting personnel with job descriptions aimed at supporting partnership activities</td>
<td>12</td>
<td>9</td>
<td>3</td>
<td>5</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>32</td>
</tr>
<tr>
<td>25.b Devoting full-time staff to working on partnership activity</td>
<td>8</td>
<td>10</td>
<td>3</td>
<td>5</td>
<td>3</td>
<td>1</td>
<td>2</td>
<td>32</td>
</tr>
<tr>
<td>25.c Devoting staff time to working on partnership activity</td>
<td>16</td>
<td>14</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>32</td>
</tr>
<tr>
<td>25.d Rewarding personnel for engaging in partnership activity</td>
<td>5</td>
<td>15</td>
<td>5</td>
<td>3</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td>32</td>
</tr>
<tr>
<td>25.e Providing cost share on grants supporting partnerships</td>
<td>13</td>
<td>11</td>
<td>1</td>
<td>3</td>
<td>0</td>
<td>3</td>
<td>1</td>
<td>32</td>
</tr>
<tr>
<td>25.f Devoting line operating budgets to supporting partnerships</td>
<td>5</td>
<td>14</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>4</td>
<td>1</td>
<td>32</td>
</tr>
</tbody>
</table>
### Scenario #1

<table>
<thead>
<tr>
<th>2a I want to know more about the interpersonal relationships involved in this proposal.</th>
<th>Strongly agree</th>
<th>Somewhat agree</th>
<th>Neither agree nor disagree</th>
<th>Somewhat disagree</th>
<th>Strongly disagree</th>
<th>No opinion</th>
<th>Missing response</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>10</td>
<td>9</td>
<td>10</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>32</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>2b I want to know more about the organizational relationships involved in this proposal.</th>
<th>Strongly agree</th>
<th>Somewhat agree</th>
<th>Neither agree nor disagree</th>
<th>Somewhat disagree</th>
<th>Strongly disagree</th>
<th>No opinion</th>
<th>Missing response</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>22</td>
<td>7</td>
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<td>1</td>
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<td>0</td>
<td>1</td>
<td>32</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>2c I want to know more about the working history of these organizations.</th>
<th>Strongly agree</th>
<th>Somewhat agree</th>
<th>Neither agree nor disagree</th>
<th>Somewhat disagree</th>
<th>Strongly disagree</th>
<th>No opinion</th>
<th>Missing response</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>17</td>
<td>11</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>32</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>2d I want to know more about the needs of the community.</th>
<th>Strongly agree</th>
<th>Somewhat agree</th>
<th>Neither agree nor disagree</th>
<th>Somewhat disagree</th>
<th>Strongly disagree</th>
<th>No opinion</th>
<th>Missing response</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>16</td>
<td>12</td>
<td>2</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>32</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>2e I want to know more about how laws, local policies, or funding opportunities that affect the organizations.</th>
<th>Strongly agree</th>
<th>Somewhat agree</th>
<th>Neither agree nor disagree</th>
<th>Somewhat disagree</th>
<th>Strongly disagree</th>
<th>No opinion</th>
<th>Missing response</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>13</td>
<td>14</td>
<td>2</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>32</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>2f I want to know more about the distribution of funds among the partners.</th>
<th>Strongly agree</th>
<th>Somewhat agree</th>
<th>Neither agree nor disagree</th>
<th>Somewhat disagree</th>
<th>Strongly disagree</th>
<th>No opinion</th>
<th>Missing response</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>16</td>
<td>7</td>
<td>6</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>32</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>2g I want to know more about the evaluation criteria to be used.</th>
<th>Strongly agree</th>
<th>Somewhat agree</th>
<th>Neither agree nor disagree</th>
<th>Somewhat disagree</th>
<th>Strongly disagree</th>
<th>No opinion</th>
<th>Missing response</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>25</td>
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<td>32</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>2h I want to know more about the distribution of work within the partnership.</th>
<th>Strongly agree</th>
<th>Somewhat agree</th>
<th>Neither agree nor disagree</th>
<th>Somewhat disagree</th>
<th>Strongly disagree</th>
<th>No opinion</th>
<th>Missing response</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>22</td>
<td>6</td>
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<td>32</td>
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</tbody>
</table>
### 3 Please tell us how strongly you agree with the following statements.

<table>
<thead>
<tr>
<th>Statement</th>
<th>Strongly agree</th>
<th>Somewhat agree</th>
<th>Neither agree nor disagree</th>
<th>Somewhat disagree</th>
<th>Strongly disagree</th>
<th>No opinion</th>
<th>Missing response</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>3a As a reviewer I think that a partnership is likely to be successfully formed.</td>
<td>1</td>
<td>7</td>
<td>6</td>
<td>15</td>
<td>2</td>
<td>0</td>
<td>1</td>
<td>32</td>
</tr>
<tr>
<td>3b As a reviewer it seems that the way this partnership is starting will limit its ability to conduct the proposed activities.</td>
<td>6</td>
<td>19</td>
<td>2</td>
<td>3</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>32</td>
</tr>
<tr>
<td>3c As a reviewer it seems that given the way this partnership is starting it will be able to conduct its proposed activities.</td>
<td>2</td>
<td>5</td>
<td>6</td>
<td>18</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>32</td>
</tr>
<tr>
<td>3d As a reviewer I think it is likely that one organization will control all partnership activities.</td>
<td>4</td>
<td>5</td>
<td>13</td>
<td>6</td>
<td>0</td>
<td>3</td>
<td>1</td>
<td>32</td>
</tr>
</tbody>
</table>

### 4. Please tell us how strongly you agree with the following statements.

<table>
<thead>
<tr>
<th>Statement</th>
<th>Strongly agree</th>
<th>Somewhat agree</th>
<th>Neither agree nor disagree</th>
<th>Somewhat disagree</th>
<th>Strongly disagree</th>
<th>No opinion</th>
<th>Missing response</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>4a As a reviewer I think the expected outcomes in this scenario are likely to be accomplished as a result of the activities of this partnership.</td>
<td>1</td>
<td>6</td>
<td>5</td>
<td>14</td>
<td>5</td>
<td>0</td>
<td>1</td>
<td>32</td>
</tr>
<tr>
<td>4b As a reviewer I think getting a partnership formed will be an important measure of this project’s success</td>
<td>15</td>
<td>11</td>
<td>2</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>32</td>
</tr>
<tr>
<td>4c As a reviewer I think that most of these activities could be handled outside of a partnership.</td>
<td>1</td>
<td>5</td>
<td>4</td>
<td>11</td>
<td>10</td>
<td>0</td>
<td>1</td>
<td>32</td>
</tr>
</tbody>
</table>
6. Given the information in the above scenario, please tell us how strongly you agree with the following statements.

<table>
<thead>
<tr>
<th>Statement</th>
<th>Strongly agree</th>
<th>Somewhat agree</th>
<th>Neither agree nor disagree</th>
<th>Somewhat disagree</th>
<th>Strongly disagree</th>
<th>No opinion</th>
<th>Missing response</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>6a As a reviewer I think the costs of regular interaction will limit the success of this project.</td>
<td>2</td>
<td>10</td>
<td>10</td>
<td>3</td>
<td>5</td>
<td>1</td>
<td>1</td>
<td>32</td>
</tr>
<tr>
<td>6b As a reviewer I think the organizations involved will need a long time (greater than one year) to develop working relationships before the proposed activity can be implemented.</td>
<td>12</td>
<td>13</td>
<td>2</td>
<td>4</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>32</td>
</tr>
<tr>
<td>6c As a reviewer I think the organizations are likely to be more interested in the partnerships activities, rather than in specific expected outcomes.</td>
<td>4</td>
<td>10</td>
<td>4</td>
<td>8</td>
<td>4</td>
<td>1</td>
<td>1</td>
<td>32</td>
</tr>
<tr>
<td>6d As a reviewer I think the outcomes predicted are likely to be impacted by factors outside of the partnership's control.</td>
<td>5</td>
<td>19</td>
<td>4</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>32</td>
</tr>
<tr>
<td>6e As a reviewer I think it is likely that the partner organizations will transform their own internal operations due to exposure to the activities outlined in this scenario.</td>
<td>0</td>
<td>5</td>
<td>7</td>
<td>14</td>
<td>5</td>
<td>0</td>
<td>1</td>
<td>32</td>
</tr>
<tr>
<td>6f As a reviewer I think it is likely that the partner organizations will learn from the measurable expected outcomes in this scenario and to use this information to modify their partnership programs (for example when teachers finish a training program some measure of the change in teacher quality will be used to try to improve training program).</td>
<td>3</td>
<td>11</td>
<td>5</td>
<td>9</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>32</td>
</tr>
<tr>
<td>6g As a reviewer I think it is likely that some functions of the partner organizations will no longer be carried out by the organizations because they will be handled within the partnership.</td>
<td>0</td>
<td>5</td>
<td>7</td>
<td>11</td>
<td>6</td>
<td>2</td>
<td>1</td>
<td>32</td>
</tr>
</tbody>
</table>
6h As a reviewer I think it is likely that some work the organizations previously wanted to do, but could not do, can now be done through the partnership.

6i The overall price tag in the budget number at the end of the scenario is sufficient to achieve the expected outcomes.

6j The overall price tag in the budget number at the end of the scenario is sufficient to engage in the proposed activities.

6k As a reviewer I would approve funding for this project.

---

Scenarios #2

9.) Please tell us how strongly you agree with the following statements. 
In order to properly evaluate the potential success of this proposed project:

<table>
<thead>
<tr>
<th>Statement</th>
<th>Strongly agree</th>
<th>Somewhat agree</th>
<th>Neither agree nor disagree</th>
<th>Somewhat disagree</th>
<th>Strongly disagree</th>
<th>No opinion</th>
<th>Missing response</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>9a I want to know more about the interpersonal relationships involved in this proposal.</td>
<td>6</td>
<td>10</td>
<td>7</td>
<td>7</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>32</td>
</tr>
<tr>
<td>9b I want to know more about the organizational relationships involved in this proposal.</td>
<td>10</td>
<td>16</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>32</td>
</tr>
<tr>
<td>9c I want to know more about the working history of these organizations.</td>
<td>12</td>
<td>12</td>
<td>4</td>
<td>2</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>32</td>
</tr>
<tr>
<td>9d I want to know more about the needs of the community.</td>
<td>8</td>
<td>14</td>
<td>4</td>
<td>4</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>32</td>
</tr>
</tbody>
</table>
9e I want to know more about how laws, local policies, or funding opportunities that affect the organizations.

9f I want to know more about the distribution of funds among the partners.

9g I want to know more about the evaluation criteria to be used.

9h I want to know more about the distribution of work within the partnership.

---

<table>
<thead>
<tr>
<th>Please tell us how strongly you agree with the following statements. Based on the information provided in the background section of this proposal:</th>
<th>Strongly agree</th>
<th>Somewhat agree</th>
<th>Neither agree nor disagree</th>
<th>Somewhat disagree</th>
<th>Strongly disagree</th>
<th>No opinion</th>
<th>Missing response</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>10a As a reviewer I think that a partnership is likely to be successfully formed.</td>
<td>17</td>
<td>10</td>
<td>2</td>
<td>0</td>
<td>2</td>
<td>0</td>
<td>1</td>
<td>32</td>
</tr>
<tr>
<td>10b As a reviewer it seems that the way this partnership is starting will limit its ability to conduct the proposed activities.</td>
<td>2</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>14</td>
<td>0</td>
<td>1</td>
<td>32</td>
</tr>
<tr>
<td>10c As a reviewer it seems that given the way this partnership is starting it will be able to conduct its proposed activities.</td>
<td>12</td>
<td>10</td>
<td>4</td>
<td>4</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>32</td>
</tr>
<tr>
<td>10d As a reviewer I think it is likely that one organization will control all partnership activities.</td>
<td>2</td>
<td>7</td>
<td>10</td>
<td>7</td>
<td>5</td>
<td>0</td>
<td>1</td>
<td>32</td>
</tr>
</tbody>
</table>
### 11. Please tell us how strongly you agree with the following statements. Based on the information provided in the activities section of this proposal:

<table>
<thead>
<tr>
<th>Statement</th>
<th>Strongly agree</th>
<th>Somewhat agree</th>
<th>Neither agree nor disagree</th>
<th>Somewhat disagree</th>
<th>Strongly disagree</th>
<th>No opinion</th>
<th>Missing response</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>11a</td>
<td>5</td>
<td>14</td>
<td>2</td>
<td>6</td>
<td>4</td>
<td>0</td>
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<tr>
<td>11b</td>
<td>12</td>
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<td>8</td>
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<td>1</td>
<td>32</td>
</tr>
<tr>
<td>11c</td>
<td>0</td>
<td>5</td>
<td>4</td>
<td>14</td>
<td>7</td>
<td>0</td>
<td>2</td>
<td>32</td>
</tr>
</tbody>
</table>

### 13.) Given the information in the above scenario, please tell us how strongly you agree with the following statements.

<table>
<thead>
<tr>
<th>Statement</th>
<th>Strongly agree</th>
<th>Somewhat agree</th>
<th>Neither agree nor disagree</th>
<th>Somewhat disagree</th>
<th>Strongly disagree</th>
<th>No opinion</th>
<th>Missing response</th>
<th>Total</th>
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<tbody>
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<td>0</td>
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<td>6</td>
<td>16</td>
<td>5</td>
<td>2</td>
<td>1</td>
<td>32</td>
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<tr>
<td>13b</td>
<td>0</td>
<td>5</td>
<td>4</td>
<td>15</td>
<td>7</td>
<td>0</td>
<td>1</td>
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<tr>
<td>13c</td>
<td>0</td>
<td>5</td>
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<td>13</td>
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<tr>
<td>----------------------------------------------------------------------</td>
<td>--------</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>13e As a reviewer I think it is likely that the partner organizations will transform their own internal operations due to exposure to the activities outlined in this scenario.</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>13f As a reviewer I think it is likely that the partner organizations will learn from the measurable expected outcomes in this scenario and to use this information to modify their partnership programs (for example when teachers finish a training program some measure of the change in teacher quality will be used to try to improve training program).</td>
<td>7</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>13g As a reviewer I think it is likely that some functions of the partner organizations will no longer be carried out by the organizations because they will be handled within the partnership.</td>
<td>0</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>13h As a reviewer I think it is likely that some work the organizations previously wanted to do, but could not do, can now be done through the partnership.</td>
<td>8</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>13i The overall price tag in the budget number at the end of the scenario is sufficient to achieve the expected outcomes.</td>
<td>4</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>13j The overall price tag in the budget number at the end of the scenario is sufficient to engage in the proposed activities</td>
<td>8</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>13k As a reviewer I would approve funding for this project.</td>
<td>7</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
**ROUND 4**

<table>
<thead>
<tr>
<th>4 The STEM partnerships that I have been most closely associated have focused on:</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Curriculum development</td>
<td>3</td>
</tr>
<tr>
<td>Teacher training</td>
<td>7</td>
</tr>
<tr>
<td>Direct classroom intervention</td>
<td>2</td>
</tr>
<tr>
<td>Creating learning communities</td>
<td>1</td>
</tr>
<tr>
<td>Education oriented, basic research</td>
<td>0</td>
</tr>
<tr>
<td>Retention of teachers</td>
<td>0</td>
</tr>
<tr>
<td>A holistic approach using multiple interventions</td>
<td>16</td>
</tr>
<tr>
<td>Other forms of education based community outreach</td>
<td>0</td>
</tr>
<tr>
<td>Missing response</td>
<td>3</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>32</strong></td>
</tr>
<tr>
<td>6. What is the likelihood that projects you have worked on within your partnerships will have substantial and lasting impacts on:</td>
<td>Very likely</td>
</tr>
<tr>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>6.a Improving student achievement in low performing schools</td>
<td>10</td>
</tr>
<tr>
<td>6.b Closing the achievement gaps</td>
<td>7</td>
</tr>
<tr>
<td>6.c Improving student retention</td>
<td>5</td>
</tr>
<tr>
<td>6.d Improving teacher content knowledge</td>
<td>17</td>
</tr>
<tr>
<td>6.e Improving teacher pedagogy</td>
<td>15</td>
</tr>
<tr>
<td>6.f Improving teacher retention</td>
<td>2</td>
</tr>
<tr>
<td>6.g Creating a learning community of STEM professionals between K-12 and IHE institutions</td>
<td>9</td>
</tr>
<tr>
<td>6.h Improving IHE faculty pedagogy</td>
<td>6</td>
</tr>
</tbody>
</table>
9. In the following questions, we ask that you reflect on how your home institution has been influenced by the partnerships in which you have participated. How strongly do you agree with the following statements?

<table>
<thead>
<tr>
<th></th>
<th>Strongly agree</th>
<th>Somewhat agree</th>
<th>Neither agree nor disagree</th>
<th>Somewhat disagree</th>
<th>Strongly disagree</th>
<th>No opinion</th>
<th>Missing response</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>9.a</td>
<td>My organization has a policy of maintaining control of all partnership activities.</td>
<td>3</td>
<td>6</td>
<td>5</td>
<td>9</td>
<td>6</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>9.b</td>
<td>When confronting a new problem, my organization actively seeks out other points of view.</td>
<td>14</td>
<td>13</td>
<td>1</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>9.c</td>
<td>My organization has demonstrated a willingness to share control of partnership decisions.</td>
<td>15</td>
<td>10</td>
<td>2</td>
<td>2</td>
<td>0</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>9.d</td>
<td>My organization regularly works with a number of organizations on an ongoing basis on issues other than STEM education.</td>
<td>18</td>
<td>8</td>
<td>0</td>
<td>0</td>
<td>2</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>9.e</td>
<td>My organization regularly works with a number of organizations on an ongoing basis but only within partnership activities.</td>
<td>2</td>
<td>3</td>
<td>2</td>
<td>11</td>
<td>12</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>9.f</td>
<td>My organization has learned and continues to learn new ideas or methods from our interactions with other organizations.</td>
<td>19</td>
<td>11</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>9.g</td>
<td>My organization has learned and continues to learn new ideas or methods from participation in STEM partnerships.</td>
<td>17</td>
<td>10</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>9.h</td>
<td>My organization regularly modifies intervention programs developed within our partnership because of things we learn from our partners.</td>
<td>11</td>
<td>13</td>
<td>2</td>
<td>2</td>
<td>0</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>9.i</td>
<td>My organization has changed in some fundamental way because of our interactions with other organizations (e.g., the way we do or approach our organizations regular work is different).</td>
<td>7</td>
<td>15</td>
<td>4</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td>2</td>
</tr>
</tbody>
</table>
Alternative Approaches to Evaluating STEM Education Partnerships

9.j My organization has changed in some fundamental way because of our STEM partnering activities (e.g., the way we do or approach our organizations regular work is different).

<table>
<thead>
<tr>
<th>Strongly agree</th>
<th>Somewhat agree</th>
<th>Neither agree nor disagree</th>
<th>Somewhat disagree</th>
<th>Strongly disagree</th>
<th>No opinion</th>
<th>Missing response</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>7</td>
<td>15</td>
<td>4</td>
<td>0</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>32</td>
</tr>
</tbody>
</table>

9.k Individuals within my organization learn a great deal through our partnering activities that would not be learned through interactions with organizations outside of our STEM partnership.

<table>
<thead>
<tr>
<th>Strongly agree</th>
<th>Somewhat agree</th>
<th>Neither agree nor disagree</th>
<th>Somewhat disagree</th>
<th>Strongly disagree</th>
<th>No opinion</th>
<th>Missing response</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>14</td>
<td>10</td>
<td>5</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>2</td>
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</tbody>
</table>

9.l My organization uses program evaluation to learn and improve programs.

<table>
<thead>
<tr>
<th>Strongly agree</th>
<th>Somewhat agree</th>
<th>Neither agree nor disagree</th>
<th>Somewhat disagree</th>
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<th>Missing response</th>
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</tbody>
</table>

9.m My organization has changed in some fundamental way because of something we learned during our STEM partnership’s program evaluation.

<table>
<thead>
<tr>
<th>Strongly agree</th>
<th>Somewhat agree</th>
<th>Neither agree nor disagree</th>
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</table>

11. Composite statements

11.a How strongly do you agree that the following statements reflect your partnership experience?

a) Partnership is not a silver bullet. We have gravitated toward this because no single institution has the capacity to address these persistent problems of student achievement, providing quality teaching, and low performing schools. Partnerships are a necessary condition under the current organization of education in this country and the best hope that we have at present for building the capacity of low performing public schools.

<table>
<thead>
<tr>
<th>Strongly agree</th>
<th>Somewhat agree</th>
<th>Neither agree nor disagree</th>
<th>Somewhat disagree</th>
<th>Strongly disagree</th>
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</table>

c) The push for accountability in public schools is a mixed blessing. On the one hand, it has forced us to develop standards by which we can benchmark academic performance. On the other hand it is a blunt instrument that can skew the strategies and responses of schools. Improvements in test scores are not a good measure for the success of the STEM partnerships in which I have participated.

<table>
<thead>
<tr>
<th>Strongly agree</th>
<th>Somewhat agree</th>
<th>Neither agree nor disagree</th>
<th>Somewhat disagree</th>
<th>Strongly disagree</th>
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<td>3</td>
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<td>2</td>
<td>32</td>
</tr>
</tbody>
</table>
e) One of the most important ways in which we use partnership is to improve communication between institutions of higher education (IHE) and K-12 schools. Both types of institutions are built on cultures of isolation. Teachers do a lot of work on their own to determine what happens in their classroom and IHE faculty are under a lot of pressure to meet tenure requirements of writing and publishing and are discouraged from doing work that might be perceived as service oriented. Similarly, IHE faculty are not particularly good at listening and often do not understand the context within which teachers work or their motivations for pursuing professional development. Finally, the pedagogy used in IHE for math and science is outdated and part of the problem of STEM education. Partnership is the best tool we have found to break down some of these barriers through better communication.

| 11 | 11 | 2 | 6 | 0 | 0 | 2 | 32 |

f) Matching up the administrative systems of the various partner organizations can be a bit of a struggle. If there are exchanges of money, it's best to have a formal contract. Getting invoices approved and the endorsement of senior management in each organization can sometimes be a challenge. But these factors are only minor irritants when it comes to determining transaction costs. What really drives up the transaction costs of a partnership stem from communication problems between partners, when goals of partners drift apart, when trust begins to break down, or when there are long geographic distances between partners.

| 14 | 11 | 1 | 1 | 1 | 2 | 2 | 32 |

i) The truth is that we have been interacting with our partners for a long time either formally or informally. We don't form partnerships in response to policy directives or to funding requirements. The funds enable our partnerships to do new things and to be more innovative in our approaches to STEM education. We might add members to our partnership in response to program requirements, but the core group has been working together for a while.

| 6 | 12 | 5 | 5 | 2 | 0 | 2 | 32 |

k) When the work of a partnership is conducted in a reciprocal fashion we are more likely to learn from one another and are more likely to be effective in meeting our objectives. When we work in a pooled fashion we are falling victim to the organizational and social forces

| 17 | 9 | 1 | 3 | 0 | 0 | 2 | 32 |
that tend to lead us to work in isolation of the larger professional community.

m) There is a distinction between partnership outcomes and the program outcomes we pursue through partnership. Partnership outcomes can be observed in the increased capacity of the individual partners to address the STEM education needs (for example, through better understanding of the issues, more effective communication between educational institutions and the STEM community, more effective leveraging of resources, and more effective representation of issues to policy makers). Program outcomes can be observed in the specific improvements (or lack thereof) in the professional development of teachers, the quality and content of curricula, or improvements in student achievement. Before a partnership can be effective in achieving program outcomes there must be improvements in the partnership outcomes.

o) It is easier for us to measure improvements in teacher quality and in curricula. We have a harder time linking these measures to improvements in student performance, and an even harder time demonstrating how these contribute to the improvement of a low performing school. But ultimately, these are the key impacts that the STEM community is seeking to achieve.

p) Through partnerships we are better able to improve the quality of teaching, improve the content of the STEM curriculum, and create a learning community of STEM professionals. As a consequence of these improvements, student achievement in low performing schools will also improve significantly.

<table>
<thead>
<tr>
<th></th>
<th>10</th>
<th>13</th>
<th>3</th>
<th>3</th>
<th>1</th>
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<td>32</td>
</tr>
</tbody>
</table>
### Appendix 2 - Qualitative Data Summary Tables

**I. Strategic Needs**

1. Round 1 summary table of all themes and sub nodes

<table>
<thead>
<tr>
<th>Strategic Needs</th>
<th>(No sub nodes)</th>
<th>(Mostly answers to question 6b, other objectives they have considered or believe are important?)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coding references: 73</td>
<td>Coding references: 28</td>
<td>• Provide information for policy making / influence policy-making. (5 respondents).</td>
</tr>
<tr>
<td>Respondents: 31</td>
<td>Respondents: 29</td>
<td>• Improve teacher recruitment and retention. (6 respondents)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Education reform. (2 respondents).</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Improve support of stakeholders (for education, and math and science education). (5 respondents).</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Improve education outcomes for student (equity, achievement, dropout rates, access to college, develop academic environment that supports learning). (4 respondents).</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Improve relationship of business and industry with legislature. (2 respondents).</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Contribute to knowledge in STEM education. (3 respondents).</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Technical support for organizations involved (universities, school districts, local and state education agencies) (3 respondents).</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Improve undergraduate education in both content courses and preservice methods courses (d332005)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• &quot;Help drive the knowledge economy and entrepreneurial cultures. Mind power for the R&amp;D and larger talent force necessary for the production of the best ideas in the STEM arenas” (d172005)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• (&quot;None” and “no opinion”: 4 responses)</td>
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</table>

<table>
<thead>
<tr>
<th>Shared agenda</th>
<th>Common goals</th>
<th>Generic response. 7 respondents</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coding references: 25</td>
<td>(15 respondents)</td>
<td>Mutual goals could not be achieved by each organization alone. 3 respondents</td>
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<tr>
<td>Respondents: 18</td>
<td></td>
<td>Mutual goals – goals of the partnership different from the organization’s needs. 1 respondent</td>
</tr>
<tr>
<td></td>
<td>Common goals</td>
<td>Common goals, mentioning an interpersonal level of analysis</td>
</tr>
<tr>
<td></td>
<td>(14 respondents)</td>
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</table>
## Alternative Approaches to Evaluating STEM Education Partnerships

<table>
<thead>
<tr>
<th>Strategic Needs</th>
<th>• Value for all partners. Help organization advance its goals. (1 respondent).</th>
<th>(partnership among individuals). 3 respondents</th>
</tr>
</thead>
<tbody>
<tr>
<td>Common problems 2 respondents</td>
<td>• Common problems or needs (generic response). 2 respondents</td>
<td></td>
</tr>
<tr>
<td>Reforms: statewide systemic reform, strategic change of organization, change in organizational culture 3 respondents</td>
<td>• Systemic statewide change (reform). 1 respondent.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Strategic change. 1 respondent</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• “the requirement for a partnership provides the impetus for a change in culture as to how we do things, work together rather than compete”. 1 respondent</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Improvement of student performance science and math. 1 respondent</td>
<td></td>
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</table>

Connection to each organization's mission or priorities. 2 respondents.

<table>
<thead>
<tr>
<th>Other resources Coding references: 16 Respondents: 12</th>
<th>• Time. 4 respondents</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>• Personnel. 3 respondents.</td>
</tr>
<tr>
<td></td>
<td>• Other resources: 2 respondents.</td>
</tr>
<tr>
<td></td>
<td>• Institutional support. 5 respondents.</td>
</tr>
<tr>
<td></td>
<td>• Effective communication system. 1 respondent.</td>
</tr>
<tr>
<td></td>
<td>• Time. 4 respondents. (Lack of time, 2 respondents; more time for dedication of faculty, 1 respondent; time to build relationships, 1 respondent).</td>
</tr>
<tr>
<td></td>
<td>• Personnel. (appropriate staffing, full-time personnel, 1 respondent; significant number of altruistic and enthusiastic personnel, 1 respondent)</td>
</tr>
<tr>
<td></td>
<td>• Other resources: “availability of outside resources was critical for critical for project success”; “Sometimes it is a case of resources, but my experience is that more often than not, if the partnership is perceived to meet a priority goal, resources are found”</td>
</tr>
<tr>
<td></td>
<td>• (strong administrative support; institutional support; Recognition in institutional value system and reward structure; strong political support)</td>
</tr>
<tr>
<td></td>
<td>• communication system (some effective way to communicate)</td>
</tr>
</tbody>
</table>
### Strategic Needs

| Knowledge | • (q3b) a clear understanding of the value added by participation in the partnership  
• (q11b) Did not share the goals of the other partners. Did not feel they were given adequate resources. Did not find that the partnership would help build their organizations capabilities.  
• Using data that clearly establishes an overwhelming need for improvement. For example, low math, writing scores or inability to recruit math and science teachers. | • Opportunity to learn what other organizations do. 1 respondent.  
• Possibility of gaining new perspectives and strategies for improving one's organization  
• (3b) "The collective view of the larger picture, often-times driven by insightful data that demonstrates a critical need, and the need to try alternative strategies. The notion of reform implies a one-time fix of "what is"; strategic change requires a willingness to suspend (temporarily) what you know and explore completely new ways of doing business. - toward the broader vision. This is the value of a third-party player who is respectful of but not bound by traditional systems."  
• (1b) We here at SKC are approached by other educational entities to enter partnerships because we have databases and American Indian data that they do not have access to. |
| Coding references: 4  
Respondents: 4 | Strategic Needs – financial resources  
Coding references: 5  
Respondents: 4 | • (4) The financial support offered to help the Districts achieve their goals.  
• (1b) Partnerships are formed in response to an RFP, i.e. availability of funding.  
• (4). To get the System universities to agree on using a big chunk of the IDC for programming was certainly critical in effectively running our large grants  
• (11b) P-16 faculty have many demands on their time. Perception of being asked to do 'yet one more thing' for unclear individual benefits is a major impediment to partnerships  
• (1b) Partnerships can also be formed by financial need, or in efforts to reduce |
### Strategic Needs – professional development

Coding references: 1  
Respondent: 1

- (4) Using data that clearly establishes an overwhelming need for improvement. For example, low math, writing scores or inability to recruit math and science teachers.

<table>
<thead>
<tr>
<th>Text Extracts From Raw Data</th>
</tr>
</thead>
</table>

**Strategic needs:** Strategic needs refer to anything that is needed to accomplish some goal. Coded references in the text to a lack of something (for example content knowledge "strat need knowledge or code lack of needed personnel as "strat need other resource").

### 1.1. Strategic Needs – not coded at sub nodes text extracts

All except one, are answers to question 6b.

Coding references: 28  
Respondents: 29

| "None" and “no opinion” | "No" (d192005, d282005, d442005)  
|--------------------------|----------------------------------|
| “No opinion” (d642005)   | "Policy and legislation development in support of the vision, and earmarked appropriations" (d112005)  
|                          | “policy formulation and adoption” (d492005)  
|                          | “Influencing state education policy” (d782005)  
|                          | “Technical assistance to SEAs and LEAs.” (d912005)  
|                          | “Influence education policy at state level” (d982005)  

| Teacher recruitment and retention | Teacher recruitment (d662005)  
|-----------------------------------|-----------------------------|
| Teacher recruitment STEM Faculty professional development (d972005)  
| recruitment of more diverse teaching force (d982005)  
| Recruiting new teachers of mathematics and science. Increasing minority participation and achievement levels (d782005)  
| retention of new teachers (d792005)  
| (6b) Increase the diversity of the teacher workforce. Improve undergraduate education in both content courses and preservice methods courses. Develop science education researchers from a cadre of disciplinary science faculty. (d332005)
### Education reform

- Statewide education reform at secondary and IHE institutions. (D452005)  
  Curriculum selection and implementation. (d362005)

### Improve support of stakeholders (for education, and math and science education)

- "Engaging parents. Engaging principals, superintendents, counselors" (d232005)  
  "Community support of education" (d362005)  
  Building Community (d832005)  
  We have achieved many intangible goals for which there has been no evaluation instruments to measure our success in these areas, i.e. our success in building win win relationships with all our stakeholders in seven different school systems that are predominately run by school boards whose members are non-Indian." (d412005)  
  To show that mathematics education may be a necessary activity for increasing future opportunities and the quality of these opportunities. (d532005)

### Improve relationship of business and industry with legislature

- "Cultivation of business and industry and direct interaction with the legislative branch of state government” (d522005)  
  Partnerships can also promote an articulation between institutions to accomplish things not possible alone--for example education and industry coming together to influence government. (d582005)

### Improve education outcomes for student (equity, achievement, dropout rates, access to college, develop academic environment that supports learning)

- "Links to business and industry, formulating career pathways in math and science, increasing college access opportunities, targeting educationally disadvantaged students, providing students with hands-on activities as an alternative learning strategy, engaging students in healthy competition, developing an academic environment that supports learning" (d482005)  
  "Student dropout/retention rates. Student achievement gap. Student equity issues” (d932005)  
  (q4) "I think that we decide to enter partnerships that ultimately benefit our students and those that teach them. If we find willingness in our potential partners to work in collaboration with us to achieve our goals, then we pursue those partnerships." (D192005)  
  (6b) “Student learning assessment through non-standardized tests” (d252005)

### Contribute to knowledge in STEM education

- Increase the capacity for STEM projects to conduct research and evaluation. (d612005)  
  Research on innovative educational practices. (d912005)  
  (6b) Increase the diversity of the teacher workforce. Improve undergraduate education in both content courses and preservice methods courses. Develop science education researchers from a cadre of disciplinary science faculty. (d332005)

### Technical support for organizations involved (universities, school districts, local and state education agencies)

- "Leadership development (principals, central office staff, university faculty, and teachers) - strategic planning for districts – (d792005)  
  Some additional examples include: Instruction Practices of Discipline Based Higher Education Faculty Content Usage of Education Higher Education Faculty Support for reform and Content Understanding of K-12 Administrators Content and Adult Learning of Teacher Leaders Increases in Content Expertise of Professional Developers Understanding by Department of Education (d952005)  
  (6b) Development of teachers as leaders. Training in systemic reform and change theory. Training in analyzing organizational culture. (d772005)

- (6b) Increase the diversity of the teacher workforce. **Improve undergraduate education in both content courses and preservice methods courses.** Develop science education researchers from a cadre of disciplinary science faculty. (d332005)

- (6b) "Help drive the knowledge economy and entrepreneurial cultures. mind power for the R&D and larger talent force necessary for the production of the best ideas in the STEM arenas” (d172005)
1.2 Strategic Needs – shared agenda

Coding references: 25  
Respondents: 18

**Summary**

<table>
<thead>
<tr>
<th>Mutually agree (generic response)</th>
<th>(q4) &quot;The single most critical component is having Mutual goals among potential partners. Having a clear picture is not necessary, but the concepts are agreed to and there is trust that the partners can achieve common goals by an going participation by all partners. This does not mean always at the beginning, but trust that common goals will be agreed to. So that revisiting the goals at the beginning to key and making revisions due to the realities of the context. Also once up a running revisit the goals at least annually and make adjusts through involving all the partners is very important to a successful partnership&quot; (q4) shared values and shared goals (q4) Shared goals. (q17b) Shared vision. Deep commitment (q3b) &quot;Agreement that a partnership is needed. Trust between different interests. Leadership of respected individuals. A clear and open process. A shared vision of what might be achieved (q3b) A common vision of what people want to accomplish (q5) A group of organizations that work together on a common mission, with formal working relationships. This is not merely a top-down hierarchical relationship, although there may be some elements of this.&quot;</th>
</tr>
</thead>
<tbody>
<tr>
<td>Common problems or need (generic response)</td>
<td>(q1b) Partnerships are formed by organizations with a common problem or need (q17b) The desire to working together on a common need or problem</td>
</tr>
</tbody>
</table>
| Mutual goals could not be achieved by each organization alone | (q4) “Single most important deciding factor is that the mutual goals of the partnership could not be accomplished by my organization alone". (q4) "Although I did not list it as critically important, from my experience it was the "Mutual goals among partners" that was the most important factor. It was the sense that we had common goals and each had something to offer that would help to achieve those goals to a greater extent than any partner could alone that made this a deciding factor." (q3b) "The creation of a public climate encouraging the partnership is very important, for example in the form of public statements and encouragement by local or state government and educational leaders. And there certainly needs to be shared perception among the partners that their educational mission can be better achieved through the partnership; that is, there are benefits of substance. This is not the same thing as organizational benefits that may accrue to partners or individuals ... it is the idealistic, visionary dimension of the partnership. Finally, it is essential that all partners feel treated with great respect and courtesy, have good reason to feel valued in the partnership, and not feel "imposed on."

Mutual goals – goals of the partnership different from the organization’s needs | (q4) "Having a common set of concerns and developing some principles of partnership are probably key because this helps move towards strategic thinking, i.e. what do we have to do to achieve the identified goals removing the concerns from merely specific institutional needs. The goals becomes the deciding factor because then the partnership does not have to worry that any one vested interest will dominate." |
### Alternative Approaches to Evaluating STEM Education Partnerships

| Common goals, mentioning an interpersonal level of analysis (partnership among individuals). | (q1b) Partnerships are formed by a small group of dedicated professionals with a desired common outcome. (q4) Individuals within each partner organization who have a common set of goals and interest in working together to achieve those goals (q1b) "Partnerships form in many different ways and develop over time. To say partnerships form based on a specific combination is to say people will want to team up with each other if they have a similar goals. I think partnerships form for a great many reasons. They are not always successful, but the formation is often due to different circumstances. For example, partnerships can form because of funding opportunities, performance deficits, personal relationships, invitations by unknown partners, perceived need, perceived expertise, common goals, new ideas, perceived improvement opportunities, financial gain, professional gain, and lack of understanding to list a few. The context for all partners is very important to learning about why a particular partnership formed."

| Improvement of student performance science and math | (q4) Mutual goals - we all saw the need to improve student performance in science and mathematics and we knew that we could do better working collaboratively than working individually.

| Systemic statewide change (reform) | (q17b) "A commonly perceived political need for action to achieve systemic, statewide change"

| Connection to each organization's mission or priorities. | (q3b) connection to each organization's mission (q11b) "In most cases, choosing not to partner was simply based on the fact that the partnership was not well matched with the current organizational priorities. Sometimes it is a case of resources, but my experience is that more often than not, if the partnership is perceived to meet a priority goal, resources are found."

| Value for all partners. Help organization advance its goals. | (q4) "The partnership must help the organization advance it goals. Working in partnership in some respects is harder than just doing your own thing - especially in the short run. Having to work across multiple institutions and develop understandings of the cultures and contexts in each is hard and slow work. To establish a commitment to do that hard work, the partnership must have a clear and valued benefit to all partners."

|  | (q1b) "Partnerships are formed in response to an RFP, i.e. availability of funding. Partnerships are formed because they are required in the RFP. Both of the above I believe provide the motivation for either an individual/institution to step outside their boundaries and form partnerships. Basically the requirement for a partnership provides the impetus for a change in culture as to how we do things. I have not found that partnering comes naturally to a lot of people. One has to believe that there is enough work to be done and enough funding available for individuals/institutions to work together rather than compete..............and that all will come out winners in the long run."

|  | (q3b) The collective view of the larger picture. ... The notion of reform implies a one-time fix of "what is"; strategic change requires a willingness to suspend (temporarily) what you know and explore completely new ways of doing business. - toward the broader vision. This is the value of a third-party player who is respectful of but not bound by traditional systems.
### 1.3 Strategic Needs – Other resources

Coding references: 16  
Respondents: 12

- **Time.** 4 respondents (Lack of time, 2 respondents; more time for dedication of faculty, 1 respondent; time to build relationships, 1 respondent).
- **Personnel.** 3 respondents. (appropriate staffing, full-time personnel, 1 respondent; significant number of altruistic and enthusiastic personnel, 1 respondent)
- **Resources.** 2 respondents. (“availability of outside resources was critical for critical for project success”; “Sometimes it is a case of resources, but my experience is that more often than not, if the partnership is perceived to meet a priority goal, resources are found”)
- **Institutional support.** 4 respondents. (strong administrative support; institutional support; Recognition in institutional value system and reward structure; one problematic statement)
- **Effective communication system.** 1 respondent.
- **A clear understanding of the value added by participation in the partnership (1 respondent)**
- **Adequate resources (1 respondent)**
- **Using data that clearly establishes an overwhelming need for improvement. For example, low math, writing scores or inability to recruit math and science teachers (1 respondent)**
- **Partnerships can be driven by community need. For example, a school district with low performance in math and science could contact a university, an ed school perhaps, present the dilemma and plant a partnership "seed". Conversations ensue, goals mesh and partnerships could develop. (1 respondent)

| Time | (q11b) Lack of time (d192005)  
(q11b) P-16 faculty have many demands on their time. Perception of being asked to do 'yet one more thing' for unclear individual benefits is a major impediment to partnerships. (d252005)  
(11b) "Time, limited resources" (d582005)  
(3b) 1. mutual benefit 2. communication system (some effective way to communicate) 3.opportunity 4. time to build relationships |
|---|---|
| Personnel | (q17b) "Institutional support through WWU. And, appropriate staffing to do the work. Lots of schools/universities want to do this kind of work, but can't be freed of their regular responsibilities to do the hard and time-consuming work of forming a partnership. WWU committed the resources to hire me to help do this work for the science ed department. A full time person dedicated to building the relationships and "doing" the initial work was needed to get the partnership off the ground." (d332005)  
(q11b) "Individuals have sometimes been too busy -- stretched too thin. The same is true with institutions (like when I've approached districts to collaborate on a science education project, but they say they're already overburdened just trying to improve their math programs)." (d442005)  
(3b) a significantly number of altruistic and enthusiastic personnel must be involved. (d532005) |
### Resources

(q4) 3a. Availability of outside resources was critical to the project's success. (d642005)
(q11b) "In most cases, choosing not to partner was simply based on the fact that the partnership was not well matched with the current organizational priorities. Sometimes it is a case of resources, but my experience is that more often than not, if the partnership is perceived to meet a priority goal, resources are found."

### Institutional support

(q4) "Partnerships among organizations REQUIRE strong administrative commitment. (d112005)
(q17b) "Institutional support through WWU… (d332005)
(q3b) Recognition in institutional value system and reward structure (not just tenure) (d112005)
(q3b) "Complementary organizational missions, organizational "elasticity", sufficient resources, strong political support, appropriate location. Sufficient expertise to execute partnership goals. The ability to create an infrastructure that isn't burdensome but that can support and sustain the partnership." (d482005)

### Communication system

(3b) 1. mutual benefit 2. communication system (some effective way to communicate) 3. opportunity 4. time to build relationships (d582005)

(q3b) a clear understanding of the value added by participation in the partnership (d352005)

(q11b) Did not share the goals of the other partners. Did not feel they were given adequate resources. Did not find that the partnership would help build their organizations capabilities (d912005)

(q4) "Using data that clearly establishes an overwhelming need for improvement. For example, low math, writing scores or inability to recruit math and science teachers." (d772005)

(q1b) "Partnerships can be driven by community need. For example, a school district with low performance in math and science could contact a university, an ed school perhaps, present the dilemma and plant a partnership "seed". Conversations ensue, goals mesh and partnerships could develop. Partnerships can also be formed by financial need, or in efforts to reduce duplication of services." (d482005)

### 1.4 Strategic Needs – Knowledge

Coding references: 4
Respondents: 4

- Opportunity to learn what other organizations do. Possibility of gaining new perspectives and strategies for improving one's organization. (2 respondents)
- (3b) "The collective view of the larger picture, often-times driven by driven by insightful data that demonstrates a critical need, and the need to try alternative strategies. The notion of reform implies a one-time fix of "what is"; strategic change requires a willingness to suspend (temporarily) what you know and explore completely new ways of doing business. - toward the broader vision. This is the value of a third-party player who is respectful of but not bound by traditional systems."
- (1b) We here at SKC are approached by other educational entities to enter partnerships because we have data bases and American Indian data that they do not have access to.

Learn about what other org. does (17b) "Opportunity to learn what other organizations do, what their interests and goals are." (d362005)
### New perspectives

<table>
<thead>
<tr>
<th>(3b) Possibility of gaining new perspectives and strategies for improving one's organization (d592005)</th>
</tr>
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<tbody>
<tr>
<td>(3b) &quot;The collective view of the larger picture, often-times driven by driven by insightful data that demonstrates a critical need, and the need to try alternative strategies. The notion of reform implies a one-time fix of &quot;what is&quot;; strategic change requires a willingness to suspend (temporarily) what you know and explore completely new ways of doing business. Toward the broader vision. This is the value of a third-party player who is respectful of but not bound by traditional systems.&quot; (d172005)</td>
</tr>
<tr>
<td>(1b) We here at SKC are approached by other educational entities to enter partnerships because we have databases and American Indian data that they do not have access to. (d412005)</td>
</tr>
</tbody>
</table>

### 1.5 Strategic Needs – financial resources

**Coding references:** 5  
**Respondents:** 4

<table>
<thead>
<tr>
<th>4 The financial support offered to help the Districts achieve their goals. Without the support the Districts would not be able to carry out the plan. (d452005)</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1b) &quot;Partnerships are formed in response to an RFP, i.e. availability of funding. Partnerships are formed because they are required in the RFP. Both of the above I believe provide the motivation for either an individual/institution to step outside their boundaries and form partnerships. Basically the requirement for a partnership provides the impetus for a change in culture as to how we do things. ...&quot; (d232005)</td>
</tr>
<tr>
<td>(4) ... How is the money divided up? By programming needs, not by institution. If people from the partnership participate in the programming, that institution will be receiving funding. In fact some of the institutions might be providing &quot;in kind&quot; contributions without receiving $s. In the long run all will benefit. 4. IDC generation/distribution. Those that earn it keep it. But in all our partnerships the partners have all committed to a certain percentage (off the top) going back into the programming because otherwise we really could not do all that was proposed. This means that the institution who has the staff and earns more of the IDC is really contributing more to the pool of money going back into the project. We call these our working principles for partnering. They have served us well. To get the System universities to agree on using a big chunk of the IDC for programming was certainly critical in effectively running our large grants.&quot; (d232005)</td>
</tr>
<tr>
<td>(11b) P-16 faculty have many demands on their time. Perception of being asked to do 'yet one more thing' for unclear individual benefits is a major impediment to partnerships. (d252005)</td>
</tr>
<tr>
<td>(1b)...Partnerships can also be formed by financial need, or in efforts to reduce duplication of services.&quot; (d482005)</td>
</tr>
</tbody>
</table>
1.6 Strategic Needs – professional development

Coding references: 1
Respondent: 1

(4) "Using data that clearly establishes an overwhelming need for improvement. For example, low math, writing scores or inability to recruit math and science teachers." (d772005)

Strategic Needs - Round 2

2.1. Strategic Needs – text extracts not coded at sub nodes

Questions 1, 2 and 3, which were coded under strategic needs in the questionnaire.

Coding references: 92
Respondents: 31

2.1.1 Summary of themes in question 1

(1 Describe the needs in your community (or region) that the partnership(s), in which you have participated, are aimed at addressing. If possible, please provide some detail as to the magnitude of the needs. In your answer also indicate how long standing and persistent these needs have been in your community or region.)

- Improvement of students’ achievement in math and science (15 respondents)
  - Improvement of student achievement in math and science (8 respondents)
  - Improve student achievement of disadvantaged, minority and rural population groups (6 respondents)
  - Improve achievement in low performing schools (1 respondent)
- Standards – need to meet standards or implement standards curricula reform (3 respondents)
- Curricula reform, development of new class materials (3 respondents)
- Improved teacher training
  - Improved teacher training
  - Improve teacher technology skills (1 respondent)
- Increase the number of qualified teachers
  - Insufficient number of teachers graduating (1 respondent)
  - Problems of teacher attrition and turnover (3 respondents)
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- Education reform (science at all levels, K12 through undergraduate, or of the education system)
  - Improve relationships among IHE and school districts (6 respondents)
  - State education reform (1 respondent)
- Improve qualifications of workforce (1 respondent)
- Securing adequate policy, legislative, and budgetary support to bring about large-scale improvement. (d112005)
- In another case, the community was generally unaware of the need for research and evaluation services provided by the partnership. (d612005)

Improve student achievement

Strengthen learning in mathematics and science by all K-12 students. Securing adequate policy, legislative, and budgetary support to bring about large-scale improvement. (d112005)

Some of our 120 counties have ranked near or at the bottom in the country on several education and economic indicators (d172005)

The communities with which we work have an incredible number of needs. Teachers in many of our schools have been teaching many years and did not receive much standards-based instructional techniques or content in math and science. Additionally, the reform curricula in math that they adopted in 1999 (Everyday Math, Math Land, etc.) has not been implemented well because of their lack of comfort with the content and strategies needed to use these curricular materials. **Our students test scores are very low in comparison to nearby schools and the state as a whole.** (d192005)

Pre-service and in-service mathematics and science programs with the intent (intended?) higher education/school district partnerships became the thrust of the MSP realizing that internal collaboration between Arts and Science and Education are absolutely necessary to address the needs of the region. **Problems of low student achievement.** Insufficient number of teachers graduating. Large percentage of mathematics and science teachers do not have a minor in those content areas. (d352005)

More highly qualified mathematics teachers and increase the math academic performance of low performing middle and secondary students. Increase the number of qualified teachers (problems of turnover and attrition) (d532005).

Low performance and student achievement (d772005)

Low educational attainment, persistently low public school performance (d832005)

Raise expectations and achievement in SM in P-12 schools, while closing achievement gaps among demographic groups.

Provide challenging SM curricula and materials for all students. Raise the awareness of students, parents, and the community of the need for all P-12 students to complete challenging courses and curricula in SM. Increase and sustain the number, quality, and diversity of P-12 teachers teaching. Provide high quality professional development to current P-12 teachers who teach SM.

Increase the responsiveness of higher education to the needs of the P-12 schools. Increase the participation of SM faculty in teacher preparation and professional development. Provide incentives for SM faculty members to engage in research with P-12 schools on effective practices in science and mathematics. (d662005)

Improve student achievement of

Address science and math education in the state, especially in high need communities, rural and minority. (especially an area of the state whose population is predominantly Hispanic, economically disadvantaged, low educational attainment along with many with limited English proficiency. It has been historically underserved by higher education and has been historically neglected by the State with respect to resources. These are unincorporated areas with no running water, no pavement, no electricity and no
economic resources. The majority, 85% at least are US citizens. Many are farm workers, but not all. (d232005)

Provide for the K16 educational needs of Native American students on the Flathead Indian Reservation, Montana. These needs, also, encompass the tribal language, traditions, and culture. (d412005)

Low academic achievement and high drop-out rates among Native American students on and around Indian Reservations. Access to professional development and for teachers in highly remote areas. With just a few teachers, it's also difficult to establish a true community of practice internally. Our region also faces shortages of qualified math and science teachers at the secondary level. (d442005)

Our partnership seeks to address issues of traditionally underrepresented youth in math and science fields. We target those students who are educationally disadvantaged, that is typically performing in the 2nd or 3rd quartile on standardized tests. Nationally and locally this has been an issue since the 1980s, particularly for diverse populations. (d482005)

Achievement gap between Native American students and non-native students. The achievement gap is most profound in mathematics, science and literacy. High dropout rate among Native American students. Native American students are severely underrepresented in higher-level mathematics classes. There is a need to examine instructional practices and instructional materials to assess the impact of these factors on achievement of Native American students. (d932005)

The key need is to improve the student learning in math and science, particularly amongst poorer school districts (d972005)

Remediate the achievement of math students at 4 underperforming high schools and their feeder schools. (d372005)

The communities with which we work have an incredible number of needs. Teachers in many of our schools have been teaching many years and did not receive much standards-based instructional techniques or content in math and science. Additionally, the reform curricula in math that they adopted in 1999 (Everyday Math, Math Land, etc.) has not been implemented well because of their lack of comfort with the content and strategies needed to use these curricular materials. Our students test scores are very low in comparison to nearby schools and the state as a whole. (d192005)

Classroom choice and treatment of content and pedagogy that are not aligned with current standards at the state and national levels. Given the historically low achievement of students of low SES the inability of schools to address the needs of these students as standards are raised is a concern now, but rests on a concern that has been around for decades. (d362005)

Provide professional development in science for teachers in different types of areas (isolated and not). Many teachers, regardless of their grade level, teach in ways that are inconsistent with reform goals. On the university side, we are reforming the science methods and content courses for elementary preservice teachers. I would suggest that there the need is less pressing. The students already get a solid dose of reform-minded science instruction. The problem is more what the students encounter when they hit the classroom -- where the concepts taught in the university are not valued by the school or classroom. This is part of the reason that this partnership is necessary. These needs are longstanding -- perhaps as old as the schools. Science instruction has never been a priority for many teachers or administrators. (d982005)

Redesign of AP (Advance Placement?) Biology. Curricular reform. (d282005)

For science it provides materials for the classroom (STC & STC/MS) and extensive professional development (PD) for K-12 teachers in application of the inquiry-approach in the use of these materials. Science PD for K-8 teachers includes curricular integration and the use of science in enhancing oral and written skills. Also offered, by OSU science faculty) are short content courses in science and math. OSU also provides pre-service (K-8) science courses, taught by scientists that are pedagogically
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The communities with which we work have an incredible number of needs. Teachers in many of our schools have been teaching many years and did not receive much standards-based instructional techniques or content in math and science. Additionally, the reform curricula in math that they adopted in 1999 (Everyday Math, Math Land, etc.) has not been implemented well because of their lack of comfort with the content and strategies needed to use these curricular materials. Our students test scores are very low in comparison to nearby schools and the state as a whole. Improve math and science teacher preparation programs and professional development for in-service teachers. (Also improve situation of out of field teachers). “Long standing need in the community to provided well prepared science and mathematics teachers.”

Pre-service and in-service mathematics and science programs with the intendent (intended?) higher education/school district partnerships became the thrust of the MSP realizing that internal collaboration between Arts and Science and Education are absolutely necessary to address the needs of the region. Problems of low student achievement. Insufficient number of teachers graduating. Large percentage of mathematics and science teachers do not have a minor in those content areas. Low academic achievement and high drop-out rates among Native American students on and around Indian Reservations. Access to professional development and for teachers in highly remote areas. With just a few teachers, it's also difficult to establish a true community of practice internally. Our region also faces shortages of qualified math and science teachers at the secondary level. (Provide elementary teachers with deeper content knowledge in math and science, better pedagogical training for high school teachers (help students develop conceptual understanding, use inquiry-based approaches))

For science it provides materials for the classroom (STC & STC/MS) and extensive professional development (PD) for K-12 teachers in application of the inquiry-approach in the use of these materials. Science PD for K-8 teachers includes curricular integration and the use of science in enhancing oral and written skills. Also offered, by OSU science faculty) are short content courses in science and math. OSU also provides pre-service (K-8) science courses, taught by scientists that are pedagogically aligned with in-service PD). (The partnership addresses the need for improved science, math, and language arts education, K-12. Curricular reform, professional development for teachers and teacher preparation.)

More highly qualified mathematics teachers and increase the math academic performance of low performing middle and secondary students. Increase the number of qualified teachers (problems of turnover and attrition) (Several of the organizations that form the Math Science Partnership existed, prior to the initiation of MSP program, as a loosely familiar network of formal and informal providers of professional development to teachers from area school districts. The professional development experiences were negotiated between individual provider institutions (some informal and others formal) and various schools. The professional development activities were attended by teachers from a variety of districts. This resulted in an increase in the capacity of provider institutions to design and implement high quality professional development and an increase in the capability of individual teachers to teach better science, but did not increase the capacity of schools and districts to
deliver a higher quality science curriculum to students. There was a need for 1) a more systemic approach to providing professional development so that teachers could access a continuum of professional development experiences that would deepen content and pedagogy, 2) a need for schools to access pd that connected with their reform based goals and 3) a need for cohorts of teachers from each school and/or district to attend, rather than individual volunteers.)

In one case, the community needs readily accessible resources that are mathematically or scientifically challenging and accurate, user-friendly from a technological standpoint, and that are also instructionally engaging and developmentally appropriate. It is a rare individual that has the necessary expertise in these three areas. The needs are long-standing and persistent across a multitude of settings and regions. In another case, the community was generally unaware of the need for research and evaluation services provided by the partnership. (d612005)

Raise expectations and achievement in SM in P-12 schools, while closing achievement gaps among demographic groups. Provide challenging SM curricula and materials for all students. Raise the awareness of students, parents, and the community of the need for all P-12 students to complete challenging courses and curricula in SM. Increase and sustain the number, quality, and diversity of P-12 teachers teaching Provide high quality professional development to current P-12 teachers who teach SM. Increase the responsiveness of higher education to the needs of the P-12 schools. Increase the participation of SM faculty in teacher preparation and professional development. Provide incentives for SM faculty members to engage in research with P-12 schools on effective practices in science and mathematics. (d662005)

Partnerships between school districts, universities, and corporations, focusing on curriculum innovation, professional development of teachers, and strategic district-level planning, help provide the depth of ideas and expertise, and the external validation, that small and large school districts need to move forward. (d782005)

Provide professional development in science for teachers in different types of areas (isolated and not). Many teachers, regardless of their grade level, teach in ways that are inconsistent with reform goals. On the university side, we are reforming the science methods and content courses for elementary preservice teachers. I would suggest that there the need is less pressing. The students already get a solid dose of reform-minded science instruction. The problem is more what the students encounter when they hit the classroom -- where the concepts taught in the university are not valued by the school or classroom. This is part of the reason that this partnership is necessary. These needs are longstanding -- perhaps as old as the schools. Science instruction has never been a priority for many teachers or administrators. (d982005)

(d582005) (Technology is still a mystery to many and it remains one of the key needs in any STEM partnership. I am still amazed at the silly mistakes that teachers make when emailing and the many things that they can't do in emailing--let alone the other issues of technology in the classroom.)

Pre-service and in-service mathematics and science programs with the intented (intended?) higher education/school district partnerships became the thrust of the MSP realizing that internal collaboration between Arts and Science and Education are absolutely necessary to address the needs of the region. Problems of low student achievement. Insufficient number of teachers graduating. Large percentage of mathematics and science teachers do not have a minor in those content areas. (d352005)

More highly qualified mathematics teachers and increase the math academic performance of low performing middle and secondary students. Increase the number of qualified teachers (problems of turnover and attrition) (d532005).

Recruit and retain high quality science and mathematics teachers. The retention issue is one that is very challenging but hard to pin down specific numbers. Where it shows up in a partnership is the teacher and administrator turnover in a schools district. Other issues concern 1) The certification of teachers at the middle level. 2) The amounts of time districts calculate into a year. 3)
Access to high quality professional development across our state. 4) Lack of materials for teach science. 5) Few higher ed faculty members who are able to work outside of their workload. (d952005)

Raise expectations and achievement in SM in P-12 schools, while closing achievement gaps among demographic groups. Provide challenging SM curricula and materials for all students. Raise the awareness of students, parents, and the community of the need for all P-12 students to complete challenging courses and curricula in SM. **Increase and sustain the number, quality, and diversity of P-12 teachers teaching** Provide high quality professional development to current P-12 teachers who teach SM. Increase the responsiveness of higher education to the needs of the P-12 schools. Increase the participation of SM faculty in teacher preparation and professional development. Provide incentives for SM faculty members to engage in research with P-12 schools on effective practices in science and mathematics. (d662005)

Overarching need to improve science learning and teaching at all levels - K-12 through undergraduate. In assembling our partnership, we recognized that both the schools and the colleges and universities had critical areas that needed to be improved and improvement in many ways required - or at least was enhanced - by collaboration. (d332005)

Pre-service and in-service mathematics and science programs with the intendent (intended?) higher education/school district partnerships became the thrust of the MSP realizing that internal collaboration between Arts and Science and Education are absolutely necessary to address the needs of the region. . ..Problems of low student achievement. Insufficient number of teachers graduating. Large percentage of mathematics and science teachers do not have a minor in those content areas. (d352005)

Raise expectations and achievement in SM in P-12 schools, while closing achievement gaps among demographic groups. Provide challenging SM curricula and materials for all students. Raise the awareness of students, parents, and the community of the need for all P-12 students to complete challenging courses and curricula in SM. Increase and sustain the number, quality, and diversity of P-12 teachers teaching Provide high quality professional development to current P-12 teachers who teach SM. **Increase the responsiveness of higher education to the needs of the P-12 schools. Increase the participation of SM faculty in teacher preparation and professional development. Provide incentives for SM faculty members to engage in research with P-12 schools on effective practices in science and mathematics.** (d662005)

Partnerships between school districts, universities, and corporations, focusing on curriculum innovation, professional development of teachers, and strategic district-level planning, help provide the depth of ideas and expertise, and the external validation, that small and large school districts need to move forward. (d782005)

Supporting teaching and learning of mathematics and science in K-12. School districts in the region had the same (foda) but addressed them in isolation, more than 45 entities that were reaching from the outside in to try to help districts strengthen the teaching and learning of STEM. Recognizing the value of working together strategically, the Math & Science Collaborative was formed to facilitate that work. The prioritized needed actions, the three highest were: (1) coordinating efforts to effectively utilize technology for students in K-12 science and mathematics education; (2) creating a clearinghouse for quality curricula and assessments in K-12 math and science; (3) facilitating the creation of a mosaic of quality professional development opportunities for K-12 math and science educators. (d812005).

Provide professional development in science for teachers in different types of areas (isolated and not). Many teachers, regardless of their grade level, teach in ways that are inconsistent with reform goals. On the university side, we are reforming the science methods and content courses for elementary preservice teachers. I would suggest that there the need is less pressing. The students already get a solid dose of reform-minded science instruction. The problem is more what the students encounter when they hit the classroom -- where the concepts taught in the university are not valued by the school or classroom. This is part of the reason that this partnership is necessary. These needs are longstanding -- perhaps as old as the schools. Science instruction has never been a priority for many teachers or administrators. (d982005)
Strengthen the education system of the State, especially in math and science. Our work was part of a complex state effort with roots in the reforms of the mid-1980’s to modernize the school system and to address historical problems concerning equity and system fairness—or more accurately, lack thereof. (d492005)

The regional need for the CMST Project originated in the workforce. Increase the pool of qualified candidates for jobs in high technology fields. (d462005)

Strengthen learning in mathematics and science by all K-12 students. **Securing adequate policy, legislative, and budgetary support to bring about large-scale improvement.** (d112005)

In one case, the community needs readily accessible resources that are mathematically or scientifically challenging and accurate, user-friendly from a technological standpoint, and that are also instructionally engaging and developmentally appropriate. It is a rare individual that has the necessary expertise in these three areas. **The needs are long-standing and persistent across a multitude of settings and regions. In another case, the community was generally unaware of the need for research and evaluation services provided by the partnership.** (d612005)
2.1.2 Summary of themes in question 2

2 Describe some of the key limitations that inhibit individual organizations from adequately addressing these needs without the partnership. In your answer, try to distinguish between limitations that are common to all partner organizations, and limitations that are unique to particular types of partner organizations.

According to the definition we are using, ALL the answers here should be coded by subnodes of Strategic Needs, and they are not. I included a table with what I would code.

| Strategic need – Other resources (improve policy) | Legislators do not listen much to educators, and are more responsive to pressure from business. Business leaders, usually well meaning, do not understand the complexities of what is involved, the magnitude of resources needed, and the coherence required. The partnership has served to build the education-business bridges that can in turn influence policy-makers. (d112005) |
| Strategic needs – knowledge | As a partnership (i.e., an independent nonprofit) we offer perspective, new ideas, and innovative strategies that may not be as easily produce in the bureaucracy of state government or sometimes even universities. Therefore, we seek to add value to other parties who are looking for new ideas but may not be in a position to aggressively promote them. (d172005) |
| Strategic needs – professional development | Some of the limitations we face is how to provide high quality professional development to the large number of people who need it, especially within the contract year and work day. Many teachers are not available on weekends or summers so finding time to work with them is a challenge. Partnerships allow us to reach more people collaboratively, making the most of all training opportunities. (d192005) |
| Strategic needs – professional development, other resources, curriculum | CARING: I believe the one of the key limitations that inhibit organizations is just plain caring about certain communities so first someone has to care enough. RESOURCES: Because rural communities are away from urban areas and in general isolated, they become invisible and/or maybe not as significant as dealing with the problems in the urban areas. Add to that the fact that Higher Ed communities have little experience with working with these communities and in general just don’t know these communities.. are uncomfortable with the people in these communities it is no wonder that it took funding opportunities to get higher education to work with minority/rural/colonia communities. You need resources to address the needs and work with rural school districts to help them have a new vision of themselves and figure out how to get what they need done. One of the big impacts of the TRSI and now the STRSI is that rural districts found each other and are now themselves partnering. WHAT WORKS: Another limitation is that we tend to want to transfer what works in urban areas/ African-American areas to rural areas or to colonies in South Texas. We don't pay as much attention to the culture and language as we should. TEACHER TRAINING: As a whole teacher training programs are not producing teachers who can be effective in high needs schools in spite of fact that this is supposed to be addressed in the curriculum. From my perspective we train teachers to function with a middle class or upper class mentality and therefore are more comfortable in these communities. Additionally, schools want teachers to involve parents; to be active in the communities they teach in.. but not only don't teachers usually live in the community they teach in, but most TE programs don't teach preservice teachers how to work with parents especially in STEM areas. So it is important that at least one of the partners really take the leadership in making a difference in these areas where traditionally HE has major limitations.. So as a partnership we overcame the limitations of individual organizations and all learned to care a bit more. (d232005) |
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While teacher preparation institutions can prepare pre-service teachers without a partnership, universities will provide much more effective preparation when working in partnership with a school system. For example, having practicing teachers involved in curricular design for content pedagogy with faculty from Arts & Sciences and Education should lead to a richer and more practical pre-service program than one designed solely by Education faculty. Similarly, involvement of master teachers as mentors in the field experience portion of the degree through a partnership that involves Professional Development School model should also lead to a better prepared teacher than one who is only supervised by an Education faculty member. (d252005)

AP Biology has impact at both the high school and college levels and even as far down as middle school to prepare students for AP classes (d282005)

The university simply does not have K-12 students of its own - we need the schools to provide real experiences for preservice teachers to bridge the theory of coursework to the application of actual teaching. Higher education faculty often teach their courses with limited or outdated school-based experiences. More opportunities for interactions with K12 schools, teachers, and administrators improves their understanding of the K12 context which has resulted in improvements in their course offerings, and their own teaching practices. From the perspective of the schools, the limitations vary. For many sites, their small and rural nature created an isolation and lack of resources (expertise as much as financial). With only one science teacher in a middle school for example, it is hard to generate a sense of learning community or to have supportive peers to focus on continuous improvement in learning and teaching. Joining into the partnership has expanded the network for these small schools allowing them to learn from others in ways they couldn't before. The infrastructure of the partnership has forged linkages between job-likes that teachers or administrators simply didn't have time to seek out on their own. These networks are helping lead the way to more coherence across the region as well as improvements in individual schools. (d332005)

Three of the limitations were mentioned above: 1. Poverty, 2. Lack of highly qualified mathematics and science teachers, and 3. student performance. The project has focuses on the later two. These are to some extent limitation, however, the partnership established between the IHE administration and the school districts can and is addressing these barriers through interactive programs that involve K-12 teachers and IHE faculty developing both pre-service courses and in-service workshops. This has been foster by mathematics, science, and program implementation advisory councils consisting of both higher education and school district teachers and by small partnership enhancement grants. (d352005)

The three key partners in the partnership I am considering are school districts, a network of higher education K-12 outreach agencies, and an education research organization. Put simply, the districts are limited in that they lack leadership and intellectual capacity to facilitate improvements in teaching and learning; the network and education research organization are limited in access to contexts where the capacity and knowledge generation functions they have can be applied to these needs. (d362005)

Without the partnership, there was no one with the time and resources to bring the parties together to facilitate the real work of a professional learning community. By providing a full time coach and part-time faculty we removed the absence of a continuously present force to encourage real implementation and mediation between the parties. Schools with limited staff generally don't have someone to focus on this need. (d372005)

SKC is arguably one of the most successful of the 33 tribal colleges. Our greatest limitations are ones of numbers and geography. There great geographic distances and small population numbers in Montana and on our 7 reservations. We have competed successfully for grants from
Alternative Approaches to Evaluating STEM Education Partnerships

NSF, NASA, DOE, and others, however, we have all been at a disadvantage when competing against larger universities where ever they may be because of these two factors. So of necessity we have entered into partnerships with educational entities that share common goals and specific needs. (d412005)

Improving academic achievement among Native American students is a big, complicated and extremely difficult issue for any organization to handle, especially if they're trying to do it alone. Indian reservations tend to be geographically isolated, so that becomes a complicating factor as well. Outside partners are quite limited in their ability to come in and fix problems on Indian reservations. That said, the schools and districts on reservations have also seen limited success. A seemingly reasonable approach is for outside entities to work in partnership with districts to provide support for teacher leaders who live and work within the Native American communities. Remote, isolated, small school districts have difficulty providing professional development internally and are, by definition, unable to create communities of practice without external partnerships. School districts have difficulty deepening teachers' content knowledge in math and science using their own expertise (due to time constraints as well as insufficient capacity) -- conceivably secondary math and science teachers could help elementary teachers, but I've seen very little of that actually happen -- possibly due to secondary staff feeling quite heavily burdened just with their regular teaching load. Universities can work to improve the preparation of their own pre-service teachers, but to impact teachers already in the field, they must partner with districts. (d442005)

Since efforts need to be made to educate a future workforce competent in the technological tools of the workplace, a local education core partnership formed between an urban school district, a local college and a suburban district and some supporting groups like the NYS Education Department. Each partner offers unique components that contribute to the overall goal. Higher ed focuses on improving the Teacher Education Program in CMST as well as increasing the number of students graduating in the field of Computational Science. The school districts need the higher ed partners to provide them with qualified new CMST Teachers 2) and to upgrade the skills and pedagogy of the existing MST teachers. Industry and State Ed also provides frameworks for the standards the partners are striving to achieve. (d452005)

In our case, we are subject to local school districts interest, enthusiasm, and matching funds. We are also subject to school organization and teacher interest. For example, we may be interested in offering an entire school period devoted to our particular intervention, but high school students may not be able to elect this period due to scheduling, or they may only be able to elect this course once during their four years. In other instances, schools only allow our intervention in a club model. We have found that the effects we can realize are determined largely by the degree to which students are able and schools allow them to participate. (D482005)

Education is a highly political and complex enterprise and making forward progress requires complex and unusual alliances. Some organizations have defined constituencies that bring power to a collaboration; others have technical expertise, yet others, have access to power for reasons that have more to do with money than constituencies. (D492005)

Lack of understanding of what constitutes quality science and math education and lack of knowledge of the elements of quality PD. Sustainable funding (can be accessed through the political process using cumulative political clout). Lack of competent trainers. No connection between science and math faculty and the schools. (D522005)

A common lack of sufficient financial resources and or time available that conflict with major operational goals and the stated purposes of the potential partners. Public schools have limited resources and multiple goals to require personnel extra tasks and when those tasks are not funded
the partnership becomes a voluntary endeavor. (D532005)

Time, particularly for teachers is always at a premium. As a result, and particularly if there are technology problems or technology inadequacies, any attempt at partnership are slowed significantly. There is an energy peak that must be overcome for teachers to become engaged. If there are problems or perceived problems, the peak becomes greater & there is less participation. The second item that can limit is the network, How effective and efficient is the network: 1) do participants have to establish the network; 2) will the network produce direct and obvious results of benefit to the participant and to the classroom; 3) is there particular value in the network, even in personal professional growth? (D582005)

There are quantitative limitations and qualitative limitations that inhibit one organization from addressing the needs stated in question 1. Common to all organizations is resource limitation of some sort. For example, Science Outreach of Washington University has a wealth of resources to share content knowledge and pedagogy with area teachers. However, they do not have the resources to offer the breadth of content courses important to elementary school teaching. The school districts understand the connections between teacher performance and student learning as they are enhanced or constrained by a state and national policy environment, but do not have staff resources to develop inservice programming to meet all their needs. The informal science institutions understand science teaching and learning from an activity base or exhibit base informed by what motivates student learning, but don't have the experience of integrating this into a formal setting. Education department contributes knowledge of strategies that sustain student learning, but don't have the pedagogies connected to specific content that teachers are grappling with implementing in classroom curricula. (D592005)

One limitation is institutional support for scientists and mathematicians to get involved in education-related projects. Collaborations can be inhibited when cost-sharing and promotion policies are set up to reward compartmentalization. These limitations occur most frequently within institutions, but can also be issues across institutions during negotiations around sub-contracts. (D612005)

In this partnership, *no one individual institution or school district could address this problem. it was a systemic problem* and all of us needed to come together to try to find a solution. Obviously, higher ed cannot solve K-12 problems but we can contribute in many ways to the solutions invented by the partnership. (D642005)

The following are key limitations that inhibit individual organizations from adequately addressing these needs without the partnership. Systemic nature of problems, not isolated but interlocking and constantly changing Power issues over resources, decision-making, etc. Traditional financial base not growing at the same rate as problems. Need for quick viable results. Increasing need for the use of data to make decisions and accountability. Institutional challenge, no one entity can solve the problems. Delivery mechanism limitations: projects, one shot events, isolated training etc. Lack of awareness of individual boundaries. Resource limitations: Schools 1) low achievement expectations for students; 2) substandard education and high pupil-teacher ratios due to tracking; 1) equity issues related to placement of students, particularly African-American males and low income students; 4) lack of a stimulating, rigorous, culturally relevant curriculum; 5) lack of a highly qualified K-12 science and mathematics teaching force; 6) equal access to equipment, materials, technologies, and relevant assessments; 7) lack of widespread involvement in schools and encouragement for academic. 8) lack of sufficient funds. Business 8) Lack of expertise in research techniques and strategies.

Individual organizations have placed an overwhelming percentage of reform elements on Reading and Language Arts. Participation in a systemic partnership allows a K-12 organization to open up another front of academic focus. Individual organizations are limited by human resource
alternative approaches to evaluating STEM education partnerships

other resources (time), financial resources

SN – professional development

capabilities, time, and financial investment shortcomings. Partnership experiences allow multiple focus opportunities, clarity of purpose, and a mutual mission statement to rally around. (D772005)

School districts are often limited by political and bureaucratic-organizational considerations, as well as the absence of resources for directly providing professional development for teachers and innovative techniques for instruction. Universities often have research goals that cannot be implemented without the knowledgeable and enthusiastic participation of cooperating schools or districts. (D782005)

Limitations that inhibit all of the partners from adequately addressing these needs without the partnership: primarily, I think this is funding and sometimes lack of qualified personnel. Without the partnership, it is often hard to have someone who can focus on these particular needs. Districts often do not have specialized content knowledge (or knowledge of research on learning math and science); the partnership helps the districts gain access to that knowledge. Universities often do not have applied knowledge (just theoretical); the partnership helps the university see how theory plays out in the real world. Universities often are also so specialized (especially science faculty) that faculty don't talk with one another about common issues enough. (D792005)

I can speak most directly about partnerships among K-12 school districts that are small (averaging 2,000 K-12 enrollment). Through the MSP, I am just beginning to understand the needs/limitations of partnering across IHE organizations. 1) A major limitation is the lack of specialized content-based personnel within the many individual school districts. That precludes their individual district capacity to do the requisite research to identify the needed resources, and then facilitate their implementation. (2) The tools that have been developed to address those concerns and support the needed change have not been widely available or easily implemented. (3) The total number of math and science teachers within the prevalent smaller districts is too small to warrant having experts from outside come to provide professional development for such a small group. That is particularly true of the implementation of the newer instructional materials, which definitely require up-front and on-going training. (3) The recent environment of math wars and science evolution challenges makes small individual districts leery of taking stands for the need to change which, as part of a larger partnership with research based strategies, they are willing to venture. (4) Districts are bombarded with vendors, each touting their research-based materials, and have great difficulty making sense out of the noise without the content-based expertise. (5) The culture of education has not been data-driven; nor has strategic long-term intervention been widely experienced. Overcoming the this too shall pass mentality is harder in isolation. (D812005)

The community has seventeen independent school districts governed by seventeen different school boards. A separate community college district, one public university and four private universities exist. the city government is independent of all the aforementioned groups. None of these organizations alone had the ability, mandate or political clout to address the STEM project without getting into someone else's turf. When organizations tried to go-it-alone in the past they received little, if any, support or encouragement from the others. D832005

The re are several factors that inhibited the school district from deal with the needs of the Native American students. The most commonly identified factor was lack of resources both fiscal and human. The partnership has been able to provide both human and fiscal resources to better address the need. The second factor that inhibited progress on the need was a lack of recognition of the magnitude of the problem. The partnership has provided extensive data analyses that help to identify the seriousness of the situation. The third factor was a self of helplessness about the school districts ability to change the situation. The partnership has been able to examine the research and suggest steps to begin to work on the areas of need. The other partners in partnership would not be able to work on this area of need without the full cooperation of the school district. The school district has provided the project with the data necessary to create a full understanding of the
Alternative Approaches to Evaluating STEM Education Partnerships

needs. District personnel have helped to understanding of the full context of the needs of the Native American students. D932005

I think the issue is capacity or the numbers of people who can carry the work load. This applies across the any partnership. The work load that is necessary is often much greater for any one partner. K-12 Districts have the pressures of policy whether federal or state, or community. These can limit and heavily influence activities if they are not addresses regularly. They can also set the direction of activities without addressing the deeper needs. For example NCLB can focus districts on getting a few students over a score hump on a test to stay off a list and not on the system. Locally parents and school boards can change agendas such as with mathematics programs. University faculty often have no idea what operating in a standards based world is like. They talk of ideas and freedoms of thinking while teachers want to know why and how it will help them stay off a list. This can cause problems with credibility. Higher education institutions are actually fighting standards right now at their level. (Perhaps rightly so, but it goes to disposition.) Teachers have no choice. D952005

School Districts don't have enough time or money to address some of the needs, or the expertise in math and science content. Conversely, content experts at universities don't necessarily know how to work with schools. Both groups sometimes have different scheduling demands that can make it difficult to work together. D972005

Much of the work at the university could be done without a partnership. The problem is that without a partnership these changes will fade since they would not be supported in the schools. As soon as the teacher graduates, there would be a pressure to conform to the school standards. Joint effort with the schools advances the cause for all -- providing quality mentoring for new teachers, continuing professional development for university faculty and inservice teachers, as well as systemic institutional support. The work of the schools in professional development could also be accomplished without the university. The partnership with the university adds some critical pieces though. First, it adds money. Second, it contributes expertise (that is available elsewhere but much more difficult to access). I think that in a generic way these are common to most all partnerships. there are always multiple ways to accomplish things but the partnerships are needed because there is some shared interest and some overlapping goals. I would think this is true is nearly all professional schools/practices. I know that professors of medicine sit and bemoan the low level of care provided by many practitioners-- the same practitioners they educated. Limitations: time (locating resources), access (enticing potential partners to play along), distance (related to access), money (to provide time and incentives), leadership (people at each institution having other obligations -- the partnership becomes an add-on), rewards (such as tenure). D982005

2.1.3 Summary of themes in question 3

3 Describe how partnership(s) expand the capacity of organizations to address community needs. Please provide specific examples of how capacity is improved for different types of partner organizations.

D172005 (3) Some collaborators join with us because we can provide access to the business sector; some seek us out because we can provide access to educators, researchers, etc. - We have survived long enough to actual develop a reputation for being always innovative and a source for new ideas (in education, R&D support, and entrepreneurial business-building)

D192005 (3) First of all, partnerships with the tribes we serve helps us to identify and address the needs specific to each community. Also,
each school has its own school board, made up of community members, so getting their support will improve the likeliness of implementation and sustainability of our efforts. Secondly, partnerships with organizations throughout the state give us a variety of avenues to address the schools' needs.

D232005 The only way to address science and math education effectively and for the long term, all stakeholder need to be involved in the solutions. The different stakeholders have different strengths and no one organization has either the expertise, or capacity to impact the problem in the most effective way. So the only way to expand the capacity needed to make address community needs is to partner. The major players are HE (both 4 year and 2 year) and K-12 schools and they will have the major responsibilities, but without the community, parents and the informal science community and/or CBOs to assist effectiveness is compromised. Faculties, especially science faculty have little experience working with kids (K-12) and teachers expand the capacity of our faculty in this area. They can also expand our capacity to have a better designed curriculum and learn how best to work with K-12 teachers. Teachers expand their expertise from the in-service experience HE provides and/or have opportunities to get MS degrees that are more reflective of their needs. Teachers expand the types of experts they can bring to their classrooms, including undergraduates. I think the overall community expands it knowledge of how HE and K-12 work and how they might help us do the job they expect us to do. Basically it is a major growth experience for all stakeholders and provides a good way to learn how to most effectively work together.

D252005 Two examples of expanded capacity are provided in #2. Capacity to provide stronger SM content pedagogy is improved by partnerships between Arts & Science and Education. Capacity is further improved by addition of K-12 school partner to A&S and Education.

D282005 AP Biology is too big for only one organization to be involved in trying to change it.

D332005 Some of this is reflected in my response to question 2 above. Bottom line is that education reform is a complex business that requires changes at all levels - K12 teachers, administrators, Higher Education faculty and administrators, policy agencies etc. Each of these partners has a part to play in it all, but alone is insufficient to really enact lasting change. Partnership where all of these bodies work in concert toward a common vision, applying their expertise and strength and drawing upon the expertise and strength of others is the only way some of these complex reform goals can be met.

D352005 Indicated in the First round, this partnership was built upon a Rural Systemic Initiative, which began a number of years ago. This project is building upon the leadership capacity begun by that project. Not only is the partnership providing teachers with the ability to utilize data to improve student performance, but also to provide leadership training. In addition, the project involves leadership training for principals and counselors to assist them in improving curriculum and student performance.

D362005 For the school districts: the partnership provides opportunity to develop in-house capacity for leadership, in-service teacher development, and knowledge generation. For the network and research organization: the partnership provides opportunity to improve their capacity by training new staff and learning from the experience of applying their unique capacities in new contexts.

D372005 Our partnership provides the opportunity for secondary teachers to take courses and attend workshops at their site. The partnership brings the mathematics content and pedagogical training to the staff.
Partnerships with our funding agencies, other educational entities provide us the increased numbers we need and through sharing of resources strengthens our programs and enhances meeting our goals. For example, NSF-RSI/LDMT programs have built capacity in our K12 schools while achieving success in our systemic school reform efforts.

Our university group has been able to help districts analyze their own data (achievement, enrollment, etc.) and do more in-depth statistical analyses than they otherwise would have capacity to do (e.g., partial correlations controlling for SES, ethnicity, etc.). Teacher leaders from partner districts sometimes help in our pre-service courses -- providing a current view from the field. University scientists and math experts (experts both in content and pedagogy) have been able to help inservice teachers deepen their content knowledge.

If any one segment of the community were to attempt to improve the quality of the workforce and science/math/technology education it would be implausible and ineffective. However, by each organization focusing on its specialty, together the groups can reach the goal. For example, if school districts on their own developed and implemented a CMST approach & prof. dev. program, the time, use of staff and the cost would be completely prohibited.

In our case, we provide additional resources and support to classroom teachers, particularly math and science teachers that become advisors. We also provide funds for additional field trips and participation in local, regional, state and national competitions for students who qualify. In addition, we offer professional development for our teachers over and above what the school district is able to provide. We also assist with curriculum and provide supplies through a per classroom stipend.

A principal strategic goal of our partnership was to improve education system performance by increasing the coherence of the education system. This required the linking of many organizations with disparate constituencies and ideologies—in a common effort to adopt policies that would improve education yet allow alternative approaches to work in local situations. By joining a partnership, small organizations gained clout; large institutions gained technical capacity and, some times political insulation from positions their leadership believed to be important but key constituents might not endorse.

The key to quality professional development (which is, in turn, key to science and math reform) is having the leadershp, the facilities and QUALIFIED TRAINERS. This requires a critical mass of participants. Example: The partnership has 100+ Certified Teacher Instructors (CTI) who are certified to instruct other teachers in the use of STC or STC/MS materials. The teachers represent 30 districts across the state. It is also important to have scientists mathematicians involved to help improve the teachers content base. Example: Summer week-long course in electric circuits for grade 4-6 teachers. Critical mass of 20 teachers for the course to be taught. Teachers from 12 different districts from throughout the state attended.

Partnerships create a mechanism directing community attention to the issues of need motivating the organizing a partnership. When partnerships include a large numbers of individuals and numbers of partners then isssues of needs can be make known to greater portions of the total population which in turn can stimulate and initiate action.

Thinking of a Venn diagram, with overlapping circles, there are three distinct parts, Circle A that is not overlapping, the parts of A & B which overlap, and the parts of B which are not overlapping. Such a diagram is static, however, partnerships are dynamic within a dynamic system, so that one must think about the Venn diagram within a broader system (S). A & B only exist because of
the value that they bring to the larger system. When A & B enter a productive partnership, there is mutual value and productivity between them. But now the value of B is not just within the system S, but is magnified, enhanced, or transformed by A before it is exchanged with S, so that B-S dynamic must now add B(A processed)-S As an example, suppose that there is an exchange between an industry and a school, such that the industry provides some support for the school—perhaps tutors for science students. Because of the partnership, and the dynamic interaction between the two, one of the tutors discovers an interest that a couple of the students have that would assist the tutor in researching something for the tutor's department. That research project allows the industry to respond to the community in some way—maybe serving an additional function that was not seen before, but because of the partnership something provoked some action not perceived in the relationship, but valuable to the community.

D592005 Designing and implementing professional development in partnerships between formal (=university science outreach program) and informal science institutions, ISIs, (Science Center, Zoo, Botanical Gardens) has increased the capacity for ISIs to construct engaging activities in a sequence of lessons that are better adapted to the sustained curriculum of a school district. Scientists doing professional development in institutions of higher education, if teacher leaders are present, increase their capacity for understanding the constraints of teachers in school systems. Both ISI and IHE partners increase their capacity for delivering content and activities in pedagogically sound ways. Prior to working with teachers, ISIs assume that what is needed most is to make science fun, focusing on the motivational needs; IHE scientists assume that what is needed most is interesting ways to explain or describe scientifically important processes, whether or not they are in the curriculum; Both ISIs and scientists are unaware of the depth of knowledge available about teaching and learning in the field of education. Higher education teacher educators increase their understanding of the power of connecting pedagogy to appropriate content, rather then assuming that pedagogy can be learned void of content. All of this requires that there exist feedback loops between partners about the success of the instruction. As feedback informs instruction, teachers learn more and implement more successful reform-based lessons in their classrooms.

D612005 The partnerships tend to expedite communications between organizations. For example, I have partnered with faculty in mathematics on several projects. When colleagues in my department (Elementary Education) have a question or concern about mathematics certification or course requirements, it is more convenient and efficient for me to contact my partners in the math department. Without the connection afforded by the partnership, my colleagues would need to initiate a contact with a staff assistant in the math department, who would forwards the question to their department head, who may or may not need to consult with a faculty member before replying via the same channels. Capacity is also increased when a partner in another department or institution is able to refer services that I offer to colleagues in other fields. This results in an indirect multiplier effect that increases my exposure.

D642005 In this partnership, bringing to the table the ideas and abilities of both school people and higher ed folks allowed the capacity of both to be expanded. Since higher ed institutions train the teachers, they can heavily affect the style of teaching in the school classrooms. However, the realities of schools soon pushes teachers into a certain mold in order to be successful. Our partnership had some success in overcoming these historical trends.

D662005 Partnerships enable individual organizations to view the systemic nature of problems related to STEM and to begin to get at some of the root causes. The systemic view often is a result of multiple perspectives coming together. Partnerships (usually required in the RFP) Increase the need for the use of data to make decisions and for accountability. Organizations have to develop technical skills related to data use. Organizations develop cross-functional and cross-institutional problem solving. People form different
departments and different institutions often begin to work within their own environment using a team or partnership approach to solve problems within the organization or department. Organizations adapt and modify their delivery mechanisms from projects, one shot events, isolated training etc. to developing the capacity to jointly solve complex problems. Organizations often discard project approaches and begin to gain technical skills to make change work. For example: Prior to the partnership the school district had addressed needs by selecting one component of the system (curriculum, instruction, assessment, professional development, technology) for reform. Reform efforts were episodic, and disconnected. Middle School mathematics teachers were provided training on TI-83 calculators. However, when they returned to their schools teachers did not have any of the resources (materials, equipment, space, and time) nor did the students have access to calculators. No one had looked at the curriculum to see where and how calculators fit into the instructional program. The teachers did not collaborate. There was no increase in the use of calculators. After the formation of the partnership, a needs assessment was conducted that focused on curriculum, instruction, assessment, professional development, technology. Data was collected and analyzed. Faculty and teachers examined mathematics content. Teachers received follow-up training on TI-83 calculators to design units of study that were aligned to the curriculum. Faculty members served as resources for the teachers online. Use of calculators by teachers and students increased. Marginal improvements were made on the mathematics state assessment.

Partnerships give additional credibility to individual organizations areas of focus. Partnerships have a systemic public relations and articulation system to the community at large. Partnerships increase the human resource and fiscal capacities of individual organizations.

Partnerships ideally bring together complementary sets of resources, and enable mathematics, science, and technology innovations to benefit teachers through professional development activity, students through activities, curriculum innovation, and so forth. For example, through one partnership of the state university, two NJ corporations engaged in scientific research, and local high schools, teachers developed science teaching modules based on current research (working with industry and university scientists), and brought these into high school classroom activity. None of the partners could have achieved this alone.

Partnerships can provide specific locations for universities to place students for field experiences or student teaching. Placing students in classrooms of teachers involved in other work with the university means that the students get a better experience and the master teacher has the opportunity to work with colleagues more. Districts seeking to improve student achievement gain benefits from conferring with faculty about curriculum - adjusting what is taught to better match state standards and the demands of each discipline. They also gain from experts providing professional development for teachers, so that teachers are better able to teach specific content.

By partnering across districts, teacher leaders can be supported in developing content-based expertise. Their combined numbers create the critical mass to be supported in effective content-based professional development and the exchange of tools and strategies. The networks of a partnership enable the dissemination of relevant research. At a broader partnership level, staff can be supported to support the teacher leaders, and resources can be sought and more effectively used.

In our case city government, the community college district and the universities were much more enthusiastic about working with a joint effort of school districts since they serve the entire community and not just a single segment. They were then working to benefit all of their constituents rather than being partial by working with only one segment of the community.

The capacity of school district to understand their data is increased with the help of the statistical expertise of the university. The capacity of the school district is also improved with access to the research literature that is provided by other project partners. The capacity of all of the partnering organizations is increased by the professional development that is offered by the partnership. An example of this is the TERC Leadership Institute that was sponsored by the partnership for elementary teacher leaders. This training was attended by project staff from all the partner organizations.
Capacity is expanded when the individual in the partnership really listen to each other and work together. Perspectives are difficult to overcome but people have to try to understand the worlds from which each come s from. For example; discipline faculty co-planning a course with education faculty and K-12 teachers. Also people (PI or faculty) taking various subservient roles. Not always the leader but letting other lead, such as teacher leaders.

One thing that I've noted as our partnerships become more ingrained, is that people simply have expanded their range of resources that are available to them. If they have specific questions that need to be answered, they now know people with a wide set of experiences and expertises that they can call on.

In our case, we (university) offer access to people who are knowledgeable about content and pedagogy. We also have the flexibility to deliver courses. The schools offer the university placements for their preservice students who otherwise may end up in field situations that do not support our goals. Much of the program can be done in isolation but in isolation, we will be much less effective. Essentially the partnership offers COHERENCE. Having said that I will also say that in many of the partnerships, perhaps all, that I have been involved in never evolve to this level. It has always been a case of playing alone together and each partner had a separate agenda. So since the partnership offers no added value -- only added work -- they dissolve.

Describe the needs in your community (or region) that the partnership(s), in which you have participated, are aimed at addressing. If possible, please provide some detail as to the magnitude of the needs. In your answer also indicate how long standing and persistent these needs have been in your community or region.

1. Strengthen learning in mathematics and science by all K-12 students; a long-standing need
2. Legislators do not listen much to educators, and are more responsive to pressure from business.

Describe some of the key limitations that inhibit individual organizations from adequately addressing these needs without the partnership. In your answer, try to distinguish between limitations that are common to all partner organizations, and limitations that are unique to particular types of partner organizations.

1. Securing adequate policy, legislative, and budgetary support to bring about large-scale improvement.
2. I call it a culture of confidence - which we have not traditionally had in this state.
3. Some collaborators join with us because we can provide access to the business sector; some seek us out because we can provide access to educators, researchers, etc.

Describe how partnership(s) expand the capacity of organizations to address community needs. Please provide specific examples of how capacity is improved for different types of partner organizations.

1. We have survived long enough to actual develop a
sometimes even universities. Therefore, we seek to add value to other parties who are looking for new ideas but may not be in a position to aggressively promote them.

| D192005 | (1) The communities with which we work have an incredible number of needs. Teachers in many of our schools have been teaching many years and did not receive much standards-based instructional techniques or content in math and science. They have indicated on surveys that they are not comfortable with much of the content they are expected to teach on math and science. Additionally, the reform curricula in math that they adopted in 1999 (Everyday Math, Math Land, etc.) has not been implemented well because of their lack of comfort with the content and strategies needed to use these curricular materials. Our students test scores are very low in comparison to nearby schools and the state as a whole. |
|         | (2) Some of the limitations we face is how to provide high quality professional development to the large number of people who need it, especially within the contract year and work day. Many teachers are not available on weekends or summers so finding time to work with them is a challenge. Partnerships allow us to reach more people collaboratively, making the most of all training opportunities. |
|         | (3) First of all, partnerships with the tribes we serve helps us to identify and address the needs specific to each community. Also, each school has its own school board, made up of community members, so getting their support will improve the likeliness of implementation and sustainability of our efforts. Secondly, partnerships with organizations throughout the state give us a variety of avenues to address the schools' needs. |

| D232005 | Since our partnership is statewide, our overall focus has been to address science and math education in the state. Our focus has been to address high need communities, rural and minority. TAMUCC has focused on South Texas particularly Hispanic, rural and Colonia communities. South Texas is an area about the size of North Carolina. It is predominantly Hispanic, economically disadvantaged, has low educational attainment along with many with limited English proficiency, especially in the Colonias. It has been historically underserved by higher education and has been historically neglected by the State with respect to resources. San Antonio and Houston have the closest professional school as well as Ph.D. granting programs. The situation in the Colonias will remain persistent until we more systematically address the situation. These Colonias are all along |
|         | CARING: I believe the one of the key limitations that inhibit organizations is just plain caring about certain communities so first someone has to care enough. RESOURCES: Because rural communities are away from urban areas and in general isolated, they become invisible and/or maybe not as significant as dealing with the problems in the urban areas. Add to that the fact that Higher Ed communities have little experience with working with these communities and in general just don’t know these communities. .......... are uncomfortable with the people in these communities it is no wonder that it took funding opportunities to get higher education to work with minority/rural/colonia communities. You need resources to address the needs and work with rural school districts to help them have a new vision of themselves and figure out how |
|         | The only way to address science and math education effectively and for the long term, all stakeholder need to be involved in the solutions. The different stakeholders have different strengths and no one organization has either the expertise, or capacity to impact the problem in the most effective way. So the only way to expand the capacity needed to make address community needs is to partner. The major players are HE (both 4 year and 2 year) and K-12 schools and they will have the major responsibilities, but without the community, parents and the informal science community and/or CBOs to assist effectiveness is compromised. Faculties, especially science faculty have little experience working with kids (K-
the border thought Texas has the majority of them. These are unincorporated areas with no running water, no pavement, no electricity and no economic resources. The majority, 85% at least are US citizens. Many are farm workers, but not all. **to get what they need done.** One of the big impacts of the TRSI and now the STRSI is that rural districts found each other and are now themselves partnering. **WHAT WORKS:** Another limitation is that we tend to want to transfer what works in urban areas/ African-American areas to rural areas or to colonias in South Texas. We don't pay as much attention to the culture and language as we should. **TEACHER TRAINING:** As a whole teacher training programs are not producing teachers who can be effective in high needs schools in spite of fact that this is supposed to be addressed in the curriculum. From my perspective we train teachers to function with a middle class or upper class mentality and therefore are more comfortable in these communities. Additionally, schools want teachers to involve parents; to be active in the communities they teach in...........but not only don't teachers usually live in the community they teach in, but most TE programs don't teach preservice teachers how to work with parents especially in STEM areas. So it is important that at least one of the partners really take the leadership in making a difference in these areas where traditionally HE has major limitations. Certainly if WT had not taken the lead in bringing quality math and science to rural communities in Texas it would not have been done. Through our work in TRSI we learned that half of the rural school children in Texas are in South Texas so we knew we had to have more than one RSI in Texas in order to address the magnitude of the situation. So as a partnership we overcame the limitations of individual organizations and all learned to care a bit more. **12) and teachers expand the capacity of our faculty in this area. They can also expand our capacity to have a better designed curriculum and learn how best to work with K-12 teachers. Teachers expand their expertise from the in-service experience HE provides and/or have opportunities to get MS degrees that are more reflective of their needs. Teachers expand the types of experts they can bring to their classrooms, including undergraduates. I think the overall community expands it knowledge of how HE and K-12 work and how they might help us do the job they expect us to do. Basically it is a major growth experience for all stakeholders and provides a good way to learn how to most effectively work together.**

<table>
<thead>
<tr>
<th>D252005</th>
<th>There is a long-standing need in the community to provide well prepared science and mathematics (SM) teachers. Several of the</th>
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<tr>
<td></td>
<td>While teacher preparation institutions can prepare pre-service teachers without a partnership, universities will provide much</td>
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<td></td>
<td>Two examples of expanded capacity are provided in #2. Capacity to provide stronger SM content pedagogy is</td>
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### Alternative Approaches to Evaluating STEM Education Partnerships

<table>
<thead>
<tr>
<th>Partnership Area</th>
<th>Description</th>
<th>Details</th>
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<tr>
<td>Solid Content Pedagogy Grounding for Both Pre-Service and In-Service SM Teachers</td>
<td>Many current teachers, especially in middle grades, are not well prepared in science and mathematics - they are not technically teaching out of field since, until recently, they had middle school endorsement for four fields. Two years ago, policies were changed so that teachers were certified in two of four areas in middle school. Many SM high school teachers are teaching out of field.</td>
<td>More effective preparation when working in partnership with a school system. For example, having practicing teachers involved in curricular design for content pedagogy with faculty from Arts &amp; Sciences and Education should lead to a richer and more practical pre-service program than one designed solely by Education faculty. Similarly, involvement of master teachers as mentors in the field experience portion of the degree through a partnership that involves Professional Development School model should also lead to a better prepared teacher than one who is only supervised by an Education faculty member.</td>
</tr>
<tr>
<td>REta to Consider Redesign of AP Biology</td>
<td>The RETA that I am involved with is to consider AP Biology. The community that will be affected is AP Biology teachers and students throughout the US and worldwide. Also, there will be some affect to the colleges/universities that receive AP scores to use for placement or credit.</td>
<td>AP Biology has impact at both the high school and college levels and even as far down as middle school to prepare students for AP classes. AP Biology is too big for only one organization to be involved in trying to change it.</td>
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<td>Critical Areas that Needed to be Improved and Improvement in Many Ways Required</td>
<td>The current partnership in which I am working sets out to address a number of needs, with of course the overarching need to improve science learning and teaching at all levels - K12 through undergraduate. In assembling our partnership, we recognized that both the schools and the colleges and universities had critical areas that needed to be improved and improvement in many ways required - or at least was enhanced - by collaboration. For example, the preservice program for science teachers needs to be able to access high quality classrooms with teachers using research-based curriculum and effective instructional practices so that practicum and internships provide rich learning and mentoring experiences. To so do, the university needs to have a strong, collaborative relationship with the schools where practicum students are placed. The schools, working feverishly to meet local, state, and federal mandates wanted to install the best</td>
<td>The university simply does not have K-12 students of its own - we need the schools to provide real experiences for preservice teachers to bridge the theory of coursework to the application of actual teaching. Higher education faculty often teach their courses with limited or outdated school-based experiences. More opportunities for interactions with K12 schools, teachers, and administrators improves their understanding of the K12 context which has resulted in improvements in their course offerings, and their own teaching practices. From the perspective of the schools, the limitations vary. For many sites, their small and rural nature created an isolation and lack of resources (expertise as much as financial). With only one science teacher in a middle school for example, it is hard to generate a sense of learning community or to have supportive peers to focus on continuous.</td>
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<td>Education Reform is a Complex Business</td>
<td>Some of this is reflected in my response to question 2 above. Bottom line is that education reform is a complex business that requires changes at all levels - K12 teachers, administrators, Higher Education faculty and administrators, policy agencies etc. Each of these partners has a part to play in it all, but alone is insufficient to really enact lasting change. Partnership where all of these bodies work in concert toward a common vision, applying their expertise and strength and drawing upon the expertise and strength of others is the only way some of these complex reform goals can be met.</td>
<td>Some of this is reflected in my response to question 2 above. Bottom line is that education reform is a complex business that requires changes at all levels - K12 teachers, administrators, Higher Education faculty and administrators, policy agencies etc. Each of these partners has a part to play in it all, but alone is insufficient to really enact lasting change. Partnership where all of these bodies work in concert toward a common vision, applying their expertise and strength and drawing upon the expertise and strength of others is the only way some of these complex reform goals can be met.</td>
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<th>Instructional materials available and prepare teacher to use them well, but often lacked the content and pedagogical expertise to provide the professional development required. Moreover, many of the partner schools are small and isolated, leaving teachers will little peer support to learn new materials and new strategies. Joining the partnership with the university and other schools created a critical mass to more effectively learn about materials and practice. This benefited the schools, while also benefiting the university by increasing the number of potential quality sites for preservice placements. The partnership relies on the expertise in resources each institution has while at the same time provided new resources and expertise by virtue of the partnership. These needs have long been in place and are not new, but took some dedication and leadership to initiate a more formal effort to really institutionalize these partnership relationships for mutual benefit to all parties.</th>
<th>Improvement in learning and teaching. Joining into the partnership has expanded the network for these small schools allowing them to learn from others in ways they couldn't before. The infrastructure of the partnership has forged linkages between job-alikes that teachers or administrators simply didn't have time to seek out on their own. These networks are helping lead the way to more coherence across the region as well as improvements in individual schools.</th>
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<td>D352005 In the region served by our partnership education obtainment trails other regions of the country. Households in the region have income rates appreciatively below the national average; they range from about 62% to about 81% of the national average. Further, the poverty rate of children of school age average is about 15% great than the national average. The needs of the region include lack of students performing at the proficiency level and analysis of assessment data concisely reveals that lower performance at all K12 levels when compared to the state averages and/or students from more affluent regions in the states involved with the partnership. Pipeline Data shows insufficient number of teachers graduating from the institutions of higher education (IHE) in the region. A sizeable percentage of mathematics and science teachers at the middle school and high school level were Three of the limitations were mentioned above: 1. Poverty, 2. Lack of highly qualified mathematics and science teachers, and 3. student performance. The project has focuses on the later two. These are to some extent limitation, however, the partnership established between the IHE administration and the school districts can and is addressing these barriers through interactive programs that involve K-12 teachers and IHE faculty developing both preservice courses and in-service workshops. This has been foster by mathematics, science, and program implementation advisory councils consisting of both higher education and school district teachers and by small partnership enhancement grants.</td>
<td>Indicated in the First round, this partnership was built upon a Rural Systemic Initiative, which began a number of years ago. This project is building upon the leadership capacity begun by that project. Not only is the partnership providing teachers with the ability to utilize data to improve student performance, but also to provide leadership training. In addition, the project involves leadership training for principals and counselors to assist them in improving curriculum and student performance.</td>
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<tr>
<td>D362005</td>
<td>Classroom choice and treatment of content and pedagogy that are not aligned with current standards at the state and national levels. Given the historically low achievement of students of low SES the inability of schools to address the needs of these students as standards are raised is a concern now, but rests on a concern that has been around for decades.</td>
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<tr>
<td>D372005</td>
<td>Our partnership is designed to remediate the achievement of math students at 4 underperforming high schools and their feeder schools. These schools’ students have been low performing for at least several years. At the particular site I work at, approximately only 16 percent meet proficiency standards.</td>
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<tr>
<td>D412005</td>
<td>SKC has a mission to provide for the K16 educational needs of Native American students on the Flathead Indian Reservation, Montana. These needs, also, encompass the tribal language, traditions, and culture. We also have a significant number of Indian students from 52 other Indian</td>
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<th>Tribes. We also have a significant number of non-Indian students and open door policy for all who come to our door. Our reservation is also impacted by many social problems that are being addressed by SKC, our tribal government, and the greater community- both Indian and non-Indian. SKC is in partnership with all of the K12 schools of the reservation. Northwest Labs in Portland and Montana State University to name a few.</th>
<th>NSF, NASA, DOE, and others, however, we have all been at a disadvantage when competing against larger universities where ever they may be because of these two factors. So of necessity we have entered into partnerships with educational entities that share common goals and specific needs.</th>
<th>programs have built capacity in our K12 schools while achieving success in our systemic school reform efforts.</th>
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<td>The largest need pertains to low academic achievement and high drop-out rates among Native American students on and around Indian Reservations. The need is enormous and has existed for decades. Poverty is clearly a contributing factor, but not the only factor. Another major need is access to professional development and for teachers in highly remote areas. With just a few teachers, it's also difficult to establish a true community of practice internally. Again, the need to serve teachers in remote districts has existed in our region for decades. Our region also faces shortages of qualified math and science teachers at the secondary level. This need is relatively new (within the last 5 to 10 years) and seems to be growing.</td>
<td>Improving academic achievement among Native American students is a big, complicated and extremely difficult issue for any organization to handle, especially if they're trying to do it alone. Indian reservations tend to be geographically isolated, so that becomes a complicating factor as well. Outside partners are quite limited in their ability to come in and fix problems on Indian reservations. That said, the schools and districts on reservations have also seen limited success. A seemingly reasonable approach is for outside entities to work in partnership with districts to provide support for teacher leaders who live and work within the Native American communities. Remote, isolated, small school districts have difficulty providing professional development internally and are, by definition, unable to create communities of practice without external partnerships. School districts have difficulty deepening teachers' content knowledge in math and science using their own expertise (due to time constraints as well as insufficient capacity) -- conceivably secondary math and science teachers could help elementary teachers, but I've seen very little of that actually happen -- possibly due to secondary staff feeling quite heavily burdened just with their regular teaching load. Universities can work to improve the preparation of their own pre-service teachers, but to impact teachers already in the field, they need help.</td>
<td>Our university group has been able to help districts analyze their own data (achievement, enrollment, etc.) and do more in-depth statistical analyses than they otherwise would have capacity to do (e.g., partial correlations controlling for SES, ethnicity, etc.). Teacher leaders from partner districts sometimes help in our pre-service courses -- providing a current view from the field. University scientists and math experts (experts both in content and pedagogy) have been able to help inservice teachers deepen their content knowledge.</td>
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**D442005**

| Improve academic achievement among Native American students is a big, complicated and extremely difficult issue for any organization to handle, especially if they're trying to do it alone. Indian reservations tend to be geographically isolated, so that becomes a complicating factor as well. Outside partners are quite limited in their ability to come in and fix problems on Indian reservations. That said, the schools and districts on reservations have also seen limited success. A seemingly reasonable approach is for outside entities to work in partnership with districts to provide support for teacher leaders who live and work within the Native American communities. Remote, isolated, small school districts have difficulty providing professional development internally and are, by definition, unable to create communities of practice without external partnerships. School districts have difficulty deepening teachers’ content knowledge in math and science using their own expertise (due to time constraints as well as insufficient capacity) -- conceivably secondary math and science teachers could help elementary teachers, but I've seen very little of that actually happen -- possibly due to secondary staff feeling quite heavily burdened just with their regular teaching load. Universities can work to improve the preparation of their own pre-service teachers, but to impact teachers already in the field, they need help. | Our university group has been able to help districts analyze their own data (achievement, enrollment, etc.) and do more in-depth statistical analyses than they otherwise would have capacity to do (e.g., partial correlations controlling for SES, ethnicity, etc.). Teacher leaders from partner districts sometimes help in our pre-service courses -- providing a current view from the field. University scientists and math experts (experts both in content and pedagogy) have been able to help inservice teachers deepen their content knowledge. | |
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<td>D452005</td>
<td><strong>The regional need for the CMST Project originated in the workforce.</strong> Jobs are technology dependent and team oriented, employers have had an inadequate number of qualified candidates to maintain the high technology dependent workforce in the area. At the same time, the number of people seeking education in the high technology fields has actually dropped significantly in the past decade.</td>
<td>Since efforts need to be made to educate a future workforce competent in the technological tools of the workplace, a local education core partnership formed between an urban school district, a local college and a suburban district and some supporting groups like the NYS Education Department. Each partner offers unique components that contribute to the overall goal. Higher ed focuses on improving the Teacher Education Program in CMST as well as increasing the number of students graduating in the field of Computational Science. The school districts need the higher ed partners to provide them with 1) qualified new CMST Teachers 2) and to upgrade the skills and pedagogy of the existing MST teachers. Industry and State Ed also provides frameworks for the standards the partners are striving to achieve.</td>
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<td>D482005</td>
<td><strong>Our partnership seeks to address issues of traditionally underrepresented youth in math and science fields.</strong> We target those students who are educationally disadvantaged, that is typically performing in the 2nd or 3rd quartile on standardized tests. Nationally and locally this has been an issue since the 1980s, particularly for diverse populations.</td>
<td>In our case, we are subject to local school districts interest, enthusiasm, and matching funds. We are also subject to school organization and teacher interest. For example, we may be interested in offering an entire school period devoted to our particular intervention, but high school students may not be able to elect this period due to scheduling, or they may only be able to elect this course once during their four years. In other instances, schools only allow our intervention in a club model. We have found that the effects we can realize are determined largely by the degree to which students are able and schools allow them to participate.</td>
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<td>D492005</td>
<td><strong>Our SSI was organized to respond to the need for Texas to strengthen its education system especially in math and science.</strong> Our work was part of a complex state effort with roots in the reforms of the mid-1980’s to modernize the school system and to address historical problems concerning equity and system.</td>
<td>Education is a highly political and complex enterprise and making forward progress requires complex and unusual alliances. Some organizations have defined constituencies that bring power to a collaboration; others have technical expertise, yet others, have access to power for reasons that have more to do with A principal strategic goal of our partnership was to improve education system performance by increasing the coherence of the education system. This required the linking of many organizations with disparate constituencies and ideologies—in a</td>
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Alternative Approaches to Evaluating STEM Education Partnerships

<p>| D522005 | The partnership addresses the need for improved science, math, and language arts education, K-12. For science it provides materials for the classroom (STC &amp; STC/MS) and extensive professional development (PD) for K-12 teachers in application of the inquiry-approach in the use of these materials. Science PD for K-8 teachers includes curricular integration and the use of science in enhancing oral and written skills. Also offered, by OSU science faculty) are short content courses in science and math. OSU also provides pre-service (K-8) science courses, taught by scientists that are pedagogically aligned with in-service PD. The partnership has been in place since 1996. | Lack of understanding of what constitutes quality science and math education and lack of knowledge of the elements of quality PD. Sustainable funding (can be accessed through the political process using cumulative political clout). Lack of competent trainers. No connection between science and math faculty and the schools. | The key to quality professional development (which is, in turn, key to science and math reform) is having the leadership, the facilities and QUALIFIED TRAINERS. This requires a critical mass of participants. Example: The partnership has 100+ Certified Teacher Instructors (CTI) who are certified to instruct other teachers in the use of STC or STC/MS materials. The teachers represent 30 districts across the state. It is also important to have scientists mathematicians involved to help improve the teachers content base. Example: Summer week-long course in electric circuits for grade 4-6 teachers. Critical mass of 20 teachers for the course to be taught. Teachers from 12 different districts from throughout the state attended. |
| D532005 | more highly qualified mathematics teachers and increase the math academic performance of low performing middle and secondary students. The teacher need has persisted for over twenty years yet high turnover and low production creates a stay and increasing need plus a relative large public school increase in enrollment. -- | A common lack of sufficient financial resources and or time available that conflict with major operational goals and the stated purposes of the potential partners. Public schools have limited resources and multiple goals to require personnel extra tasks and when those tasks are not funded the partnership becomes a voluntary endeavor. | Partnerships create a mechanism directing community attention to the issues of need motivating the organizing a partnership. When partnerships include a large numbers of individuals and numbers of partners then issues of needs can be make known to greater portions of the total population which in turn can stimulate and initiate action. |</p>
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<td>D582005</td>
<td><strong>Technology is still a mystery to many and it remains one of the key needs in any STEM partnership.</strong> I am still amazed at the silly mistakes that teachers make when emailing and the many things that they can't do in emailing—let alone the other issues of technology in the classroom.</td>
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<td>Time, particularly for teachers is always at a premium. As a result, and particularly if there are technology problems or technology inadequacies, any attempt at partnership are slowed significantly. There is an energy peak that must be overcome for teachers to become engaged. If there are problems or perceived problems, the peak becomes greater &amp; there is less participation. The second item that can limit is the network, How effective and efficient is the network: 1) do participants have to establish the network; 2) will the network produce direct and obvious results of benefit to the participant and to the classroom; 3) is there particular value in the network, even in personal professional growth?</td>
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<td>Thinking of a Venn diagram, with overlapping circles, there are three distinct parts, Circle A that is not overlapping, the parts of A &amp; B which overlap, and the parts of B which are not overlapping. Such a diagram is static, however, partnerships are dynamic within a dynamic system, so that one must think about the Venn diagram within a broader system (S). A &amp; B only exist because of the value that they bring to the larger system. When A &amp; B enter a productive partnership, there is mutual value and productivity between them. But now the value of B is not just within the system S, but is magnified, enhanced, or transformed by A before it is exchanged with S, so that B-S dynamic must now add B(A processed)-S As an example, suppose that there is an exchange between an industry and a school, such that the industry provides some support for the school—perhaps tutors for science students. Because of the partnership, and the dynamic interaction between the two, one of the tutors discovers an interest that a couple of the students have that would assist the tutor in researching something for the tutor's department. That research project allows the industry to respond to the community in some way—maybe serving an additional function that was not seen before, but because of the partnership something provoked some action not perceived in the relationship, but valuable to the community.</td>
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<td>D592005</td>
<td><strong>Several of the organizations that form the Math Science Partnership existed, prior to the initiation of MSP program, as a loosely familiar</strong>.</td>
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<td>There are quantitative limitations and qualitative limitations that inhibit one organization from addressing the needs stated in question 1.</td>
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|   | Designing and implementing professional development in partnerships between formal (=university science //
network of formal and informal providers of professional development to teachers from area school districts. The professional development experiences were negotiated between individual provider institutions (some informal and others formal) and various schools. The professional development activities were attended by teachers from a variety of districts. **This resulted in an increase in the capacity of provider institutions to design and implement high quality professional development and an increase in the capability of individual teachers to teach better science, but did not increase the capacity of schools and districts to deliver a higher quality science curriculum to students.** There was a need for 1) a more systemic approach to providing professional development so that teachers could access a continuum of professional development experiences that would deepen content and pedagogy, 2) a need for schools to access pd that connected with their reform based goals and 3) a need for cohorts of teachers from each school and/or district to attend, rather than individual volunteers.

| network of formal and informal providers of professional development to teachers from area school districts. The professional development experiences were negotiated between individual provider institutions (some informal and others formal) and various schools. The professional development activities were attended by teachers from a variety of districts. **This resulted in an increase in the capacity of provider institutions to design and implement high quality professional development and an increase in the capability of individual teachers to teach better science, but did not increase the capacity of schools and districts to deliver a higher quality science curriculum to students.** There was a need for 1) a more systemic approach to providing professional development so that teachers could access a continuum of professional development experiences that would deepen content and pedagogy, 2) a need for schools to access pd that connected with their reform based goals and 3) a need for cohorts of teachers from each school and/or district to attend, rather than individual volunteers. | Common to all organizations is resource limitation of some sort. For example, Science Outreach of Washington University has a wealth of resources to share content knowledge and pedagogy with area teachers. However, they do not have the resources to offer the breadth of content courses important to elementary school teaching. The school districts understand the connections between teacher performance and student learning as they are enhanced or constrained by a state and national policy environment, but do not have staff resources to develop inservice programming to meet all their needs. The informal science institutions understand science teaching and learning from an activity base or exhibit base informed by what motivates student learning, but don't have the experience of integrating this into a formal setting. Education department contributes knowledge of strategies that sustain student learning, but don't have the pedagogies connected to specific content that teachers are grappling with implementing in classroom curricula. | outreach program) and informal science institutions, ISIs, (Science Center, Zoo, Botanical Gardens) has increased the capacity for ISIs to construct engaging activities in a sequence of lessons that are better adapted to the sustained curriculum of a school district. Scientists doing professional development in institutions of higher education, if teacher leaders are present, increase their capacity for understanding the constraints of teachers in school systems. Both ISI and IHE partners increase their capacity for delivering content and activities in pedagogically sound ways. Prior to working with teachers, ISIs assume that what is needed most is to make science fun, focusing on the motivational needs; IHE scientists assume that what is needed most is interesting ways to explain or describe scientifically important processes, whether or not they are in the curriculum; Both ISIs and scientists are unaware of the depth of knowledge available about teaching and learning in the field of education. Higher education teacher educators increase their understanding of the power of connecting pedagogy to appropriate content, rather then assuming that pedagogy can be learned void of content. All of this requires that there exist feedback loops between partners about the success of the instruction. As feedback informs instruction, teachers learn more and implement more successful reform-based lessons in their classrooms. |
In one case, the community needs readily accessible resources that are mathematically or scientifically challenging and accurate, user-friendly from a technological standpoint, and that are also instructionally engaging and developmentally appropriate. It is a rare individual that has the necessary expertise in these three areas. The needs are long-standing and persistent across a multitude of settings and regions. In another case, the community was generally unaware of the need for research and evaluation services provided by the partnership. The need for these services was increased by new reporting pressures instituted by the funding agency. Subsequently, services provided by the partnership were seen as more valuable. In this case, the needs (while considered long-standing in the research community) were neither long-standing nor persistent in the scientific community.

The partnership I will be discussing was the partnership formed by the development and implementation of the National Science Foundation's Statewide Systemic Reform Initiative. In my state, we had five years of systemic funding to address poor performance of graduates of the K-12 system of education in the state. The resulting collaborative partnerships between higher ed institutions and K-12 school districts helped us to address the need for standards and helped initiate the standards movement in Colorado. All of the higher ed representatives knew of the poor performance of many high school graduates in higher ed institutions. We stopped

One limitation is institutional support for scientists and mathematicians to get involved in education-related projects. Collaborations can be inhibited when cost-sharing and promotion policies are set up to reward compartmentalization. These limitations occur most frequently within institutions, but can also be issues across institutions during negotiations around sub-contracts.

The partnerships tend to expedite communications between organizations. For example, I have partnered with faculty in mathematics on several projects. When colleagues in my department (Elementary Education) have a question or concern about mathematics certification or course requirements, it is more convenient and efficient for me to contact my partners in the math department. Without the connection afforded by the partnership, my colleagues would need to initiate a contact with a staff assistant in the math department, who would forwards the question to their department head, who may or may not need to consult with a faculty member before replying via the same channels. Capacity is also increased when a partner in another department or institution is able to refer services that I offer to colleagues in other fields. This results in an indirect multiplier effect that increases my exposure.

In this partnership, no one individual institution or school district could address this problem. It was a systemic problem and all of us needed to come together to try to find a solution. Obviously, higher ed cannot solve K-12 problems but we can contribute in many ways to the solutions invented by the partnership.

In this partnership, bringing to the table the ideas and abilities of both school people and higher ed folks allowed the capacity of both to be expanded. Since higher ed institutions train the teachers, they can heavily affect the style of teaching in the school classrooms. However, the realities of schools soon pushes teachers into a certain mold in order to be successful. Our partnership had some success in overcoming these historical trends.
The need for systemic change emerged from the dual realities that characterize the metropolitan area. There are two groups of Atlantans—those who prosper and those who do not. In the African-American community, one child in five is on welfare, one in four is on food stamps, and overall two in five live in poverty. Residents within the inner city are primarily African-American and poor, and have the lowest high school achievement. Those who reside in the surrounding suburban region, whether African-American or Caucasian, are generally more affluent. Education continues to be the delineating factor, especially educational training that leads to jobs related to mathematics, science, and technology. Target Population for the partnership: 170,172 P-12 Students in Urban and Rural Public Schools in Georgia. The partnership will reach over 10,000 teachers of SM in the 277 schools within the thirteen partner school districts in four regions of Georgia. This will impact the 170,000 plus P-12 students in the core partner school districts, with great potential to impact the 1.4 million P-12 students in Georgia. Example Baseline Data (Similar data was collected on various aspects of STEM) Partnership Middle Schools 34% of 8th graders DO NOT meet the standard in mathematics on the Georgia criterion referenced test 24% of 8th graders DO NOT meet the standard in science on the Georgia criterion referenced test Georgia’s Middle Schools 45% of Georgia’s 8th graders score below basic on NAEP test in mathematics (2000) 48% of Georgia’s 8th graders score below

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<td>Partnership no</td>
<td>The following are key limitations that inhibit individual organizations from adequately addressing these needs without the partnership Systemic nature of problems, not isolated but interlocking and constantly changing Power issues over resources, decision-making, etc. Traditional financial base not growing at the same rate as problems Need for quick viable results Increasing need for the use of data to make decisions and accountability Institutional challenge, no one entity can solve the problems Delivery mechanism limitations: projects, one shot events, isolated training etc. Lack of awareness of individual boundaries Resource limitations Schools 1) low achievement expectations for students; 2) substandard education and high pupil-teacher ratios due to tracking; 1) equity issues related to placement of students, particularly African-American males and low income students; 4) lack of a stimulating, rigorous, culturally relevant curriculum; 5) lack of a highly qualified K-12 science and mathematics teaching force; 6) equal access to equipment, materials, technologies, and relevant assessments; 7) lack of widespread involvement in schools and encouragement for academic, 8) lack of sufficient funds,8) Lack of expertise in research techniques and strategies Colleges No incentives for faculty to engage in K-12 activities access to up to date equipment, materials, technologies, and relevant assessments; Business Lack of understanding</td>
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### Basic Needs

Raise expectations and achievement in SM in P-12 schools, while closing achievement gaps among demographic groups. Provide challenging SM curricula and materials for all students. Raise the awareness of students, parents, and the community of the need for all P-12 students to complete challenging courses and curricula in SM. Increase and sustain the number, quality, and diversity of P-12 teachers teaching SM. Provide high-quality professional development to current P-12 teachers who teach SM. Increase the responsiveness of higher education to the needs of the P-12 schools. Increase the participation of SM faculty in teacher preparation and professional development. Provide incentives for SM faculty members to engage in research with P-12 schools on effective practices in science and mathematics.

### The K-12 Culture

The K-12 culture is disconnected. Middle School mathematics teachers were provided training on TI-83 calculators. However, when they returned to their schools teachers did not have any of the resources (materials, equipment, space, and time) nor did the students have access to calculators. No one had looked at the curriculum to see where and how calculators fit into the instructional program. The teachers did not collaborate. There was no increase in the use of calculators. After the formation of the partnership, a needs assessment was conducted that focused on curriculum, instruction, assessment, professional development, technology. Data was collected and analyzed. Faculty and teachers examined mathematics content. Teachers received follow-up training on TI-83 calculators to design units of study that were aligned to the curriculum. Faculty members served as resources for the teachers online. Use of calculators by teachers and students increased. Marginal improvements were made on the mathematics state assessment.

### D772005

The K-12 students in the region were performing below the state and national average in SAT scores. Students were graduating from K-12 schools lacking problem solving skills. These realities were in existence for at least twenty-five years. The results were that students were entering the world of work without the necessary critical thinking skills.

### D782005

The schools of our state are administered in School districts are often limited by political and financial investment shortcomings. Partnership experiences allow multiple focus opportunities, clarity of purpose, and a mutual mission statement to rally around. Partnerships give additional credibility to individual organizations areas of focus. Partnerships have a systemic public relations and articulation system to the community at large. Partnerships increase the human resource and fiscal capacities of individual organizations.
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<th>Approximately 600 autonomous local school districts, ranging from very small (one school) to mid-size urban districts (e.g. 8 elementary schools, 1 high school), to large urban districts, to regional vocational districts. The smaller districts do not have the depth of expertise and resources for strengthening mathematics, science, and technology in the schools. The larger districts often need validation for the directions in which they might move. <strong>Partnerships between school districts, universities, and corporations, focusing on curriculum innovation, professional development of teachers, and strategic district-level planning, help provide the depth of ideas and expertise, and the external validation, that schools need to move forward.</strong></th>
<th>Bureaucratic-organizational considerations, as well as the absence of resources for directly providing professional development for teachers and innovative techniques for instruction. Universities often have research goals that cannot be implemented without the knowledgeable and enthusiastic participation of cooperating schools or districts.</th>
<th>Complementary sets of resources, and enable mathematics, science, and technology innovations to benefit teachers through professional development activity, students through activities, curriculum innovation, and so forth. For example, through one partnership of the state university, two NJ corporations engaged in scientific research, and local high schools, teachers developed science teaching modules based on current research (working with industry and university scientists), and brought these into high school classroom activity. None of the partners could have achieved this alone.</th>
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<tr>
<td><strong>D792005</strong> Over the past 30 years or so, there has been a set of urban districts in NJ designated as the Abbott districts. These districts have persistently had little to no success in improving student achievement, especially in math and science. As a result of ongoing litigation, however, they have had access to substantially increased funding in recent years. One of the needs our partnerships have aimed to address is providing effective, sustained professional development to help these districts improve student achievement. Sometimes we have been able to document success, other times we have not. In addition, there are a number of other districts, both urban (just not quite so poor) and rural, that are in our geographic area and also have continuing low levels of student achievement, particularly in math. Our partnerships have also aimed to address these needs. Also, due to the overwhelming emphasis on math achievement and testing, science often gets overlooked. A number of districts have desired to address science, providing professional development for teachers, especially at the elementary level. So, we have had Limitations that inhibit all of the partners from adequately addressing these needs without the partnership: primarily, I think this is funding and sometimes lack of qualified personnel. Without the partnership, it is often hard to have someone who can focus on these particular needs. Districts often do not have specialized content knowledge (or knowledge of research on learning math and science); the partnership helps the districts gain access to that knowledge. Universities often do not have applied knowledge (just theoretical); the partnership helps the university see how theory plays out in the real world. Universities often are also so specialized (especially science faculty) that faculty don't talk with one another about common issues enough.</td>
<td>Partnerships can provide specific locations for universities to place students for field experiences or student teaching. Placing students in classrooms of teachers involved in other work with the university means that the students get a better experience and the master teacher has the opportunity to work with colleagues more. Districts seeking to improve student achievement gain benefits from conferring with faculty about curriculum - adjusting what is taught to better match state standards and the demands of each discipline. They also gain from experts providing professional development for teachers, so that teachers are better able to teach specific content.</td>
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some partnerships that addressed this area. Finally, the university needs good classrooms and schools in which to have preservice students learn about teaching.

| D812005 | Our partnership has been aimed at strengthening teaching and learning of mathematics and science in K-12 situations. In 1994, research conducted as part of a regional planning process indicated that the 43 school districts surrounding and including Pittsburgh were identifying the same strengths, weaknesses, threats and opportunities to math and science education, but that they were working in isolation to address them. The same research also identified more than 45 entities that were reaching from the outside in to try to help districts strengthen the teaching and learning of STEM. Recognizing the value of working together strategically, the Math & Science Collaborative was formed to facilitate that work. One of the partnership first steps was to engage stakeholders to agree on a vision and belief statements which capture their desired future-- and also were indications of the needs, i.e. what was not occurring in the region. The founding conference that examined that research also prioritized the needed actions from 13 possible ones identified from their responses. The three highest were: (1) coordinating efforts to effectively utilize technology for students in K-12 science and mathematics education; (2) creating a clearinghouse for quality curricula and assessments in K-12 math and science; (3) facilitating the creation of a mosaic of quality professional development opportunities for K-12 math and science educators. Having added 10 counties and more than 90 additional school districts, the vision and beliefs still stand, though progress has been made-- particularly in having districts work together across their boundaries. I am emailing the vision and belief statements. | I can speak most directly about partnerships among K-12 school districts that are small (averaging 2,000 K-12 enrollment). Through the MSP, I am just beginning to understand the needs/limitations of partnering across IHE organizations. 1) A major limitation is the lack of specialized content-based personnel within the many individual school districts. That precludes their individual district capacity to do the requisite research to identify the needed resources, and then facilitate their implementation. (2) The tools that have been developed to address those concerns and support the needed change have not been widely available or easily implemented. (3) The total number of math and science teachers within the prevalent smaller districts is too small to warrant having experts from outside come to provide professional development for such a small group. That is particularly true of the implementation of the newer instructional materials, which definitely require up-front and on-going training. (3) The recent environment of math wars and science evolution challenges makes small individual districts leery of taking stands for the need to change which, as part of a larger partnership with research based strategies, they are willing to venture. (4) Districts are bombarded with vendors, each touting their research-based materials, and have great difficulty making sense out of the noise without the content-based expertise. (5) The culture of education has not been data-driven; nor has strategic long-term intervention been widely experienced. Overcoming the this too shall pass mentality is harder in isolation. | By partnering across districts, teacher leaders can be supported in developing content-based expertise. Their combined numbers create the critical mass to be supported in effective content-based professional development and the exchange of tools and strategies. The networks of a partnership enable the dissemination of relevant research. At a broader partnership level, staff can be supported to support the teacher leaders, and resources can be sought and more effectively used. |
| TIMSS 1995 validated the need to strengthen teaching and learning of math and science. Our region's participation in TIMSS 1999 made clear that the national concerns were ours too. | The community has seventeen independent school districts governed by seventeen different school boards. A separate community college district, one public university and four private universities exist. The city government is independent of all the aforementioned groups. None of these organizations alone had the ability, mandate or political clout to address the STEM project without getting into someone else's turf. When organizations tried to go-it-alone in the past they received little, if any, support or encouragement from the others. | In our case city government, the community college district and the universities were much more enthusiastic about working with a joint effort of school districts since they serve the entire community and not just a single segment. They were then working to benefit all of their constituents rather than being partial by working with only one segment of the community. |

| The central community is high minority, high poverty, **low educational attainment**, persistently low public school performance, high teen pregnancy, preponderance of low-wage jobs. These characteristics developed over the past 40 years as freeways were built and wealthier, better educated families left for the suburbs | The needs in my community that our partnership is aimed to address all revolve around the **achievement gap between Native American students and non-native students.** The **achievement gap is most profound in mathematics, science and literacy.** The lack of academic success among Native American students appears to be a strong contributing factor in the **high dropout rate among Native American students.** The achievement gap is large, ranging from 30% to 50% depending on the grade band. The problem is long standing; as far back as we have data the problem has existed. There is a need to work more closely with the Native American community to identify the barrier to academic success among Native American students. There is also a need to examine the tracking policy to identify the impact of tracking on Native American students. **Native American students are severely underrepresented in higher-level mathematics classes.** There is a need to examine instructional practices and instructional materials to assess the impact of these factors on achievement of Native American students. | There are several factors that inhibited the school district from deal with the needs of the Native American students. The most commonly identified factor was lack of resources both fiscal and human. The partnership has been able to provide both human and fiscal resources to better address the need. The second factor that inhibited progress on the need was a lack of recognition of the magnitude of the problem. The partnership has provided extensive data analyses that help to identify the seriousness of the situation. The third factor was a self of helplessness about the school districts ability to change the situation. The partnership has been able to examine the research and suggest steps to begin to work on the areas of need. The other partners in partnership would not be able to work on this area of need without the full cooperation of the school district. The school district has provided the project with the data necessary to create a full understanding of the needs. District personnel have helped to understanding of the full context of the needs of the Native American students. |

| The capacity of school district to understand their data is increased with the help of the statistical expertise of the university. The capacity of the school district is also improved with access to the research literature that is provided by other project partners. The capacity of all of the partnering organizations is increased by the professional development that is offered by the partnership. An example of this is the TERC Leadership Institute that was sponsored by the partnership for elementary teacher leaders. This training was attended by project staff from all the partner organizations. |
American students.

| D952005 | The needs that exist in the northeast and Maine are most likely not greatly different than other area, with one exception and that is high number of minority students. While we have many different cultures and languages represented in Maine those students are general limited to a small number of districts. With that caveat the needs we have include a new to recruit and retain high quality science and mathematics teachers. One partnership I ma involved in has increased the number of people in the pipeline by 70% in four years to 128 but we are still short by about 100 people. The retention issue is one that is very challenging but hard to pin down specific numbers. Where it shows up in a partnership is the teacher and administrator turnover in a schools district. If you start and initiative in a districts and three years later 1/3 or more of the staff has moved it causes problems. Do you start over, a sort of level one level of training for the new people each year. What happens to the advance folks. Do you train them and if they leave? We have about a 30% turnover rate in Maine but about 17% of those people are moving from one district to another. So if we could solve the retention issue it would reduce these concerns greatly. Other issues concern 1) The certification of teachers at the middle level. They can have a K-8 certification and teach middle school with only two courses in discipline area. 2) The amounts of time districts calculate into a year. Helping them solve this issue will open up the progress that can be made so teachers can work together on an on going basis. 3) Access to high quality professional development across our state. Partnerships are great except they only reach a small number of the teachers or address a small number amount the larger problem. 4) Lack of materials for teach science. 5) Few higher ed |
| --- | --- | --- |
| I think the issue is capacity or the numbers of people who can carry the work load. This applies across the any partnership. The work load tat is necessary is often much greater for any one partner. K-12 Districts have the pressures of policy whether federal or state, or community. These can limit and heavily influence activities if they are not addresses regularly. They can also set the direction of activities without addressing the deeper needs. For example NCLB can focus districts on getting a few students over a score hump on a test to stay off a list and not on the system. Locally parents and school boards can change agendas such as with mathematics programs. University faculty often have no idea what operating in a standards based world is like. They talk of ideas and freedoms of thinking while teachers want to know why and how it will help them stay off a list. This can cause problems with credibility. Higher education institutions are actually fighting standards right now at their level. (Perhaps rightly so, but it goes to disposition.) Teachers have no choice. |
| Capacity is expanded when the individual in the partnership really listen to each other and work together. Perspectives are difficult to overcome but people have to try to understand the worlds from which each comes from. For example; discipline faculty co planning a course with education faculty and K-12 teachers. Also people (PI or faculty) taking various subservient roles. Not always the leader but letting other lead, such as teacher leaders. |
faculty members who are able to work outside of their workload. We have not large research institution so all education faculty are teaching 4-5 courses and discipline faculty are balancing their research agenda. That’s all for now. I know I missed several.

D972005 The key need is to improve the student learning in math and science, particularly amongst poorer school districts. These needs have been around essentially forever.

School Districts don't have enough time or money to address some of the needs, or the expertise in math and science content. Conversely, content experts at universities don't necessarily know how to work with schools. Both groups sometimes have different scheduling demands that can make it difficult to work together.

One thing that I've noted as our partnerships become more ingrained, is that people simply have expanded their range of resources that are available to them. If they have specific questions that need to be answered, they now know people with a wide set of experiences and expertises that they can call on.

D982005 This project deals with providing professional development to teachers in geographic areas that vary to the extent to which they have access to professional development in science. Some have ready access and others are extremely geographically isolated. In our preliminary observations of teachers i would suggest that the need for professional development is high. Many teachers, regardless of their grade level, teach in ways that are inconsistent with reform goals. In terms of magnitude, there are some geographical areas that are 5-8 hours away from any opportunities for professional development. They are also so small (as few as 30 students in a district) that it is seen as too far away for too little impact for many people who deliver professional development. Science teaching varies but some teachers are very traditional and text-bound. Others are not. Some suffer from the a little knowledge is a dangerous thing syndrome in which students are left on their own to discover biology. The university needs are that we often place our students in places that are inconsistent with our vision of quality science teaching. The schools send us students who have had chemistry, biology

Much of the work at the university could be done without a partnership. The problem is that without a partnership these changes will fade since they would not be supported in the schools. As soon as the teacher graduates, there would be a pressure to conform to the school standards. Joint effort with the schools advances the cause for all -- providing quality mentoring for new teachers, continuing professional development for university faculty and inservice teachers, as well as systemic institutional support. The work of the schools in professional development could also be accomplished without the university. The partnership with the university adds some critical pieces though. First, it adds money. Second, it contributes expertise (that is available elsewhere but much more difficult to access). I think that in a generic way these are common to most all partnerships. There are always multiple ways to accomplish things but the partnerships are needed because there is some shared interest and some overlapping goals. I would think this is true is nearly all professional schools/practices. I know that professors of medicine sit and

In our case, we offer access to people who are knowledgeable about content and pedagogy. We also have the flexibility to deliver courses. The schools offer the university placements for their preservice students who otherwise may end up in field situations that do not support our goals. Much of the program can be done in isolation but in isolation, we will be much less effective. Essentially the partnership offers COHERENCE. Having said that I will also say that in many of the partnerships, perhaps all, that I have been involved in never evolve to this level. It has always been a case of playing alone together and each partner had a separate agenda. So since the partnership offers no added value -- only added work -- they dissolve.
and physics but remember little of it or still have deeply engrained misconceptions. **On the university side, we are reforming the science methods and content courses for elementary preservice teachers.** I would suggest that there the need is less pressing. **The students already get a solid dose of reform-minded science instruction.** The problem is more what the students encounter when they hit the classroom -- where the concepts taught in the university are not valued by the school or classroom. This is part of the reason that this partnership is necessary. These needs are longstanding -- perhaps as old as the schools. Science instruction has never been a priority for many teachers or administrators.

bemoan the low level of care provided by many practitioners-- the same practitioners they educated. Limitations: time (locating resources), access (enticing potential partners to play along), distance (related to access), money (to provide time and incentives), leadership (people at each institution having other obligations -- the partnership becomes an add-on), rewards (such as tenure)

2. Subnodes

**Strategic Needs – shared agenda**

Coding references: 13
Respondents: 11

(8a) When new issues are to be addressed, you bring the needed partners to the table. When there is a common cause, the relationships build quickly. (8c) (Partner organizations) are recruited by their talents and experience, or where there appears to be a commonality of interests or benefits to all partners. (8c) Partners are selected by having common goals and/or target groups. I think representatives are chosen based on availability and decision making power. (27b) We all agreed to put kids first rather than the institution. This more than anything resolved most issues that might have been problematic. Another factor is that we were all committed to REALLY making a difference. That passion and enthusiasm has carried us through the most hectic and crazy times. (27b) Bringing together people from across various partnerships to deliberate on standards was important. This process which focused on a common goal had a strong positive outcome on the partnership. (4) The partnership simply needs to unite a group of organizations around some portion of those broader goals that the partners do in fact share and value. (8a) We engage in partnerships if we think it will benefit and expand educational services to our students in positive ways. Experience with how their partnership works as well as content knowledge are important. (27b) Clear goals and defining incremental steps to getting there. A sense of common goals unites partners, even if they take slightly different routes to getting there. (27b) Sharing a common goal is the most important factor. Focusing on this goal allows the partners to see their contributions and this develops a sense of ownership for the program.
(27b) Sharing a common vision of the desired future is crucial. A shared understanding of how that operationalizes is developed by sharing common experiences and co-creating meaning out of them. Without the opportunity to experience the training together, the nature of the outcome that we are working to achieve was abstract. It could be interpreted in a variety of ways --and the less clarity, the less likelihood that the outcome will be achieved.

(8a) In our case city government, the community college district and the universities were much more enthusiastic about working with a joint effort of school districts since they serve the entire community and not just a single segment. They were then working to benefit all of their constituents.

(27b) I think the biggest item is a clear, shared knowledge of the goals of the partnership and how each partner can expect help and how it can offer help. Without that clear initial buy-in, the partnership is just another resource and another pot of money.

(27b) The commitment of individuals at all levels - college, school, and legislature. There must be a shared vision and commitment to be successful.

**Strategic Needs – knowledge**

- **Coding references:** 9
- **Respondents:** 7

(8c) New partners (orgs.) are recruited that have specific talents and experience to offer. Individuals are chosen by their position and prior experience.

(8c) Wherever I go, always looking for new people to work with. Sometimes finding a new like-minded person is a highly effective sounding board to develop new ideas or projects.

(27b) Smart people that are open-minded to new ways of thinking and doing (are an important factor for developing and implementing partnerships)

(27b) Willingness to think broadly and innovatively to propose and possibly implement large changes in AP Biology culture.

(4) K12 partners have less content knowledge and extensive pedagogical preparation, their specific needs to attain the goal vary. The expertise each partner brings is complementary and can be applied to help one another.

(8c) Individuals from partner organizations were selected for a range of reasons – some for rank to make sure we had administrative authority, some for disciplinary specialty, some for experience with K12 and Higher Education.

(8a) We engage in partnerships if we think it will benefit and expand educational services to our students in positive ways. Experience with how their partnership works as well as content knowledge are important.

(8c) New members may be recruited because a particular area of expertise is missing from the group. New members of the organization may be recruited at anytime. Individuals are designated based expertise, or position.

(8c) Districts with specific needs in the areas of science and math are actively sought to be recruited. Individuals are recruited by considering their responsibility and expertise in the subject area(s).

**Strategic Needs – other resources**

- **Coding references:** 7
- **Respondents:** 7

(8a) We are always looking for new opportunities to expand our networks of contacts, resources, without which we risk standing still. If a key strategy is the relentless pursuit of new ideas (through which we add value to all partners) then there are considerable benefits to be gained from fresh perspectives.

(2) lack of resources (expertise as much as financial)

(8c) (Partner organizations) are recruited by a process based on identifying some capacity or opportunity that the partnership does not currently have.
(8a) We engage in partnerships if we think it will benefit and expand educational services to our students in positive ways. However, in some instances this has been problematic due largely to their inexperience with the ways in which our organization is run.
(27b) There must exist a mutual need, or a perceived need from one partner which can (and only can) be addressed within the partnership
(8c) It varies. In some cases, partners have been recruited because they provide services that are unique and valued (strategic recruitment). In other cases, recruitment has been rather informal and based on individuals’ capacities to work together.
(2) I am just beginning to understand the needs/ limitations of partnering across IHE organizations. 1) A major limitation is the lack of specialized content-based personnel within the many individual school districts. That precludes their individual district capacity to do the requisite research to identify the needed resources, and then facilitate their implementation. (2) The tools that have been developed to address those concerns and support the needed change have not been widely available or easily implemented. (3) The total number of math and science teachers within the prevalent smaller districts is too small to warrant having experts from outside come to provide professional development for such a small group. That is particularly true of the implementation of the newer instructional materials, which definitely require up-front and on-going training. (3) The recent environment of math wars and science evolution challenges makes small individual districts leery of taking stands for the need to change which, as part of a larger partnership with research based strategies, they are willing to venture. (4) Districts are bombarded with vendors, each touting their research-based materials, and have great difficulty making sense out of the noise without the content-based expertise. (5) The culture of education has not been data-driven; nor has strategic long-term intervention been widely experienced. Overcoming the this too shall pass mentality is harder in isolation.

**Strategic Needs – professional development**

Coding references: 3
Respondent: 3

It seems that these text extracts (except the last one) were not coded considering professional development as the type of training provided for inservice teachers.

(8c) New partners were recruited to either broaden the reach of the partnership or to bring in expertise that the partnership did not have in sufficient depth. For the Metro Atlanta P-16 council, a general invitation was sent to all organizations involved with support of K-12 education. Major educational support organizations such as the Chamber of commerce and Georgia Partnership for Excellence in Education were contacted for suggestions. Partner organizations have normally chosen the professional to be their representatives.

(8c) Generally partners come together when each perceives the other has something beneficial to bring to the partnership. More often if the partnership is formed in an attempt to pursue a specific funding source the organization targeted for recruitment is selected based partially on the funding requirements. Individuals are often selected based upon the function of job duties and or professional connections.

(8c) We recruited our partners (but no new members will be recruited) through the foot work of our PI and project director. We had a targeted geographical area and they solicited participation from agencies that could help and all of the school districts. This question is frustrating because it would take pages and pages to describe— even as a summary. Schools selected teacher leaders. This was done in many, many different ways. Some were selected by principals and others volunteered. **They participate in professional development and deliver professional development.** The co-PIs who comprise our leadership group were recruited through previous contact. We knew all of them, respected them, and knew they had something to offer. Faculty were recruited who were already involved as STEM faculty in education.
**Strategic Needs – curriculum**
Coding references: 1  
Respondent: 1  

(Coded under Strategic Needs, and Formation Strategic Needs curriculum, NOT Strategic Needs/curriculum)

(1) Our partnership has been aimed at strengthening teaching and learning of mathematics and science in K-12 situations.

I think this is an example of a text that does not fit easily the definition of strategic needs: The goal is strengthening teaching and learning of mathematics and science at K-12 level, what is “needed to accomplish” that goal is the partnership in this text extract.

**Strategic Needs – financial**
Coding references: 1  
Respondents: 1

(8a) I would say the likelihood is low, but possible. It all depends on how much we or another group initiates the partnership and if there is funding to collaborate.

**Round 3**

**Strategic Needs**
Coding references: 0  
Respondents: 0
Alternative Approaches to Evaluating STEM Education Partnerships

Round 4

Strategic Needs

Coding references:
Respondents:

agree - we are not likely to add to the board of directors just for a specific purpose - more likely we will create project teams to reflect needed partners and especially to solicit new ideas and perspectives.
I think some partnerships are formed as a result of funding requirements, but they can be maintained after funding ends. Some partnerships exist because of need, not funding.
Agree
The statement might be true in some specific cases but is probably not true in general. There probably is an ongoing interaction among some of the partners.
However, funding gives a sharper edge and urgency to the work of a partnership and probably allows a partnership to be broadened.
having a core group that is willing to accept new members is quite effective in developing a successful partnership
Agree
Our formal partnership was formed to develop a MSP proposal. However, a RSI which had been in effect in the region for 7 years served as the foundation to build upon. Obviously, sustaining a partnership of this type is extremely difficult. Efforts are being made to sustain a number of initiatives.
Totally depends on which partnership I am thinking about. In some cases, this statement would apply exactly as is. In others, the partnership was formed specifically to respond to an RFP. Some partners might have worked together here and there, but the impetus for considering a real partnership was the RFP. Some individuals of the organizations have been working together for a long time which facilitated the resulting partnership. Others are new to the team.
agree
I've seen partnerships that have formed or substantially blossomed as a result of a particular grant, but once up and running, these partnerships (when truly healthy) have transcended the existence of the funding and were likely to persist beyond the funding.
This is the only part of the statement that I agree with: The truth is that we have been interacting with our partners for a long time either formally or informally. In reality, we directly respond to policy directives and external funds may allow us to develop specialized programs, or events, but we generally adhere to our main goals.
This is an accurate description of only some of our work. There are opportunistic and new relationships forming all the time as the demand for support and the changing nature of felt needs is omnipresent
Agree
sprinkled throughout the partnership are teachers previously trained by our university and others that use our university to send students due to its regional qualities and the large numbers of low income student families in the region.
The working together is there, to a degree, but it seems to me that there are stronger ties, meaning better listening, as money is there and there is a pervasive essence toward STEM partnerships. The money does allow for innovation. However, I am not convinced that all the funded projects make the most sense for their in situations or effected students. There is politics & some people can pull the strings well to look like real partnerships, but they and their research is still superficial. I have been to some of the paper presentations of some in Georgia & elsewhere, although I am most familiar with the names and institutions in GA. Perhaps these are merely collateral effects. What works is genuine change in thoughts and in real relationships that find themselves reinforced over and over. Some of the smaller institutions do that & still get some funding. My experiences with GaTech consistently shows strong habits that reinforce the partnership thinking. Another major institution in the state (not GSU) consistently squanders opportunities & systemic change is less systemic and more
smoke & mirrors - maybe because of tenure requirements of its professorate. There is not a believable drive or passion that breeds change. The truth is that we have been interacting with our partners for a long time either formally or informally. We sometimes form partnerships in response to policy directives or to funding requirements. The funds enable our partnerships to do new things and to be more innovative in our approaches to STEM education. We might add members to our partnership in response to program requirements, but the core group has been working together for a while.

Agree

None of these partnerships were founded on existing partnerships. Getting higher ed and schools together was a major change, particularly giving each a say in the work to be done.

(q7) Of the three partnerships I am reporting on, the only one with a formal evaluati on process is CONNECT. We had an evaluation team which worked on evaluation. The evaluation team's leader was a part of the management team and she assisted us to make corrective changes upon discovering problems with the effort. These discoveries were based on evaluations done on various aspects of the initiative. One action taken was a decision to review formally one of the teacher collaboratives which were part of our Initiative. That decision was based on data collected in our ongoing evaluation process. The collaborative corrected its direction after our review and before future funding would occur. Although yearly evaluations were done, the only real summative evaluation was done by NSFD at the end of the first five years of funding. Unfortunately, they chose not to refund the Initiative as a result of their summative evaluation.

We had partnerships with the K-12 districts but the work was not formalized and systemic. The truth is that we have been interacting with our partners for a long time informally. We form partnerships in response to policy directives or to funding requirements. The funds enable our partnerships to formalize relationships and to do new things and to be more innovative in our approaches to STEM education. Many partnerships are formulated with people who do not have established relationships or experience working as a team. Hopefully, we form partnerships to solve a defined educational problem, such as low mathematical performance of our students. The partnership's purpose transcends the external mandated reality and becomes the foundation for its existence. Additional funds are important but not significant. The glue is the development of a collaborative vision to serve as Merchants of Hope and to establish a systemic plan where Failure is not an Option.

I am beginning to appreciate how over-generalized some of these statements may be. Of course, at a certain point in time, this statement may approximate the truth for some institutions and their partnerships. Yet partnerships do form initially, and many of these have been in response to funding opportunities or policy directives. When I arrived at my institution in the mid 1980s to direct a new center, we had only one or two active STEM partnership projects, of limited scope. In the past 20 years, we have formed numerous ongoing partnerships, some of which meet have been working together by now for a long time. While we often have a pretty stable group of partners, we are in a state with 600 school districts, and our university has probably worked with half of them in some way. I personally have worked with more than 200 of these districts in a substantive way. It is just not possible to maintain all of these as partnerships. Some districts wind up involved in some partnerships and others in other partnerships.

The truth is that we have been interacting with our K-12 partners for a long time and the IHE partners informally. We don't form partnerships in response to policy directives or to funding requirements. The funds enable our partnerships to do new things and to be more extensive in our approaches to STEM education. We might add IHE members to our partnership in response to program requirements, but the core K-12 group has been working together for a while.

This is basically how I feel. I do think that sometimes a grant or funding opportunity may have brought the core group of partners together in the beginning. While we have worked with some of our partners for a long time, the partner organizations continue to evolve in new projects, and the funding availability and requirements certainly has had a big impact on our partnerships. In our partnership there is a big difference between the informal interactions that existed before the grant and the formal interactions that exist now. That difference seems to be rooted in the shared decision-making that is necessary in the formal partnership. Before the formal partnership, each organization made independent decisions; in making those decisions others organizations were not usually considered.

This statement describes an ideal K-20 partnership. I don't know if it accurately reflects reality.
Sometimes true, sometimes not. In general, our partnerships have been a mix of people with whom we've had a long-standing relationship, as well as some people with whom we've never really worked at all. I believe that many people in the university believe that we already had a partnership because we sent student teachers out to the schools. I don't see that as much of a partnership. In fact, it is barely interacting. The truth is that this partnership is funding-driven. Otherwise those people would never be in the same room together. Perhaps this is a local phenomenon -- just isolated to our project.

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<tr>
<th>Embeddedness</th>
<th>No subdimensions</th>
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| (Since these text extracts can be coded under the subnodes, the latter are incomplete) | - N/A. Three respondents (d482005, d582005, d972005)  
- (16) "varies, cannot recollect" (d282005)  
- Several years, **org embeddedness positive**:  
  - (16) Other university - close working relationship - 10 years. School districts - close working relationships - varied from 2-6 years (d792005)  
  - (16) "ACCD - four years, close working relationship" (d832005)  
- **Professional embeddedness positive**:  
  - (16) I was hired after the partnership was established; although I had known of the co-PI's for several years. (d372005)  
  - (16) "I've had a close working relationship with the lead evaluator for 7 years. I had a close working relationship with a co-author on the proposal from TIE for 3 years, and I had been an acquaintance with a key administrator from the Rapid City School District for 2 years." (d442005)  
  - (16) I had a close working relationship with one of the Principal Investigators from RCAS for three years and six months before this grant started. I was provided a major professional development component for the school district. (d932005)  
  - (16) "I had known some of the key people for around eight months. I had known others for five years, but I had left the state for three of those five years."  
  - (16) I was a relative newcomer to Texas which possibly made it easier for me to assume a leadership role. I had only a casual relationship with the Governor's education advisor who proposed that I play the role I did.  
<table>
<thead>
<tr>
<th>Trust building</th>
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</thead>
<tbody>
<tr>
<td>(3c) establishing mutual understand and a spirit of cooperation</td>
</tr>
<tr>
<td>Problematic case (contradictory), embeddedness organizational and professional</td>
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| Embeddedness | Coding references: 55  
| Respondents: 29 |  
| No subdimensions | Coding references: 13  
<p>| Respondents: 13 |</p>
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<tr>
<th>Organizational embeddedness</th>
<th>positive</th>
<th>Coding references: 5 Respondents: 4</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>I had no relationship prior to the development of the partnership. There was no discussion about partnership only joint goals in improving teaching and learning of science in K-12 schools and sharing of strategies that might increase impact. The partnership grew over several years of shared involvement in the graduate program we developed together.</em></td>
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</tbody>
</table>
| - (q16) In a strategy setting meeting of the TEES Regional Division meeting in 1995, a common set of concerns came up. TEES decided to convene a group of representatives from each of the Divisions to work with the proposal writing team to set up a strategic plan to get grants to address science and math education. This was the birth of what we call OUR PARTNERSHIP. ...It took us a year to move from focusing on our own institutional needs to focusing on the needs for kids. ... So since 1995, the TEES Partnership has been stable and most of the players from the beginning are still active and we have built capacity are a number of institutions and more people have joined and enriched the FAMILY."
| - (q22a) "It took almost a year of meetings and discussions to develop trust and have the partners focus on the goals we all agreed we wanted to address rather than their individual organizations. We were fortunate in have the Texas Engineering Experiment station, an A&M System Agency provide the glue that assisted us in persisting."
| - (q16) "Wisconsin Center for Education Research, 2 years, close working relationship"
| - (q7c) Inviting the program officer to be involved in yearly retreats. This provides an opportunity for the partnership to obtain feedback from the funding agency
| - (q11b) closer ties to other institutions or could not see benefit to them of participating - sometimes think their way is better than anyone else's |

<table>
<thead>
<tr>
<th>Embeddedness</th>
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<th>Coding references: 7 Respondents: 5</th>
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<tbody>
<tr>
<td><em>For the COOL grant, none of us knew the university people before writing the proposal</em></td>
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</table>
| - (q16) In a strategy setting meeting of the TEES Regional Division meeting in 1995, a common set of concerns came up. TEES decided to convene a group of representatives from each of the Divisions to work with the proposal writing team to set up a strategic plan to get grants to address science and math education. This was the birth of what we call OUR PARTNERSHIP. ...It took us a year to move from focusing on our own institutional needs to focusing on the needs for kids. ... So since 1995, the TEES Partnership has been stable and most of the players from the beginning are still active and we have built capacity are a number of institutions and more people have joined and enriched the FAMILY."
| - (q16) I had not previously known people from most of the partner
Alternative Approaches to Evaluating STEM Education Partnerships

<table>
<thead>
<tr>
<th>Organizational embeddedness negative</th>
<th>Coding references: 1</th>
<th>Respondents: 1</th>
</tr>
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</table>
| (q17b) "The Metro Atlanta P-16 Council (partnership) was formed at the start of the P-16 initiative in Georgia. Governor Zell Miller had just started the Georgia P-16 Council (of which I was a member). The University System of Georgia had decided to give seed funding to any of the teacher preparation institutions to start local P-16 councils. While there wasn't political pressure to start the partnership, there was a positive political climate in which to do so."
| (q16) "SKC IMSI K-12 basically started from scratch nine years ago networking in building relationships with program officers in D.C., reaching out to other tribal colleges, Montana State colleges and universities."
| (q16) No prior relationship. |

<table>
<thead>
<tr>
<th>Professional embeddedness positive</th>
<th>Coding references: 14</th>
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</thead>
</table>
| (q4) partnerships are not all organizational. Partnerships among organizations REQUIRE strong administrative commitment. Partnerships among individuals require a vision.
| (q16) "three to six years with Education, Mathematics, and Science Faculty, 10 years with FDOE administrators, all professional or administrative relationships"
| (q22a) “In a strategy setting meeting of the TEES Regional Division meeting in 1995. It took us a year to move from focusing on our own institutional needs to focusing on the needs for kids. I have to admit that Judy and I were kind of already there (as was the lead proposal writer) and we had to move the group along. Our personalities are totally different... But anyway, I think all would agree that Judy and I became the "leaders" of the group and instant friends. They called us "good cop" and "bad cop"...guess which one I was. But it took us a year to really jell and by 1996 we had submitted several grants and were beginning to behave as a FAMILY"
| (q17b) "The Metro Atlanta P-16 Council (partnership) was formed at the start of the P-16 initiative in Georgia. Governor Zell Miller had just started the Georgia P-16 Council (of which I was a member). The University System of Georgia had decided to give seed funding to any of the teacher preparation institutions to start local P-16 councils. While there wasn't political pressure to start the partnership, there was a positive political climate in which to do so."
| (q16) "I had worked with Pinky Nelson (the PI) for 6 months in another capacity..."
before being asked to come to Western to help created the partnership. Pinky persuaded me to come to WWU - I arrived in Sept, the grant that helped form the partnership was prepared between Sept and Jan. We continued communicating with the partners during the time between submission and funding. Other than my previous working relationship with Pinky, virtually every person involved in the project was new to me." (d332005)

(15) "NSF has sponsored all of our systemic reform efforts with a reservation tribal and public schools.

(q16) One year - working relationship
(q16) "over twenty five years, he was a former student and a teaching professional as well as a fellow chairman. He and I are joint members of three professional mathematics organization. Both have been very active in promoting mathematics education in math departments in Texas colleges and universities."

(q16) I had a personal friendship with one of the five key individuals for 4 years prior to the partnership. He was a mathematician at the same institution in which I am a math educator.

(q17b) mutual respect

(q16) I have had a personal and working relationship with faculty members from Auburn University for approximately ten years. I did not know the leaders from Tuskegee University nor did I know the project director before becoming a part of the grant writing team. As AASA district four presidents I knew all the local school superintendents.

(q16) "My former doctoral student, with whom I'd had a close working relationship, led the involvement by Rowan University. When the project began (1993), we had known each other for about 20 years, though we had not been in touch continuously throughout that time. I’d had professional relationships with individuals at other important partner groups (Merck & Co., the NJ Dept. of Education, the NJ Dept. of Higher Education, other universities, some of the school districts) that went back for eight years, but few of these were really close."

(q11b) Did not share the goals of the other partners Did not feel they were given adequate resources Did not find that the partnership would help build their organizations capabilities

* (q16) "The partnership consisted of a faculty member for Colby College and Mathematics and Science Alliance (MMSA) and secondarily the Maine Department of Education. I knew the person at Colby College and the people at the Maine Department of Education. The faculty at Colby I had known for about one year and did not know very well (Acquaintance), but we worked together on the proposal together. The staff at the MMSA knew each other for several years, (Professional working relationship). I knew the people at the Maine DOE for one year (Professional working relationship). The school that joined the partnership
Alternative Approaches to Evaluating STEM Education Partnerships

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<th>Coding references: 8 Respondents: 6</th>
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(q4) partnerships are not all organizational. Partnerships among organizations REQUIRE strong administrative commitment. Partnerships among individuals require a vision.

(q4) "The partnership must help the organization advance its goals. Working in partnership in some respects is harder than just doing your own thing - especially in the short run. Having to work across multiple institutions and develop understandings of the cultures and contexts in each is hard and slow work. To establish a commitment to do that hard work, the partnership must have a clear and valued benefit to all partners."

(q8d) "Our experience has been that generic "team building" or "trust building" experiences are poorly regarded and considered "fluff". We have found it significantly more effective to build teams and build trust in ways that are centered around the actual work of the partnership. In providing structured ways for different stakeholders within the partnership to work together, trust and a sense of team really evolves in a meaningful way."

(q17b) "Institutional support through WWU. And, appropriate staffing to do the work. Lots of schools/universities want to do this kind of work, but can't be freed of their regular responsibilities to do the hard and time-consuming work of forming a partnership. WWU committed the resources to hire me to help do this work for the science ed department. A full time person dedicated to building the relationships and "doing" the initial work was needed to get the partnership off the ground."

(q11b) Saw no worthwhile value of the partnership for their organizations. Commitment of time and resources was more than they were willing to invest.

(q16) "I worked as a researcher, grant writer and evaluator in the region for 30 years but I had had no prior relationship with the PI or his department."

(q16) I have had a personal and working relationship with faculty members from Auburn University for approximately ten years. I did not know the leaders from Tuskegee University nor did I know the project director before becoming a part of the grant writing team. As AASA district four president I knew all the local school superintendents.
Alternative Approaches to Evaluating STEM Education Partnerships

<table>
<thead>
<tr>
<th>Professional embeddedness negative</th>
<th>(q16) &quot;I had met several of the key people from other organizations over the prior 2 or 3 years, but did not have close connections with them.&quot;</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coding references: 1</td>
<td>(q25) Personality conflicts with staff. Some staff members lacked competence and skills to get the job done. Some partnership members were manipulative. Differences of philosophy and ways of working. Difficult to keep lines of communication open. Ineffective use of data to make decisions. Financial and time commitments outweigh the potential benefits.</td>
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<td>Respondents: 1</td>
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| Trust positive                   | (q3d) "Our experience has been that generic "team building" or "trust building" experiences are poorly regarded and considered "fluff". We have found it significantly more effective to build teams and build trust in ways that are centered around the actual work of the partnership. In providing structured ways for different stakeholders within the partnership to work together, trust and a sense of team really evolves in a meaningful way." |
| Coding references: 2             | (q3c) Generating interest in groups beyond your normal working relationships. Building a network for future professional opportunities. |
| Respondents: 2                   |                                                                                                                                  |

| Trust none                       | (q25) "The focus for many (at least at early stages) can often be on resources - rather than on the learning goals and benefits. For some, "this is how we have always done it" hinders moving forward in new ways or really becoming a partnership. This kind of thinking just directs some new resources to moving in parallel but doesn't really result in change or a true partnership. SLOW PROGRESS - it can often seem that working in a partnership is a waste of time because it can be much more complicated to get multiple organizations to move forward together in a spirit of trust, respect, and shared vision. Getting people to stay the course and see the LONG TERM goal is tough. Those without patience for this hard work or the larger vision break off and just want to do their own thing which in the end limits them and the partnership over the long term. Partnerships often feel constrained by outside forces - many want to do good work, but feel that their own system or legal matters, etc prevent them from doing so. Hard to find ways to attend to those constraints, but not let them become barriers to doing the right thing. Turnover - partnerships hinge on commitment from individuals and organizations. Loss of people and rebuilding relationships while not making all other partners feel like their are "Moving backwards" is tough for some." |
| Coding references: 1             |                                                                                                                                  |
| Respondents: 1                   |                                                                                                                                  |
Alternative Approaches to Evaluating STEM Education Partnerships

<table>
<thead>
<tr>
<th>Trust negative</th>
<th>(q25) There is much distrust emanating from the schools to higher ed. This lack of trust hindered the continuation of the partnership.</th>
<th>(q25) The example I will give is a District administrator who said he would assist teachers in a particular way and provide materials to help. They had previously committed to support the partnership. He did neither. He told teachers in a school that they could do what they wanted. This was very destructive and took much effort to bring a positive sense to the school and initiative.</th>
</tr>
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<tbody>
<tr>
<td>Trust building</td>
<td>(q1b) &quot;... Time is not the only aspect, frequency and length of interactions matter just as much. It is a matter of establishing mutual trust and respect. If partners meet once a month it takes a lot longer than if they meet twice a week.&quot;</td>
<td>(q8b) Trust is not built by exercises but by continuing collaboration on professional tasks that matter</td>
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<td>(q8b) &quot;.. Partnerships build trust by taking action &quot;together&quot; and dealing professionally and opening with every issue, having the utmost fiscal integrity and always, always being respectful of others' ideas.&quot;</td>
<td>(q3b) Having a track record and reputation for effective partnering is critical when a partnership has to be put together in response to opportunities that arise (i.e. not planned on strategically). .......... Basically using lessons learned.</td>
</tr>
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<td></td>
<td>(q22a) &quot;It took almost a year of meetings and discussions to develop trust and have the partners focus on the goals we all agreed we wanted to address rather than their individual organizations. We were fortunate in have the Texas Engineering Experiment station, an A&amp;M System Agency provide the glue that assisted us in persisting.&quot;</td>
<td>(q4) &quot;Mutual respect, trust, and a shared mission. These are always the deciding factors in any partnerships.&quot;</td>
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<td></td>
<td>(q3b) &quot;Agreement that a partnership is needed Trust between different interests. Leadership of respected individuals. A clear and open process. A shared vision of what might be achieved. Time to build the partnership. The development of compatible ways of working, and flexibility. Applying research to solving problems. Good communication, perhaps aided by a facilitator. Collaborative decision-making, with a commitment to achieving consensus. Effective organizational management&quot;</td>
<td>86</td>
</tr>
</tbody>
</table>
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(q17b) mutual trust and respect

(q4) "The single most critical component is having Mutual goals among potential partners. Having a clear picture is not necessary, but the concepts are agreed to and there is trust that the partners can achieve common goals by ongoing participation by all partners. This does not mean always at the beginning, but trust that common goals will be agreed to. So that revisiting the goals at the beginning to key and making revisions due to the realities of the context. Also once up a running revisit the goals at least annually and make adjusts through involving all the partners is very important to a successful partnership"

(q8d) "Our experience has been that generic "team building" or "trust building" experiences are poorly regarded and considered "fluff". We have found it significantly more effective to build teams and build trust in ways that are centered around the actual work of the partnership. In providing structured ways for different stakeholders within the partnership to work together, trust and a sense of team really evolves in a meaningful way." (d332005)

## Embeddedness round 2 summary table of all themes and subnodes

### Embeddedness organizational

<table>
<thead>
<tr>
<th>Embeddedness org positive (ONLY) Coding references: 4 Respondents: 4</th>
<th>Embeddedness org positive AND Embeddedness org none Coding references: 7 Respondents: 6</th>
<th>Embeddedness org none (ONLY) Coding references: 6 Respondents: 6</th>
<th>Embeddedness org negative Coding references: 1 Respondents: 1</th>
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<tr>
<td>(8c) Basically, the management team or individuals working on the project identify potential partners we want to/ need to explore. Once identified we decide who will take the leadership. Usually the PD makes the initial inquiry, but not all the time. Then research is done to identify the appropriate person to call/email/write and then we initiate contact.</td>
<td>(8a) It is very likely that our partnership group and/or individual organizations in our partnership group will enter into a partnership in which there are no individuals with whom we have a history of interaction. We have always believed that to really make a difference we have to involve as many</td>
<td>(8a) The likelihood of our organization entering a partnership where there had been no history of interaction is very small. The partnership was established and approved by the National Science Foundation and we are not planning on accepting any new partners and if</td>
<td>(8a) I would say the likelihood is low, but possible. It all depends on how much we hope another group initiates the partnership and if there is funding to collaborate. (d192005)</td>
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</table>
In most cases it is done by phone. We just call the organization, introduce ourselves and tell them we are interested in exploring how we might work together to address science and mathematics education. A time to meet is usually set up so that the players get to know each other. Usually more than one of us goes to these meetings. We usually prepare a packet of information that tells them what we are all about so that they might have the background information. We are also well prepared with a power point presentation and/or outline of what we would like to accomplish. Most meetings usually involve travel in Texas. What results is that either the individual we called will take the lead or the person will appoint someone for us to work with. We then work very hard to make sure that the experiences developed are successful. We are also very careful to make sure that once we decide to partner, that the new partner uses ownership language. They need to say Our Project, not Your Project. We are not shy. You can't be. We are persistent. You have to be. We are enthusiastic. It is easy because we believe in what we are doing. How do we select what professional will represent our organization. We usually go with the PD who have always been people who passionately believe what they are doing and can be persuasive. But we also usually send a team of two or three, especially if we are developing a proposal. In some cases we include an individual with a title (like Dean) if we are meeting with another administrator. Insome cases the team is complementary, i.e good cop/bad cop or more quiet spoken and more as possible to work on the problem(s). Therefore in most cases we actively seek out new partners, especially those that make sense. For example, at the beginning of our partnership when we were setting up the Texas Rural Systemic Initiative we did not have informal science providers other than the ones we already had established relationship with. Basically, once we have decided to try to establish a partnership, the PI, CO-PIs, Project Director and/or other staff members just call the organization, introduce ourselves and tell them we are interested in exploring how we might work together to address science and mathematics education. We identify the individual to call in a variety of ways......website, by referral. A time to meet is usually set up so that the players get to know each other. What results is that either the individual we called will take the lead or the person will appoint someone for us to work with. We then work very hard to make sure that the experiences developed are successful. This is how an initial meeting with Texas Parks and Wildlife grew into a major partnership for us.....in that, now it not only includes the State, but several individual State Parks. We are also very careful to make sure that once we decide to partner, that the new partner uses ownership language. They need to say Our Project, not Your Project. Some school district partners resign we probably would not accept any more because it is such a large project to begin with. This does not mean that we would not be collaborating with other individuals who would be assisting us, but most of that would be on consulting basis. (d352005)

(8a) We are always open to exploring new partnerships. There would be, of course, some apprehensions with individuals or organizations that we are not familiar with but that would not hold us back. What is important to us is that we be accorded full or near full partner status. SKC is approached often by those who would use our ethnic status to achieve their own goals that may or may not be in harmony with our own. (d412005)

(8a) It's certainly more likely for us to partner with an entity where we have a close personal contact, but it's not absolutely necessary. Here's an example where no personal relationship previously existed: We've worked with about five Tribal College Rural Systemic projects over the past 7 years. Just this past spring, a long-time contact from one of these projects recommended our services to a tribal college where we had no personal connection. As of this fall,
aggressive type. Sometimes new partnership formation comes from an immediate need. For example, when a major partner dropped out from the proposed MSP Colonias Initiative.....the one I earlier described as a failed partnership.....we needed to replace them with another HE institution and their partner ISD. The logical one was University of Texas Pan American so I just called the VP for Research and proposed the concept and scheduled a meeting to go down and meet with them. As it turned out the chemistry WORKED with both UTPA and the school district. It has turned out so positive that even when the MSP was not funded, we have gone on to organize the Dean getting together to see how we can collaborate. We just submitted a joint CCLI (the one Judy and I developed while driving to work when she was last here). We are also including both UTPA and UTB (University of Texas Brownsville) in a NOAA proposal going out in the Feb. (d232005)

(8a) Pretty low. Most of the partnerships that I've been involved in require a fair amount of commitment from all parties. Without prior working relationships, it would be hard to justify that level of commitment. Of course, sometimes that prior relationship is with an organization and sometimes with an individual. For example, we've been involved with a couple of people who have moved from district to district and maintained their individual involvement with us. Conversely, sometimes we've been involved with institutions where we've had prior relationships, although we might not have worked with the people who would be part of a new partnership. (d972005)

We are not shy. You can't be. We are persistent. You have to be. We are enthusiastic. It is easy because we believe in what we are doing. (d232005)

(8a) For the Metropolitan Atlanta P-16 Council - a large partnership of over 30 organizations - many of the partners had no previous history of interaction with Georgia State University. However, it is much more likely that future partnerships would be made primarily with organizations with which we have a history. (d252005)

(8a) Low. My organization is careful about working with other organizations because any partnership requires additional work and a poorly matched partnership is even more work and not likely to help us move our work forward. Without some history of working together, it would be too hard to tell what the partnership might be like. (d362005)

(8a) The likelihood of my organization entering a partnership in which there are no prior relationships is low, however, if the initiative has a number of partners in which there is a familiarity and history of partnering successfully, we are more likely to look for one or two new partners. So, under stable circumstances, the likelihood of looking for an unfamiliar partner is high. In our Math Science Partnership program, two of five we are now partnering with them. It took a couple of meetings and e-mails, and then it was clear that we had services and experience they valued, and they were serving a community need that we felt strongly about. (d442005)

(8a) Given our organization's emphasis on securing external sponsorship, I would think the likelihood is high. Our institution recently received funding (as a costcenter) for a multi-organization center project involving institutions with whom no previous history of partnership existed. (d612005)

(8a) The likelihood that we would enter a partnership in which there are no individuals with whom we have had a history of interaction is high. In fact, each year we begin new partnerships with 2-6 districts. We solicit new participants for a 12-day strategic planning program focusing on science and math reform each year and build an ongoing partnership from that basis. (d792005)

(8a) Our partnership assembled with a real hodgepodge of institutions. We wanted to work on bringing coherence across a region. We had relationships in some sites, but not in others. Where we had relationships, we built on them. Where we didn't we approached them in the spirit of honest, open communications - said here's what we're thinking, does this
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(8a) Our partnership assembled with a real hodge podge of institutions. We wanted to work on bringing coherence across a region. We had relationships in some sites, but not in others. **Where we had relationships, we built on them.** Where we didn't we approached them in the spirit of honest, open communications - said here's what we're thinking, does this work for you, what changes would you suggest, would you like to join. For some, they were open to it, even without a relationship. For others, they turned to their peers in neighboring schools with whom they had relationships to ask is this really worth joining. To build a larger network you often have to extend yourself beyond just those with whom you have relationships. If you truly value equity at all levels, you need to identify who has needs and make sure that they get access. You then need to ask yourself what needs to you have and does your partnership include members who can address them - if not, who do you reach out to. So, yes, we indeed reached out to districts with whom we had previously never worked - and even some that those who were at the institution before us made have worked, but relationships were poor at best. It was all about the greater good, not about individual connections, old-boy networks, and who knows who. (d332005)

(8a) The likelihood of my organization entering into a partnership with an organization with no individuals with whom we have had a history is low. We live in a small rural state and my organization is a statewide service organization we have existing relationships with most education entities in the state. (d932005)

(8c) We have recruited new partners with different strategies: (1) direct approach to people we already know at potential partner institutions, (2) invitation through public announcements of grants to be awarded, followed by informational meetings to describe the opportunity. We have selected organizations based on a track record of having worked with people there, or based on a high level of respect for the professional achievements of individuals there; in the case of school districts, also based on expressed interest in innovation and change, and based on location in low-income neighborhoods. Selecting individual professionals begins with an approach to possible individuals based on the above criteria, but ultimately the decision as to who represents the partner institutions is with those institutions. Usually it is recognized that individuals have to be acceptable to the partners. (d782005)

(8a) It is relatively unlikely. We would tend to build partnerships based on some track record of success in working together. However we are open to being approached, and occasionally would initiate an approach, when a particular reason exists to form a new partnership and there is someone we know by reputation to be a potentially strong working partner. (d782005)

(8a) The school district partners were new contacts. (d592005)
(8a) Our partnership assembled with a real hodge podge of institutions. We wanted to work on bringing coherence across a region. We had relationships in some sites, but not in others. Where we had relationships, we built on them. Where we didn't we approached them in the spirit of honest, open communications - said here's what we're thinking, does this work for you, what changes would you suggest, would you like to join. For some, they were open to it, even without a relationship. For others, they turned to their peers in neighboring schools with whom they had relationships to ask is this really worth joining. To build a large network you often have to extend yourself beyond just those with whom you have relationships. If you truly value equity at all levels, you need to identify who has needs and make sure that they get access. You then need to ask yourself what needs to you have and does your partnership include members who can address them - if not, who do you reach out to. So, yes, we indeed reached out to districts with whom we had previously never worked - and even some that those who were at the institution before us make have worked, but relationships were poor at best. It was all about the greater good, not about individual connections, old-boy networks, and who knows who. (d332005)
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### Embeddedness professional

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<th>Embeddedness prof positive</th>
<th>Embeddedness prof positive AND none</th>
<th>Embeddedness prof none</th>
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<td>Respondents: 3</td>
<td>Coding references: 3</td>
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<td>Respondents: 3</td>
<td>Respondents: 3</td>
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<tr>
<td>(8c) Wherever I go, I'm always looking for new people to work with both formally and informally. Sometimes finding a new like-minded person whose candid judgment you respect can be a highly effective sounding board when developing new ideas or projects. It's critical to do this in a scenario-building process - you need to know the stumbling blocks before you end up tripping over them. - This is also true for finding new members for our board of directors. It's often a chance meeting that can open the door to a coffee meeting just to take a read on their interests and perhaps mutual goals. (d172005)</td>
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<td>(8a) We are always looking for new opportunities to expand our network of contacts, resources, without which we risk standing still. If a key strategy is the relentless pursuit of new ideas (through which we add value to all partners) then there are considerable benefits to be gained from fresh perspectives. (d792005)</td>
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<td>(8a) High likelihood. When new issues are to be addressed, you bring the needed partners to the table. When there is a common cause, the relationships build quickly. (d112005)</td>
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<td>(8a) It is very likely that our partnership group and/or individual organizations in our partnership group will enter into a partnership in which there are no individuals with whom we have a history of interaction. We have always believed that to really make a difference we have to involve as many as possible to work on the problem(s). Therefore in most cases we actively seek out new partners, especially those that make sense. For example, at the beginning of our partnership when we were setting up the Texas Rural Systemic Initiative we did not have informal science providers other than the ones we already had established relationship with. Basically, once we have decided to try to establish a partnership, the PI, CO-PIs, Project Director and/or other staff member just call the organization, introduce ourselves and tell them we are interested in exploring how we might work together to address science and mathematics education. We identify the individual to call in a variety of ways........website, by referral. A time to meet is usually set up so that the players get to know each other. What results is that either the individual we called will take the lead or the person will appoint someone for us to work with. We then work very hard to make sure that the</td>
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<td>(8a) It's certainly more likely for us to partner with an entity where we have a close personal contact, but it's not absolutely necessary. Here's an example where no personal relationship previously existed: We've worked with about five Tribal College Rural Systemic projects over the past 7 years. Just this past spring, a long-time contact from one of these projects recommended our services to a tribal college where we had no personal connection. As of this fall, we are now partnering with them. It took a couple of meetings and e-mails, and then it was clear that we had services and experience they valued, and they were serving a community need that we felt strongly about. (d442005)</td>
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<td>(8a) The possibility is high if the references of the partner are validated. Earlier this year, our MSP agreed to partner on a RETA proposal with the National Science Research Center although we have never worked directly with the principal investigator. Just this past week, our MSP agreed to be part of a partnership for an IES grant proposal with an asst. professor who is a co-PI on another MSP. In both cases, it is because we and strong philosophical agreement and saw the possibility for mutual benefit. In both cases, our MSP would benefit from the resources to be developed through the grant proposal, i.e. the middle level science professional development modules; and the high school science</td>
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experiences developed are successful. This is how an initial meeting with Texas Parks and Wildlife grew into a major partnership for us...in that, now it not only includes the State, but several individual State Parks. We are also very careful to make sure that once we decide to partner, that the new partner uses ownership language. They need to say Our Project, not Your Project. We are not shy. You can't be. We are persistent. You have to be. We are enthusiastic. It is easy because we believe in what we are doing.

(8b) We write regular (at least monthly) electronic partnership updates and make every effort to include info on what’s going on in the STEM professional work just as we do the K12 work so that we all learn more about the work each of us does.

(8c) The initiating partner turns to someone they know or who has been recommended to be involved. Sometimes the partnership is looking for an entity which meets given criteria, a search is made for qualifying partners and then an invitation is extended. Individual professionals from our organization has either been through the individual requesting the opportunity to do so or the organization asking for a volunteer or a specific person to meet that need.

(8c) For the most part we are referred by our partners or other members of our network and vise versa. We also have program officers within the beltway that provide us with a heads up on new possibilities and who has shown an interest. If we see a possible benefit to our target populations we reach out to them. The most common selection process is a fellow professional at one organization reaching out to us or again vice versa.

(8c) In the statewide systemic initiative, partners were recruited through other partners. I helped recruit the higher
ed partners, the school people recruited other school people in other districts and these helped bring in their organizations. In this partnership, we recruited people we knew or knew about. The we travelled the state and held information and recruitment meetings in each region. Districts designated their representatives and so did the higher ed institutions after they joined the partnership.

(8c) We have recruited new partners with different strategies: (1) direct approach to people we already know at potential partner institutions, (2) invitation through public announcements of grants to be awarded, followed by informational meetings to describe the opportunity. We have selected organizations based on a track record of having worked with people there, or based on a high level of respect for the professional achievements of individuals there; in the case of school districts, also based on expressed interest in innovation and change, and based on location in low-income neighborhoods. Selecting individual professionals begins with an approach to possible individuals based on the above criteria, but ultimately the decision as to who represents the partner institutions is with those institutions. Usually it is recognized that individuals have to be acceptable to the partners.

(d782005)

(8c) This usually happens based on the needs of the existing or potential partnership. We look for contacts within an interest group (ex. the aerospace committee of the chamber of commerce), solicit ideas/names from partnering boards, etc. The professionals representing different organizations appear to be there because they are very interested in possibilities of partnership as a benefit for their own organization or for the community at large.

(d832005)

(8a) Pretty low. Most of the partnerships that I've been involved in require a fair amount of commitment from all parties. Without prior working relationships, it would be hard to justify that level of commitment. Of course, sometimes
that prior relationship is with an organization and sometimes with an individual. For example, we've been involved with a couple of people who have moved from district to district and maintained their individual involvement with us. Conversely, sometimes we've been involved with institutions where we've had prior relationships, although we might not have worked with the people who would be part of a new partnership.

(8c) We recruited our partners (but no new members will be recruited) through the foot work of our PI and project director. We had a targeted geographical area and they solicited participation from agencies that could help and all of the school districts. This question is frustrating because it would take pages and pages to describe—even as a summary. Schools selected teacher leaders. This was done in many, many different ways. Some were selected by principals and others volunteered. They participate in professional development and deliver professional development. The co-PIs who comprise our leadership group were recruited through previous contact. We knew all of them, respected them, and knew they had something to offer. Faculty were recruited who were already involved as STEM faculty in education.

(d972005)

(d982005)
## Alternative Approaches to Evaluating STEM Education Partnerships

### Trust

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<th>Trust positive</th>
<th>Trust none</th>
<th>Trust none AND negative</th>
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<td>(2) More opportunities for interactions with K12 schools, teachers, and administrators improves their understanding of the K12 context which has resulted in improvements in their course offerings, and their own teaching practices. (d332005)</td>
<td>(8c) I think I partially answered this in 8.a, but will expand. Basically, the management team or individuals working on the project identify potential partners we want to/need to explore. Once identified we decide who will take the leadership. Usually the PD makes the initial inquiry, but not all the time. Then research is done to identify the appropriate person to call/email/write and then we initiate contact. In most cases it is done by phone. We just call the organization, introduce ourselves and tell them we are interested in exploring how we might work together to address science and mathematics education. A time to meet is usually set up so that the players get to know each other. Usually more than one of us goes to these meetings. We usually prepare a packet of information that tells them what we are all about so that they might have the background information. We are also well prepared with a power point presentation and/or outline of what we would like to accomplish. Most meeting usually involve travel in Texas. What results is that either the individual we called will take the lead or the person will appoint someone for us to work with. We then work very hard to make sure that the experiences developed are successful. We are also very careful to make sure that once we decide to partner, that the new partner uses ownership language. They need to say Our Project, not Your Project. We are not shy. You can’t be. We are persistent. You have to be. We are enthusiastic. It is easy because we believe in what we are doing. How do we select what professional will represent our organization. We usually go with the PD who have always been people who passionately believe what they are doing and can be persuasive. But we also usually send a team of two or three, especially if we are developing a proposal. In some cases we include an individual with a title (like Dean) if we are meeting with</td>
<td>(16) Mutual respect and mutual status in the governance process is crucial. The governance structure must be composed of individuals who are respected by both groups. If this is not true, there will be an inherent air of mistrust and imposing of higher to lower level organizations perspective. (d772005)</td>
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<td>(27b) We require trust and competence when we develop partnerships. All other factors, while important, can always be worked out if a problem arises. We have always been successful by following this rule. (d412005)</td>
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<td>(22) I have only had experience with very stable partnerships. None of the key players ever left -- in any partnership. Occasionally we would add someone with experiences we found that we needed. I think turnover would be a real problem. While I am replaceable, our project director is not. I think any significant level of turnover would undermine the trust that develops. These type of educational partnerships thrive when there is trust. Trust takes time. Turnover reduces the amount of time to do good work. (d982005)</td>
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<td>(8a) The most important factors are the established credibility level of the post secondary partner and the lead K-12 partners. The other decision making factor is the perceived or real sense of urgency of the purpose of the proposed partnership. The chemistry or lack of chemistry and perception of credibility of the proposed partnership leadership team determined my desire to consider this partnership. (d772005)</td>
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another administrator. In some cases the team is complementary, i.e. good cop; bad cop or more quiet spoken and more aggressive type. Sometimes new partnership formation comes from an immediate need. For example, when a major partner dropped out from the proposed MSP Colonias Initiative.....the one I earlier described as a failed partnership.....we needed to replace them with another HE institution and their partner ISD. The logical one was University of Texas Pan American so I just called the VP for Research and proposed the concept and scheduled a meeting to go down and meet with them. As it turned out the chemistry WORKED with both UTPA and the school district. It has turned out so positive that even when the MSP was not funded, we have gone on to organize the Dean getting together to see how we can collaborate. We just submitted a joint CCLI (the one Judy and I developed while driving to work when she was last here). We are also including both UTPA and UTB (University of Texas Brownsville) in a NOAA proposal going out in the Feb.

(d232005)
NOT SURE WHERE IS TRUST NONE MENTIONED HERE.

Trust building

(22) Between 10 and 15% of individual are likely to turn over within a year. Replacements need to be acculturated, and new trust relationships have to be developed. This slows down progress. For example, the High School Math supervisor retired, and even after a full year the replacement is still learning the job and more concerned with getting handy on things internally than in working with external partners.

(d112005)

(8d) "Our experience has been that generic "'team building'" or "'trust building'" experiences are poorly regarded and considered "'fluff'". We have found it significantly more effective to build teams and build trust in ways that are centered around the actual work of the partnership. In providing structured ways for different stakeholders within the partnership to work together, trust and a sense of team really evolves in a meaningful way." (d332005)
(27b) An important factor in providing an MSP project with evaluation assistance is developing a relationship of trust and respect. Many MSP projects are skeptical about the degree to which our project can help them improve their evaluation activities. Reasons for the skepticism include concern about time away from their project activities (transaction costs), concern about what we do with information they share about their project, and willingness to admit that they have weaknesses. Many issues related to these concerns are related to trust and respect and it can result in ineffectual project evaluation.

(d612005)

(27b) **Building trust:** At the initial stages partners may have little faith in each other's commitment to the process. Partners need to be honest about their expectations of each other - and to identify what is working well in their current relationship. If partners do not begin to move away from entrenched positions, program outcomes will be impossible to achieve. If partners are unable to build trust partners will not identify a shared agenda and an action plan to deliver the necessary changes. They may or may not be able to reach a formal agreement but it is essential nevertheless to have a common understanding of the ground rules. Ex: if teachers do not trust college faculty, the teachers will not allow them to provide needed content knowledge.

(d662005)

(27b) An important factor is the presence of key trustworthy individuals at several of the partner institutions, ready to be cooperative and helpful, ready to engage in joint planning, with a shared vision and excitement about the possibilities. This affects partnership outcomes by allowing us to maintain momentum in the face of difficulties, opposition, or negative/pessimistic thinking.

(d782005)

(23b) In reciprocal interdependent relationships everyone has a stake in doing the work. You build trust and mutual respect more rapidly and each organization and the individuals representing them have the sense that 'we're in this together'. No one feels as though they're on the sidelines or that they have no influence in shaping the direction or activities of the partnership.

(d832005)

(27b) One factor that was important for developing and implementing our partnership was the formation of an effective governance structure. We needed a structure that would help to build trust between partners and allow for the effective coordination of activities. We started with a large planning and support team that gave each partner a voice at the table and kept all the partner organizations in the loop about all of the project activities. That structure also had some negative affects, the meetings were very long and often the content was only relevant for a few folks at a time. The other drawback is that some groups felt disempowered and unable to act until the planning and support team had acted on their ideas. We have moved to a more distributed structure where we now have subgroups that meet on issue only relevant to them and keep the rest of the partners in the loop through more written communication. The briefing meetings are now focused on common issues or issues that subgroups want to bring to the table for input. We are still trying to decide if this is a better structure, much of the collegiality is gone with this process.

(d932005)

(8a) It depends. We would work with districts and schools with whom we have never worked but we would not enter a partnership with some other entity with which we are not familiar. **We would not trust them, truthfully.** We would want to know more about them from their beliefs about education to personal issues of collaboration, negotiation.

(d982005)
Embeddedness Round 3

Embeddedness

Embeddedness org positive

(q10) The fact that the partners have worked together/have a relationship, that they recognize their needs, and have involved all the stakeholder will influence this partnerships ability to engage in the proposed activities. (d232005)

(q10) The fact that they have a long history of working together - assuming it is a positive relationship!! The presence of math + education experts. The commitment of time and resources from CCC and STC. The willingness of the school system to run the training program for all teachers in the summer. (d252005)

(q10) Accountability: The accountability required by the No Child Left Behind Act has resulted in monitoring both student and teacher performance in the high schools. The monitoring has revealed that mathematics scores lag behind improvements in reading scores. The accountability will be ongoing and will need specific strategies. In addition state government, business community and the media are focused on high school achievement. Prior Collaboration: The group has twenty-year, positive working relationship between faculty and administrators at County Community College (CCC), State Teacher College (STC) and the area high schools. Background information does not discuss the relationships of the groups with teachers and principals. Demographics of the targeted audience: Poor, hyper-mobile, minority population with some 2400 high school students (80% of the total enrollment) qualifying for free lunches. Funding: $10 million in grant monies to addressing the poor math scores in low-income high schools and Title I. Leadership: A leadership council s issue represented by a senior administrator from each of the network including the CCC, the three school districts in which the high schools are located, the feeder high schools, and the state as well as representatives from the local business community. Curriculum: Standardized math curriculum that will be applied across all 5 high schools in the district. Professional development: extensive professional development in the standardized curriculum for all math teachers in the district. STC and the professional development programs of the CCC will interact with the day-to-day classroom activities in the high schools. Description does not go into detail. Teachers have indirect input. (d662005)

(q10) The history of cooperative relationships, and the expertise of the participants, are the most encouraging aspects described. These are likely to have a positive influence. Also, there is a concrete plan that addresses an identified variable - student mobility. This concreteness of approach is also likely to have a positive influence. The exclusive focus on raising test scores is likely to have a negative influence. There is a need for approaching the development of mathematical concepts and skills in a way that balances (a) conceptual development, with (b) the kinds of skills that are easily tested, and with (c) the kinds of problem solving skills that are tested only with greater difficulty. In my experience, it is rare that all the partners described (business community, schools professionals, administration, college-level faculty) understand this in a sophisticated way. But if a shared understanding is absent, this can have a negative influence. (d782005)

(q10) Past history and collaboration in developing the proposal will be positives. Lack of involvement of district in curriculum development is a red flag! (d792005)
Alternative Approaches to Evaluating STEM Education Partnerships

(q10) Several aspects were identified that should have a positive influence on the partnerships ability to engage in the proposed activities. These aspects include: The history of successful work between the partners. The resources that are already committed to the work. The interest of the community in the work. The identified need that all partners support.

(d932005)

(q10) The following would influence their ability to get engaged in the partnership activity: Their history of working together; There seems to be an agreement about the problem; They have a variety of partners.

(d952005)

(q10) What about the business partners mentioned in the last paragraph? I'd like to know more about the mobility. Have they actually done a mobility analysis? The links between the school districts, CCC, and STC look good.

(d972005)

(q10) They already know each other and have working relationship. That is good. They have done some preliminary (but not complete) needs assessment monitoring performance. There is support from local business which can be positive. All of the partners are contributing to the efforts. Each of the partners has a stake in the outcome.

(d982005)

**Embedd prof positive**

(q10) The fact that the partners have worked together/have a relationship, that they recognize their needs, and have involved all the stakeholder will influence this partnerships ability to engage in the proposed activities.

(d232005)

(q10) Longstanding organizational relationships. Clearly defined, targeted, and agreed upon goals. Understanding of the local needs. Sounds like the partners have worked together already on defining needs and the goals and approach of this proposal much better than one group starting and then trying to involve others. State and districts funding already committed Leadership council already in place. Common curriculum strategy appears to fit district needs. Overall, project sounds manageable and focused.

(d912005)
Embeddedness round 4

Embeddedness organizational positive

(2) 1. In one of our partnership grants NSF required a National Visiting Committee and they provided a list of individuals we could choose from. Since several of us had interacted with many of them we used our knowledge of them to determine which might bring the best insights. We wanted to have a broad spectrum of views in a variety of areas and also balance the NVC by gender and ethnicity too. 2. For grants that we felt would benefit from having an Advisory Committee, but were limited by budget we looked for individuals locally and/or in the State who again would provide us with guidance for the various aspects of the grant. We used our network to identify individuals who had an interest in what we were doing, who we knew would come to the meetings and who's opinion we trusted and valued. The composition for both #1 and #2 was determined by the proposal writing team when the grant was being written. We made decisions very strategically, i.e. we determined advisory board membership based on what complement of people would be good for the project, not who might want to be on an Advisory Board. Not one individual makes strategic decisions, but rather the group does. While for each project we have a management team that makes the majority of the strategic decisions, we also have a core group of TEES Partnership participants that the management teams look for guidance. Since many of us are on both we tend to work together in making decisions. We have been very fortunately that all of us have been able to put students first, i.e. what is best for the project, rather than what might be best for a particular institution thereby removing any personal gain.

(d232005)

Only under embeddedness

11j

D172005 agree - we are not likely to add to the board of directors just for a specific purpose - more likely we will create project teams to reflect needed partners and especially to solicit new ideas and perspectives.

11r Would suspect this is true in some instances, but seems to underestimate the need to expect students to learn. Just today I saw a presentation to a visiting team from NASA by a teacher and 3 young students from a formerly low-performing school. I noted with keen interest the teacher's ability to resist speaking for the students but instead routinely expected them to provide the content. The self-confidence of these quite young students was evident; so was their demonstrated learning in areas that were of interest to them. I believe that terminology matters - it's an inherently different mindset to focus on learning (rather than teaching, curriculum, instruction, standards, etc.) Try using only words associated with learning (NOT teaching) for just a week - and pay attention to how you think about STEM issues. At least when I try this, it forces me to think about completely different models for improving STEM learning - and they don't fit too well in our current education systems.

D192005 I think some partnerships are formed as a result of funding requirements, I agree in part, but I also think there are a lot of other factors that
but they can be maintained after funding ends. Some partnerships exist because of need, not funding.

Affect student achievement in low performing schools. Therefore, it's hard to say that those improvements will increase student achievement significantly.

D232005 Agree

D252005 The statement might be true in some specific cases but is probably not true in general. There probably is an ongoing interaction among some of the partners. However, funding gives a sharper edge and urgency to the work of a partnership and probably allows a partnership to be broadened.

Agree, but will also improve significantly over time. It takes time for these improvements to occur and one has to keep at it. I don't agree with the last sentence. As a consequence of these improvements, student achievement in low performing schools will also improve significantly. While the three listed improvements should lead to improved student achievement, they will only have a potential impact if teachers from low performing schools are seriously engaged in the effort. Also, such teachers probably will require an ongoing supportive environment in their schools for the statement to be valid.

D282005 having a core group that is willing to accept new members is quite effective in developing a successful partnership

D32005 Agree

Agree it sounds so simple doesn't it! I have to take issue with the notion of achievement again - we should be worrying about what students are learning and this is a problem in all schools, not just low performing schools. Joining forces with partnership who share the goal of improving teaching, improving student learning, and working in community does empower us and provide access to more resources and expertise. It is our grand experiment here in the context of an MSP to see if this really holds true.

D352005 Our formal partnership was formed to develop a MSP proposal. However, a RSI which had been in effect in the region for 7 years served as the foundation to build upon. Obviously, sustaining a partnership of this type is extremely difficult. Efforts are being made to sustain a number of initiatives.

Partnerships bring to the table interested stakeholders with complementary expertise, i.e. individuals or educational units that have worked at different levels of the K-16 chain and therefore make contributions in course development, challenging curricula, best practice pedagogical approaches.

D362005 Totally depends on which partnership I am thinking about. In some cases, this statement would apply exactly as is. In others, the partnership was formed specifically to respond to an RFP. Some partners might have worked together here and there, but the impetus for considering a real partnership was the RFP.

This statement feels quite premature to me. I’ve seen some evidence in support of this statement, but not much that is definitive or even convincing. The real issue as far as I am concerned is not whether partnerships can improve these intermediate goals and ultimately student achievement, but whether partnerships are a cost-effective way of doing so compared to other alternatives, and whether partnerships set up a trajectory toward sustained and scalable improvements. Also, if partnerships are effective in these ways, we
Alternative Approaches to Evaluating STEM Education Partnerships

need to know what the nature of those partnerships is—who is involved, in what contexts, and how do they operate to achieve effectiveness, efficiency, sustainability, and scalability. From my perspective, we still do not know much about the answers to these questions.

Some individuals of the organizations have been working together for a long time which facilitated the resulting partnership. Others are new to the team.

We have realized that while significant improvement is being made, there are variables outside the control of the partnership. Often systemic change needs to be made at the district level without which improvement may not be sustainable or as significant.

I agree with the statement but as we all know change is incremental so can take quite a while in some cases for the partnerships work to bare fruit.

I've seen partnerships that have formed or substantially blossomed as a result of a particular grant, but once up and running, these partnerships (when truly healthy) have transcended the existence of the funding and were likely to persist beyond the funding.

I'm nervous about the word significantly. I'm HOPEFUL that this will happen, but I wouldn't bet the farm on it. Also, as mentioned elsewhere, I think the nature of the test, itself, is important. It quite plausible that student achievement on some measures could be quite immune to improved instruction.

This is the only part of the statement that I agree with: The truth is that we have been interacting with our partners for a long time either formally or informally. In reality, we directly respond to policy directives and external funds may allow us to develop specialized programs, or events, but we generally adhere to our main goals.

It isn't only a learning community of STEM professionals that should be created, it is a learning community of students and parents as well.

sprinkled throughout the partnership are teachers previously trained by our university and others that use our university to send students due to its regional qualities and the large numbers of low income student families in the region.

we must stabilize or eliminate well trained math teachers leaving the profession .. This is a major factor plus the fact that large number of non English speaking students are arriving into Texas schools.

Absolutely, the creation of a learning community is central—particularly if it were to begin to change society (our society has little understanding of STEM and almost no valuing except where impacts directly upon an industry or security. The weakness, however, in the statement is in lack of necessary connected between student achievement in low performing schools with the rest of the statement. We could do effectively the 1st sentence and still miss the second. We
presentations of some in Georgia & elsewhere, although I am most familiar with the names and institutions in GA. Perhaps these are merely collateral effects. What works is genuine change in thoughts and in real relationships that find themselves reinforced over and over. Some of the smaller institutions do that & still get some funding. My experiences with GaTech consistently shows strong habits that reinforce the partnership thinking. Another major institution in the state (not GSU) consistently squanders opportunities & systemic change is less systemic and more smoke & mirrors - maybe because of tenure requirements of its professorate. There is not a believable drive or passion that breeds change.

**D592005** The truth is that we have been interacting with our partners for a long time either formally or informally. We sometimes form partnerships in response to policy directives or to funding requirements. The funds enable our partnerships to do new things and to be more innovative in our approaches to STEM education. We might add members to our partnership in response to program requirements, but the core group has been working together for a while.

**D612005** Agree

**D642005** None of these partnerships were founded on existing partnerships. Getting higher ed and schools together was a major change, particularly giving each a say in the work to be done.

**D662005** We had partnerships with the K-12 districts but the work was not formalized and systemic. The truth is that we have been interacting with our partners for a long time informally. We form partnerships in response to policy directives or to funding requirements. The funds enable our partnerships to formalize relationships and to do new things and to be more innovative in our approaches to STEM education.

**D772005** Manu partnerships are formulated with people who do not have established relationships or experience working as a team. Hopefully, we form

must value the individuals and cultures within the low performing schools community and invite them into the learning community. We are at a cross roads where those students and communities can slip between the cracks because of the effort needed and we can cover them over with our created learning community that works for x % of the population. We need to get STEM partnerships to include parents and local businesses in these low performing places.

Through partnerships we are better able to improve the quality of teaching, improve the content of the STEM curriculum, and create a learning community of STEM professionals. As a consequence of these improvements, key conditions are present that will support improvement in student achievement in low performing schools. However, since most low performing schools are in economically depressed districts, have difficulty attracting and retaining high quality teachers, and have a highly mobile student population, significant changes in public policy would have to accompany the partnership work.

**D612005** I agree with all but the student achievement in low performing schools will also improve significantly. Given the lack of parental involvement in the learning community, I hesitate to suggest improvement will be significant. I think the chances are good that student achievement will improve, but we know so little about the influences of home environment, and parents are often overlooked in STEM partnerships. So, I'd stop at improve.

**D662005** I hope that you are right. It is the best game in town but Low Achieving Schools are very difficult to change. Take for example Gove middle School in Denver Public Schools. It appears to be doomed to close instead of rising in the way we hope. agree

**D772005** Systemic and collaborative partnerships increase the probability of improving the quality of teaching, increase the probability of
Alternative Approaches to Evaluating STEM Education Partnerships

Partnerships to solve a defined educational problem, such as low mathematical performance of our students. The partnership’s purpose transcends the external mandated reality and be comes the foundation for its existence. Additional funds are important but not significant. The glue is the development of a collaborative vision to serve as Merchants of Hope and to establish a systemic plan where Failure is not an Option.

I am beginning to appreciate how over-generalized some of these statements may be. Of course, at a certain point in time, this statement may approximate the truth for some institutions and their partnerships. Yet partnerships do form initially, and many of these have been in response to funding opportunities or policy directives. When I arrived at my institution in the mid 1980s to direct a new center, we had only one or two active STEM partnership projects, of limited scope. In the past 20 years, we have formed numerous ongoing partnerships, some of which meet have been working together by now for a long time.

Partnerships are one strategy that sometimes helps to improve the quality of teaching, improve the content of the STEM curriculum, and create a learning community of STEM professionals. As a consequence of these improvements, when coupled with appropriate educational policies implemented with adequate resources, student achievement in low performing schools can improve significantly.

I think that the hoped-for outcome here may be torpedoed by administrative choices (sometimes made by individuals who have not been involved in the partnership) and/or policy initiatives (e.g., the state decides to change the content tested to narrow the curriculum).

The truth is that we have been interacting with our K-12 partners for a long time and the IHE partners informally. We don't form partnerships in response to policy directives or to funding requirements. The funds enable our partnerships to do new things and to be more extensive in our approaches to STEM education. We might add IHE members to our partnership in response to program requirements, but the core K-12 group has been working together for a while.

This is basically how I feel. I do think that sometimes a grant or funding opportunity may have brought the core group of partners together in the beginning.

The only question in my mind is how long will it take? It seems that we will have to establish some sort of critical mass of expertise and will within schools systems to get the levels of achievement that we seek.

Given time, persistence, continuity of the work, commitments from all the players, etc. -- We need to convey that there aren't simple answers and that this is a complex, long-term endeavor, not something that will be fixed by one project.

Agree
exist now. That difference seems to be rooted in the shared decision-making that is necessary in the formal partnership. Before the formal partnership, each organization made independent decisions; in making those decisions others organizations were not usually considered.

**D952005** This statement describes an ideal K-20 partnership. I don't know if it accurately reflects reality.

I do not agree with this statement because it is implying that partnerships are the only way to improve student learning. Districts have done this work on their own but when outside interventions occur it is best done as a partnership rather than as one partner coming to fix the system. There are too many factors involved to agree with this statement with more qualification. In the ideal world the statement would be true.

**D972005** Sometimes true, sometimes not. In general, our partnerships have been a mix of people with whom we've had a long-standing relationship, as well as some people with whom we've never really worked at all.

Well, the significantly part of this might be a stretch. Also, the part about creating a learning community is tougher I think that improving curriculum or instruction.

**D982005** I believe that many people in the university believe that we already had a partnership because we sent student teachers out to the schools. I don't see that as much of a partnership. In fact, it is barely interacting. The truth is that this partnership is funding-driven. Otherwise those people would never be in the same room together. Perhaps this is a local phenomenon -- just isolated to our project.

Agree
## Environment (Rules / Inducements)

### Environment round 1 summary table of all themes and subnodes

<table>
<thead>
<tr>
<th>Environment external</th>
<th>No subdimension</th>
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</thead>
<tbody>
<tr>
<td>Coding references: 8</td>
<td>Coding references: 21</td>
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<tr>
<td>Respondents: 12</td>
<td>Respondents: 12</td>
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| (3b) | "The creation of a public climate encouraging the partnership is very important, for example in the form of public statements and encouragement by local or state government and educational leaders. And there certainly needs to be shared perception among the partners that their educational mission can be better achieved through the partnership; that is, there are benefits of substance. This is not the same thing as organizational benefits that may accrue to partners or individuals ... it is the idealistic, visionary dimension of the partnership. Finally, it is essential that all partners feel treated with great respect and courtesy, have good reason to feel valued in the partnership, and not feel "imposed on." (d782005) |
| (3b) | "I was interested to note that you listed as the choices for this section relationship and more personal concerns. What was missing for me was the lack of other contextual issues such as Federal policy environment, i.e. NCLB and Annual Yearly Progress, that causes schools to have a higher interest in working/partnering with other. This also would apply to the state Department of Education requiring school districts to work in partnership. I am saying the need for change/improvement/achievement changes can be a critical incentive for people to work together. This is not an endorsement of this type of partnership development is the best approach, but it has happened." (d952005). |
| (q7b) | "Clear articulation of credit for partnership products (e.g., articles, software, data about the project). Articulation of procedures for communicating with program officers from the funding agency. This relates to the need for partnership activities to be transparent to all members." (d612005) |
| (q7b) | "All partners must gain something from the relationship, or they become less interested over time." (d582005) |
| (q7b) | "Carefully selected partners to begin with. Clearly defined reasons for each partner being part of the partnership. Answers to some of the above items depend upon the nature of the partnership, so they cannot be answered well without more information about the context." (d912005) |
| (q3d) | external facilitation (is – for ops) (d112005) |
| (7d) | Administrative mandates (are – for form-ops) (d112005) |
| (8d) | top-down mandates (are – for outcomes) (d112005) |
| (8c) | "While it is important to have administrative support, it is usually not seen as critical to make sure that the Provost and President and the Public Information Officer be well versed with your project. Same with legislators." (are – for outcomes) (d232005) |
| (FALTA N PREG) | Partnerships often feel constrained by outside forces - many want to do good work, but feel |
that their own system or legal matters, etc prevent them from doing so. Hard to find ways to attend to those constraints, but not let them become barriers to doing the right thing. Turnover - partnerships hinge on commitment from individuals and organizations. Loss of people and rebuilding relationships while not making all other partners feel like they are "Moving backwards" is tough for some."

(25) ".. None of my negative experiences were such as to cast doubt on the value or importance of partnership activity and achievements, or to discourage me personally. But I believe it is extremely important to know of them and study them, for the purpose of (hopefully) modifying public policy and setting a positive environment for new partnerships. Education is a field in which there are many vested interests or "stakeholders", and where blaming commonly substitutes for constructive contributions. In identifying negatives, it is important to emphasize a focus on "cause and effect" rather than one on attributing blame. Mistakes or short-sighted decisions are made by individuals, but often the climate in which the same mistakes occur repeatedly is set by public policy or culture. Having said all this, the most negative experiences for me have had to do with out-of-control government bureaucracy, and absence of governmental integrity. My experiences include conflicting state and federal requirements for grants administration, and audits by both levels of government in the same year (motivated perhaps by some mistrust of each other rather than any question of the integrity of the project). No individual, not even the state governor or education commissioner, had the power to change conflicting requirements; their power tended to be only in the direction of enforcement. In addition, I experienced much absence of vision and broken promises by state officials, based on the political constraints they were under. I experienced rapidly changing federal-level expectations, and pressure from funding agencies to overstate the results achieved to satisfy political pressures. [Incomplete" (D782005)

the major expense that the university had to cover...a BUS to be converted into an Earthmobile, became problematic because Institutional Advancement was not on the same page. Faculty who should have known better: In submitting the GK-12 grant, Judy and I really did not think that institutions like us would really be competitive because we felt this program was targeting research universities....to get them involved in K-12. Well we got it. The problem was that we really did not write any staff into it so we had to do it on top of all we were already doing. Turned out to be alot more work than we had expected. We certainly learned our lesson." (d232005).

Environment internal
Coding references: 2
Respondents: 2

(25) "The negatives center around one partner organization, which was rigid in its approach and therefore unable to respond to changing needs of the work. The same partner lost key staff during the project, which created further negatives." (D912005)

(25) I will use the BEAMM partnership here as I think the negative aspects are illustrative of one of the most challenging aspects of a partnership. This is the lack of participation or outward support that can lead to an undermining of the partnership. The example I will give is a District administrator who said he would assist teachers in a particular way and provide materials to help. They had previously committed to support the partnership. He did neither. He told teachers in a school that they could do what they wanted. This was very
Alternative Approaches to Evaluating STEM Education Partnerships

<table>
<thead>
<tr>
<th>Work environment inside the work group²</th>
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<tbody>
<tr>
<td>Coding references: 5</td>
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<tr>
<td>Respondents: 4</td>
</tr>
<tr>
<td>(7c) &quot;meeting space that is conducive to interaction &quot; (+ for form-ops) (D112005)</td>
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<tr>
<td>(11a) &quot;Faculty promoting their self-interest such as trying to generate enrollment for pet courses, cultural isolation, defensiveness of K-12 staff, preoccupation with addressing daily routine work problems and thus inability to go to a higher plane. Misplaced senses of social egalitarianism precluding establishment of peer groups for evaluating effectiveness,&quot; (- for form-ops) (D112005)</td>
</tr>
<tr>
<td>(q25) People were not sharing the same levels of commitment so people didn't attend regularly. It was also all on one group to organize everything. (- for ops-outcomes) (D192005)</td>
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<tr>
<td>(8b) &quot;Continuous staff development, update events for key administrators, continuous self evaluation by core team leaders. Articulation through PR is crucial at every phase of partnership.&quot; (+ for outcomes) (D772005)</td>
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Environment round 2
Coded under sub nodes

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<tr>
<td>D112005</td>
<td>Generally, federal policies are more like external mandates that can be subverted locally. There is no meaningful enforcement. Considering school change, states and districts are key through funding priorities, assessment, curriculum, and approval of materials (textbooks etc.)</td>
<td>Almost every federal agency has (such as NSF, ED, Energy, NASA, Defense ...) Those about which I know all use partnership.</td>
<td>1. We have shown that a quality induction program that combines formal content and pedagogy training with intensive mentoring leads to statistically significant improvement of student learning in classes of participating (treated) career-change teachers. 2. We have secured inclusion of Science in the State's assessment and school evaluation requirements, and secured a multi-million dollar state funded professional development effort (for a limited</td>
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² This code was previously environment mutuality
### Alternative Approaches to Evaluating STEM Education Partnerships

<table>
<thead>
<tr>
<th>Time Period</th>
<th>Description</th>
<th>Key Programs/Initiatives</th>
<th>Notes</th>
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<tbody>
<tr>
<td>D172005</td>
<td>We have several contracts with the State - more to do with financial management than program changes - any federal influence comes from a granting agency and you know the conditions going in with an application so changes aren't really relevant here.</td>
<td>-DOE - School College University Partnerships (no longer exists but was a great program that still some 20 years later has some of these activities still underway from other funds) -NSF - SSI, RSI (we created collaboratives and teacher partners (vs lead</td>
<td>The governor introduced and the legislature passed and funded the Innovation Act (of 2000), making major investments in a research-driven economic development approach, and making the human capital (i.e., a STEM educated talent force) an even more critical resource in this strategy. It is allowing many new types and levels of discussion not just about the importance of STEM education but for what purpose. It's not just about reform, it's about the context for creating an education system that responds to and fuels the knowledge economy.</td>
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<tr>
<td>D192005</td>
<td>The No Child Left Behind act is the federal policy that comes to mind first. As a result, we have to work with our partners and schools in support of achieving Adequate Yearly Progress (AYP) for each school. Schools are looking for quick fixes so they don't get taken over, yet we all know that reform takes time. So we have to balance our approach to give them ways to fix problems quickly, but also encourage them to stick with the challenge of truly reforming their approaches to teaching and learning.</td>
<td>SEDL McRel NcRel Eisenhower Goals 2000 MSP (Math Science partnership)</td>
<td>The CENAC partnership has had an impact on policies within the BIA. Whenever there is a concern within the group, it is discussed and often times position papers are written and presented to the BIA officials in Washington DC.</td>
</tr>
<tr>
<td>D232005</td>
<td>First of all Texas has the Closing the GAPS by 2015. The Initiative was adopted in October 2000 by the Texas Higher Education Coordinating Board with strong support of the state's educational, business and political communities. The plan, which is directed at closing educational gaps within Texas as well as between Texas and other states, has four goals: to close the gaps in student participation, student success, excellence, and research. There are strategies for reaching</td>
<td>I thought I had answered this in the last round. All our grants for the partnership have primarily come from NSF and they all have required partnership and even if they didn't we are just so used to working in partnerships that we don't</td>
<td>This is more diffuse to document. I think the impact for business has been at the District level. We work with our lobby group to get legislature knowlegible of our programs and we are working to get State funding for TRSI.......so they know who we are.......we have also gotten awards so are visible.........and we do involve</td>
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</table>
Alternative Approaches to Evaluating STEM Education Partnerships

each of the goals and an annual performance measuring system. (The TAMUCC College of Science and Technology won the Texas Higher Education Coordinating Board STAR Award Dec 2003 for our Pathways to Success in Science programming...........which reflected the impact all our partnership work has had. This was TAMUCC's second STAR Award. In 2001 our Learning Communities model received one of the first five awards.) To complement this, the Texas A&M System initiated the Regent's Initiative for Excellence in Education. This initiative was approved by the Board of Regents in March 1999 and build on the Partnership for Texas Public Schools established in 1996. It outlines a leadership path and a course of action that the System universities may pursue in order to significantly impact the quality and productivity or education preparation programs. The Regent's Initiative expands university services and outreach to the state's public schools. All System universities MUST participate. Add to this the Leave no Child Behind one can definitely say that federal, state and local needs influence our partnerships. But, TAMUCC was well on its way to addressing the needs mandated by these policies, but it is clear that the pressure is on the universities. Therefore there tends to be support given when our partnership initiatives are in line with the state and federal mandates. We are also mandated to work with the lowest achieving schools that exist in our area. Some of this work can be done with Regents II, but it will be done whether with direct resources or without. We were able to use GK-12 funding to address working with West Oso ISD, but after this year we will have to figure out how to sustain the assistance. I won't be here so it will be interesting to see how this is accomplished. The Dean of Outreach is also retiring and she has provided a lot of the think of going it alone anymore........even when it complicates our life. For example, I think it is unusual for an NSF CCLI grant to be proposed as a partnership grant.................i.e. to reform the same courses at a two institutions. We not only proposed an innovated curriculum reform, but across two institutions............crazy. So if you are not able to retrieve what I had submitted before I will reconstruct or maybe I am misinterpreting this question.

require that the disciplinary departments work with Colleges of Education and vice versa, a partnership that would not have happened to the same extent without this initiative. This type of partnership is also critical to most of the NSF grant programs in science and math education.

our legislators in our work (make sure they know us). Have to tell you that we know that the community knows us when we have a truck representing STRIS and our Colonia's Supplement grant and the Migrant Program appear in a football booster parade. We have the pictures. We said, only in South Texas would you see this...........really only in rural communities would you see this. We also have many newspaper articles re our work that have appeared in rural papers.......so yes the broader community knows we are there.
### Alternative Approaches to Evaluating STEM Education Partnerships

<table>
<thead>
<tr>
<th>D252005</th>
<th>The federal policy environment includes NCLB and the requirement that there has to be a qualified teacher in every classroom in the next few years. State policy interprets this poorly by defining a qualified teacher as one who has passed PRAXIS II in the subject matter they are teaching. Local University System policies include a minimum 80 percent pass rate for all pre-service teachers in teacher education programs. There is only a weak influence on the partnership since we intend to produce highly qualified teachers who surpass these minimal requirements. New policy initiatives of the University System include a requirement that teacher candidates demonstrate their effectiveness in having all their pupils achieve high learning.</th>
<th>I'm only familiar with NSF and DOE programs that encouraged partnerships either between A&amp;S and Education faculty or among A&amp;S, Education, and K-12.</th>
<th>I'm not aware of state programs with the exception of ones from the University System of Georgia. Starting in 1996, USG provided competitive grants for partnerships of various types including local P-16 councils, teacher preparation partner schools, and induction. There was no linkage with federal programs but there was a linkage with some private support - for example, with the Council for Basic Education/AACTE.</th>
<th>It is too early to tell. However, one component of the partnership deals with increasing public expectations and knowledge of the importance of science and mathematics and the necessity that all children should learn science and mathematics in order to function more fully as citizens.</th>
</tr>
</thead>
<tbody>
<tr>
<td>D282005</td>
<td>I know nothing about this.</td>
<td>I know nothing about this.</td>
<td>I know nothing about this.</td>
<td>None yet</td>
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<tr>
<td>D332005</td>
<td>Naturally, our partnership operates in the context of NCLB mandates and associated state assessment practices to meet them at the K12 level. In higher education, we are challenged to prepare teachers to meet those mandates once hired and are also governed by a host of policies from the state and national accrediting bodies. Though there is no doubt we have to attend to these mandates, and in the schools in particular, the pressure is enormous, we do not see these mandates or policies as drivers for the partnership. We have to make sure anything we do will help - and certainly not hinder - schools meet these</td>
<td>In my experience, agencies such as NSF, NIH, NASA, Dept of Ed, and other large federal agencies have all, at times supported grants or other efforts to broker partnership at some level. Some - like NSF - have funded large scale systemic efforts. Others have funded smaller efforts to partner</td>
<td>Historically, the primary source of state partnership funds in our region were Eisenhower dollars. Here again, the extent to which those were real partnerships was highly variable. A higher education institution was often required as a partner - but whether they served as a real partner, or only</td>
<td>We really haven't gone there yet - we know we will need to engage these broader groups, but haven't yet extended ourselves to them. As clear needs emerge where roles for business and parents are clear, we'll seize the opportunity. We do have a policy board that we are scheduled to meet with (in January?) to begin a dialogue about mutual policy interests and how the partnership might generate data to help inform those policy</td>
</tr>
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</table>
Alternative Approaches to Evaluating STEM Education Partnerships

<p>| requirements, but we are driven much more by the research base on how people learn. If these practices are truly put into place at all levels, then meeting these mandates will undoubtedly happen. So, the policies issues are real and in some case have been useful to bring science education to the forefront, but they are not drivers of the work. | scientists and teachers through lab experiences for example. All kinds of terms of have been used - partnership, collaborations, consortia, collaboratives, cooperatives, alliances, networks, etc. Many did not necessarily really reflect a partnership where both parties were learners with something to gain, but were rather groupings to put experts in contact with those who had something to learn from them (ie. scientists and teachers). The recognition that scientists have something to learn and in fact, do not have all the answers - is only reflected in more recent STEM partnership efforts and it frankly, still sometimes perceived as an expert model. Few partnerships really operate in the spirit of mutual benefit, and co-learning. | a signator to comply with funding requirements was debatable. In some cases, these funds did indeed broker lasting partnerships. In our state, Eisenhower funds were instrumental in moving forward what has now become our statewide science reform efforts. A consortium of small and rural schools in SW Washington (along the Columbia Gorge) used Eisenhower funds to pool PD resource and implement curriculum collaboratively. These early venues resulted in their successful application for an NSF Local Systemic Change grant. This alliance now serves as a model site for our state. We have 6 other alliances that have formed via private, state, and federal funds to try and replicate elements of the model initially implemented in SW Washington. So, these things really can work to build a larger network and foster coherence across a state. We aren't there yet, but we continue to make progress. | areas. |</p>
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<tr>
<th>ID</th>
<th>Description</th>
<th>Response</th>
<th>Notes</th>
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<tbody>
<tr>
<td>D352005</td>
<td>Federal State and local policies affect the program. School districts must follow state and federal policies. The project is addressing state and federal policies that affect its meeting benchmarks established which include increased teacher productions, students taking higher-level mathematics and science courses and issues relative to curriculum alignment.</td>
<td>No Comment</td>
<td>Two IHE partners received MSP federal funds from the US Department of Education that were part of a bloc grant to Tennessee and to Kentucky. The fact that they were AMSP partners and complemented the AMSP goals in the region had a positive effect. Also, there was some overlap of school districts with AMSP.</td>
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<tr>
<td>D362005</td>
<td>School districts are under immediate concerns and threats due to the requirements of No Child Left Behind, specifically the Adequate Yearly Progress and Highly Qualified Teacher requirements. These concerns are not as immediate for other partners (higher ed, research). The main influence of these policies is the need for the higher ed and research partners to understand and respect what pressures the districts are under, being realistic about what is and isn’t possible in this environment, and to work with the districts to find ways that doing the work of the partnership aids the districts not only in terms of trying to address these requirements substantively, but also in terms of responding to the data/documentation requirements of the policies.</td>
<td>The only ones I can think of are the NSF Centers for Learning and Teaching, systemic initiatives, and the GK-12 program, although I am sure there are others.</td>
<td>Not my realm, so I don't know of any.</td>
</tr>
<tr>
<td>D372005</td>
<td>Obviously we are affected by the NCLB legislation as it affects the schools we work with. We know the schools are being evaluated by that legislation as well as state mandates and must work within that framework. I am personally less concerned about the national requirements as we are a grant sponsored by the National Science Foundation. I have not worked with other programs at the federal level.</td>
<td>We are a grant sponsored by the National Science Foundation. I have not worked with other programs at the federal level.</td>
<td>California Math Professional Development Institutes were funded by a state program as are California Math Professional Development Institutes.</td>
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knowledgeable about the policy ramifications than the PI's of the project.

<table>
<thead>
<tr>
<th>Knowledgeable about the policy ramifications than the PI's of the project.</th>
<th>Level.</th>
<th>Math and Science projects, Writing and Literacy projects. The Math Diagnostic Testing Project is also funded by a state program. I don’t know if they used a term other than partnership.</th>
<th>Knowledgeable about the policy ramifications than the PI's of the project.</th>
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<tr>
<td>These are of uncertain times and national educational policy has been found wanting by many of us in the west. The unfunded mandate part has stained the resources of our public schools while there has been some modifications to the provisions, the policies have been unrealistic in many cases and impossible in others in rural America and especially in Montana other parts of Indian country. We have no quarrel with some increase of accountability but it appears that for the foreseeable future I believe a larger portion than necessary will be required for evaluation, etc. which will leave less dollars for needed program activities. Many of our partners as well as ourselves are also concerned that policies coming from on high will further shrink available dollars for all needed domestic programs including education. We are hunkered down but still believe the glass is half full and will continue with proactive positive approach to assist all who we can, while we can.</td>
<td>NSF, NASA, DOE-Ed, Dept of Energy, NSA, CIA, NIH. Sometimes they were consortia, cooperative agreements, but they were partnerships where we assisted a federal agency by performing a service that was beneficial to all parties and achieved mutual goals.</td>
<td>We have been involved with two Montana Office of Public Instruction awards. In both cases we formed partnerships with our public school systems and we were successfully awarded based on those partnerships. SKC also has a partnership with Montana State University to achieve NASA space science goals important to the three entities.</td>
<td>The community is interested to see if the partnership will succeed with the lofty goals it has set for itself. Also, some parents are concerned that the approach of the partnership is not focusing enough on skills and drill.</td>
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<tr>
<td>Our university center for math and science education has needed to focus much more heavily on math and much less on science over the past few years because of NCLB. The state test for science is still a ways away, and even when science gets tested, it won't count in the same way that math does. State standards influence our work to some degree, but not hugely (and our university center and teachers from our partner</td>
<td>From NSF: Rural Systemic Initiatives (partnerships between tribal colleges, schools and districts, other universities, and other entities) Local Systemic Change Projects Math and Science Partnerships State</td>
<td>We're involved in a multi-university partnership that manages and implements a Mobile Science Lab and serves highly remote K-12 school districts throughout our state. This is funded by our</td>
<td>The community is interested to see if the partnership will succeed with the lofty goals it has set for itself. Also, some parents are concerned that the approach of the partnership is not focusing enough on skills and drill.</td>
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<tr>
<td>Districts have been adequately represented in recent revisions of state standards). State testing is a big deal, and the test isn't so great (in our opinion), but it rarely gets in the way of our work. We typically say that we want students to perform well on the state test but that we also want them to do well on alternative assessments.</td>
<td>and Urban Systemics EPSCoR Dept of Ed: The current Title II programs, especially Parts A, B, and D The old Eisenhower program (both higher ed and K-12), which I think was Title II as well.</td>
<td>State's Dept of Tourism and State Development (but it's not really a program per se -- i.e., the receipt of funding didn't involve responding to an rfp). Our state as Intermediate Educational Service Agencies that serve to link school districts with one another and with other resources like university outreach programs.</td>
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<tr>
<td>D452005 NA</td>
<td>For the last thirty years most federal grant programs encouraged or required partnerships i.e. ESSA, NSF, NIE, IHE, Magnet Schools (MSAP), Community Use of Schools, They also called them alliances and collaborations.</td>
<td>Reading First, Even Start, Headstart, Eisenhower Funds, were examples of federal programs requiring partnerships that also flowed to local agencies via state programs.</td>
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<tr>
<td>D482005 At this time, college outreach-like programs in the state of California are under increased scrutiny to demonstrate outcomes. This is particularly true for all programs of this nature at the Federal level as well. As a result, we have increased our efforts toward developing an equitable outcomes assessment plan that will address the range and scope of our program in multiple sites.</td>
<td>Since I do not work at the policy level in our office, I can not answer # 6 and#7. I can provide you this information via e-mail after doing a bit of research, however.</td>
<td>We have established strong ties with business and industry and they are committed to the work we do with students. Our program is very visible to state policymakers at the state and federal level.</td>
<td></td>
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<tr>
<td>D492005 NCLB, NCLB, NCLB!!!!!!! At the state level, we are currently in a cycle where politics rather than policy is shaping state education funding and legislation. This change is state level approach to</td>
<td>IN our case, all our partnerships were supported by either the NSF or the Department of</td>
<td>None of our state programs use the term partnership but almost all of them require that</td>
<td></td>
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<tr>
<td></td>
<td>None of our state programs use the term partnership but almost all of them require that</td>
<td>Our partnership has increased our influence with the legislature and has very likely shaped at least a few important education bills.</td>
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<tr>
<td>D522005</td>
<td>The federal emphasis on literacy and math to the exclusion of science can cause some districts to opt out of participation in science PD. Also, the lack of understanding at both the state and federal levels of the need for an integrated curricular approach in K-6 can be a detriment to effective PD.</td>
<td>The NSF, through the Collaboratives for Excellence in Teacher Preparation and the US Department of Education, through the Star Schools program have sponsored our partnership. In</td>
<td>The principal source of sustained funding has been through legislative appropriations to the Oklahoma Commission for Teacher Preparation (OCTP). This Commission administers contracts for PD in science, math, mentoring, and literacy. There are no linkages between this funding and the feds. We have also received significant private funding because there is a K-21 partnership.</td>
</tr>
<tr>
<td>D532005</td>
<td>The greatest influence that the federal policies have are those concern inf issues of evaluation and accountability that conflict or disrupt the operational activities or the member of the partnership. Federal calendars for reporting can conflict with school and universities calendars and make various evaluations required by federal agencies incomplete and preliminary.</td>
<td>National Science Foundation sponsors the Texas Middle and Secondary Math Project. The terms used by NSF in introducing what they call the Culture of Evidence are well known in various statistical disciplines. It is highly qualitative approach to evaluation but these terms can be</td>
<td>The Texas Coordinating Board of Higher Education through the Eisenhower Grants Program. Other terms were used in their evaluation projects.</td>
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### Alternative Approaches to Evaluating STEM Education Partnerships

<table>
<thead>
<tr>
<th>D582005</th>
<th>Some of the NSF programs (&amp; other federal programs) specifically require some sort of partnership, or collaboration (public schools &amp; higher education, math/science/technology groupings, etc.)</th>
<th>Dept of Educ, innovative technology grants--seems like they used integrated curriculum Math/Sci partnerships from NSF, specifically mention partnerships A few address partnerships, many express networking, collaboration, etc. GIFT program at CEISMC which encouraged integration of science/math/technology</th>
<th>Dept of Educ, innovative technology grants--seems like they used integrated curriculum Math/Sci partnerships from NSF, specifically mention partnerships A few address partnerships, many express networking, collaboration, etc. GIFT program at CEISMC which encouraged integration of science/math/technology</th>
<th>There have been other business &amp; industrial leaders who have heard about these partnerships and want to become involved. Some of our partners have been beyond the local community, so these more distant relationships begin to effect a broader based political body, and at least provide some visibility for math &amp; science</th>
</tr>
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<tr>
<td>D592005</td>
<td>Federal policy influences partnerships in our region. Firstly, the mandate to have partnerships with districts changes the design of professional development that was previously focused on individual teachers. The state and federal standards as well as the state testing program has also influenced the topics offered through professional development programs. Informal science institutions, previously entrenched in the philosophy of free choice are now developing standards-based professional development on demand by school districts. The state testing program has resulted in our evaluators attempting to link the items on the state test to the professional development learning objectives and assessments, because, for some districts, these are the only data that are important. When the first round of MSP RFPs were issued, school districts</td>
<td>Howard Hughes Medical Institution National Institution of Health-Science Education Partnerships National Science Foundation Urban Systemic Initiative National Science Foundation Local Systemic Change National Science Foundation Centers for Learning and Teaching National Science Foundation Math Science Partnership</td>
<td>Eisenhower Professional Development Program-Explicitly listed partnership variables as part of the scoring rubric for proposals.</td>
<td>Businesses/corporate foundations contact the partnership to identify areas of potential funding. They are much more interested in funding partnership activity than individual institutional activity.</td>
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</tbody>
</table>
could only sign on with one proposal. This negatively impacted relationships in the region. School districts were put in the position of having to choose a higher ed institution over another, when previously they had worked with all. This policy decision was divisive and damaging to partnerships.

| D612005 | In the case of the longer, more successful partnership, the federal policy environment has changed to the extent that we are fairly convinced that our various projects may not have been funded under current policy guidelines. These projects involved creative activities where evidence to substantiate development expenditures was minimal. In the case of a newer partnership, our emphasis on project accountability was likely the reason we were funded. In this project, expenditures are solely on providing evaluation and accountability services and there are no creative development components. In both cases, policy dramatically influences partnership activities. New policy initiatives that require a higher level of accountability at both proposal development, and project implementation phases come at a cost to creative development efforts. | State Systemic Initiatives Rural Systemic Initiatives Urban Systemic Initiatives Local Systemic Change (?) Centers for Learning and Teaching Math Science Partnership I think the term collaborative has been used to describe the partnership idea. Eisenhower Math and Science Act Math Science Partnership The Eisenhower program encouraged partnerships between universities and public school systems in providing professional development. Sometimes it was a requirement of funding, sometimes it wasn't. | I think our model of technical assistance (which was based on a previous model from the 1980's) is appropriate for transfer into a broader community. There is no doubt that NSF projects, in general, suffer from historical neglect of evaluation. Projects, need evaluation technical assistance. |

| D642005 | State policy was directly affected by our partnership as was the intent of the National science Foundation. Now school standards are the backbone of the No Child Left Behind federal initiative. At the state level, state law had changed as a result of the emerging standards movement, but our partnership helped facilitate the transition in the STEM disciplines. The primary federal programs were offered by the National Science Foundation and the Department of Education. The Department of Energy and NASA also involved partnerships in their funded activities. The Systemic Reform arm of the NSF was the primary mover and shaker along with Eisenhower | The state Department of Education offered the Eisenhower grants to K-12 and some technology grants to partnerships. The Colorado Commission on Higher Education administered the Eisenhower grants to higher education. The federal sources of all these grants I believe was the US Department | The systemic initiative resulted in changes in education law in the state and also affected the higher ed community. The Governor was directly involved with the effort so it had impact on his cabinet and other politicians in the state. Business people testified at hearings about the need for school standards so it also impacted them somewhat. |
Alternative Approaches to Evaluating STEM Education Partnerships

| D662005 | Federal Policies | No Child Left Behind States and school districts are responding to the requirements of The No Child Left Behind Act of 2001 that requires adequate yearly progress, a level of improvement school districts and schools must achieve to ensure all students are proficient in reading and mathematics by 2013-2014. The NCLB Act, which reauthorizes the ESEA. In technical terms, adequate yearly progress (AYP) refers to the growth rate in the percentage of students who achieve the state's definition of academic proficiency. Each state sets the AYP gains every school must meet to reach 100 percent proficiency at the end of 12 years. The No Child Left Behind Act (NCLB) requires that every child be tested. By testing all children, parents and teachers know the academic achievement of every child, every group of students and all students. This enables parents and teachers to work together to ensure that no child will be left behind and to ensure not only school-wide and individual progress, but subgroup progress as well. Test scores are broken out into the following subgroups: economic background, race and ethnicity, English proficiency and disability. The new law includes increased accountability for States, school districts, and schools; greater choice for parents and students, particularly those attending low-performing schools; more flexibility for States and local educational agencies (LEAs) in the use of Federal education dollars; and a stronger emphasis on reading, especially for young children. Under the NCLB are Title I Improving Academic Achievement for the Disadvantaged and Title II Improving Teacher Quality programs. The Title II |
| US DOE Eisenhower Professional Development - partner Flow through funds from USDOE to State Department of Education MSP Partnerships Flow through funds from USDOE to State department of Education Teacher Quality partnerships Flow through funds from USDOE to higher education NSF Systemic Initiatives State Systemic initiatives - partnerships Local Systemic initiatives - partnerships Rural Systemic initiatives - partnerships Urban Systemic Initiatives - partnerships |
| US DOE Eisenhower Professional Development (formerly Eisenhower) - partner Flow through funds from USDOE to State Department of Education MSP Partnerships Flow through funds from USDOE to State department of Education Teacher Quality partnerships Flow through funds from USDOE to higher education NSF Systemic Initiatives State Systemic initiatives - partnerships Local Systemic initiatives - partnerships Rural Systemic initiatives - partnerships Urban Systemic Initiatives - partnerships |
| The Georgia Department of Education and the Board of Regents share a staff member. The Georgia Department of Education and the Board of Regents are preparing to jointly brief university faculty on the new Georgia performance Standards. |
programs are where partnership programs are defined and funded. The outline below indicates policy and program focus for K-12 partnership activities. Title II- Improving Teacher Quality Part A Teacher and Principal Training and Recruiting Part B Math and Science Partnerships Part C Innovation for Teacher Quality Transition to Teaching, National Writing Project, Civic Education, Teaching Traditional American History, Teacher Liability Protection Part D Enhanced Education through Technology Descriptions State Level Georgia's Teacher Quality Higher Education Program is a federally funded program under the Board of Regents of the University System of Georgia. It is funded through the United States Department of Education. This is part of the No Child Left Behind Act. The Title II, Part A, of Public Law 107-110. Funds are used to enhance science, mathematics, reading, language arts, and social studies teaching at the elementary, middle, or high school level in public and private schools. This is the replacement program for the Georgia Eisenhower Professional Development Higher Education Program. The purpose of each proposal is to conduct professional development of teachers in academic subjects so that teachers have necessary subject matter knowledge in the subjects they teach or in technology related matters to enhance learning and instruction. This includes professional development in implementing Georgias academic content standards, and using student achievement standards and state assessments to improve instructional practices. Regular faculty at all public and private Colleges and Universities

| D772005 | The global climate of K-12 organizations is the reality of an externally controlled and regulated environment. This creates a compliance mentality rather than a true professional and local control | No Child Left Behind IDEA NSF Partnerships and individual K-20 organizations such as | Alabama State Assessment and Accountability Programs have been in | The parents and business and industrial communities are receiving the systemic reform in a favorable manner. |
Alternative Approaches to Evaluating STEM Education Partnerships

| Structure. The state government and local government structure create a cover my tail mentality rather than a participative think tank mentality. The major work change is documentation and paperwork. This restricts the art of teaching and attempts to make teaching an exact science. | Schools and universities were commonly used terms. | Effect for the last fifteen years. These movements have been increasing since 1995. The major terms are the State Department of Education and the Local Education Agency. The State Department acts as monitoring and regulatory arm of the federal government. | The current federal policy environment is heavily influenced by the No Child Left Behind act, which among other provisions places a high emphasis on testing outcomes, and includes punitive measures for schools which fall short. The partnership environment is, in my view, becoming increasingly difficult and bureaucratized, as a result of policies on at all three levels of government, with sensible human judgments of quality education being replaced by more automatic organizational procedures. Most of the federal programs that have supported partnerships in which I have been involved have been through the National Science Foundation. Sources of support have included Teacher Enhancement funds, Systemic Initiative funds, and Math Science Partnership funds. Partnerships have also been supported with Eisenhower funds provided by the federal government but administered and awarded by the state. I don't recall terms other than partnership being used to describe organizational interactions. Partnerships in NJ have been supported by the Department of Higher Education, which was succeeded by the Commission for Higher Education, by the Department of Education, and directly by the state with a targeted grant for our Statewide Systemic Initiative. The latter began as a match for the federal SSI funding, and has continued for two years (thus far) beyond the federal grant period. Earlier, the award of Eisenhower funds was influenced by the SSI process. This became very political, with a kind of clash among the NSF, the NJ DHE, and the NJ DOE that bore no relation to the quality of. | It has helped to bring curriculum standards into the public consciousness. It has made it a desirable thing for businesses to play a role in educational reform in mathematics, science, and technology. |

| D782005 |
**Alternative Approaches to Evaluating STEM Education Partnerships**

| D792005 | The federal policy environment, with its changing definitions of partnerships, seems to actually be moving from a focus on intensive collaborative work between universities and districts to a more traditional model in which the university provides some services to the district but does not become enmeshed in the activities of the district. The more traditional, course-focused view of professional development is changing our activities from a modular focus on pd to one that is composed of longer units. It remains to be seen whether this will enable us to meet the needs of the districts. The evaluation models promulgated at the federal level have also caused us to change our activities, to focus more on pre and post tests (in spite of the negative attitudes that may be engendered) and on classroom observations. The funds we must now spend on evaluation are ones that we do not have available for the activities themselves; so we are reaching fewer teachers. Our state policy has affected our partnerships primarily through the new MSP funding and the state RFP, which has focused entirely on middle school. Thus, we are presently focusing more of our activities on middle school. Local policies really do not affect us greatly, since we work with so many different small districts. |
| D812005 | The major federal policy impacting our partnership is No Child Left Behind (NCLB). Through its implementation by our state government, NCLB has manifested in 3 positive ways of importance to our partnership: (1) its influence has acted to coerce partner districts into paying attention to their student achievement data in new ways, Title II, Eisenhower grants for math and science professional development encouraged the development of consortia, rather than partnerships. Title I | Systemic Initiatives (SSI, LSI, USI/USP) MSP (at NSF) | Eisenhower Higher Education Professional Development Programs state required partnerships with districts that were very effective in our experience State MSP | We really have not had much effect at all here. | Most of the federal programs that I describe above, except for the NSF ones, are administered by the state. Several technology partnership programs | We have not sought press coverage to alert the community to the work of the partnership. However, in a recent article identifying educators who have had the greatest impact on education in the region, the PI was noted, in great part because of |
Alternative Approaches to Evaluating STEM Education Partnerships

including the mandate to disaggregate data by sub-
groups. (2) it has forced districts to consider
whether their teachers have the content
background to effectively teach students; (3) it has
required districts to plan how to change their status quo.
Our partnership is working to help districts understand that plans are meant to be implemented and refined, rather than filed away. With NCLB as the coercive source of those manifestations, our partnership is able to be the cooperative partner who helps them meet the mandate. We have adopted the state's planning framework recommended as a School Improvement tool as the action planning tool for our partnership, replacing our own. As much as possible, we have adopted
the language of the state about school improvement action planning as well with the goal of helping partner districts see the partnership as helping them accomplish their mandated work-- rather than as a thing apart or add-on. The negative aspects of the environment created by NCLB are (1) the mounting expectations of the moving targets for AYP create an unrealistic demand by districts for quick fixes. Districts focus on super-tutoring budgets for a few students on the cusp, rather than on beginning the hard job of making the systemic changes, like building teacher's pedagogical content knowledge. Teachers say they would like to spend time developing deep conceptual understanding in kids, but they need to be drilling for the state exam. Our partnership is increasingly focused on helping schools get the message of All Students Reaching the Top, that the best way to build transferability of knowledge that can manifest itself on a state exam is to build the deep conceptual understanding. (2) In our state, the focus on special education students most often not making AYP has the State Dept. of Education trying to encourage quick fixes for special ed teachers who have no BACKGROUND

grants encourage the development of partnerships with parents. The tend to talk about involvement rather than partnership. The Regional Eisenhower Consortia grants encouraged the development of partnerships along multi-state lines. They used the terms, Consortia and Collaborative. The TIMSS Benchmarking in 1999, out of the US Dept. of Ed, encouraged the participation of regional collaboratives or consortia as opposed to partnerships. Most NSF RFPs encourage partnerships or consortia. The NSF Teacher Enhancement grants invited participation by partnerships. A number of federal technology programs invited the development of partnerships or consortia by applicants. The Math Science Partnership program by NSF, and separately by the US DOE, administered through the states, both encouraged the development of partnerships.

have been offered by the state, occasionally with their own funds. There are two prominent ones. (1) The Eisenhower IHE Professional Development grants are awarded from the state to IHE institutions to provide experiences for K-12 teachers, which they referred to most often as partnerships or collaborations. (2) Math Science Partnerships sponsoring professional development partnerships between high needs districts and IHEs. There seemed to be NO linkage between the state IHE Eisenhower professional development program and the local Title II Eisenhower Consortia or with the Regional Eisenhower Consortia. The US DOE sponsors of the state MSPs have attended NSF MSP meetings, but the state sponsors have hardly acknowledged the existence of the NSF MSPs in their own state.- -- and have very different reporting requirements.

the partnership
Alternative Approaches to Evaluating STEM Education Partnerships

<table>
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<tr>
<th>IN MATH. An added factor to that is the establishment of the Institute for Educational Studies (IES) and the narrow definition of scientific-based research is also impacting the environment. With an emphasis that only control group experiments produce reliable results, special ed consultants have suggested that studies out of the early 70s define direct instruction as the only proven methodology for students in mathematics. This environment is requiring our partnership to spend time with special education administrators and our district special education teachers to make sense out of that noise.</th>
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<tr>
<td>Right now I don't see much influence by federal policy. I believe that we are more encouraged to do this on our own because it is more cost effective, is better for our community and produces results that none of could have achieved without the others. There is one key state policy that provides incentives: high school students enrolled in community college classes may be counted in attendance by both the public schools and community college. This removes an economic barrier from both systems and neutralizes a potential negative cost effect.</td>
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<td>The National Science Foundation through its Urban Systemic Initiative program encouraged and required partnering among school systems, universities and local governments. The USDE Technology Challenge Grant program also required partnerships between public and private school systems. I don't recall that a term other than partnership was used to describe the relationships expected.</td>
</tr>
<tr>
<td>We have many state programs that require participation or involvement of parents, community members or local businesses but none, in my experience have sponsored the development of partnerships. I have not seen any that establish a state-federal link either.</td>
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<td>The partnership is touted by our mayor and his economic development office as one of the reasons that new industry should move to our community. It is also used as an example of more efficient uses of resources by school districts and the community college district.</td>
</tr>
<tr>
<td>Right now I don't see much influence by federal policy. I believe that we are more encouraged to do this on our own because it is more cost effective, is better for our community and produces results that none of could have achieved without the others. There is one key state policy that provides incentives: high school students enrolled in community college classes may be counted in attendance by both the public schools and community college. This removes an economic barrier from both systems and neutralizes a potential negative cost effect.</td>
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<tr>
<td>Our project is impacted both positively and negatively by the federal NCLB mandate. On the positive side, the requirement to disaggregate achievement results by subgroups has added emergency to our project goal of decreasing the achievement gaps. On the negative side, the increased focus on achievement scores on standardized tests has made it more difficult to implement reform pedagogy, which focuses more</td>
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<tr>
<td>The federal programs that I am aware of that have sponsored the development of educational partnerships besides the MSPs are: Technology Challenge Grants-required collaboration of public</td>
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<tr>
<td>I am not aware of many state level partnerships. We do have three Centers for Excellence located at state universities, which work in partnership with our Department of Education to provide services to</td>
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<tr>
<td>Our partnership does not have any business or community partners. Our outreach to the community has been focused on parents. The goal of our interactions has been to increase awareness of the importance of mathematics success to future success. We are also working with parents to build</td>
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</table>
on mathematical understanding and less on procedural fluency. The standardized tests in our area are heavily procedural. There are two state policies that are beginning to impact our work. One state policy has been on the books for some time is now being enforced for the first time at some of the state universities. This policy requires students to have three years of upper level mathematics to be admitted to state universities. Last year for the first time some students graduating from the school district in our project very not admitted to the university of their choice because they did not have enough higher level mathematics. The state has just passed a new law that will change the graduations requirement from schools in our state. Beginning in 2007, all students will be required to take three years of higher level mathematics to graduate from high school. Parents will be able to request a waiver from this requirement for a child. Both of these policies will impact our work to increase the number of students taking higher level mathematics.

<p>| D952005 | The policy environment constantly changes and that may be the lesson. NCBL was not in place with one partnership and so how do you adapt and help districts stay true to the goals. NCLB is huge and influences so much. At the state level we have a local assessment initiative that has overwhelmed districts causing them to spend huge amounts of time on it to the determent of instruction and understanding of standards-based instructional materials. |
| National Science Foundation Statewide Systemic Initiatives Local Systemic Initiatives Urban Systemic Initiatives Rural Systemic Initiatives Teacher Professional |
| State DOE Eisenhower Title II Funds Mathematics and Science Partnerships These funds come from the U.S. DOE so the link is direct. | From a policy or broader community impact, the partnership has influence policy at the Maine DOE. They have been using this partnership as an example and taking about reform and what it takes. They also have used the ideas in this model for another |</p>
<table>
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<tr>
<th>Model</th>
<th>Description</th>
<th>Funding Sources</th>
<th>Note</th>
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<tbody>
<tr>
<td>D972005</td>
<td>Obviously NCLB has a significant effect on the kinds of things that school districts are interested in. Surprisingly (and thankfully), our partner school districts are still interested in working in the area of science, even though that isn't a real key demand of the current environment. Another federal issue that is currently affecting us, however, is the infighting between NSF (which is our funding agency) and Dept. of Ed. This has made life a little difficult for us.</td>
<td>NSF’s Math Science Partnership NSF’s SSI programs (local, urban, and stateside)</td>
<td>Can't think of any for NJ. Very little. Unfortunately, while we originally had a goal of working on community involvement within the partnership, we had to drop this due to lack of time and resources.</td>
</tr>
<tr>
<td>D982005</td>
<td>Federal policy affects us in the reporting requirements, various requirements for structure and in evaluation. We are concerned with keeping our federal funders happy. State policy affects us in the sense that our schools are concerned with performing well on the state science tests. We also are working with the state definitions (per federal requirements) of what a highly qualified teacher is. We also, partly in response to testing, focus on the state learning standards. We hope to inform state policy through our research and evaluation. Local policies affect us in terms of things such as contractual issues with teachers (e.g., substitute requests), mentoring of teachers, other commitments for professional development that compete for time.</td>
<td>NSF’s MSP is the only federal program involved. I don't know the answer to the second part of the question</td>
<td>1. Pacific Science Center -- LASER 2. Office of Superintendent of Public Instruction Laser receives federal funding. Part of different OSPI programs are funded thru federal dollars. None.</td>
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Alternative Approaches to Evaluating STEM Education Partnerships

**Text extracts**

**Environment round 1 summary table all text extracts**

| “None” and “no opinion” | “No” (d192005, d282005, d442005)  
| | “No opinion” (d642005)  
| Provide information for policy making / influence policy-making | "Policy and legislation development in support of the vision, and earmarked appropriations" (d112005)  
| | “policy formulation and adoption” (d492005)  
| | “Influencing state education policy” (d782005)  
| | “Technical assistance to SEAs and LEAs,” (d912005)  
| | “Influence education policy at state level” (d982005)  
| Teacher recruitment and retention | Teacher recruitment (d662005)  
| | Teacher recruitment STEM Faculty professional development (d972005)  
| | recruitment of more diverse teaching force (d982005)  
| | Recruiting new teachers of mathematics and science. Increasing minority participation and achievement levels (d782005)  
| | retention of new teachers (d792005)  
| Education reform | State-wide education reform at secondary and IHE institutions. (D452005)  
| | Curriculum selection and implementation. (d362005)  
| Improve support of stakeholders (for education, and math and science education) | "Engaging parents. Engaging principals, superintendents, counselors” (d232005)  
| | “Community support of education” (d362005)  
| | Building Community (d832005)  
| | We have achieved many intangible goals for which there has been no evaluation instruments to measure our success in these areas, i.e. our success in building win win relationships with all our stakeholders in seven different school systems that are predominately runned by school boards whose members are non-Indian.” (d412005)  
| | to show that mathematics education may be a necessary activity for increasing future opportunities and the quality of these opportunities. (d532005)  
| Improve relationship of business and industry with legislature | “Cultivation of business and industry and direct interaction with the legislative branch of state government” (d522005)  
| | Partnerships can also promote an articulation between institutions to accomplish things not possible alone--for example education and industry coming together to influence government. (d582005)  
| Improve education outcomes for student (equity, achievement, dropout rates, access to college, develop academic environment that supports learning) | "Links to business and industry, formulating career pathways in math and science, increasing college access opportunities, targeting educationally disadvantaged students, providing students with hands-on activities as an alternative learning strategy, engaging students in healthy competition, developing an academic environment that supports learning" (d482005)  
| | “Student dropout/retention rates. Student achievement gap. Student equity issues” (d932005) |
(q4) "I think that we decide to enter partnerships that ultimately benefit our students and those that teach them. If we find willingness in our potential partners to work in collaboration with us to achieve our goals, then we pursue those partnerships." (D192005)

| Contribute to knowledge in STEM education | Increase the capacity for STEM projects to conduct research and evaluation. (d612005)  
Research on innovative educational practices. (d912005) |
|------------------------------------------|--------------------------------------------------------------------------------------------------|
| Technical support for organizations involved (universities, school districts, local and state education agencies) | "Leadership development (principals, central office staff, university faculty, and teachers) - strategic planning for districts – (d792005)  
Some additional examples include: Instruction Practices of Discipline Based Higher Education Faculty Content Usage of Education Higher Education Faculty Support for reform and Content Understanding of K-12 Administrators Content and Adult Learning of Teacher Leaders Increases in Content Expertise of Professional Developers Understanding by Department of Education (d952005) |
Environment round 3

Env external

(q10) Accountability: The accountability required by the No Child Left Behind Act has resulted in monitoring both student and teacher performance in the high schools. The monitoring has revealed that mathematics scores lag behind improvements in reading scores. The accountability will be ongoing and will need specific strategies. In addition state government, business community and the media are focused on high school achievement. Prior Collaboration: The group has twenty-year, positive working relationship between faculty and administrators at County Community College (CCC), State Teacher College (STC) and the area high schools. Background information does not discuss the relationships of the groups with teachers and principals. Demographics of the targeted audience: Poor, hyper-mobile, minority population with some 2400 high school students (80% of the total enrollment) qualifying for free lunches. Funding: $10 million in grant monies to addressing the poor math scores in low-income high schools and Title I. Leadership: A leadership council s issue represented by a senior administrator from each of the network including the CCC, the three school districts in which the high schools are located, the feeder high schools, and the state as well as representatives from the local business community. Curriculum: Standardized math curriculum that will be applied across all 5 high schools in the district. Description does not discuss a standards-based curriculum. Professional development: extensive professional development in the standardized curriculum for all math teachers in the district. STC and the professional development programs of the CCC will interact with the day-to-day classroom activities in the high schools. Description does not go into detail. Teachers have indirect input.

(d662005)


(d772005)

(q10) Longstanding organizational relationships. Clearly defined, targeted, and agreed upon goals. Understanding of the local needs. Sounds like the partners have worked together already on defining needs and the goals and approach of this proposal much better than one group starting and then trying to involve others. State and districts funding already committed Leadership council already in place. Common curriculum strategy appears to fit district needs. Overall, project sounds manageable and focused.

(d912005)

(q10) Several aspects were identified that should have a positive influence on the partnerships ability to engage in the proposed activities. These aspects include: The history of successful work between the partners. The resources that are already committed to the work. The interest of the community in the work. The identified need that all partners support.

(d932005)

(q3) The state mandate will get districts interested but not teachers or faculty. The teachers must be on board in terms of wanting a new curriculum developed by amateurs. The faculty, given the context, will be seen as coming in to rescue the high school teachers. This would create an antagonistic context from the beginning. The only needs assessment appears to have been hey, we are #48 let's throw everything we do out and create a new curriculum. Who knows how to teach high school science? Apparently, research scientists are expert high school teachers. The values of research scientists are NOT the same as for high school teachers. That could be a big problem. I actually see nothing positive in the proposal in terms of potential success. I also wonder if the students entering this curricula are prepared for it none of the teachers for younger kids are involved.
Alternative Approaches to Evaluating STEM Education Partnerships: A Review of Evaluation Methods and Application of an Interorganizational Model

(NSF 02-061 Award #: 0231904)

A Cross-Case Analysis of STEM Educational Partnerships

March 31, 2008

Prepared by

Dara O’Neil
University System of Georgia

This paper reports on the findings from the National Science Foundation sponsored Research, Evaluation, and Technical Assistance (RETA) project (NSF 02-061 Award #: 0231904): Alternative Approaches to Evaluating STEM Education Partnerships: A Review of Evaluation Methods and Application of an Interorganizational Model. Gordon Kingsley, Principal Investigator, Dara O’Neil & Marion Usselman – Co-Principal Investigators.

Case study authors Gordon Kingsley, Dara O’Neil, Jeff Jones, Michael Waschak
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Alternative Approaches to Evaluating STEM Education Partnerships

**Introduction**

In this phase of our research, we use the findings from the literature review and Delphi study to develop an evaluation model of STEM partnerships. We then test this evaluation model using case study analysis of eight NSF-funded STEM projects drawn from the Systemic Initiative (SI) programs (including the Local Systemic Change program, Urban Systemic Change Initiative, and Rural Systemic Change Initiative), and the Math and Science Partnership Program (MSP). Each case study was developed using a common set of semi-structured instruments derived from the conceptual model to enhance the comparability of cases. Our primary objective in using this multi-case design was to establish the internal validity of the model. To do so, we sought to compare the robustness of the model in different settings and between partnerships that were significantly involved in achieving outcomes and those that were not. This approach allows us to ground theories in the partnership activities of eight STEM partnership projects, resulting in a model of partnerships that is internally valid and provides a foundation on which to pursue further evaluations of partnership relations in a variety of fields.

**Case Selection**

Eight cases were selected for the case study analysis of STEM partnership projects. We picked the Systemic Initiatives for drawing case studies because the Math and Science Partnership Program builds upon the SI program. The advantage of studying cases from the SIs is that we had a complete retrospective evaluation of the model, as the partnerships have already fully developed. The advantage of studying cases from the MSPs is that we were able to test for the predictive accuracy of the model, since the observations were made while the partnership was still in existence. Both programs emphasize the roles of universities in partnerships with K-12 school systems; however, only the MSP program explicitly requires the involvement of a higher education institution. We reviewed projects from the SI programs to determine which ones based their plan on a partnership. Because the MSP program requires an active higher education institution partner, we selected SI cases that also included a key higher education partner.

The selection criteria included awards that were over $500,000 and were geographically diverse, to ensure representativeness across the United States. We also chose several MSP cases with
Alternative Approaches to Evaluating STEM Education Partnerships

some continuity from previous Systemic Change and Systemic Initiative projects to explore how projects with organizations that have a history of working together may differ from projects with organizations with no previous relationship in partnership arrangements. When choosing Systemic Change and Systemic Initiative projects, we chose from the most recent projects first to ensure that individuals involved in the projects would be more likely to be available for interviews.

We solicited input from NSF Program Officers on case selection to ensure that some projects were not overburdened by being studied extensively from outside researchers. We started with a field of approximately 24 cases and narrowed it down to about 10 possible sites for NSF input. After our prospective cases were identified, the NSF sent a letter to the Principal Investigator (PI) of each case to ask for his or her participation. Several of the prospective case study sites had questions about the level of involvement required for their participation which were clarified by the Georgia Tech project team. Some prospective cases chose not to participate; however, eight cases agreed to take part in the case study research.

We selected one case from the Urban Systemic Initiative (USI) Program\(^1\), one from the Rural Systemic Initiative (RSI) Program\(^2\), and four from the Math and Science Partnership (MSP) Program\(^3\). Of the four MSPs, one was previously an RSI project, one was previously a Local

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\(^1\) The NSF’s Urban Systemic Initiative (USI) Program in science, mathematics, and technology education is a comprehensive and systemic effort designed to enable fundamental reform of K-12 science and mathematics education in large urban school systems. Eligibility for the program is limited to school systems in cities having the largest numbers of school-aged children (ages 5-17) living in poverty as determined by the 1990 Census.

\(^2\) The NSF’s Rural Systemic Initiative (RSI) Program addresses barriers to systemic and sustainable improvements in science, mathematics, and technology education in rural, economically disadvantaged regions of the nation. The RSI is designed to fund projects from coalitions in regions defined by similarities in social, cultural, and economic circumstances, rather than by governmental boundaries. The program supports activities that lead to the formation of partnerships and coalitions; determination of present needs and resources and of future educational goals; implementation of strategies directed toward systemic educational reform, (e.g., professional development for teachers and administrators that is aligned with national science and mathematics standards); adaptation of high quality, challenging curricula to address cultural diversity; and formulation of appropriate assessment strategies that measure achievement for all students regardless of socioeconomic status.

\(^3\) The NSF’s Math and Science Partnership (MSP) Program is a major research and development effort that supports innovative partnerships to improve K-12 student achievement in mathematics and science. MSP projects are expected to raise the achievement levels of all students and significantly reduce achievement gaps in the mathematics and science performance of diverse student populations. In order to improve the mathematics and science achievement of the Nation's students, MSP projects contribute to the knowledge base for mathematics and
Systemic Change (LSC) project, and two are new MSPs. We chose our cases in this manner so that we could examine how a partnership with a history of working together differs from a newly formed partnership. Two of the MSPs are Targeted MSPs with a narrower focus than the larger Comprehensive MSP program. Our selected cases were:

1. Alaska Rural Systemic Initiative
2. Appalachia Rural Systemic Initiative
3. Appalachia Math and Science Partnership
4. Duke TASC Targeted Math and Science Partnership
5. Jacksonville Urban Systemic Initiative
6. Rochester Local Systemic Change
7. Rochester Targeted Math and Science Partnership
8. Wisconsin SCALE Math and Science Partnership

science education and serve as models that have a sufficiently strong evidence base to be replicated in educational practice. The MSP program includes Comprehensive Awards and smaller Targeted awards which focus on studying and addressing issues within a specific grade range or at a critical juncture in education, and/or within a specific disciplinary focus in mathematics or the sciences.

4 The NSF’s Local Systemic Change (LSC) Program focuses on projects that engage entire school districts in the reform of science, mathematics, and technology education. Systemic change projects are characterized by: a shift in the focus from the professional development of the individual teacher to the professional development of all teachers within the whole school organization; a vision of what the K-12 science/mathematics/technology (SMT) program should be; and a plan for the implementation of exemplary, standards-based instructional materials. This should lead to the creation of professional communities, where teachers are empowered to bring about change and encouraged to reflect on their own teaching and learning.
Table I:  
Case Study Sites

<table>
<thead>
<tr>
<th>Grant</th>
<th>NSF Award Number(s)</th>
<th>Dates</th>
<th>Amount</th>
<th>Program</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alaska Rural Systemic Initiative</td>
<td>9554466 &amp; 0086194</td>
<td>1995-2006</td>
<td>$10,000,000 &amp; $7,199,438</td>
<td>Rural Systemic Initiative</td>
</tr>
<tr>
<td>Appalachia Rural Systemic Initiative</td>
<td>9554465 &amp; 0086188</td>
<td>1995-2008</td>
<td>$10,822,306 &amp; $6,707,398</td>
<td>Rural Systemic Initiative</td>
</tr>
<tr>
<td>Appalachia Math and Science Partnership</td>
<td>0227028</td>
<td>2002-2008</td>
<td>$24,267,713</td>
<td>Math and Science Partnership</td>
</tr>
<tr>
<td>Jacksonville Urban Systemic Initiative</td>
<td>9727647</td>
<td>1998-2006</td>
<td>$15,000,000</td>
<td>Urban Systemic Initiative</td>
</tr>
<tr>
<td>Rochester Local Systemic Change</td>
<td>9553579</td>
<td>1996-2002</td>
<td>$508,042</td>
<td>Local Systemic Change</td>
</tr>
<tr>
<td>Wisconsin SCALE Math and Science Partnership</td>
<td>0227016</td>
<td>2003-2008</td>
<td>$35,000,000</td>
<td>Math and Science Partnership</td>
</tr>
</tbody>
</table>

Each of the eight sites agreed to participate in the research as a case study. Two of the four case studies (Appalachia RSI and MSP; Rochester LSC and MSP) are analyzed concurrently as the projects had continuity between the two grants and are written as combined case studies. Table II below presents how two of the MSP projects we examined evolved from two Systemic Initiative/Change grants, while two SI projects did not continue on to be MSP projects. The remaining two MSP projects are newly formed and did not evolve from projects funded under the SI program.
Table II:
Cases Funded through the Systemic Initiative and Math and Science Partnership Program

<table>
<thead>
<tr>
<th>Systemic Initiative Program</th>
<th>Math and Science Partnership Program</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alaska Rural Systemic Initiative</td>
<td>Appalachia Math and Science Partnership</td>
</tr>
<tr>
<td>Appalachia Rural Systemic Initiative →</td>
<td>Appalachian Math and Science Partnership</td>
</tr>
<tr>
<td>Duke TASC Math and Science Partnership</td>
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<tr>
<td>Jacksonville Urban Systemic Initiative</td>
<td>Rochester Math and Science Partnership</td>
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<tr>
<td>Rochester Local Systemic Change →</td>
<td>Rochester Math and Science Partnership</td>
</tr>
<tr>
<td>Wisconsin SCALE Math and Science Partnership</td>
<td></td>
</tr>
</tbody>
</table>

Case Study Process

The first step in conducting the case study for each site was to contact the Principal Investigator to request access to project documents including: the original grant proposal to the NSF, interim and annual reports, and the project final report if available. We also reviewed the project website if available and conducted a search on the Internet to find any publicly available reports on the project. Reviewing these documents prior to traveling to each site provided us with the necessary background details to make our trip time at the site most valuable.

After reviewing the documents available, we scheduled site visits to conduct interviews with project staff. We requested one-hour in-person interviews with the following individuals for each project:

- Principal Investigator
- Lead contact from each participating organization
- Project managers who are responsible for organizing activities such as professional development for teachers, business participation, and integration of new curriculum
- Participants who actively implemented project activities such as teachers and school principals
- Administrators (e.g., school boards and school superintendents) responsible for setting policies such as faculty and teacher release time

Two researchers traveled from Georgia Tech to each of the sites: one person was responsible for conducting the interview and the second person was responsible for taking notes. In several
cases, the case study team traveled to the site multiple times in order to obtain interviews with a wide range of project participants. In other cases, the case study team traveled to the site only once and followed up with telephone interviews for participants who were not available to be interviewed during the site visit. Each interviewee was requested to complete a Human Subject Consent Form (Appendix A).

**Interview Protocol Development**

After reviewing the research and evaluation literature (both academic and grey literature) with regards to partnership and analyzing the results of the Delphi Panel study on the formation and operation of STEM partnerships, the project team began development of three interview protocols for the case studies. The first interview protocol was used to request documents that would provide a good overview of the partnership. This first interview was conducted over the telephone. A second interview protocol was developed for face-to-face interviews to be conducted with the key actors for the primary partner organizations. A third interview protocol was developed for teachers, IHE faculty, and other district officials who were important participants and leaders in organizing the specific programs and activities but not necessarily key actors in getting the complete portfolio of programs and activities delivered. Each of the interview protocols was targeted with a level of specificity for its audience. The protocols were approved by the Georgia Tech Institutional Review Board.

An initial version of the interview protocols was used during interviews for the Duke MSP during the first site visit to North Carolina. These protocols used a Likert rating scale based upon the programs and activities that the site had proposed to NSF. The goal in using the Likert items was understanding which activities the participants viewed as needing the highest degree of partnership among the organizations. During this initial round of interviews, our respondents found this approach somewhat difficult to respond to, and did not capture the learning and adaptation the project had done since the initial proposal. Our project team revised the interview protocol to ask more general questions about how the partnership evolved and how the work was progressing.

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5 Some of the case study sites involved very large numbers of partner organizations. When using the second protocol we concentrated upon those organizations from which the PI’s and co-PIs for the project were drawn and partners from any other organization designated by respondents as a key actor.
The final interview protocols include questions that ask how the individual and the individual’s organization became involved in the partnership, whether there were outside influences that affected the partnership’s formation and operations, the process by which the partnership conducted its work, and outcomes associated with the project. The full set of interview protocols is attached in Appendix B.

**Case Study Logic Model**

Building on the literature review and Delphi panel, we developed a list of factors describing how the partnership might influence outcomes. This logic model (Figure I) began by capturing the policy inducement that encouraged the partnership to form. We explored the embeddedness of the organizations prior to the partnership’s formation, during the formation, and during the partnership’s operations. We also looked at the strategic needs of each of the organizations in relation to the policy inducement, partnership formation, and partnership operations stages of the project. We examined the partnership’s formation and operations and looked at the process outcomes and performance impacts of the partnership. Finally, we examined what took place during the dissolution of the partnership.
Each of the case studies follows the same outline. First, the preconditions for the partnership are explored. The preconditions for the partnership include the generic policy conditions affecting the partnership’s formation such as new state educational standards, changing fiscal policies, and new federal reporting requirements. The strategic needs of the organizations involved in the partnership are explored to gauge how they affect the partnership. Embeddedness among the partnering organizations from a prior history of working together is reviewed to see how this affects the organizational relationships and levels of trust among the organizations and individual players. Embeddedness is a concept designed to capture the nature and extent of relationships amongst actors over time. Individuals can have high levels of professional embeddedness when they share a common social network based upon their work lives which makes them aware of each others work and reputation. Stronger and more intense forms of embeddedness are formed when there is a history of working together which requires more frequent interactions and commitment to working towards shared or complementary goals. In a partnership, project-work embeddedness requires the collaboration of actors from two or more organizations whose efforts
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are bound, sometimes loosely so, in agreements between the actors home organizations. Other preconditions such as barriers to partnering or facilitating situations are also explored.

The second section of the case studies examines the grant event and the partnership’s formation. The grant event includes details related to the funding opportunity that brought the partners together. We examine the policy inducement – the NSF program solicitation – which contains several eligibility requirements with regard to the constitution of the partnership. The solicitation is also likely prescriptive about the range of activities that would be funded and the desire that such activities generate transformative change amongst the higher education and K-12 partners (as in the case of the MSP Program). Respondent reactions to these inducements are part of the formation process as individual partners vary in the degree to which they view such elements of the policy inducement as a guide to their behavior. The partnership’s formation also explores the motivations for the organizations’ involvement and how the partnership was intended to be structured; the work distributed; and plans for partnership sustainment after the grant funding ended. There may also be a champion for the partnership who was crucial in bringing the partners together. This section looks at who was involved in writing the proposal and deciding the focus areas for the partnership’s program areas to determine if the partnership organizations were jointly involved in this process or whether a few individuals were the key decision makers and power brokers.

The next section of the case studies looks at the operations of the partnership. It details the nature of the partnership and how it conducted its work. This section looks at the level of involvement from the organizations and the types of collaboration taking place. When partnerships are formed in response to an external stimulus such as a grant, and particularly when actors have low levels of experience in working together, a key factor is the degree to which they exhibit goal complementarity. Goal complementarity is the degree to which actors view their goals as contributing to a common enterprise. Goal complementarity can be important in the formation of partnerships as the goals that lead an organization to form a partnership may not be the same as the goals they have in the operation of the partnership. Actors do not have to have the same goals; they merely acknowledge that each others goals are legitimate and can be pursued and accomplished through a plan of action. Changes to the partnerships original goals and activities
are explored and the reasons for any modifications. The case studies focus on the knowledge and work flows taking place within the partnership and how power relations affected project implementation. They also examine organizational buy-in, champions for the partnership, turnover within organizations that affected the partnership, capacity building, and local adaptations as a result of the partnership’s activities.

We also examine factors associated with the interaction amongst partners that may influence the capacity of partnership to function and prosper. A key factor is the mutuality in exchange that actors have in their communication patterns. One of the fundamental characteristics of partnerships is a willingness of actors to try and work together in pursuit of a common set of goals. A factor that may influence this is whether communication patterns are mutual, i.e. the flow of communication goes both ways and the actors perceive that their point of view is heard and understood by their partner. This is also important during the partnership formation process. Another relational factor is identity enhancement, e.g. the degree to which a partner organization believes that its stand-alone identity is enhanced by participation in the partnership. An additional factor is the level of trust that actors in the partnership have in the intentions and behaviors of their partners with regards to collaborative work. A final factor for observing interactions is the level of transaction cost associated with the partnership. Transaction costs refer not only to monetary costs but also costs of time and effort devoted to maintaining and operating the partnership.

A set of factors that we use to examine both formation and operation of the partnership are associated with the structure and leadership of the partnership. We examine the administrative network, i.e. the composition of actors responsible for the strategic and administrative operations of the partnership. Changes in the administrative network over time also signal changes in the goals and operations of the partnership. They also serve as an indicator of the types of adaptation strategies that have been developed by the partnership to accommodate challenges to the original strategic and operating goals. An important related concept is the champions, i.e. the number and types of leaders who view the partnership as an important element in their work life and are willing to exert influence in their own organization and across partner organizations in promotion of partnership goals.
A final set of factors that we examine in the operations of partnerships addresses the way in which work is structured in the partnership. The first addresses the range and depth of partnering, which we refer to as the locus of partnership. In this we examine the portfolio of activities in the partnership and assess how many involved partnering behaviors. The second addresses the linkages, if any, between activities and whether or not these required additional collaborative work. Activities might be organized in a pooled fashion where the collective outputs constitute the outcomes from the partnership. But activities might also be organized in a sequential or reciprocal fashion in which the outputs of one activity become the inputs of other activities.

A fourth section of the case studies examines the outcomes of the partnership. It looks at the partnership’s achievements including any changes in organizations’ processes. Of particular interest is whether the partnership generated changes in the routines of organizations. One of the goals of the MSP program is to engender learning communities as a means of generating transformative change in the operations of schools and institutions of higher education. We examine whether the innovations generated by partnerships were sustained in the standard practices and operating procedures of partners. This section also details how the partnership participants link the partnership to educational outcomes such as educational improvements and whether or not the case site made efforts to link partnership interventions to performance measures such as student test scores. Finally, we examine the resulting changed relationships among the partnership partners and any changes in organizational capacity as a result of participation in the partnership. The final section of the case study summarizes the case and makes conclusions.

**Cross-Case Analysis**

Comparing the eight cases, one can find many similarities and dissimilarities that have affected the partnerships’ formation, the way the partnerships operated, and the outcomes that they achieved. Variables can be identified that are important considerations for evaluations of partnerships. Each of the sections of the case study are explored below in relation to themes that could be addressed in an evaluation of partnerships among organizations in a STEM educational
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project or partnerships formed for other types of projects. The similarities and dissimilarities in the cases with relation to our variables of interest are discussed.

**Preconditions for the Partnership**

In many of the partnerships we studied, policy inducements in the environment influenced the partnership’s formation in some capacity. For example, the Appalachia Rural Systemic Initiative was influenced by the Kentucky Education Reform Act which held school systems more accountable to the state department of education and threatened sanctions if school systems were not meeting the goals. Schools had a strategic need to meet new accountability standards or face sanctions from the state. ARSI provided one means of help to improve academic achievement. In the case of Duke’s TASC MSP, schools in North Carolina were facing a new science test beginning in the 2007-2008 school year in grades 5 and 8 as a result of the federal No Child Left Behind Act of 2001. Previously, schools in North Carolina were not required to teach science in the elementary grades but these new policy conditions changed this requirement. Suddenly outside sources of help in implementing this new science requirement became more appealing to the school districts and TASC materialized to help meet that need. Similarly, the Jacksonville USI was facing outside policy pressures due to a federal desegregation order and was facing pressure to close achievement gaps among races. The Rochester LSC was facing environmental pressure from New York to improve student test scores, as the Board of Regents had approved an overall plan for raising standards in 1995 and a new set of learning standards in 1996. In a 1997 pilot exam, 80 percent of the students failed. These outside environmental forces and policies set the stage for the context in which many of the STEM partnerships developed.

Although the cases faced outside environmental forces prior to the formation of the partnerships, they did not all face the same kinds of pressures. For example, the Jacksonville USI was under a federal desegregation order which was a motivator for its pursuit of a USI grant. The Appalachia RSI, TASC MSP, and Rochester MSP were not under any federal orders, but were influenced by policy changes outside of their control. While the Appalachia RSI faced state accountability requirements, the TASC and Rochester MSPs were encountering new educational standards which influenced their involvement in the partnerships.
Another important consideration for understanding partnerships is the strategic need or needs of the organizations involved. The Rochester MSP and Duke TASC MSP case studies found that teachers had a strategic need for content knowledge to teach according to the newly adopted curricula. Similarly, the SCALE MSP found that school districts were searching for a way to strengthen math and science education and that there was no off-the-shelf curriculum or professional development system that would meet their needs. The school systems had a strategic need for a tailored solution that would fit their individual needs.

However, the strategic needs of the universities and colleges differed from their K-12 counterparts. In the case of the SCALE MSP, the researchers were interested in improving education from a research perspective, not because they were pressured to improve test scores. In the Appalachia RSI, the IHEs were interested in having better prepared students enter their classrooms so that they would not be required to engage in remedial education. Each of the partners had strategic needs which they were seeking to address through joining the partnership, but these needs were not always congruent.

A third variable for understanding the preconditions factoring in to a partnership is the embeddedness of the organizations and actors involved. In the case of the Jacksonville USI, a high level of individual embeddedness existed between the superintendent of the school system and the president of the University of North Florida. This relationship facilitated the proposal development process, even after two unsuccessful attempts at winning previous USI grant funds. The school district and the university also maintained organizational embeddedness as the two organizations had a history of working on grants together. A similar situation existed for the Rochester LSC. Prior to the grant, all four middle schools participating in the grant were involved in a previous NSF Teacher Enhancement Program grant with the University of Rochester. This grant involved many teachers who the PI considered to be friends. This organizational and individual embeddedness transferred to the Rochester MSP as the organizations continued working together.

In the case of the Duke MSP, Alaska RSI, SCALE MSP, and Appalachia MSP, professional embeddedness among the partners was important as the grant began to materialize. For Duke, the
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colleagues who put the proposal together were friends from the same professional community interested in inquiry-based learning. However, they were not highly embedded with the participating school systems. Professional embeddedness was highly apparent in the Alaska RSI and the Appalachia RSI. In Alaska, the key champion of the project had ties to both the Alaska Native community and the academic community, and was well-respected in both. His professional embeddedness enabled him to break down barriers between the two as the Native community was hesitant to partner with a large university unless they could be in control of the project, and the university administrators resisted this attempt at control of their turf. In the Appalachia RSI, the professional embeddedness of the champion of the project made it easy for him to call up important players in the region and invite them to participate. His reputation and knowledge of the community facilitated the process by which the RSI developed in a region where there was previously low levels of interaction between the universities and school systems. The later MSP built on the increasing embeddedness between the partnering organizations as the RSI progressed. The SCALE MSP involved professional embeddedness which also facilitated bringing the actors together.

The levels of embeddedness and types of embeddedness among the organizations varied. The SCALE MSP and Duke TASC MSP had lower levels of organizational embeddedness than the Appalachia MSP and Rochester MSP, which benefited from having previous Systemic Initiative grants with their partner organizations. However, the SCALE MSP and Duke TASC MSP benefited from a high degree of professional embeddedness as they key players were committed to a particular research area. These two cases appeared to struggle because of these low levels of organizational embeddedness as they wrestled with defining goals and the role of their respective organizations.

**Partnership Formation**

The NSF’s policy inducement of providing a grant opportunity proved to be the impetus for each of the partnerships in either continuing efforts from previous partnerships, as was the case with Appalachia’s RSI and MSP and Rochester’s LSC and MSP, or establishing new partnerships among organizations as they developed a proposal to the funding solicitation. The program solicitations included requirements to which each of the partnerships responded. For example,
the Rural Systemic Initiative Program solicitation stipulated that at least 30 percent of school-aged children in the communities the grant serves must live in poverty. The Appalachia RSI responded by identifying the 66 counties in five states that met this requirement in the Appalachia region and wrote them into the proposal. Later, the Appalachia MSP responded to the MSP program requirement for participation of minority students by reaching beyond the initial scope of the Appalachia RSI to include more school districts that had high minority student populations.

When partnerships are forming, a champion for the partnership sometimes emerges. This person is a leader who is responsible for bringing the groups together, organizing efforts, and lobbying on behalf of the partnership’s goals. In the Appalachia RSI and MSP, the same champion – the PI – worked to bring groups together and on board with the partnership’s goals. The Appalachia MSP also involved micro-champions who were key in spreading this vision at their home organizations within their local communities. The Rochester LSC also involved a champion, again the PI of the project, who pushed the local region to work together. Like the Appalachia cases, this PI acted as the champion again for the Rochester MSP. She used embedded relationships with individuals from other organizations to bring them to the table.

The involvement of a champion differed in the partnerships. A clear champion emerged during the formation phase for the Alaska RSI, Appalachia RSI and MSP, and Rochester LSC and MSP. In the cases where the partnership extended beyond the first grant (i.e., Alaska RSI’s Phase II, Appalachia RSI’s Phase II and MSP, and Rochester MSP), the same champion lobbied on behalf of the partnership during its tenure. In other cases, such as the Wisconsin SCALE MSP, a definitive champion did not appear to emerge as the partnership was more of a collaborative effort in the beginning.

Different organizations and individuals have different motivations for joining the partnership, or in some cases, resisting becoming a partner. Having the players involved in defining the partnership in relation to their strategic needs seems to be a key factor in many of the partnerships we examined. In the Rochester MSP, the purpose of the partnership was formed in collaboration with teachers. The strategic needs of the teachers to have more knowledge about
new curricula were the key drivers of their participation. Similarly, the champion of the Appalachia MSP also asked each of the partnering organizations to define their strategic needs when he was writing the grant. For the IHEs, a strategic need was having freshman who are ready for the academic rigor of the university. It also served the needs of faculty members who are required to work with pre-service teachers as once those teachers entered the workforce, they would be better teachers, resulting in better students for the university as the process came full circle. In the case of the school systems, some teachers resisted becoming involved as they thought it would be one more burden on their already busy work schedules. Having them be involved in this process works to increase their level of buy-in to the partnership. Another factor that motivated some IHEs to join the Appalachia MSP is that they were considering forming their own partnership to submit a proposal. However, once they realized that the University of Kentucky was submitting a proposal, they thought it would better fit their strategic needs to join that partnership rather than act as competitors for funding.

As the projects became more finely tuned and specific goals were detailed, different types of goal setting processes became apparent. Further, two types of goal setting occurred at this initial stage of the partnership. First, the partnership must define the project goals and what the overall goals of the partnership will be. Second, they must define the operational goals by which the structure of the partnership will be arranged and how the project goals will be achieved. In the Wisconsin SCALE MSP, the project leadership had high degrees of shared commitment to the goal of transforming the classroom environment, but they could not agree on how to achieve this goal. They had high levels of project goal complementarity but they were in less agreement with regards to operational goal complementarity. In other words, they shared a common vision of what the project might achieve, but did not have common ideas for how this might be achieved.

The structure of the partnerships was often defined in this phase of the project. For some, such as the Appalachia MSP, the plan was to be decentralized with Resource Collaboratives – coalitions of schools, community organizations, and IHEs – working together in regions and making decisions impacting their activities on a daily basis. The Alaska RSI case was also designed to be a bottom-up and grassroots organization that empowered individuals at the local level to make decisions about the project’s implementation. It was designed with the culture of Alaska Natives
in mind in which the decisions were made collaboratively with the blessing of the Elders. There was a high level of interdependence between districts since they were sharing resources developed by each of the districts. The Jacksonville USI was designed to keep the administration at the school district level, rather than at the university level, as the partnership intended for the project to be more grassroots and bottom-up in its implementation. In the Appalachia RSI, it was much more top-down directed and led by a few individuals at the Kentucky Science and Technology Corporation, with some decentralized decision making due to the regional Resource Collaborative approach. The champion and leader of the project was very clear in stating that the Appalachia RSI was not a true partnership among IHEs, but instead was a project with specific goals that were dictated from the top and meant to be implemented at the local level. A similar top-down directive took place in the Duke TASC MSP in which Duke held the power of the partnership and made daily decisions affecting its implementation. Other partnerships such as the Rochester MSP involved a combination of decision-making approaches with highly centralized decision making at the top levels, but local autonomy to make decisions at the micro level as well.

In the Rochester MSP and Appalachia RSI and MSP, the administration of the grant was centrally located which seems to have facilitated the operations of the partnership. In cases such as the Wisconsin SCALE MSP, the administration was geographically and ideologically dispersed which hindered the partnership’s daily operations as the organizations could not decide on appropriate courses of action. The centralization of the administration of the partnerships seems to have played a role in whether conflict existed within partnerships.

Some universities established boundary organizations at the fringe of the university to house the partnership. Because the work of many of the partnerships was very different from traditional academic research, some universities compensated for this by setting up a buffer between the partnership and the university. For example, Duke worked through CIBL and was even located off campus. The boundary organization for Duke maintained its ties to the Duke name and community but operated independently.
Partnership Operations

The partnerships operated in many different ways, with some displaying a high degree of involvement from the organizations, and some being involved only at the surface or with a few individuals being involved. For example, the Rochester MSP found some resistance from university faculty members who did not feel it was their responsibility to participate. While the plan was to have more involvement of faculty from both the mathematics and education departments, the participation of the mathematics department was more limited since only a few members were interested in participating in the project. Only a few of the faculty members in the mathematics department found that the work of the partnership had legitimacy for them in that it had meaning for their ongoing professional life. The project also found limited interactions between the faculty and the K-12 teachers and administrators. In the earlier Rochester LSC, the participation of the school districts was tempered, as the teachers were not required to participate in the professional development meetings which challenged the grants implementation. No one from the school system followed up to make sure they participated.

The issue of legitimacy for participants is an important variable to consider. In the Duke MSP, the teachers were hesitant to work with the scientist volunteers who were to serve as mentors, possibly because the issue of a scientist mentor relationship was not legitimate for them. In the Rochester LSC, the project planners did not consider the needs of the special education teachers at first, but needed their involvement for the grant to be successful. The project goals did not serve the needs of the special education teachers and the partnership was therefore not legitimate for these teachers and they found no incentive to participate. The Jacksonville USI was designed to ensure that the project had a high level of legitimacy for the teachers involved in the project.

The issue of transaction costs for participating in the partnership affected some organizations’ and individuals’ level of involvement. In the Rochester LSC, some school districts found high levels of transaction costs due to the funding required to pay substitute teachers while the regular classroom teachers attended professional development meetings. Additional transaction costs for these school districts involved the funding required to purchase new books and other instructional materials. In the Rochester MSP and the Appalachia MSP, teachers complained
about difficulties in traveling to the university for professional development and found that the transaction costs were lesser when the IHE faculty came to their schools for the trainings or provided the training at a location in their community. However, having previous relationships with organizations seems to have reduced some of the transaction costs involved with partnering. For example, the infrastructure in place from the Appalachia RSI facilitated the establishment of contractual and Memorandums of Understanding with universities and school systems in the Appalachia MSP.

Another variable that affected partnership operations is that of turnover among participants. Some cases were not highly affected by turnover and had stable leadership during their implementation (i.e., Duke MSP, Alaska RSI, Appalachia RSI and MSP). Others faced turnover from the start such as the Jacksonville USI, which faced a change in the school district superintendent at the beginning of the grant which resulted in reduced senior administrative support for the Jacksonville USI as the new superintendent pursued other initiatives. Other respondents identified turnover as a challenge in that it could potentially affect the buy-in if administrators changed their minds about participating (i.e., respondents from the Duke TASC MSP, and Appalachia MSP). These fears were realized for the Rochester MSP when one new school system administrator decided not to participate. The Duke TASC MSP faced turnover issues with its evaluator and ended up having to find a new evaluator for the grant.

Due to changes that took place as the grant progressed, each partnership was forced to make adaptations to their plans for how the partnership would organize its activities. In some cases, these changes were beneficial to the partnership’s goals. For instance, the Duke TASC MSP benefited from a revision to the North Carolina textbook adoption law which allowed all school systems to purchase instructional kits for classroom use in place of textbooks. So beginning in 2005, all North Carolina school districts were permitted to spend textbook adoption funds on the kits that the TASC project was providing. However, this also resulted in a new competitor entering the market so the Duke partnership changed its focus to kit refurbishment, rather than kit rental. In the Rochester MSP, the partnership made adaptations related to the timing of professional development since state testing was taking place at inconvenient times for participating teachers.
Partnership Outcomes
Evaluating how the partnership affected the outcomes of the partnership is complicated, as one cannot draw a causal line between the nature of the partnership and gains in students’ academic achievement, per se. Instead, an evaluation of partnerships should focus on changes that took place in the organizations’ operations and interactions with each other and plans for sustaining the partnerships’ activities. For example, one interesting outcome of the Duke TASC MSP is the development of a tenure route for “professor of the practice” which institutionalizes and legitimizes outreach activities for academic faculty at a top research university. The Alaska RSI found that having 10 years to implement the grant resulted in an increased level of trust between Alaska Native organizations and the University of Alaska, which in turn facilitated further partnering between the two. The university in this case also faced political pressures due to the popularity of the partnership’s work to institutionalize the project and is working to develop a research center for Native knowledge systems. Further, some Alaskan school systems have picked up the costs of continuing the programs and the state department of education has institutionalized the project by incorporating Native knowledge into its academic standards and curriculum for all Alaskan K-12 students. Alaska has also seen echo effects of the partnership through successful grant acquisition for related projects. Such a large display of commitment to continuing the project is a testament to the successful outcomes of the Alaska RSI partnership.

The commitment to sustaining the partnership’s activities is not as apparent in some cases. In the Duke TASC MSP, the role of Duke in the partnership is dispersed as the partnership formed a non-profit independent of Duke to maintain its ties with the school systems. In the Appalachia MSP, one successful outcome stated by participants is that both the university faculty and K-12 teachers have shared their respective knowledge areas: The university faculty have learned more about pedagogy and revised their own lessons accordingly, while the K-12 teachers absorbed content knowledge from the university faculty. In other cases, simply having the organizations continue to work together on future endeavors indicates a successful partnership. The Rochester LSC transformed into the Rochester MSP and other grants, as was the situation for many of the partnerships studied.
Conclusions

The approach taken to evaluate partnerships in the cross-case analysis phase of our research involves using variables identified in a literature review of inter-organizational research and a Delphi study of STEM evaluation experts. We expanded on our original logic model by including additional variables we found to be important as one evaluates partnerships. We used these variables to analyze eight cases of STEM partnerships and found that the variables affect the cases in different ways. For example, as detailed in Table II, our case selection included two SIs that did not continue on to be MSPs; two that were MSPs with no extensive history of working together; and two that were SIs that continued on to be MPSs. Some partnerships involved organizations with a high degree of organizational embeddedness which seems to have facilitated the interactions with other organizations involved in the partnership. However, newly formed partnerships such as the Alaska RSI did not have high levels of organizational embeddedness and yet found that the process of partnering went smoothly once power struggles at the beginning were solved. The two newly formed MSPs (TASC and SCALE) seemed to face more challenges in implementation as they worked out relationships among the partners. The Alaska and Jacksonville cases, although they did not evolve into MSPs, have realized echo effects of the partnership as their work continues on today. Many other variables affected the partnerships’ formation, operations, and outcomes which would be useful to consider in an evaluation of partnerships.

The context used for this research – STEM educational partnerships – involved researching the relationships between IHEs and K-12. However, the variables we identified would be applicable in any organizational partnership as the factors at play would remain the same. Teasing out these relationships involves extensive qualitative research through interviews with players from many organizations and document reviews to glean details about the partnerships not stated in interviews. This process provides rich details about the organizations and individual actors involved in the partnerships which make possible an evaluation of partnerships.
Appendix A:
Human Subject Consent Form
Research Consent Form

You are being asked to be a volunteer in this research.

Purpose of the Research: The purpose of this phase of our research is to develop case studies of partnerships between institutions of higher education and K-12 schools sponsored by the National Science Foundation under the Math Science Partnership program, the Systemic Initiative program, or both. Each case study will be based upon review of archival records, face-to-face and telephone interviews with partnership leaders and managers, and telephone interviews and web-based surveys of participants in programs performed under the auspices of the partnership.

Procedures: If you decide to be in this study, you will be interviewed for approximately 1 hour. Your responses to the questions will be audio-taped, and the tape will be transcribed. The tape and the transcription will be kept in the principal investigator’s office. A few of the respondents may be asked for an additional interview lasting no more than 1 hour to offer clarifications and answer follow-up questions.

Foreseeable Risks and Discomforts: The risk associated with participating in this research is minimal; the research team will seek to eliminate any risk to you by not revealing the individual identities of respondents.

Benefits: We do not anticipate any direct benefit to you from this interview. We will offer the results of our research with all participants. This may give you additional insight regarding your work and the work of the partnership.

Compensation/Costs: No compensation for participation will be provided.

Confidentiality: The following procedures will be followed to keep your personal information confidential in this study. The data that is collected about you will be kept private to the extent allowed by law. To protect your privacy, your responses will be kept under a code number rather than by name. Your records will be kept in locked files and only study staff will be allowed to look at them. Your name and any other fact that might point to you will not appear when results of this study are presented or published.
To make sure that this research is being carried out in the proper way, the Georgia Institute of Technology IRB will review study records. The Office of Human Research Protections may also look at study records.

**Injury/Adverse Reactions:** Reports of injury or reaction should be made to Gordon Kingsley at 404-894-0454. Neither the Georgia Institute of Technology nor the principal investigator has made provision for payment of costs associated with any injury resulting from participation in this study.

**Contact Persons:** If you have any questions about the research, call or write Gordon Kingsley at the School of Public Policy, Georgia Institute of Technology, Atlanta, GA 30332-0345, Tel: (404) 894-0454

**Subject Rights**
- Your participation in this study is voluntary. You do not have to be in this study if you don't want to be.
- You have the right to change your mind and leave the study at any time without giving any reason, and without penalty.
- Any new information that may make you change your mind about being in this study will be given to you.
- You will be given a copy of this consent form to keep.
- You do not waive any of your legal rights by signing this consent form.

**Questions about the Study or Your Rights as a Research Subject**
- If you have any questions about the study, you may contact Gordon Kingsley at telephone (404) 894-0454.
- If you have any questions about your rights as a research subject, you may contact Ms. Melanie Clark, Georgia Institute of Technology at (404) 894-6942.

**Signatures:**

Your signature below indicates that the researchers have answered all of your questions to your satisfaction and that you consent to be interviewed for this study.

---

Subject’s Name Printed  Subject’s Signature  Date
Appendix B:
Case Study Interview Protocol
MSP and SI Case Study Protocols: An Overview

The following protocols will be used to develop the case studies for our RETA Partnership project. There are several important themes that will be examined through this protocol. The themes are drawn from the following sources of information:

1) Our understanding of the research and evaluation literature (both academic and grey) with regards to partnership.
2) The initial findings of the Delphi Panel of experts in the formation and operation of STEM partnerships.
3) The hypotheses and swags that have come from our team discussions aimed at understanding how the policy induced partnerships (PIP) generate partnership operating paths (POP) aimed stimulating a variety of educational impacts.

Unfortunately, PIP-POP is not developed well enough for us to use this protocol as a theory testing tool. Instead the protocol will need to be used in a more grounded approach as a means for theory development. We will all keep pushing for that sudden flash of inspiration and if we get it we can certainly adapt the protocol. But at present the case studies are going to have to support our efforts in developing the theory.

Current State of Our Research Questions

However, our thinking towards PIP-POP theory has generated some important research questions that need to be explored in protocol (the questions below are not questions we will ask in the protocol; they are research questions we that we will want to be attentive to in the design and implementation of the protocol):

1) What is the life span of a partnership? Is a partnership something that is generated by policy, is it a set of relationships that are longer-standing and fueled by periodic policy programs, some combination of the two, or something different?
2) To what degree is NSF’s MSP policy providing an independent policy influence upon schools and school districts? What other policies might be influencing the formation and operation of the partnership?
3) Do policy inducements shape the structure of the network(s) associated with the partnership? Does the structure of the network(s) associated with the partnership provide a useful vantage point for observing the development of POPs?
4) What unit of analysis provides the best perspective for understanding the development, operation, and impact (if any) of partnerships: individual, work groups within a partnership, the network of professionals associated with the partnership, the interorganizational relations (IOR) used to form the partnership, or the field of network relationships that participants bring to the partnership? (our proposal is at the IOR level but I’m not sure this provides us the best vantage point).
5) What is the degree to which a partnership becomes a separate entity in the work lives of the individuals and groups participating in the effort; i.e., do participants begin to strongly identify with the partnership as a part of their work lives?
6) What are POPs? Right now we are including everything below the partnership goal as part of the POP including activities, people, processes, events, and critical incidences. Which of these provides the best vantage point for observing the POP in action? Which expression of the POP explains the most variance in the outcomes and impacts from the partnership efforts?

7) Are all activities associated with a partnership a type of POP? If so, then other dimensional properties may become important such as the coherence of the POP, the length of the POP (in terms of linking goals to student-teacher interactions), the alignment of the POP between a) partnership goals and values, organizational goals and values, teacher goals and values, and student goals and values, and b) partnership goals and values with other school/district goals and values.

8) How much mutuality is there in the relationship between schools, districts and IHE? If the program is determined by the IHE and delivered by the IHE with only feedback coming from the schools and/or districts, should we consider this a partnership? It is certainly an observable relationship. Low mutuality in the relationship may be an indication that there is not much “partnering” and more service provision and consumption. Is there a threshold when a relationship does not constitute a partnership?

9) In the Delphi respondents were comfortable discussing the factors that brought the partnership together and the formative outcomes associated with the partnership, i.e., the programs and activities done in conjunction with the schools and school districts. However, they had a very hard time discussing how the partnership actually operated on a day-to-day basis, discussing the impacts of partnership, and making causal attributions that firmly linked the partnership activities to the outcomes and impacts. This may be an artifact of talking to a particular class of leader. We need to be careful to monitor if respondents in the MSP and SI case studies have similar problems. Is this a problem of the roles that respondents play (i.e. are we talking to enough folks at a sufficient range of roles)? Or this an endemic problem of attribution within partnerships? Can respondents distinguish the impacts of partnership from other efforts on which they might be working?

10) In a similar vein to the previous question, can we distinguish the work of the partnership from the normal work associated with teacher enrichment, curriculum development, student enrichment, etc.? Another way of asking this is whether POPs are dependent upon the routine working patterns of schools districts and schools? At what point (if ever) do POPs become channeled into the routines of the schools?

11) What level of cooperation can we expect from the sites in terms of talking to or collecting responses from teachers or other participants? If we can then how broad a sample of teacher responses is feasible on each site?

12) If we can access district officials/teachers we should anticipate low levels of attribution to the partnership. One of the reasons we are defining POPs broadly is that we want to be able to identify the point of interface between district officials/teachers and partnership activities. Can the recipients of partnership programs distinguish between and describe qualitative differences between the “treatments” delivered by partnerships and the other similar services which they may receive?

As we explore these questions we need to keep in mind the central hypothesis that was in the proposal to NSF and which we will explore in this study:
Partnerships formed on the basis of positive embedded relationships and matched by congruence or complementarity of strategic needs among the partners are likely to develop more harmonious and efficient partnerships that will be more effective in achieving process and performance outcomes.

In doing so we must be mindful of a null hypothesis that may be very strong. Partnerships might not have any impact at all. The key policy argument is that the formation of partnerships will either produce a higher quality or more tailored “treatment” for teacher/school needs, or that the because district officials/teachers feel their organizations (if not themselves) are engaged as partners in the development of the “treatment” they will be more likely to implement the treatment and be more committed to sustaining the effort sufficiently so that positive educational impacts are more likely. These propositions may not be true:

a) The treatments might not be qualitatively different;

b) district officials/teachers will not be sufficiently motivated by participation in the partnership to overcome the existing barriers that prevented good educational outcomes;

c) other non-partnership related factor may explain positive impacts that are happening in the school.

Issues in Designing Questions and Conducting Interviews

Another issue that we must address in the design of the protocol is the difficult respondents have in describing and making attributes about partnerships. This is an issue that we have already run into with the Delphi. One way of dealing with this would be to become ethnographers and spend a good deal of time with respondents. Unfortunately that option is not open to us because the case study sites are widely dispersed and time will become an issue.

Instead we will try to provide respondents with alternative ways of visualizing relationships through the protocols. First, we will use archival data about each partnership to develop visual displays and rosters of individuals, groups, activities, events, and processes. Second, we will reduce this data to decks of cards and then ask respondents to sort out the cards in reaction to questions of frequency of interaction, importance towards the various goals of the partnership, mutuality of the relationship, outcomes, and impacts (to name a few). These card exercises will be interlaced within the open ended questions of the interview protocol.

No two sites will be the same. So we will need to construct a deck for each site. To do this we will need to go through the following steps:

1. Collect an initial set of information from archival records.
2. Identify a key informant (no more than two informants per case) for each case study, have a very brief initial interview and ask them to provide any additional documents that may provide a good overview of the partnership. Good candidate documents are the original proposal and the annual reports to NSF (if we don’t have these already).
3. Complete our visualization of the partnership based on the archival data and mirror this back to the key informants for review and comment. Our objective to develop as detailed a structural description of the partnership as possible with tables listing the programs,
activities, organizations, individuals, events and processes associated with the major objectives of the partnership. Our present understanding of the MSP’s and SI’s is that each will be pursuing a set of goals under which several objectives may be pursued. Associated with each objective one or more programs will be designed. There may be several activities that will be associated with the program. Under each activity there will be events, rosters of individuals working on the activity, processes, and critical incidences. It is unlikely that this list will be complete based upon the archival record. An example is provided below of how we are currently thinking of about the partnerships:

a. Goals – enrich teacher capabilities
b. Objectives – 1) professional development that reduces the math phobia of teachers; 2) improve the technological sophistication of teachers.
c. Programs – under professional development objective there might be several programs including a Coaching Program which matches teachers with university math faculty or district sanctioned professional development Seminar series which is aimed at updating the math skills of teachers.
d. Activities – several activities might be associated with the Coaching Program. There might be a coaching activity aimed at K-5 teachers. There might be another coaching activity aimed at strengthening knowledge of algebra among teachers in 6-8.
e. Events – The coaching activity aimed at K-5 teachers might have kick-off events, events to bring publicity to the program, events to honor the performance and achievements of participants.
f. Rosters – This will include the list of individuals participating in the activity, the organization in which they were affiliated, and any working groups with which they were affiliated as part of doing the Coaching program.
g. Products – This will include any manuals, videos, CDs, websites produced to support the coaching program.
h. Processes – This will include the administrative processes associated with getting the coaching program authorized, planning with district officials about the topics and schools with the highest needs, signing up and matching coaches and teachers, assessing the needs and performance for teachers, processes for paying participants or providing participants certifications, etc.
i. Critical Incidents – Respondent perceptions of key combinations of programs, activities, events, clusters of individuals or work groups, and processes that were particularly effective in terms of a key partnership goal or objective.

4. Conduct a second interview with the key informant to discuss our understanding of the organization, goals, programs and activities of the MSP or SI. During this interview we will be pursuing two important goals. First, we will be correcting and completing any of our descriptions of goals, objectives, programs, activities, events, rosters, processes and critical incidences. Again, it is unlikely that the key informant will be able to give us a complete listing but our goal is to get a fuller description than that available through the archival record. Subsequent interviews will fill in the gaps. Second, most of the MSP’s and SI’s were quite complex and pursued a number of objectives and programs. We will not be able to do a complete set of interviews for all of them. We should discuss with the key informant those activities in which the partnership has had the greatest experience.
and concentrate our case studies there. At this point we will not pick an arbitrary number of these embedded cases. Rather we will make this decision after conferring with the key informants. It is possible that both the first and second interviews with the key informant can be done by phone. But the second interview should not be done until after the key informant reviews the archival records.

5. Based on key informant respondents we will develop visualizations, tables and card sets that respondents to which respondents can react.

6. A second interview protocol has been developed for interviews that will be conducted the key actors for each of the partner organizations. We will also seek to interview the majority of the key actors who are responsible for conducting the MSP or SI regardless of where they reside (thus, if one organization has taken a lead in running the partnership we will be sure to interview the major players who might be involved). This set of folks is the group we have been referring to as the administrative group. These interviews will be done face-to-face.

   a. There is a second group of actors who are in what we have been calling the operational group. These individuals might be evaluators or IHE faculty, district officials, or other professionals retained to deliver the substance of the various programs sponsored by the MSP or SI. We also should consider meeting with at least one representative from the governing board of the partnership and doing phone interviews with more. Depending on the geographic distribution of the partnership we will do interviews face-to-face where possible. If we need to do a phone version of these interviews we should develop a web-based presentation of our cards.

7. A third protocol has also been developed. This is a relatively simple protocol that is aimed at teachers, IHE faculty, and other district officials who were participants in the programs but not necessarily key actors in getting the programs delivered. Our focus in this protocol is upon several issues: a) identifying where in the POP these respondents became aware of the programs being delivered; b) identifying the value of the programs to the respondents; c) the qualitative difference (if any) of the partnership program from other programs they may have been exposed to in recent years; and d) identifying the context in which they work (type of school they teach in or administer, etc.) and the trend lines of performance in their work environment. This will be administered by phone or through mail and/or web-surveys depending upon the nature of the access given through the case study. We anticipate that not all case study sites will be willing or able to provide access to their target community (particularly amongst the SI’s).

Our goal is to design the protocol to limit the interview time to one hour or less. We will run into respondents who will be willing to talk longer. If that occurs then use your best judgment as to whether this is reasonable. Normally you will not have a lot of free time to let the interview run long. When you are on-site conducting interviews try to schedule no more than four interviews during a single day. Trust me on this, four semi-structured interviews of this complexity makes for a very long day. Sometimes it will not be possible to limit the number to four. If that is the case consult with me so that we can devise a strategy to manage your time and do a good complete and accurate job of collecting data.
Key Informant Protocol #1

The purpose of the first protocol is to discuss and acquire the documents that provide the most detailed description of the activities associated with the partnership. This interview should be conducted by phone. It should be conducted by phone with the key informant.

Introduction: The phone call should begin with a brief description of our RETA project so that the respondent understands that our primary focus is upon understanding the workings of their partnership and how partnering influences the capability of the participating organizations to improve educational performance.

1. What documents provide the best description of the workings of your partnership? We are particularly interested in reports that describe the types of activities and events that were pursued in the project and the types of interactions that took place among different organizations or work teams in the project.
   a. Can we get copies of the following documents: your proposal to NSF, annual reports to NSF? [Note: these may be difficult to come by for the SI’s as respondents may have archived or even lost these files.]
   b. Can you provide copies of any other reports that describe the MSP or SI?

2. At this point we would like to establish a broad overview of the goals of your MSP or SI? [Note: respondents may ignore the larger goals of the project and respond by providing programs and activities. At this point you will need to exercise some judgment.]
   a. [Note: If respondent discusses goals by referring to specific activities or programs ask the following:] What were some of the larger goals or objectives being pursued through these activities?
   b. [Note: If respondent begins with something similar to our use of the term goals or objectives use the following questions:] What were some of the specific programs or activities that were pursued to achieve these goals?

3. Please list out the organizations who were key participants in your project?

4. What were the names of the individuals who represented these organizations?

5. How long has this project been in operation?
   a. [Note: For MSP] What aspects of the project are further along than others?
   b. [Note: For SI] What aspects of the project were the most fully completed?

[At this point a judgment call is required. If the respondent has access to specific documents that we are requesting and has agreed to send them then thank them for their time and tell them we will be back in touch within two weeks after we receive the documents. If they cannot provide any documentation or point you to the documentation then arrange for a time in which we can proceed to the next protocol for key informants. Have a copy of this protocol with you in case they want to continue the interview at that time.]

End of Key Informant Interview #1
**Key Informant Protocol #2** – (by phone or face-to-face)

You will note that following each question are several prompts. You should **NOT** attempt to ask every prompt. However, it is OK to ask several of the prompts following a question. Your chief goal in an interview is to get the respondent to tell their story. An emphasis should be given to allowing them to develop their own narrative thread. If the respondent covers the information asked for in a prompt or in questions further down in the protocol there is no need to return to this topic. You will need to exercise your judgment as to which prompts will be help the respondent tell their story.

You must be respectful of the respondent’s time. The key informant protocol is designed to take about an hour to complete. Remember, they are doing you a huge favor in answering our questions. If they say they can only allot 40 minutes to the interview or that there has been a change of plans be flexible. Offer to do what we can in the available time and call them back later with follow-up questions.

**TOPIC: STARTING POINTS**

**Q1. How did you first become involved in the MSP?**

Prompts:
- a. Who initiated the grant proposal? (Who said we ought to do this?)
- b. Which people were most involved in the intellectual design of the project?

**Q2. Were there any groups of organizations or individuals within the MSP that had long-standing relationships that you might characterize as a pre-existing partnership?**

Prompts:
- a. Names of organizations or individuals?
- b. Which organizations or individuals had no history of working together?
- c. Why were they working together?

**Q3. What are the major goals of this partnership?**

Prompts:
- a. What’s the distinction between goals and objectives? Are objectives fine-tuned goals?
- b. Are there any goals or objectives missing from the table?
- c. Are some objectives more closely aligned to certain goals?
Q4. Based upon documents that were shared with us earlier we have created the following table (Table 2). Do you think that this table provides an accurate description of your MSP's focus areas?

Table 1: Program Areas

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Prompts:
   a. Are there any program areas missing from the table?
   b. How do the program areas relate to the goals?

Q5. Which of these program areas has your MSP made the most progress towards achieving?

Prompts:
   a. How were the program areas chosen?
   b. Which of the program areas has required the most time for the MSP to develop? Why?
   c. Which of the program areas are looking like they might be problematic to achieve? Why?
   d. Is a partnership among organizations important to achieving each of the program areas? Is a partnership more important for some program areas than others?

TOPIC – ORGANIZATION AND INDIVIDUAL NOMINATION ROSTERS

In this section we will be focusing upon identifying the major organizations and individuals that are active in the partnership. Our objective is to get as complete a list of organizations and individual names that the key informant(s) can provide.

Q6. Based upon the project documents that we have reviewed we have developed the following table (Table 2) that lists out the organizations and individuals that have been involved in specific activities.
Table 2: Nomination Matrix

<table>
<thead>
<tr>
<th>Areas</th>
<th>Organizations Involved</th>
<th>Individuals and Roles Involved (with org affiliation)</th>
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Partners Prompts:

a. In your review of Table 2 what are the names of organizations and key individuals that are missing?
b. Are there any names of organizations or individuals that are misplaced?
c. Briefly describe the role(s) that organization and/or individual plays in the MSP?
d. Which organizations and individuals do you most frequently interact?
e. In your judgment, which organizations and/or individuals have had the most influence in affecting the capacity of the MSP achieve partnership goals?
f. Which organization do you identify yourself as most involved in?

**TOPIC – EVENTS, PRODUCTS, PROCESSES NOMINATIONS**

In section we are trying to identify how the organizations and individuals involved in the partnership have gone about doing their work. It is unlikely that the proposals or the annual reports will shed a great deal of light on these in the same way that that they spell out organizations and individuals. Also, it is quite possible that a specific process, product and/or event may apply to more than one goal-activity set.

One of the key points that we want to be looking for is when the partnership starts to plug into standard operating procedures used by a particular partner or service recipient. It is important that we understand how partnerships fit with the normal work patterns of partners.
Q7. Let’s turn our attention to some of the key activities of the partnership. Based upon the project documents that we have reviewed we have developed the following table (Table 3) that lists out some of the specific focus area - activity sets.

Table 3: Example Program Area/Activities Matrix from one of our cases

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<thead>
<tr>
<th>Program Area</th>
<th>Activities</th>
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Prompt: Is this accurate? Any misplaced? Are there any missing?

Q8. Describe the processes by which the RSI (or MSP) engages in these activities.

Prompts:
- a. What types of agreements or permissions were required among the partners?
- b. How was the schedule set?
- c. Who delivered the services and how were they selected?
- d. How were teachers (or other targeted groups) notified of the opportunity?
- e. What types of exchanges of resources were required? Who paid who?
- f. How was performance observed and evaluated?

Q9. Based upon the project documents that we have reviewed, we have developed the following table (Table 4) that lists out some of the events and products that have been involved in specific focus area-activity sets. In your review of Table 5, are there any other events that should be included? How about products (i.e. manuals, videos, etc.) created by the partnership?

Table 4. Example of Events, Products and Administrative Processes

<table>
<thead>
<tr>
<th>Area</th>
<th>Focus Area</th>
<th>Events</th>
<th>Products</th>
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Prompt:

1. Technical assistance in the form of people with STEM expertise
2. Written materials—manuals, curricula, documents
3. IT communication backbone
4. Technical assistance related to management (e.g. IFL)
5. Formal long-term training programs (> day)
6. Formal short-term training programs (< day)
7. Anything else come to mind?

Q10. Did any of the partner organizations have on-going procedures or programs that the partnership could plug into? How were these useful for achieving goals and activities?

Prompts:
   a. What were the advantages and disadvantages?
   b. How did you distinguish the partnership activity from other activities that might be going through the on-going process or program?
   c. Did the partnership activity change the way in which the partner organization conducted the on-going procedure or program?

TOPIC – CRITICAL INCIDENTS, OUTCOMES, AND COUNTERFACTUALS

In this section we examine some of the outcomes from the partnerships (if any), associated critical incidents, and any counterfactuals that provide an alternative explanation for outcomes. We will also examine some the strategies and procedures that are being used for evaluating the work of the partnership. Keep in mind that for many of the MSP’s it may still be early for producing clear outcomes.

Q11. Considering all that we have discussed in reviewing tables 1-4, what have been the most important to achieving your accomplishments thus far? What were the key things that helped? (ie. establishing research collaboratives…)

Prompt:
   a. What is the supporting evidence?
   b. What evaluation strategies have been used to identify outcomes? Impacts?
   c. Who has been responsible for the evaluation of the MSP? What organization?

Q12. Are there programs and activities not related to the MSP that are also key to achieving the outcomes you have identified? Please list all that might be relevant.

Prompt: Are there programs and activities outside of the partnership that are important? (ie. Other sources of funding for programs)

End of Key Informant Protocol #2
Core Partnership Interview, Protocol#3 – face-to-face interviews Early Version

This protocol was the early version of our interview protocol and was used in the first two sets of case study interviews. The #3 protocol that follows is the final version used in the later cases. It was administered during semi-structured interviews of participants at the administrative and operating levels (i.e. the core partnership group). This protocol builds off of the responses from the key informant interviews.

TOPIC -- CONTEXT QUESTIONS

Q1. What was the motivation for creating (or participating in) this [SI or MSP]?  
Prompts:  
   a. Did you have a prior working relationship with any of your organizational partners?  
   b. How about prior professional relationships with the people representing these organizations?  
   c. How long have your organizations been interacting on STEM-education related activities?  
   d. Describe some of the previous projects or programs that you have worked on together?  
       Would you characterize these earlier engagements as partnerships?

Q2. Why did your organization decide to join in with the [SI or MSP]?  
Prompts:  
   a. How does this project serve your organization’s strategic needs?  
   b. What are some of you most critical resource constraints in STEM education confronting your organization?  
   c. Did your organization feel it had to join?  
   d. To your knowledge, are there other STEM-related partnerships in which your organization is engaged? Please describe.

Q3. Why did you personally become involved with this [SI or MSP]?  
Prompts:  
   a. How does this project serve your interests?  
   b. What does participation enable you to do that you couldn’t otherwise do?  
   c. Did you have a choice as to whether or not you were involved?  
   d. Have you been involved in other STEM partnerships? Please describe.

Q4. Describe the social context that stimulated the development of this [SI or MSP]?  
Prompts:  
   a. What was the political/legal context?  
   b. What was the social context in terms of student, teacher, or school conditions?  
   c. What were the issues in the professional community of educators?  
   d. Were there demands from public opinion that led to the partnership?  
   e. What was the financial/budget context?
f. How volatile was this context?

Q5. We have developed a table (Table 1) of the goals, objectives, programs and activities associated with the [SI or MSP] based upon the project documents that we have been provided. In your view is this an accurate representation of the goals and activities of the [SI or MSP]? How would you edit or change Table 1?

a. As you review Table 1 please answer the questions concerning your involvement and the value you place upon the following activities.

Q6. How much influence does the [SI or MSP] have to implement goals within the school district?

Prompts:
   a. Review any of goals from Table 1 that the respondent hasn’t covered already.
   b. If the MSP has very limited power, who has control?
   c. Do different powerful parties have conflicting agendas related to MSP goals?

TOPIC -- PARTNERSHIP QUESTIONS

Q7. How is a partnership substantively different from other types of working relationships with other organizations?

Prompt:
   a. Do you find that your view of partnership widely held within your SI or MSP?

Q8. In Table 2 (below) is a list of the organizations and individuals that are associated with specific [SI or MSP] goals based upon the documents we have reviewed describing the partnership. Please review this list and make any corrections by adding names, deleting names or reassigning names to different goals.

Table 2: Nomination Roster Matrix

<table>
<thead>
<tr>
<th>a. Orgs Involved</th>
<th>b. Names Involved (with org affiliation)</th>
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Q9. Reflecting on the card sort exercise, have the values among partner organizations been aligned with the goals of the activity?

Prompt:
   a. How well were the values of district officials, school officials, teachers and others aligned with the goals of the activity?
   b. Does the level of alignment vary from one activity to another? Provide an example.

Q10. Did any of the partner organizations have on-going procedures or programs that the partnership could plug into? Were these opportunities useful for achieving goals and activities?

Prompts:
   a. What were the advantages and disadvantages?
   b. How did you distinguish the partnership activity from other activities that might be going through the on-going process or program?
   c. Did the partnership activity change the way in which the partner organization conducted the on-going procedure or program?

Q11. What has been the role of your governing or advisory board?

Q12. What have been some of the major bottlenecks that you have encountered in achieving the goals of the [SI or MSP]?

Prompt:
   a. What have been some of the major facilitators?
   b. Are there champions for the partnership? Who are they and what role do they play?
   c. What lessons have you learned that have led to a change in the way you organize the partnership?

Q13. Describe some of the transactions costs that you have encountered in working with the partnership.

Prompts:
   a. Opportunity costs for your organization? For you personally?
   b. Ease with which administrative interfaces with partner organizations can accommodate requests or demands from the partnership.
   c. Does one [or a small set of] organization(s) take the lead in administrative matters associated with the partnership?

Q14. What has been the turnover of partner organizations and/or key individuals during the life of the [SI or MSP]?

Prompts:
   a. What conditions would lead you to dissolve your partnership?
b. Has your partnership come close to dissolving?
c. In your view, would the dissolution of the partnership signal a failure?

**TOPIC -- OUTCOME/IMPACT/EVALUATION QUESTIONS**

**Q15. Describe the outputs from the [SI or MSP] activities?**

Prompts:
- a. Teacher enhancement?
- b. Curriculum improvement?
- c. Student enrichment?
- d. Achieving IHE goals?
- e. Sustaining the partnership?

**Q16. Did the project outputs result in improvements in teacher or student performance?**

Prompts:
- a. What evidence does the partnership have of effective activities?
- b. What evaluation strategies have been pursued?
- c. What evidence do you have of improvements in IHE pedagogy?
- d. What evidence do you have that the activities of the partnership caused any improvements (or failures)?

**Q17. What aspect of partnering produced a distinctive output or impact?**

Prompts:
- a. Have these outputs proven to be substantively different from other programs that produce these outputs?
- b. Was forming the partnership a necessary way of achieving these outcomes?

**Q18. What are some non-partnership related factors that may have led to the outputs or impacts produced by the [SI or MSP]?**

Prompts:
- a. For example, similar types of programs that were being pursued at the same time.
- b. Or, key individuals that championed the effort but did not require the framework of a partnership to accomplish outcomes or impacts.

**End of Core Partnership Interview Protocol**
The following is the final version of the Core Partnership Interview Protocol.

**Instrument #3: Core Partnership Interview Protocol** – face-to-face interviews

**TOPIC -- CONTEXT QUESTIONS**

**Q1. How did you personally become involved with this RSI?**

Prompts:
- a. How does this project serve your interests?
- b. What does participation enable you to do that you couldn’t otherwise do?
- c. Did you have a choice as to whether or not you were involved?
- d. Have you been involved in other STEM partnerships? Please describe.

**Q2. Why did your organization decide to join in with the RSI?**

Prompts:
- a. How does this project serve your organization’s strategic needs?
- b. What are some of your most critical resource constraints in STEM education confronting your organization?
- c. Did your organization feel it had to join?
- d. To your knowledge, are there other STEM-related partnerships in which your organization is engaged? Please describe.

**Q3: What types of political and social pressures made the RSI seem like a good idea?**

Pay attention to how the respondent frames the answer. Is their answer based upon their own professional views or are they answering from an organizational point of view? If it is hard to distinguish then your prompt needs to ask them to make this distinction.

Prompts:
- a. Aspects of the political/legal context?
- b. Aspects of the social context in terms of student, teacher, or school conditions?
- c. Issues in the professional community of educators?
- d. Demands from public opinion that led to the partnership?
- e. Financial/budgetary issues?
- f. How volatile was this context?

**Q4. We have developed two tables (Table 1a & Table 1b) of the goals, objectives, programs and activities associated with the RSI based upon the project documents that we have been provided. In your view is this an accurate representation of the goals and activities of the RSI? How would you edit or change Tables 1a or 1b? As you review Table 1 please answer the questions concerning your involvement and the value you place upon the following activities.**
Q5. Using Table 1b as a reference, what are the ways in which you spend your time in the RSI?

Q5a. Can you provide a rough percentage of the amount of your time associated with each of the efforts that you mentioned?

Or

Q5a. You have allocated your time in the following ways. Could you describe for each of these whether you work on this on a daily basis, weekly, quarterly, semi-annually, annually, or rarely?

Q6: What are the most important ways in which you participate in the RSI?

Q7. Do you represent the full extent of your organization’s commitment to the RSI? Again building on Table 1b, identify other places where your organization has committed people or resources.
TOPIC -- PARTNERSHIP QUESTIONS

In Table 2 (below) is a list of the organizations that are associated with specific RSI goals based upon the documents we have reviewed describing the partnership. Please review this list and make any corrections by adding names, deleting names or reassigning names to different goals. If you find it easier, please feel free to add names of specific individuals beside an organization.

Q8: Please indicate the organizations in which your history of interaction is separate from the RSI.

[Note: If the respondent lists off a large number of organizations then ask which of these they interact with frequently on a professional basis?]

Q8a. Please give some examples of your professional interactions with these organizations.

Q8b. Have any of these past interactions been influential in the workings of the RSI?

Q9: Returning now to the RSI, which of these organizations are you in the most frequent contact?

Q9a. Why are you in such frequent contact with these organizations?

Q9b. Has this changed over the life of the RSI? In what ways?

Q10: Describe how decisions affecting your work are made within the RSI. Who are the key decision-makers? Does this vary by program, activity, etc.?

Q10a. How smoothly does this process go on most decisions?

Q10b. Describe an instance when you have sought a decision from the [SI or RSI].

Q10c. Describe how conflicts are resolved in the RSI. Please give an example.

Q10d. How often do participants in the RSI have to seek guidance from their parent organization on key decisions?

Q11. Which organizations (or individuals) in the RSI are most influential?

Q11a. What is the source of influence? (Money, prestige, resources)

Q11b. How frequently does this organization exert influence? Describe some instances of this (for each of the organizations named).
Q12. With which organizations (or individuals) in the RSI have you developed an effective working relationship?

Q12a. What are the key factors in making this working relationship effective?

Q12b. Are there organizations (or individuals) in the RSI that your working relationships have been less effective? What are the key factors that have contributed to these working relationships?

[Note: You should be listening for evidence that indicates any of the following:
  ▪ Level of trust
  ▪ Level of mutuality in relationship
  ▪ The power of each actor in terms of influencing partnership goals
  ▪ The importance of the relationship to the stand-alone identity of their organization
  ▪ The importance of the relationship to achieving partnership goals.

If you are not hearing these themes in the responses then you should pursue them as prompts. To do this you should first mirror back their response and then pose a question like… “how important is the pattern of communication between your organizations?” or “does working with this organization enhance your own reputation?”]

Q13. Did any of the partner organizations have on-going procedures or programs that the partnership could plug into? Were these opportunities useful for achieving goals and activities?

Prompts:
  a. What were the advantages and disadvantages?
  b. How did you distinguish the partnership activity from other activities that might be going through the on-going process or program?
  c. Did the partnership activity change the way in which the partner organization conducted the on-going procedure or program?

Q14. What have been some of the major bottlenecks that you have encountered in achieving the goals of the RSI?

Prompt:
  • What have been some of the major facilitators?
  • Opportunity costs for your organization? For you personally?

Q15. Did the RSI develop standard operating procedures for doing work?

Q15a. Who set these procedures?

Q15b. How formal were these rules?
Q15c. How were bills paid and participants reimbursed? Did this happen in a timely manner?

Q15d. Were there changes in performance over time?

Q16. What has been the turnover of partner organizations and/or key individuals during the life of the RSI?

Prompts:
   a. What conditions would lead you to dissolve your partnership?
   b. Has your partnership come close to dissolving?
   c. In your view, would the dissolution of the partnership signal a failure?
TOPIC -- OUTCOME/IMPACT/EVALUATION QUESTIONS

Q16. How much influence does the RSI have to implement its goals?

Prompts:
   a. Review any of goals from Table 1 that the respondent hasn’t covered already.
   b. If the RSI has very limited power, who has control?
   c. Do different powerful parties have conflicting agendas related to RSI goals?

Q17. Describe the outputs from the RSI activities?

Prompts:
   a. Teacher enhancement?
   b. Curriculum improvement?
   c. Student enrichment?
   d. Achieving IHE goals?
   e. Sustaining the partnership?

Q18. Did the project outputs result in improvements in teacher or student performance?

Prompts:
   a. What evidence does the partnership have of effective activities?
   b. What evaluation strategies have been pursued?
   c. What evidence do you have of improvements in IHE pedagogy?
   d. What evidence do you have that the activities of the partnership caused any improvements (or failures)?

Q19. What aspect of partnering produced a distinctive output or impact?

Prompts:
   a. Have these outputs proven to be substantively different from other programs that produce these outputs?
   b. Was forming the partnership a necessary way of achieving these outcomes?

Q20. What are some non-partnership related factors that may have led to the outputs or impacts produced by the RSI?

Prompts:
   a. For example, similar types of programs that were being pursued at the same time.
   b. Or, key individuals that championed the effort but did not require the framework of a partnership to accomplish outcomes or impacts.

End of Core Partnership Interview Protocol
### Example Response Matrix

<table>
<thead>
<tr>
<th></th>
<th>Principal</th>
<th>MSP liaison</th>
<th>IHE</th>
<th>Union Representative</th>
<th>State Board</th>
<th>Other Nominated People/Orgs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adopting curricula</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Providing Funding</td>
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<td></td>
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<tr>
<td>Organizing Events</td>
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<tr>
<td>Teaching Assistance</td>
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<tr>
<td>Other Nominated Activities</td>
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</tbody>
</table>
Appendix C: Alaska Rural Systemic Initiative
Alaska Rural Systemic Initiative: Alaska Native/Rural Education Consortium for Systemic Integration of Indigenous and Western Scientific Knowledge
Case Study

Summary of the Project

At over 663,000 square miles, Alaska is geographically the largest state in the United States. It is also a vast wilderness with 40 percent of its 555,000 residents living in isolated rural communities with populations that range in size from 25 to 5,000 individuals. Approximately 20 percent of Alaska residents are Alaska Natives – Eskimos, Aleuts, and other tribes – who represent 16 distinct indigenous cultures, knowledge systems, and languages. Alaska Natives have commonly felt isolated and marginalized by non-Alaska Natives. One venue in which this isolation is acute is in the public education system.

An ambitious National Science Foundation project sought to bridge this divide using one single idea: that math and science education must reflect and strengthen the values and wisdom of traditional Alaska Native cultures. According to those involved in the project, a key difference between Western knowledge and indigenous knowledge is that Western science and education tend to emphasize compartmentalized knowledge that is often decontextualized and taught in the detached setting of a classroom or laboratory, while Alaska Natives have traditionally acquired their knowledge through direct experience with the natural world.

The Alaska Rural Systemic Initiative (AKRSI) was a ten-year project to implement a set of initiatives to systematically document the indigenous knowledge systems of Alaska Native people and develop pedagogical practices and school curricula that appropriately incorporate indigenous knowledge and ways of knowing into the formal education system. This project, funded at over $17 million and sponsored by the National Science Foundation’s Rural Systemic Initiative Program, took place in two phases: Phase I from 1995-2000 ($10,000,000) and Phase II from 2000-2006 ($7,199,438). Led by the Alaska Federation of Natives (AFN), in cooperation with the University of Alaska Fairbanks (UAF), the project has been highly successful and attracted international recognition as a model of fostering connectivity between Native ways of knowing and Western education systems. Furthermore, AKRSI has been successful in, among other things, increasing the student achievement of Alaska Native students; developing a large
amount of curriculum; decreasing the drop out rate of Alaska Native students; and providing the incentive for the formation of the Alaska Native Education Commission which represents Alaska Native’s education interests.

Preconditions for the Partnership

History

The history of the difficult relationship between Alaska Natives and Western settlers and their educational system is an important factor in shaping the Alaska Rural Systemic Initiative’s formation and operations. Native claims to land have been a long-standing issue as settlers came in and took over property previously occupied by the indigenous population. Spurred by the desire to build an oil pipeline across Alaska Native lands to the port of Valdez, in 1971, President Nixon signed the Alaska Native Claims Settlement Act (ANCSA) for land in contention since the U.S. purchased it from Russia in 1867. This was the largest land claims settlement in the history of the United States. The ANCSA was intended to resolve the long-standing issues surrounding Alaska Natives’ claims to the land they had occupied for generations and to stimulate economic development across Alaska. The settlement transferred land titles for 40 million acres to 12 Alaska Native Regional Corporations and over 200 local village corporations. The 12 Alaska Native Regional Corporations were established to share a payment of $462.5 million paid over 11 years from the U.S. Treasury and an additional $500 million from mineral revenues deriving from specific Alaska lands.

In the years leading up to passage of the ANCSA, Alaska Natives seeking a secondary education were forced to attend boarding high schools where they were punished for speaking anything but English in a process of assimilation into Western culture. In 1972, a court case challenged this system. While in the Lower 48 states, boarding schools disappeared for Indian children in the early twentieth century, they continued to be a reality for Alaska Natives who were forced to leave their homes to attend high school. In 1976, an out-of-court settlement was reached that led to the creation of 20 local school districts and construction of 126 state-supported high schools in Alaska’s rural communities. For the first time, students could obtain a secondary education in
their own community. Passage of the Alaska Native Claims Settlement Act in 1971 and the 1976 case that created local high schools represented a growing power base for Alaska Natives.

However, new challenges developed. In these new schools, the curriculum typically came from Western sources and focused on Western ways of knowing. The curriculum was not culturally relevant to the students it purported to reach and engage. Further, most teachers were outsiders who came in with a sense of adventure to teach at rural, isolated schools with little cultural preparation. Teachers commonly lasted one year before returning to the Lower 48 to continue their career in education. Many teachers faced tiny one-room schoolhouses where a small group of children of all ages are taught by one teacher who is not prepared for this teaching environment. By some estimates, only 4.6 percent of teachers in Alaska are Alaska Natives, while 80 to 90 percent come from the Lower 48 states. As a result of this and the cultural disengagement, the academic achievement of Native students consistently lagged behind non-Native students and Native students had a high dropout rate.

Attention to Native Knowledge Systems
By the early 1990s, Native approaches to topics such as scientific information were gathering increasing attention. In 1991, the Arctic Environmental Protection Strategy was signed by eight Arctic countries to help protect the Arctic region. It emphasized the need to recognize Indigenous environmental and ecological knowledge. In 1993, an Alaska Native and key player in AKRSI did his dissertation research at the University of British Columbia on indigenous knowledge systems which received a lot of attention both from the indigenous and academic communities and was later published as a book. His dissertation was notable in that it proposed a way of teaching that incorporates the ways of knowing available in Yupiaq and Western science. His dissertation committee included the key champion of AKRSI who was a professor at the University of Alaska Fairbanks. At about the same time, in April 1992 and May 1993, the Alaska Federation of Natives – the largest statewide Native organization in Alaska whose membership includes 178 villages, 13 regional Native corporations, and 12 regional nonprofit and tribal consortiums – and the University of Alaska Fairbanks, including the professor on the PhD students dissertation committee, sponsored three sessions examining the meaning of math and science in the Alaska Native world. The discussions at these sessions resulted in specific
recommendations for 60 Alaska Native leaders and educators related to the improvement of math and science education in public schools. These recommendations provided the AKRSI leaders with their agenda in developing the project. During these sessions, a group of Elders were recruited from each of the communities to help guide the reform effort. The Elders were to provide specific guidance based on Native ways of knowing. Also in 1993, the National Science Foundation brought together individuals working on State and Urban Systemic Initiatives to explore how a rural program could be established. One of the key suggestions was that the leadership in rural areas must come from that rural community as regions have a strong regional identity.

In May 1994, the Alaska Natives Commission, a federal and state task force formed to conduct a comprehensive review of programs and policies impacting Native people, released a report that articulated the need for all future efforts addressing Alaska Native issues to be initiated and implemented from within the Native community. The report stated that Alaska Natives felt the need to develop public school curricula that met the needs of Alaska Native students, which represented a growing dissonance between Western education systems and the increasingly powerful Native community.

**Partnership Formation**

**Grant Event**

In 1994, the National Science Foundation released a Request for Proposals for the Rural Systemic Initiative. Alaska was well poised to put together a strong proposal due to the previous work and collaboration ongoing between the Alaska Federation of Natives and the University of Alaska Fairbanks. The Alaska Federation of Natives and University of Alaska Fairbanks applied for grant funds to “document the indigenous knowledge systems of Alaska Native people and develop pedagogical practices that effectively integrate indigenous and Western scientific knowledge in educational programs.” The grant was primarily written by a professor at UAF who had been involved in teaching and research related to rural and Native education issues since 1970 in Alaska. He had helped to coordinate the three sessions at UAF examining the
meaning of math and science in the Alaska Native world in 1992 and 1993 in collaboration with the AFN and was highly involved in Alaska Native education issues.

However, a power struggle erupted between the Alaska Federation of Natives and the University of Alaska Fairbanks administration immediately over who would be the prime on the contract with the National Science Foundation, as the group acting as prime would be in the control of the grant funds and direction of the project. The Rural Systemic Initiative program allowed a non-profit to be the lead on the proposal. While the proposal was written by a non-Native professor in the university who was well-liked, respected, and trusted by Alaska Native groups, the AFN recognized that for it to have authority over the direction of the work, it must also have control of the finances. Having the AFN directly involved in the project also gave the project more credibility than if the UAF had implemented the project alone.

The AFN had previously not operated large programs such as the Rural Systemic Initiative prior to the grant; their main task had been community outreach and lobbying on behalf of Native people, largely funded by ANCSA settlement award money. The AFN had also had previous negative experiences working with universities and did not trust them. The AFN did, however, trust the professor and the Alaska Native doctoral student leading the effort. As one Alaska Native interviewee noted:

“AFN’s trust of specific individuals led to the work going forward. There was no special trust of the university."

The disagreements between the AFN and UAF resulted in the UAF visiting the NSF in Washington, DC to complain. The university was upset about the AFN encroaching on NSF funds which were typically university turf. The grant funding amount of $10 million for Phase I of AKRSI would have resulted in a significant amount of indirect cost funding for the university. Not surprisingly, some animosity developed between the AFN and UAF. The professor and his previous PhD student who wrote his dissertation on Native ways of knowing acted as the intermediary between the university system administrators who were fighting for control of the grant and the AFN, while trying to ease tensions on both fronts. In the end, the AFN convinced the NSF to let them be the prime organization and the university came around once the grant was awarded.
Once funded, the project was managed by a coordinating committee consisting of three co-directors: an Alaska Federation of Natives representative who had previously acted as a school superintendent and who was responsible for the overall grant management and served as a link between the consortium of organizations involved and the AFN; a well-liked professor at the university who wrote the grant; and the Alaska Native researcher who completed his doctoral dissertation on Native ways of knowing. Five Regional Coordinators managed activities in the five cultural regions of Alaskans (as explained below). Two graduate students also provided assistance to the UAF office staff. AKRSI had stable leadership during the 10 years of project implementation.

**Organizations Involved**

The grant involved over 30 associated Alaska Native organizations, state agencies, rural campuses of the University of Alaska, professional organizations, and 20 rural school systems. The 20 school systems representing 185 rural schools serve nearly 20,000 predominantly Alaska Native students. The remaining 28 rural school districts in Alaska, representing 103 rural schools serving mostly non-Native communities, served as the comparison group for AKRSI’s work for assessing AKRSI’s outcomes. Five rural school districts served as AKRSI focal districts where most of AKRSI’s activities took place. These focal districts contain 9,342 students in 61 schools served by 711 certified staff. The remaining rural school districts were impacted by AKRSI by participating in AKRSI-sponsored activities and benefiting from changes in state policies and creation of new curriculum. The Alaska Department of Education and Early Development Data and Assessment division was a partner to perform the data collection associated with the schools and districts for the evaluation of AKRSI’s performance.

AKRSI organized its activities in five major cultural regions in Alaska, with 20 participating rural school districts evenly distributed across the five regions. The five cultural regions are the Yup’ik/Cup’ik, Inupiaq, Athabascan, Southeast (Tlingit, Tsimshian, Haida), and Aleut/Alutiiq. The following map outlines the five cultural regions of Alaska where grant activities took place.
Partnership Operations

Goals and Initiatives

AKRSI took place in two phases: Phase I from 1995 to 2000 and Phase II from 2000 to 2005. The 12 goals of AKRSI were to:

1. To increase the presence of Alaska Native people, knowledge, and perspectives in all areas of science and education in rural Alaska;
2. To integrate Native ways of knowing and teaching that are compatible with student educational needs in rural Alaska and can build a foundation for all learning;
3. To develop curriculum models that are responsible to and compatible with the cultural makeup of the communities in rural Alaska and are consistent with the science education standards adopted at the state and national levels;
4. To document the indigenous knowledge systems and resources in the various cultural regions of Alaska to serve as a basis on which culturally appropriate educational practices can be built;
5. To create more appropriate learning environments for the integration of Alaska Native Elders and traditional knowledge as cultural resources for all educational programs;
6. To demonstrate the everyday uses of science in village life;
7. To improve the quality and increase the quantity of Alaska Native students who pursue careers in science and related fields;
8. To develop an infrastructure for making more effective use of technology as a tool for expanding educational opportunities in rural Alaska;
9. To increase Alaska Native parental involvement in all aspects of their children’s education;
10. To strengthen Alaska Native self-identity and to increase recognition of the contributions of Native people to society as a whole;
11. To improve Alaska Native students’ academic performance in science; and
12. To integrate all of the above into the fabric of rural education on a self-sustaining basis without NSF/RSI support after the year 2000.

The two Phases of the project were structured to achieve these goals. The purpose of Phase I was to strengthen rural schools and teachers while improving student achievement. The purpose of Phase II was to ingrain the curricula and educational practices achieved in Phase I in rural and Native Alaska and within the entire Alaskan educational system. As one Alaska Native noted, having ten years to implement the project was important as it took several years for the Alaska Native communities to really come on board and trust the work of the university and other non-Native groups and individuals involved in the project. He stated,

“The first five years laid the groundwork by building trust. The second five years made the difference.”

The primary difference between Phase I and II is that the latter Phase had an increased emphasis on sustainability of the initiatives that were implemented in the project.

In the original plan and proposal, there were 25 major initiatives for AKRSI. After the grant was funded, AKRSI narrowed the scope of the project to six major initiatives that were chosen to be best representative of the educational agenda of Alaskan Native people. The AKRSI project was organized around these six major initiatives:

1. Native ways of knowing and teaching: Document and apply traditional forms of math/science and associated pedagogy

2. Culturally aligned curriculum adaptations: Develop a comprehensive, culturally aligned curriculum framework in a cooperative effort with the participating school districts. Provide a balanced and integrated consideration of Native and non-Native knowledge and skills, utilizing local examples and resources while at the same time articulating with state and national standards.

3. Indigenous science knowledge base: Undertake a comprehensive survey and documentation of indigenous knowledge systems in each cultural region of Alaska under the guidance of a
coalition of organizations forming the Alaska Native Knowledge Network.

4. **Elders and cultural camps:** Elders-in-Residence program and cultural camps established at schools and at the University of Alaska rural campuses as a vehicle for integrating Alaska Native expertise into the educational and scientific programs and services offered throughout the state.

5. **Village science applications:** Foster interest in science-related careers on the part of Alaska Native students by bridging programs exposing students to scientists doing work related to everyday village life.

6. **Educational technology infrastructure:** Develop an integrated system for the effective utilization of multimedia and telecommunications technology in educational systems throughout rural Alaska.

Each year, the first five initiatives were introduced separately in each cultural region on a rotating annual basis. The educational technology infrastructure initiative was implemented in all five cultural regions over the term of the grant. By the end of Phase I of the grant, the five regions had participated in all six of the initiatives. Phase II continued the initiatives with an emphasis on sustaining them once the grant funds ran out in 2005.

**AKRSI Coordination**

At the top level of AKRSI, the three co-directors (one from AFN and two from the UAF) ran the program. Because AKRSI’s implementation was distributed across the rural regions of Alaska, much of the coordination of day-to-day activities took place at the local levels. In each of the five cultural regions, a Regional Coordinator was recruited and hired by AKRSI to coordinate the activities in that region. The Regional Coordinator was to act as the contact between AKRSI and the rural school district. The Regional Coordinators specialized in bringing the resources to the rural schools and the rural schools to the resources. It was important for AKRSI for the Regional Coordinators to be familiar with the local culture and language of the region, rather than hiring an outsider to run operations in that region. Each of the coordinators met with the AFN approximately five times a year to keep the project on track. The communication with UAF between the Regional Coordinators and other groups typically filtered through the two Co-Directors located on the UAF campus. The level of communication usually did not go any further up the chain of command at the university as the UAF’s involvement in the project was structured in such a way that the two Co-Directors had autonomy over the project.
Having student teachers and graduates from UAF placed in rural communities as teachers helped build collaboration between the university and the Native communities. With one of the Co-Directors of ARSI having taught at the university since 1970, he had many contacts with prior students, including many Alaska Natives, who were out working in the field in many areas of Alaska, including one of the Regional Coordinators working on the project who had been a graduate student of his. These relationships helped build the success of the project and break down barriers between the university and Alaska Native communities who often were distrustful of universities.

In each of the six initiative areas, partnerships with other organizations were critical to project implementation as numerous other entities at a regional and statewide level were responsible for specific tasks. Approximately 70 percent of the AKRSI funding from the NSF was subcontracted out to partnering organizations such as school districts, Native organizations, non-profit organizations, university campuses, and state agencies. AKRSI organized these relationships with Memorandums of Understanding (MOUs) and contracts for specific work. AKRSI was structured to allow more authority at the local control over budgets and day-to-day work. One challenge that AKRSI faced is that small rural school systems were often hesitant to take control of their own budgets in support of the AKRSI initiatives, but this changed as they gained more experience with the grant.

AKRSI also partnered with 20 businesses that sponsored K-12 students to attend the Alaskan Native Science and Engineering Society’s (ANSES) science camps where students’ work was judged on cultural content and science. Businesses also paid for travel for community participation in AKRSI’s activities. Native corporations provided resources for curriculum materials development. AKRSI supplemented its grant funds for additional activities through external sources including, but not limited to, Title I⁶, Eisenhower Mathematics and Science

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⁶ Title I of the No Child Left Behind (NCLB) Act is a federally funded program that provides financial assistance to local educational agencies and public schools with high numbers of children living in poverty to enable those children to meet challenging State academic content and performance standards.
AKRSI also established partnerships with the scientific community. For example, AKRSI jointly developed new curriculum with the assistance of the Geophysical Institute and the College of Science, Math and Engineering at UAF. The Alaska Native Science Commission (ANSC) was formed by the AFN with funding from the NSF. The ANSC provided guidance to practitioners of science on Native science and also documented traditional knowledge.

Efforts among the many partner groups were facilitated by the development at UAF of the Alaska Native Knowledge Network which provided teachers with a searchable, online curriculum database for Alaska-based curriculum standards related to Native student teaching and learning. Resources range from science units to research on Native learning styles. Each of the five regions contributed curriculum to the database, and then the resources were made available to all partners and the outside world. A bi-monthly newsletter, Sharing Our Pathways, was distributed throughout Alaska to keep everyone informed about what was taking place within AKRSI’s activities.

One of the most pressing issues facing AKRSI’s implementation was the development of trust among the partnering organizations. Given Alaska’s history and Alaska Natives experience with non-Native groups, it should not be a surprise that the AKRSI was designed for the AFN to have

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7 The Eisenhower Mathematics and Science Education Program is a U.S. Department of Education program dedicated to math and science which provides funds for professional development to improve teachers' skills and the quality of teaching in math and science in elementary and secondary schools.
8 The Johnson-O’Malley Program is a federally-funded program which provides supplemental education programs for Native American students attending public schools.
9 The U.S. Department of Education’s Migrant Education program seeks to ensure that all migrant students reach challenging academic standards and graduate with a high school diploma (or complete a GED) that prepares them for responsible citizenship, further learning, and productive employment.
10 The National Science Foundation is an independent federal agency that seeks to promote the progress of science and other fields such as mathematics, computer science and the social sciences.
11 The Rural School and Community Trust is a national nonprofit organization addressing the crucial relationship between good schools and thriving communities.
12 The Bill and Melinda Gates Foundation is a charitable foundation that aims to enhance healthcare and reduce extreme poverty, globally and, in the United States, to expand educational opportunities and access to information technology.
13 The Alaska Native Knowledge Network is available online at http://www.ankn.uaf.edu.
authority over the project with project management and guidance provided by the University of Alaska Fairbanks. Initially, one respondent stated that:

“There was resistance from the Native community in the beginning to get involved with the school district. Personal connections were key to overcoming difficulties.”

It was important for Elder and Native community involvement in all aspects of ARSI implementation. Academies of Elders were formed during the proposal submission phase to help guide the project and the Elders maintained this role throughout the project’s ten years of implementation. The Academies of Elders were groups of Native Elders from the local communities who shared their traditional knowledge with the Native educators who were seeking to apply that knowledge to teaching various components of the standards-based curriculum. Each of the communities participating in AKRSI had an Academy of Elders who helped to shape the project. AKRSI found it important for small rural communities to take ownership for the activities taken place in their schools and having the Academies of Elders in each of the communities facilitated this process. One interviewee noted,

“Rural people want to meet face-to-face for them to trust you. Local place-based development was a key feature in this program.”

Having the rural communities take ownership of the project was the way to changing the relationship between the communities and the schools. Without the Elders’ support of the project, it would have faced barriers in the communities. However, some lingering distrust of non-Natives involved in the project continued as not all were convinced of its merits. One interviewee stated that,

“Some Native Alaskan educators who were developing curriculum materials wanted to protect their intellectual property rights. Some of it was minor, but they still did not want to share their work. It was almost paranoia to protect their Native knowledge. Some of this is based on a prejudice against non-Native people.”

AKRSI experienced some difficulties in implementing the grant due to high turnover of non-Native participants in AKRSI’s activities. Once AKRSI would find that non-Native participants were up-to-speed on issues and working well within the partnership through their regular participation, then they would often stop participating because they moved away. On the Native Alaskan side, however, participants became increasingly enthused about the nature of the work
that was validating the importance of Native knowledge. An example comes from the *Handbook for Culturally Responsive Science Curriculum*\(^\text{14}\) developed by AKRSI. The handbook gives an example of how an Elder has little use for physics formulas to describe sea ice movement, yet that Elder intimately knows when ice is safe to walk on or what ice conditions to be careful of when out hunting. The implication is that Alaskan Native students should begin their science study with the application of knowledge and then work toward an understanding of why and how, which is often the opposite approach taken with Western ways of teaching science.

The role of the Elders was very important. Elders stated,

> “Elders who were sleeping got woken up. Good work in small villages got noticed and supported.”

> “Qualitative changes were more important than test scores. The project getting Elders involved has led to their emerging interest in continuing the efforts of AKRSI.”

This buy-in and commitment to the project helped to increase the community’s ownership of the project and the level of involvement by partnering organizations. One Native Alaskan was hesitant to participate but was surprised by the level of collaboration among organization in the AKRSI partnership:

> “I was contacted about a meeting in Anchorage to learn about AKRSI. I was a bit skeptical but went anyway and was surprised to see the number of organizations involved. Educators in the five regions came together to learn about the program and then we went back to our areas and worked with other organizations. Before the AKRSI, we were working like little islands. This changed as the groups started working together.”

Previously, there was not an effective means for collaboration across the vast communities of Alaska for groups that were working to improve education for Alaska Natives; AKRSI provided that vehicle.

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Institutional Adaptations

One of the key motivators for the project was that educational curriculum brought into schools in Native Alaskan communities was not culturally relevant for students. Hence, a host of problems including low test scores, high drop out rates, and disengagement from the educational system were the norm for many Alaskan communities. AKRSI found it important to make policy changes at the state level and was successful on several fronts.

Beginning in 1998, AKRSI participated in the Alaska Quality Schools Initiative which was co-sponsored by the Governor’s Office and the Alaska Department of Education and Early Development as Alaska’s major school reform initiative and resulted in revised Alaska education standards for K-12. The Alaska Native Education Coalition is a partnership of 20 organizations, including the AFN, which helped to influence the Alaska Department of Education and Early Development to integrate cultural standards into the science and mathematics curricula. Through their participation, the Quality Schools Initiative included suggestions for making sure that the needs of Alaskan Native students were met as the state developed policies on standards-based curriculum and assessment. Also, with support from AKRSI, the Commissioner and Board of Education created the “Native Student Learning Action Plan” to align the elements of reform with the educational needs of Alaska Native and rural students. During this time, the Alaska Department of Education and Early Development established a joint position for rural and Native education in the Alaska Commissioner of Education’s office as a result of discussions with AKRSI staff. This position created a direct link between the Quality Schools Initiative being implemented by the Alaska Department of Education and AKRSI’s initiatives. The Commissioner of Education was an important player in getting the broader Alaskan education community behind the goals of AKRSI. The Commissioner was well-respected and had a lot of power given her reputation and contacts across Alaska. Her enthusiasm and commitment to the project helped to promote Native-based education.

In 2000, school districts shifted basic funding for staff and curriculum development to direct support for AKRSI’s school reform initiatives. This commitment to AKRSI from the school districts showed their level of involvement and ownership of the goals of AKRSI.
The Native Alaskan community also made significant adaptations. First, the Native Alaskan community has become increasingly engaged in the educational system and has found ways to collaborate with the non-Native educational community. Academies of Elders share their traditional knowledge with Native educators who seek ways to apply that knowledge to teaching various components of the standards-based curriculum. The teachers then field-test the curriculum ideas they have developed, discuss the results with the Academy of Elders, and then prepare a final set of curriculum units that are shared with other educators. In 1998, AKRSI in partnership with the Assembly of Alaska Native Educators published *Alaska Standards for Culturally Responsive Schools* and *Guidelines for Respecting Cultural Knowledge*. These publications were aimed at helping schools seeking to integrate Indigenous knowledge and ways of knowing into their curriculum and pedagogical practices. The Alaska Board of Education adopted the *Alaska Standards for Culturally Responsive Schools* to assist teachers, schools, and districts in their development of curricula standards that address the unique desires of rural and Native education and its alignment with state and national standards. These and other publications have been distributed across Alaska for use in Alaska’s schools. Several have also been developed as distance education courses and offered through the Alaska Staff Development Network as a way to meet teacher state certification requirements.

Alaska Natives have formed new institutions including the Consortium for Alaska Native Higher Education, the Alaska Native Science Commission, and the First Alaskans Institute. Native Educator Associations were formed during AKRSI’s implementation in each cultural region in order to sustain the initiatives after AKRSI officially ended in 2006. These associations carry on the work of AKRSI by sponsoring curriculum development work, organizing Academies of Elders, and hosting meetings as a means of information dissemination. The First Alaskans Foundation (FAF) serves as a voice for Native students by campaigning for enhanced educational funding and policy changes in rural schools.

Native Alaskan groups are committed to the goals of AKRSI but still maintain their independence and do not want to completely lose their identity. One Native Alaskan interviewed for the project stated about the potential for continuing AKRSI’s work with future grant money:
“We want money but will not take it from anyone who puts too many strings attached to it.”

AKRSI may have also helped to stimulate the Alaska Natives commitment to respecting their heritage and culture:

“There is rebellion because English is the official language of Alaska now – by state law. All public meetings need to be in English. The Alaska Natives said ‘no’ and still do meetings in the Native languages. Our language is so much more. It fits more where we are. The legislature is out of touch and is still trying to make nice little English speaking folks out of Native people.”

The AKRSI sought to empower Alaska Natives in mathematics and science education and it appears to have done that and more.

Outcomes

“Education in Alaska would not be where it is today if it were not for this initiative. The timing was right to do it; test scores showed the need; the culture lacking was being noticed; but grassroots efforts were needed to break out of the inertia. Most people would not know what the AKRSI was but they would see the results.”

The Alaska Rural Systemic Initiative was very successful in meeting its goals. Academic achievement has been raised among Native Alaskan students; drop out rates of Native Alaskan students have been reduced; more Native Alaskan students are attending colleges and universities; more Native Alaskan students are choosing to pursue studies in the fields of science, mathematics and engineering; and more Native Alaskan teachers are teaching in their communities.15 The partnership created a large amount of culturally relevant curriculum – most of which is available to anyone free of charge on the Alaska Native Knowledge Network website.16 The project has attracted considerable international attention, with the AKRSI website being the most accessed website on the University of Alaska Fairbanks servers.

The University of Alaska Fairbanks has established a new M.A. and a new Ph.D. program with an emphasis on Indigenous knowledge systems. Six courses are available to students anywhere through distance education at the Center for Cross-Cultural studies at UAF. UAF also has a new

15 The Alaska Rural Systemic Initiative: Phase II Final Report submitted to the National Science Foundation details the specific accomplishments on AKRSI using each of these indicators. The report is available online at http://www.ankn.uaf.edu/download/AKRSI2005FinalReport.doc
16 http://www.ankn.uaf.edu/
program to target Native Alaskan Ph.D. students which is attracting more graduate students to
the university. The university is also exploring the idea of developing a research center based on
Native knowledge. The Alaska Native Education Commission was founded with 25 newly
established organizations involved from across Alaskan communities.

In the future, AKRSI expects there to be more interaction between UAF and Native Alaskan
groups. Because AKRSI has been so successful, there is pressure from the university to keep the
project going. This pressure is also felt in rural, Native Alaskan communities:

“Once the funding runs out, it is politically untenable for school administrators to stop
this work. The ideas are too public and too well received. For the past two years,
many of the locals have not needed the impetus of the AKRSI because people have
brought in and institutionalized the changes. They are a part of the system now.”

Unfortunately, two Math and Science Partnership proposals were rejected by the NSF because
Alaska did not have enough students to meet the eligibility criteria for reaching large numbers of
students. AKRSI reached approximately 20,000 rural Alaska Native students in each of its years
of implementation. However, the NSF’s Math and Science Partnership program solicitation in its
first year (2002) provided general guidelines for funding of comprehensive awards. The general
guideline was that there should be:

“A 1:25 ratio between the number of preK-12 students impacted and the maximum size of
the award. For example, the award maximum for a partnership involving a school
district or consortia of districts partners enrolling 20,000 students would be $500,000
per year or those enrolling 80,000 students would be $2 million per year.” (NSF Math
and Science Partnership Program Solicitation, NSF-02-061)

The AKRSI partnership reached too few students to apply for large grant funds. Given the NSF’s
criteria outlined in the solicitation, AKRSI was eligible for approximately $500,000 per year but
it applied for additional funds and was rejected by the NSF.

Many school systems are continuing the work of AKRSI out of their own pockets. The AFN has
decided that due to the high number of non-profit organizations established to carry on the
activities of the project, it will defer to these organizations as the project moves forward:

“The AFN does not want to compete with non-profits so they may not do more projects
like the AKRSI.”
Overall, the collaborative efforts of AKRSI have influenced the educational system in Alaska and improved the learning environment for thousands of Alaskan Native students.

**Conclusions**
The Alaska Rural Systemic Initiative was born in an environment where the Alaskan Native population was increasing its political capital in Alaska. These gains in political power resulted in the Alaska Native population forming political groups that advocated for future efforts addressing Alaska Native issues, including culturally relevant public school curricula, to be initiated and implemented from within the Native community. Prior positive relationships between one of these groups – the Alaska Federation of Natives – and two researchers at the University of Alaska Fairbanks facilitated the development of a successfully funded Rural Systemic Initiative project by the National Science Foundation. These personal relationships helped overcome barriers between the university system and the AFN.

The structure of AKRSI was bottom-up and collaborative among partnering organizations, with AFN and UAF coordinating all of the efforts. Collaboration took place horizontally among partnering organizations and school districts. The involvement and commitment of Alaskan Native Elders played a key role in building trust with the Native Alaskan community. The building of trust was an integral component of the project as the Native Alaskan community was highly skeptical at first about the role of a large university in the project. Another important aspect of the project was the capacity of AKRSI to leverage other resources and programs in the state such as additional grant funds and the Alaska Quality Schools Initiative, which was revising the Alaska curriculum standards and included the work of AKRSI in this effort.

The Alaska Rural Systemic Initiative was an ambitious project with significant outcomes. It was managed in a true collaboration with all partners equally valued. The decentralized nature of the project facilitated trust-building by allowing hesitant partners to overcome their reluctances by participating on their own terms. While administrators in the university fought to maintain control of the grant’s budget at the beginning of the project, the university now faces pressure to keep the project going and has taken steps to institutionalize some of these efforts. Although the
organizations involved were not highly embedded prior to the grant, they worked well together once the grant was funded and gave birth to more than 25 regional organizations and one umbrella organization – the Alaska Native Education Commission – to further the goal of AKRSI in bringing Native knowledge systems and the formal education system together.
Appendix D: Appalachia Rural Systemic Initiative / MSP
The Appalachian Rural Systemic Initiative

The Appalachian Rural Systemic Initiative (ARSI) was one of the first Rural Systemic Initiatives funded by the National Science Foundation (NSF). Based in Lexington, Kentucky, ARSI operated in five geographically dispersed states in Appalachia including Ohio, Kentucky, North Carolina, Tennessee, Virginia, and West Virginia between 1996 and 2005. This NSF funded project involved a consortium of education and community stakeholders, including five universities: Marshall University, Ohio University, University of Kentucky, University of Tennessee, and University of Virginia at Wise. These five universities worked with 50 rural K-12 school systems throughout the grant’s years in operation.

ARSI took place over 10 years in two phases and in two NSF Rural Systemic Initiative funding cycles. Phase I (1996-2000) focused on developing the knowledge and skills of the teaching workforce; developing a sustainable system to support teachers and students; and developing the leadership and ancillary support to sustain the project. Phase II (2001-2005) added the focus areas of documenting the effectiveness of the program; developing a research base of mathematics and science reform in rural communities; and establishing rural mathematics and science education sites at Appalachian-serving universities. Throughout its ten years of implementation, ARSI had three strategic goals:

1. To strengthen the knowledge and skills of teachers in grades K-12 so they can teach math and science more effectively;

2. To establish a timely and coordinated system for helping schools enhance their capacity to deliver active, standards-based teaching and learning environments on a long-term basis; and

3. To build regional partnerships, local leadership and local community involvement and support for long-term educational improvements.
Within each of these three goals, ARSI sought to build on local efforts and to keep local educators in the driver’s seat in project implementation.

**Preconditions for the Partnership**

In the Appalachia region, many communities are widely spread out and relatively isolated due to the nature of the terrain. The jobs in the communities are typically blue collar labor jobs such as coal mining or farming. In many Appalachian communities, school districts are the largest employer; however, ironically, the founder of ARSI found that many Appalachians did not seem to value education – something he sought to improve through ARSI’s efforts. High poverty rates in these communities compounds the educational issues facing Appalachia. This lack of value placed on education resulted in low test scores for students in Appalachia who may not have seen any future beyond a coal mining job. The lack of jobs in the geographic area was an impediment to motivating students. Furthermore, while resources to help the schools succeed existed outside of the local communities, the channels to make those connections often did not exist. For example, state universities may have been willing to assist local K-12 educational efforts; however, those connections did not seem to exist. Local schools were isolated in their communities and received little outside assistance.

Prior to the formation of the Appalachian Rural Systemic Initiative partnership, several of the participating states had ongoing educational reform efforts. For example, the Kentucky Education Reform Act (KERA) required that beginning in 1990, school systems were more accountable to the state department of education and faced rewards or sanctions if the school systems were not meeting the goals. Furthermore, requirements for school-based decision making resulted in decentralization of the school system to local schools with more decisions being made at the local level. As a result, local schools had more authority to make decisions about the day-to-day management of their resources, but in turn were also made more accountable to both the state and their local school district. Some schools in Kentucky were struggling with this new responsibility and were looking for ways to improve education at the local level.
Partnership Formation

Recognizing the educational challenges facing rural communities, and in particular Appalachian rural communities, in 1993 the NSF sponsored a conference in Huntington, West Virginia that brought educators, community members and business people from Appalachia with national level policymakers to explore the issues of teaching mathematics and science in high poverty rural areas. After the conference in 1994, the NSF sent out a Request for Proposals for funding Rural Systemic Initiatives. ARSI received a planning grant to fund regional conferences and interviews with educational stakeholders in the region in order to explore the educational issues facing Appalachia.

The National Science Foundation designed the Rural Systemic Initiative Program to have strict eligibility requirements. These requirements stipulated that at least 30 percent of school-aged children in the communities the grant serves must live in poverty. As one of the members of ARSI stated,

"The NSF rules make a difference in strategic choices for designing the grant as they are designed to game the system."

Applying the NSF’s poverty rule, the ARSI team found that 66 counties in the five states met this requirement and wrote them into the proposal. Partnerships were formed with individuals at five universities that the lead grant writer knew from working on other education projects. ARSI’s targeted areas included 66 counties within Kentucky, North Carolina, Ohio, Tennessee, Virginia, and West Virginia. The Appalachian team put together a proposal, and in 1996 was awarded a grant as part of the first cohort of four grantees (along with the Alaska RSI) for the RSI program. The grant proposal and proposed activities were essentially the brainchild of one individual who had lived in Appalachia most of his life and wanted to find a way to help improve the educational opportunities for Appalachian students.

The Kentucky Science and Technology Corporation (KSTC) was the lead organization for ARSI and had very little involvement from IHEs in the development of the grant proposal. Established
in 1987, KSTC is a private, nonprofit corporation that seeks to advance science, technology, and innovative economic development in Kentucky. It is comprised of leaders in the business, education, and government sectors. At the time of this grant, KSTC had a history of developing and managing education initiatives in Kentucky, and seemed like a good fit to house ARSI as the program requirements did not demand a university to lead the project. Once funded, ARSI maintained three staff at KSTC who ran the program. The involvement of the five universities in ARSI came about as the grant team needed a means of reaching communities in the five participating Appalachian states.

**Partnership Operations**

**Phase I**

The first phase of ARSI (1996-2000) focused on developing the knowledge and skills of the teaching workforce; developing a sustainable system to support teachers and students; and developing the leadership and ancillary support to sustain the project. The Appalachian Rural Systemic Initiative’s three strategic goals were addressed through its development of Resource Collaboratives, Teacher Partners, community engagement, and resource awareness.

The foundation of ARSI’s ability to impact education in five states was its use of Resource Collaboratives, which were coalitions of schools, community organizations, and institutions of higher education (IHEs). The Resource Collaboratives functioned as extensions of ARSI’s primary location in Lexington, Kentucky by being located in the five states served by ARSI. Based out of local universities and colleges, each resource collaborative provides training, resources, and guidance to the Teacher Partners and District Liaisons within their region.

Resource Collaboratives were located at the University of Virginia, Marshall University (West Virginia), Ohio University, University of Kentucky, and University of Tennessee. These five Resource Collaboratives partnered with teachers, schools, and communities in their area to improve mathematics and science instruction by improving the communities’ access to resources. The Resource Collaboratives provided several key services such as improving access
to resources; coordinating mathematics and science program improvement reviews at the school level; helping districts develop educational improvement plans; providing professional development opportunities; and providing opportunities for networking among school-level partners.

Although the Resource Collaboratives were housed at IHEs, the level of involvement of the IHE did not fully equate to a partnership. Instead the Resource Collaborative simply consisted of one individual at each IHE – the Resource Collaborative Director – who acted as a coordinator of activities for that region and typically involved the work of only one person performing these activities. One interviewee stated that the Resource Collaborative Directors served as “field agents” in facilitating local planning with Teacher Partners and districts in their region. The universities had no real involvement in ARSI beyond providing an office for the Resource Collaborative Director.

Critical to the work of the Resource Collaboratives were Teacher Partners at participating schools in their region. The Teacher Partners were experienced mathematics and science teachers who received support from ARSI for part-time release from their teaching duties, in order to facilitate the work of ARSI at their school. ARSI provided the funds in a contractual arrangement to pay for half of their salary as release time. The half-time salary match required for participating schools was designed by ARSI to encourage commitment on behalf of the school as well as increasing the potential for sustaining the effort beyond NSF funding.

ARSI found that in some instances, a school district’s inexperience in dealing with contracts led that district to take the money without expecting to be required to do the contracted work. ARSI found enforcement of the contractual terms fixed the situation. In later years, ARSI began a process of granting sub-awards to school systems that were audited and contracts to school districts that were not audited. This resolved issues with expectations for performance.

The role and specific responsibilities of the Teacher Partner, were mutually decided by the Resource Collaborative Director and the Teacher Partner based on the specific needs of that Teacher Partner’s school. These activities commonly included:
• Acquiring more in-depth knowledge about mathematics and science;
• Planning and implementing research-based instructional practices in their classrooms;
• Providing hands-on learning opportunities for their students;
• Serving as mentors with other teachers in their school and district; and
• Providing valuable resources for their colleagues

In turn, Teacher Partners were seen by ARSI as a valuable means of broadening ARSI’s impact by sharing what they had learned with other teachers in their school district. The support of Teacher Partners was a means for ARSI to have a broader impact with minimal investment. Initially the Teacher Partners were to be paid for by ARSI for two years; however, ARSI found that it was important to continue supporting many Teacher Partners beyond the initial two-year commitment, due to limited funds in the schools to pay their salaries.

The Resource Collaboratives provided support to the Teacher Partners by bringing in national mathematics and science experts to provide localized professional development opportunities; helping the teachers to access standards-based curriculum activities and educational materials available on the Internet; helping the Teacher Partners develop classroom lessons that were specific to their unique circumstances; and developing specific strategies for instruction based on students’ assessment results in mathematics and science tests.

ARSI brought the Teacher Partners together within their regions at periodic meetings to share resources and to generally obtain support from one another. Once a year ARSI organized a larger meeting that brought all participants together. This provided good opportunities for networking among ARSI participants and helped individuals connect with people outside their region.

A third key element of ARSI’s activities was the use of community engagement teams. The Resource Collaboratives assisted the community engagement teams with the tools to investigate the status of mathematics and science education in their schools. ARSI’s strategy was to develop:

“Grass root partnerships with local community leaders whose awareness of the importance of mathematics and science education ensures a brighter future for the
children of Appalachia. Parents, business and community leaders, teachers, and students form Community Engagement Teams to develop local leadership and to explore ways the community can assist its schools in the areas of mathematics and science." (ARSI website, http://www.arsi.org)

However, according to interviews with ARSI staff, community engagement was one of the largest challenges faced for successful ARSI implementation, as the Resource Collaboratives struggled with ways to engage community members who often were not very interested in participating.

**Phase II:**

The second phase of ARSI (2001-2005) built on Phase I by continuing the work of Phase I and adding the focus areas of documenting the effectiveness of the program; developing a research base of mathematics and science reform in rural communities; and establishing rural mathematics and science education sites at Appalachian-serving universities. The Resource Collaborative Directors continued assisting the participating districts with systemic reform strategies but shifted the emphasis to be more district-wide rather than focusing on individual school development. The Resource Collaborative Directors also worked with their IHE to get the services that ARSI had provided to be institutionalized in the universities, with the ultimate goal that the universities would evolve into a more service-oriented institution that serves their Appalachian region by working to improve access to educational resources. An additional focus for the Resource Collaboratives in Phase II was to expand their efforts to engage the five state departments of education to support and promote the ARSI model in all districts, regardless of their eligibility for participating in ARSI (i.e., 30% of students living in poverty).

In order to expand the reach of ARSI beyond individual schools and make district-wide changes in school systems, ARSI established a catalyst school in each participating district to act as a model school. The catalyst schools were to lead other schools in the district by showing how to effectively improve student performance in mathematics and science. They were to serve as a model of change and educational reform for other schools in the district. While there were no
specific guidelines for identifying which school would serve as a catalyst school, ARSI found that it was important to have a supportive principal and an enthusiastic Teacher Partner identified.

ARSI also worked with local leadership teams composed of a District Liaison, school principals, and the district superintendent, to create the capacity for sustainable change within school districts. The involvement of school and district leadership in ARSI was not an initial focus for ARSI in Phase I of its implementation. However, ARSI found that some school districts were initially reluctant to release teachers to work on ARSI’s activities. The Resource Collaboratives were spending quite a bit of time bringing administrators on board with the goals of ARSI and establishing their buy-in. Obtaining release time for teachers was complicated by struggles over who to establish as the Teacher Leader in a school. Once ARSI worked with leadership in the school districts, they recognized the benefits of participating in ARSI, which led to better cooperation and more support from the participating school districts. In many instances, the Teacher Leaders have now moved up into other positions of power in the school districts.

ARSI found that many schools did have good models to follow for high-quality science and mathematics programs in their schools. ARSI conducted program improvement reviews that helped schools assess their mathematics and science programs upon which to base their plan for improvements. ARSI noted that it was important for the program improvement reviews to be referred to as such, as schools were reluctant to participate if they were referred to as “audits.” A program improvement review consisted of outside consultants visiting the participating school and interviewing the teachers and students, observing classroom instruction, and reviewing the curriculum. The resulting report included recommendations for school organization, leadership, curriculum, instruction, training and development, school climate, and evaluation and assessment. The report was then used by the principal and Teacher Partner as they worked to improve their mathematics and science programs in the school.
Ongoing Operations

Throughout the implementation of ARSI’s two phases, the decision-making (such as which teachers would be funded as Teacher Leaders with grant funds) was typically top-down and led by one or two individuals at the Kentucky Science and Technology Corporation. The champion and leader of the project was very clear in stating that ARSI was not a true partnership among IHEs but, instead, was a project with specific goals that were dictated from the top and meant to be implemented at the local level. He stated,

“ARSI was not a partnership. It was run by a non-profit and had a good network within Appalachia, but ARSI did not “partner” per se.”

While the Resource Collaboratives, districts, and schools had flexibility in how they implemented the day-to-day management of activities, the goals were to be the same across the Appalachian regions and implemented in much the same manner. The IHEs that housed the Resource Collaboratives acted as convenient loci for managing activities, but they took direction from the leaders at KSTC and there was limited involvement between the Resource Collaboratives and other actors within the university. As one interviewee stated, the primary leader for ARSI,

“Acted as the center of a spoke and made connections across Appalachia.”

Being a charismatic personality certainly helped his situation. As another interviewee noted,

“He could bring the governors together if he wanted to.”

The leader is the type of person individuals respected and were very willing to work with on large-scale, ambitious projects such as ARSI.

As the project progressed, participants in ARSI found that there was some overlap in ARSI’s data reporting requirements with other ongoing state-level initiatives for curriculum development.
projects. This led to more collaboration among some programs but also more caution about putting additional burdens on participating teachers.

**Outcomes**

ARSI credits its success to being able to work in some capacity with 46 of the 66 eligible RSI school districts during its ten years of project implementation. ARSI found that its regional delivery system, while not a full partnership by its own account, was able to reach its mission of improving capacity at the local level for educational improvements. Much of that infrastructure is now being leveraged by the Appalachian Math and Science Partnership program which was funded by the National Science Foundation for $22 million to expand science, technology, engineering, and mathematics (STEM) education improvements in Kentucky, Tennessee, and Virginia. Further, ARSI points to the $10,038,030 in additional grant funds obtained for STEM educational improvements by ARSI’s “partners” in Appalachia from private, state, and federal sources during ARSI’s ten-year tenure.

In the final year of ARSI, a conference was held called the “End of the Beginning” that discussed sustainability of ARSI’s work. It encouraged teachers and principals keeping in touch and networking among themselves in order to sustain the work that ARSI had accomplished. To accomplish this, ARSI established listservs for the two groups to facilitate communication and resource sharing.

**The Appalachian Math and Science Partnership**

The Appalachian Math and Science Partnership (AMSP) brings together 51 school districts in rural parts of central and eastern Kentucky, Tennessee, and western Virginia. In addition to the local partners, there are 10 institutes of higher education included in the project, some serving as sites for resource collaboratives and regional collaboration centers. The majority of the administrative network for AMSP resides at the University of Kentucky in Lexington.

The region served by AMSP is best described as an underserved area that is often impoverished and definitely isolated. Collaboration between districts for professional development activities is
often difficult due to excessive travel needs. As mentioned earlier, the impoverished atmosphere found in the region often means that little focus is placed on the importance of education.

Whereas many of the Math and Science Partnerships deal with similar educational issues, very few of them deal with them on such a large scale in such an isolated region. As our research shows, these geographic and economic challenges come into play throughout the history and prehistory of AMSP, from its regional design to an almost inevitable reliance upon information technology for knowledge management and distance learning.

Within AMSP, decisions are centrally made by an executive committee upon the recommendation of various advisory councils. There are two principle administrative components to the partnership - planning and development, and program delivery - both hosted at the University of Kentucky. The Principal Investigator oversees the entire partnership. The planning and development component is lead by the Project Director. Included in the program delivery component are a Science Program Director and a Math Program Director, both serving as chairs for their respective subject area advisory councils. Another Co-PI does evidence-based aspects of evaluation, with a consultant from Inverness acting as external evaluator.

The second administrative component to the partnership is program delivery, which is administered by the Director of Program Delivery who is responsible for promoting the AMSP program, working with regional and local coordinators, and recruiting teacher participants. In addition, a number of actors at various resource collaboratives located at institutes of higher education throughout Appalachia are included in the administration of program delivery.

The first goal of AMSP is to eliminate the achievement gap in science and math for preK-12 students in Appalachia. AMSP also has a goal to build an integrated prek-16 education system which insures the selection, development, and career-long support the math and science teacher workforce. In order to achieve these goals, AMSP tackles four objectives through its programs and activities; pre-service teacher and administrator education; professional development of preK-12 personnel; student learning opportunities including parent/community engagement; and
research to advance the understanding of educational reform in rural school environments. A list of partnership goals, objectives, and programs and activities can be found in Table 1.

The pre-service teacher and administrator education objective is addressed through student teaching programs like the Explorer program which allow university students to explore teaching in partner districts. Courses are also designed and implemented at partner institutions of higher-education to better educate pre-service teachers. In addition, the AMSP addresses its pre-service and administrator education objective through recruitment efforts and Alternative Certification procedures.

Figure 1: Map of Region Directly Served by AMSP (source: www.apalmsp.org)
<table>
<thead>
<tr>
<th>Objective</th>
<th>Program</th>
<th>Activity</th>
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<tr>
<td>Preservice teacher and administrator education</td>
<td>Student Teaching</td>
<td>Explorer Program</td>
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<tr>
<td></td>
<td></td>
<td>Undergraduate teaching assistantships</td>
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<tr>
<td>Professional development</td>
<td>Math for teachers</td>
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<td></td>
<td>Physical Science for Middle School Teachers</td>
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<td></td>
<td>Earth and Space Science for Elementary Teachers</td>
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<td></td>
<td>Geometry for Middle School Teachers</td>
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<td></td>
<td>Mathematics for High School Teachers</td>
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<tr>
<td></td>
<td>Recruitment</td>
<td>Recruitment</td>
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<td></td>
<td>Alternative Certification</td>
<td>Alternative Certification</td>
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<td></td>
<td>Peer-Supportive Collaborative Learning</td>
<td>ScienceExcel</td>
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<td></td>
<td>MathExcel</td>
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<tr>
<td>Professional development of Pre-K personnel</td>
<td>Teacher Training Program</td>
<td>Leadership Internship Initiative</td>
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<td></td>
<td>Summer Institute for Teachers</td>
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<td></td>
<td>Leadership training for administrators</td>
<td>Training</td>
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<td></td>
<td></td>
<td>Principal partner support system</td>
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<tr>
<td></td>
<td>Counselor training</td>
<td>Workshops</td>
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<td></td>
<td>AMSP Graduate Certificate</td>
<td>AMSP Graduate Certificate</td>
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<tr>
<td></td>
<td>Technology Training for Distance Learning</td>
<td>Technology Training for Distance Learning</td>
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<tr>
<td>Student learning opportunities including parent/community engagement</td>
<td>Advanced Placement</td>
<td>Delayed Credit program</td>
</tr>
<tr>
<td></td>
<td>Teaching and mentoring activities</td>
<td>Teaching and mentoring activities</td>
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<tr>
<td></td>
<td>AMSP Summer program</td>
<td>AMSP Summer program</td>
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<tr>
<td></td>
<td>Parent/Community involvement</td>
<td>Prichard Committee for Academic Excellence</td>
</tr>
</tbody>
</table>
A number of programs and activities are designed to achieve the professional development objective. A teacher training program that includes components of graduate education, workshops, classroom materials, and a summer institute is designed to enhance the development of teachers who are already in the work force. Similarly, leadership training for administrators and counselors is achieved through training academies, formative assessment and improvement review programs, and the “Principal Partner” support system.

The student learning and parent/community engagement objective is accomplished in a number of ways. While these objectives are hardly mutually exclusive and almost all programs and activities arguably enhance student learning, students are directly touched by the AMSP program through the Delayed Credit program that pays for students to take AP exams in Math and Science, and the AMSP summer program for students. Parents and communities are engaged through teaching and community mentoring activities and the Prichard Committee for Academic Excellence.

Finally, the research objective is achieved by the research and evaluation strand of the MSP. While little evaluation work has been done to date, a recent RFP was published in order to acquire the outside support needed to address specific research questions.

Relationships and collaboration between districts and the AMSP have improved over time thanks to the partnership enhancement program and the utilization of regional program coordinators and outreach professors. Over the course of the partnership, relationships have formed to the point of embeddedness, making it easier for the partnership to solve problems, raise money, and launch new programs.

In the history of the partnership, there were a number of key events. The use of the SENTRA system as a knowledge management backbone has enhanced communication and collaboration, especially in winter months when long distance travel is not really an option. The partnership enhancement program has been critical in getting school districts to partner with both universities and other school districts in their region – increasing collaborative program development at the local level. Educating the institutes of higher education on the impact of the
program at the local level has also helped the program by encouraging participants at the university level.

Recently, the development strand has formed to find ways to maintain the programs and projects once funding ends. Once MSP funding ends, a plan has been made to transform the MSP into the Partnership Institute for Mathematics and Science Reform, headed by John Yopp. Recent efforts to enhance the grassroots approach to the partnership is another way in which sustainability is achieved – if the partnership fills local need, then activities are expected to find other sources of funding after the NSF grant is finished. Outreach full professors at the university level are chosen from within the math and sciences, with idea that only full professors have the clout necessary at the university to keep the program continuing after the MSP money is gone.

**Preconditions**

A great deal of the pre-story of AMSP is written in the history of ARSI. By the time NSF came to the ARSI leadership group with the promise of an even larger program aimed at enhancing math and science education, relationships between individuals and organizations involved in AMSP were firmly entrenched, and the strategic needs of all stakeholders in the region had been discussed and fleshed out. AMSP knew what they wanted to do and who they wanted to do it with, all it took was the promising of NSF funding to serve as a catalyst for further partnering.

Embeddedness in general, and embedded relationships promoted by ARSI in particular, was crucial to identifying the strategic needs of many of the players involved in AMSP. As one AMSP administrator put it, “…there was a very active professional development and instructors group, and it was common that they would work together on issues.” As noted in our earlier case study of the Appalachian Rural Systemic Initiative, AMSP administrators had a long history of working with NSF, having received a RSI grant in 1996 that was extended again in 2000.

At the local level, school administrators stressed a need to improve student test scores in math and science as well as the need to improve parent and community involvement in student learning. And while many local administrators were able to identify the same needs for better
teacher training and enhanced pedagogy, they were unable to address them for lack of a very pressing strategic need: money.

The needs of the students overlap the needs of the teachers, as better education and training for pre-service and in-service teachers, as well as a system of recognition for teacher efforts was consistently identified by teachers as a strategic need at the local level.

While teachers were voicing their needs, they were also voicing what they didn’t need: namely, a burdensome program that was not helpful to them. As one former teacher turned local administrator noted, “[another barrier I faced] was the teachers themselves. Usually anywhere I have been within my 34 years of teaching, I have found that the math and science teachers are the hardest working teachers – it is hard enough for the children to process science and math – and they don’t need another ‘thing’ laid on them.”

The need for enhanced teacher preparation and improved pedagogy among teachers was echoed among university faculty who identified a strategic need to fulfill community service requirements, one of which is to train good teachers to work at the local level.

Outside of the need for more money and better teachers, the need to change the prevailing attitudes and norms of the surrounding community was also consistently identified. This is mirrored in the AMSP grant proposal, which places great emphasis on the need to positively influence a regional culture that places little importance on math and science education. As one local administrator said, “…[our] county did not really expect very much for their kids. They kind of felt that they didn’t need to excel that much in math and science.” A partnership administrator elaborates further when he says that, “parents do not encourage students to get a great math and science education out of fear that the student will get a better education and leave town.”

The norms of rural culture not only placed little importance on math and science education, they also made strong partnerships with IHEs difficult. As one administrator commented, “rural culture is totally different. Many rural people feel like their education level is not respected by
universities. They are independent people and they do have lower levels of education, and so they do not want to be ‘shown up’ and do not want to be talked down to…they are reluctant to do new things.”

Despite observable state and federal pressure for education reform, respondents consistently failed to identify how these pressures influenced local reform efforts. As with many states, the state testing requirements for math and science were beginning to be put into place, which did put pressure on teachers and administrators to improve test scores. In line with testing requirements, there were a number of state initiatives for curriculum improvement, at both the local and university level. One initiative was specifically aimed at developing a seamless curriculum between community colleges and universities. In addition there was pressure from high level university administrators to revamp teacher education and emphasize teacher training. During this time, the US Department of Education was beginning to implement No Child Left Behind, which did share common needs with those found in the state, but at no time did anyone feel that NCLB was serving as an impetus for action.

Respondents at both the partnership administration and local administrator level pointed at the large influx of federal and state money for technology before the formation of AMSP. Despite the provision of technology in many local districts, there was often a need for teacher training in order to utilize the technology. In some instances, local administrators were offered technology money, but they had no idea what was needed in their districts or how to spend the money.

**Formation**

NSF formally announced the MSP program in 2002, and soon thereafter spoke directly with ARSI administrators about the possibility of expanding ARSI into AMSP. While AMSP is a continuation of much of the same work that ARSI started, it was still quite different in a number of ways. As mentioned in our ARSI case study, the Systemic Initiative was “not a partnership,” but was instead a top-down program run by a non-profit utilizing an extensive network of participants. These differences meant that new partners would have to be brought to the table, and new commitments would need to be forged. As he had for many years before, the PI of the ARSI project stepped up to recruit and organize the partners that would eventually form AMSP.
For ten years the PI “really established the ‘environment of relationships’ with the other organizations, especially the school districts,’” according to another member of the AMSP leadership team. Once NSF promised additional funding through the MSP program, the PI began to call upon his extensive connections to get potential partners to the table. As one administrator put it, “the whole thing was based on personal connection” and everything “at UK and AMSP was based on relationships in the beginning.”

While “the ability to pick up the phone and call people and get them on the phone had a big role in who they partnered with,” AMSP leadership was also skilled at bringing others to the table where they were “telling what [they] were thinking about, but [they] were also asking what the needs of the local schools were.” In addition to meeting with educators, administrators, and faculty at the IHE and local level, the formation champion kept in close contact with NSF, inviting them to talk to folks in the region.

A traveling road show put on by partnership administrators during the formation process was crucial in identifying commonly agreed upon strategies to address those common interests. As one IHE faculty member put it, “when we started with the AMSP they filled us up with a room full of science people from a variety of institutions who had common interests, which were working with school teachers and trying to enhance their ability to do science, but we truly had divergent points of view on how it would happen.”

This formation process can best be described as one that went from informal discussions about needs and strengths to a formal grant writing process that addressed the identified needs in ways that built upon the efforts of earlier programs such as ARSI and a Preparing Tomorrow's Teachers to Use Technology (PT3) grant. As one local administrator put it, “it seems to me like I started talking first, then I filled out a grant application, and then there was a formal grant process with AMSP…” In some ways, because of high embeddedness and previous work, the formation process was fluid and foreseeable. In explaining how AMSP grew from an earlier PT3 program, one IHE faculty member noted, “we had a PT3 grant which in our instance was a collaboration with the college of education and the college of arts and science, and that process
brought us in contact with teachers...so we began working together as a team, designing programs for pre-service teachers, and that sort of expanded when the NSF put out a proposal calling for the MSP thing.”

At the time of partnership formation, a number of future AMSP partners had forged ahead on their own and were pursuing their own NSF grants separate than the ones coming out of UK. Despite thoughts of leading their own MSP grant, almost all of the potential IHE partners in the region came to the table under UK leadership to form AMSP. Part of their willingness to commit to the AMSP partnership came from their realization that the chances of competing against UK and winning grant funds were slim.

Without a doubt, there were champions that helped in the formation of AMSP. The lead driver of the entire partnership is the current PD, a well tenured faculty member who has long showed interest in math and science education and from all accounts knows almost everyone in the Appalachian region. Prior to partnership formation, the future PD and PI were traveling the region talking with potential partners about the possibilities offered by an MSP.

There were also a number of micro-champions who were key in spreading this vision at their home organizations or within their local communities. Since so much of the partnership relied upon diffusion of buy-in over heavy local resistance, there was a great need for champions at every level to get people on board and get the ball rolling. When asked about why his IHE decided to participate, one faculty member noted that the question was hard to answer because, ”there were several of us involved in the decision. To some extent, I was the one that had an ‘a-ha moment’ that we had to align ourselves with the MSP to be involved in that.” As with many other organizations in the partnership, it took one or two local champions to have that ‘a-ha’ moment, which then slowly influenced the rest of the organization.

The previous history of partners, whether formal or informal, had a great impact on partnership formation. The desire of AMSP leadership to include stakeholders from all levels of education in the discussion, and the results of those discussions, were all enhanced by the familiarity of those at the table. When it came time for leadership to line up potential partners, members of the
leadership team used their personal connections to get the word out and gain new partners. As one respondent put it, “the ability to pick up the phone and call people and get them on the phone had a big role in who they partnered with.”

There are a number of strategic needs that came into play during the formation of AMSP. A universally shared need of all organizations involved is the need for funding. While some organizations have more dire needs than others, respondents at all levels replied that the promise of money was a driver for partnership formation. At the local level, the greatest motivation for forming AMSP was the promise of grant money. The funding also motivated the University of Kentucky because it would enhance the capacity of the school and increase its prestige among other universities. More generally, all parties were motivated by the common interest of enhancing teacher education. Among many of the locals it was not just raw money that was needed, but resources and enhanced organizational capacity that is simply not available outside AMSP activities.

A number of IHE faculty noted that K-12 math and science education helped meet their strategic need for better prepared freshman who are ready for the academic rigor of the university. In at least two instances, participation in partnership activities helped STEM faculty in their obligations as pre-service educators and in fulfilling their strategic needs of teacher preparation. As one IHE faculty member put it, “in this service region, 70 percent of the teachers are a product of [this university], so [this university] has a vested interest in providing better teachers in order to better educate the student – its like a dog chasing his tail.”

The need for minority involvement specified in the terms of the RFP was another strategic need that impacted formation. Because participation by minority populations was desired, local district partnerships were expanded from the previous RSI grant to include more school systems with high minority populations. As one partnership administrator put it, “we thought the MSP rules would need the minority involvement. Rules do make a difference in strategic choices gaming the system.”
This is an example of how strategic needs alone do not influence formation or operations. The same problems regarding math and science education among minority populations existed before the NSF announced the MSP program; it is just that the grant requirements of NSF led partnership leaders to focus on those problems and address them as formal strategic needs. In many instances a strategic need at the local level is not enough to spur action -- action requires that the strategic needs be identified by those wielding the power of the purse.

There is some mild environmental pressure impacting formation in both positive and negative directions. As noted earlier, there was already a growing concern in the states about the shape of math and science education. Various types of curricula reform were being debated at the state and local level, with pressure from both sides of the inquiry-based learning debate.

While there was some mild pressure for the types of reform provided by AMSP, there was just as much, if not more pressure against formation. In a discussion about teacher resistance, one local administrator noted that, “people didn’t want it at first because they thought it was just another job we were putting on them. There was some pressure within the district who didn’t want to participate, so there was some pressure locally who didn’t want [the partnership].” When asked to identify why some teachers would be motivated to resist reform efforts, one IHE faculty member suggested that, “maybe they feel threatened about what we are telling them…some teachers aren’t very good and are in their positions because they knew someone in the school district. They are pathetic and are here because some local administrator told them they have to be here and they also feel threatened. It’s not fun having them in a classroom situation…”

Because partnership leaders were often met with a lack of enthusiasm for the partnership, gaining support for formation was a slow process that required time. This is further hampered by site-based planning within the states, allowing districts to decide at anytime whether they were going to continue with the program. As one local administrator put it, “the way I got around this was by talking to the principals and telling them the advantages of working with the program. With AMSP, our P-16 council already knew we were in trouble and knew that we needed to do something. I convinced some math people who convinced some other people that this was a good thing, and we were able to convince them that this partnering was a good thing.”
The bulk of the proposal was written by the administrative team at UK and the KSTC, but input and feedback from all of the organizations involved was solicited throughout the process. Both university and local administrators discussed how the leadership team from AMSP came around and visited with various stakeholders during the proposal period to identify the needs and desires of those involved. This was not always the case, as at least one IHE partner came on board late and was not privy to the proposal until it had been written and submitted, but for the most part involvement from all players was secured. In two cases, regional universities had set out to secure their own full MSP before realizing that they were more likely to receive an award if they partnered with UK and operated within UK’s infrastructure, which was more suited for administering a grant of this magnitude.

A number of respondents from other universities noted that the crux of the power in the partnership rests in the administrative team located at the University of Kentucky. This power stems from a number of places. Both the PD and PI reside at the University of Kentucky, and final decisions on the grant are made by those at UK. UK gained early power as the partnership leader because it was the only university among IHE partners with the infrastructure and size needed to secure the grant.

**Operations**

Environmental factors as well as strategic needs drive the operation of the partnership, while embeddedness indirectly influences operations via its effect on transaction costs and environmental pressures. While champions are not essential to the day-to-day operations of the partnership, they continue to play an important role in steering the operational evolution of the partnership, as well as their continued efforts to bring more partners to the table. In other words, champions are crucial actors in that they identify the strategic needs, embeddedness, and environmental pressures. Champions choose programs that seek to take advantage of previous relationships and address strategic needs in the face of environmental obstacles.

As with the formation phase of the partnership, embeddedness plays an important role in the operations phase; however, the effect of embeddedness on operations is more indirect than
during the formation phase. It should be noted that the level of embeddedness between two individuals or organizations is not a static variable. Quite to the contrary, in most partnerships we can assume that embeddedness between actors will increase over time, as individuals participate in various programs, and navigate their way through the standard operation procedures for the partnership.

Despite some initial suspicion between the two groups, respondents reported high interaction between IHE faculty and K-12 staff, mainly within the confines of summer workshops and other professional development activities. As one IHE faculty member put it, “AMSP has brought together a relationship with K-12,” which according to one partnership administrator “never existed before.” This interaction has benefited both teachers and professors. As one faculty member stated while commenting on a professional development program for middle school teachers, “[teachers] introduced us to a lot of education language because there was a lot we didn’t know….the teachers were essential in helping us understand what middle school teachers actually do.”

Not only are faculty and teachers interacting more, some respondents have pointed out that the two groups feel more comfortable around each other compared to times when there was little direct contact between the groups. As trust is built between individuals participating in the partnership, the negative pressure from the social environment, and within individual schools and school districts that fought against partnership formation and participation in the beginning of the partnership, begins to lessen.

To say that increased embeddedness over time led to an easement of environmental pressures resistant of the partnership is not to deny the tension between K-12 and IHE faculty that continued throughout the operations phase of the partnership. In describing this imbalance, an IHE faculty member says that many high school teachers resist the efforts of IHE partners and suggests that perhaps the teachers feel threatened by the message faculty is delivering. In discussing the same phenomenon from a different angle, a local administrator noted that, “in the hierarchy of things [at the local level], teachers are at the top and now we are talking about someone [IHE faculty] on top of them…”
While AMSP has been successful in bringing interaction between STEM faculty at different universities, they have been less successful in increasing embeddedness and encouraging interaction between STEM and education faculty. When asked about his interactions with education faculty, a STEM faculty member noted that they, “had worked with them before asking for help on evaluations, but [were] unsuccessful. Math and science departments wanted numbers analysis, but the education department wanted focus groups as the solution – different approaches.”

As with almost any activity, time is a transaction cost to participation, as time spent on partnership activities often comes at the expense of one’s normal work. Simply operating various partnership activities comes at the cost of time because of the sheer amount of communication between partners than is necessary. And while there will always be transaction costs associated with time spent on individual activities, respondents reported a decrease in these transaction costs as embeddedness increased.

The majority of the reductions in transaction costs were centered around the standard operating procedures and paperwork surrounding financial reimbursements and billing/invoicing procedures. Despite a number of respondents mentioning billing and contractual issues as a transaction cost, most acknowledged a decrease in problems over time and a general feeling that “in the grand scheme of things it works out.”

Organizational embeddedness via previous collaborations or partnerships had little effect on transaction costs in this way, as a whole new set of standard operating procedures and even staff changed for the AMSP program. As a result, even staff members that had worked with the University of Kentucky on the RSI were forced to learn the new SOPs of AMSP.

As noted in the preconditions section, geography plays a key role throughout the region. Geography plays a significant role in operations as well. Both IHE and district respondents noted that working with some partners is difficult simply because of geographic distance. For
example, one district administrator noted that he would rather work with the regional university as opposed to the large state university because “its just easier to get to and more accessible.”

Unlike the formation phase of the partnership, environmental pressure emanating from state and federal standards had a direct effect on the operation of the partnership. This is most likely due to a perceived increase in policy pressure after the formation phase that was not there during the formation phase. Pressure from policy reform and government pressure affects program operation by guiding the focus of math and science education in the direction illuminated by the specific state policies. For example, the state of Kentucky has made Algebra II mandatory for high school education, ensuring that high school students have four years of math education.

During a description of the development of AMSP standard operating procedures, an IHE faculty member commented that a thorough look at the state science standards occurred at the beginning of the activity building process, further suggesting the environmental impact of state standards on operations.

At the local district level, the most basic need is for better trained and more educated teachers. Because of the need for better teachers, money, resources, and expertise are all strategic needs that feed into operations because they are the means by which schools and districts aim at bettering their in-service teachers. Teachers participate because the AMSP provides them with resources and knowledge they need at a cost cheaper than they would have been able to pay on their own.

At the local level, individuals and organizations are willing to participate in AMSP despite high transaction costs because they feel that their strategic needs will be met. As one local administrator put, “there is just a lot of paperwork as a condition of participation…but if I can do the paperwork then get the resources I need, then I am willing to do the paperwork.” This paperwork is largely centered around reimbursements for time spent at professional development activities and teacher release time.

At the partnership level, programs such as the teacher certification program and the pre-service teacher modules are designed to meet the strategic need for better math and science teachers by
ensuring that new teachers are well trained for the pedagogical demands of inquiry-based learning. The partnership also recognizes overall participation in its programs to be a strategic need that is crucial to meeting the partnership goals.

At the IHE level, a commitment to service is a strategic need somewhat fulfilled by AMSP participation. A number of regional universities participating in AMSP were founded as teachers colleges, with community outreach and teacher training as a top priority in their educational mission. This is not to say that the partnership alone is sufficient to fulfill service requirements. As one faculty member pointed out, “this does not fulfill our service components. It is only one part of a large thing. I am chair of the tenure committee, on curriculum committee, on a bunch of committees, and all this stuff sucks away my time – and I am not alone in this.” This suggests that when partnership participation does not fulfill service requirements, transaction costs associated with AMSP participation are higher than instances in which participation counts toward service requirements.

There are two types of decisions being made within AMSP: those concerning the overall administration of the partnership and those made at the frontline. As one member of the executive committee put it, “the PIs are not the ones who do the work – they are the coordinators, budget managers, and administrators.”

Champions continue to play an important role in AMSP during the operations phase of the partnership. In addition to continuing to diffuse the overall goals and message of AMSP to the wider community, and bringing more partners to the table, the champions play an essential role in the operational evolution of the partnership. Here, champions assume a role that is similar to a policy entrepreneur; guiding the partnership in new directions in response to identified strategic needs and environmental pressures.

An example of the AMSP champion playing this role is found in the development of the PEP grant program. While not originally part of the proposal, the PEP grant program was developed to meet the strategic needs of the partnership in the face of environmental constraints. Development of PEP grants to overcome site-based planning and negative social pressure as
environmental factors, coupled with a strategic need by the partnership for increased participation and the strategic need for money among PEP grantees, led to the development of the PEP program and individual PEP grants. This operational evolution required a champion to ID the environmental factors and strategic needs and to develop the PEP program. It also requires a microchampion at the local level to identify the strategic need for money and the opportunities provided by the partnership.

Development of the SENTRA and other knowledge management systems were designed to overcome geographic isolation as an environmental constraint, reduce the transaction costs associated with individual participation, and meet the strategic needs of increased participation.

Champions are able to drive operational evolution because of the decision making structure of AMSP which is best described as “a lot of inputs, but centralized decision making.” The project director has ultimate decision making authority but works closely with an executive committee made up of six co-PIs. The executive committee is informed in the decision making process by a number of councils including the math, science, technology, and program delivery groups as well as the management team and a national advisory board. A number of respondents at multiple levels of organization noted that these councils provide those at the districts and IHE organizations with the opportunity to collaborate on decision making strategy and reach consensus among partners through open dialogue. As the project director put it, “nobody is going to try and take off on their own.”

Even in instances in which the administrators decide to step into a new direction (like with the development of the PEP grant program), the PD and PIs are careful to collect feedback and opinion from all levels of the partnership before decisions are ultimately made. While the final decisions rest with the executive committee at the host university, the PEP program and other efforts by the leadership group lend themselves to increasing decision making at the ground level. For example, a PEP grant might provide the money and rough framework for a local program, but the decisions about content are made with heavy input from local leadership and IHE faculty.
While champions were crucial to the provision of a common vision and the steering of the ship, micro-champions were essential in providing the fuel needed to keep the ship moving. As these micro-champions participated in the first year of AMSP activities, their enthusiasm for the program led to the participation of their peers. As one administrator put it, “after the first summer people saw something they wanted to persistently participate in.”

These micro-champions were able to increase participation in a couple of ways. Their early experiences in the partnership helped belay the fears of reluctant teachers who worried that AMSP participation was simply “one more thing” to add to their already full plates. In essence, by reporting back on their experiences and using their acquired knowledge of the SOPs of the partnership, microchampions are able to increase buy-in among their peers and lower the potential and perceived transaction costs associated with participation.

Micro-champions are not the only ones responsible for increasing frontline buy-in for AMSP. However, an overall look at buy-in suggests that the teachers and administrators in the trenches are increasingly willing to contribute to the program. Respondents at all levels mentioned how teachers are very excited about the work AMSP is doing, and feel it is good work. As one district administrator put it, “people are almost willing to work for free because it’s a good thing to do.” Another district administrator told a story about a particular teacher in his district who had traditionally been a vocal critic of AMSP, and declared herself converted to the inquiry method after attending an AMSP workshop. Despite positive comments concerning buy in, one AMSP administrator suggested that there was a lack of buy in regarding their web-based knowledge management system as “most people don’t use it because it takes time to learn how to use it and there is not enough push from top administrators to use it.”

Outcomes
The overarching goals of the partnership have been described by district administrators as, “pie in the sky,” and are quite ambitious in their wording. And while the partnership has not succeeded in “eliminating the achievement gap in science and mathematics,” respondents generally feel that it has reduced the achievement gap. The partnership has also been successful in building an integrated PreK-16 education system through its efforts to build a seamless
transition for students from PreK through college, and by enhancing the ability of local school
districts to prepare their students for the academic rigors of college. As a part of this, the
partnership has especially excelled in the development of pre-service courses at the university
level and delivery of professional development and teacher training at the local level. While
fairly new in the history of the partnership, all respondents unanimously said that the PEP grant
program has also been successfully utilized by the various partners.

Regarding the partnership’s efforts toward community outreach, the results have been more
mixed. Several respondents reported successful efforts to involve parents and the community,
with a number of communities hosting parent nights and “college reality stores” for students and
parents. This is not to say that all outreach efforts were successful, as partnership administrators
have noted little success at involving business and industry in the partnership.

A number of respondents noted that the partnership has been less successful in its efforts aimed
at teacher recruitment and alternative certification. Although these initiatives were goals of
AMSP, efforts to meet these goals have been limited, and success in meeting them has been even
more limited. At times there have been issues surrounding teacher involvement, but this problem
has waned with time as organizations begin to view the partnership with more legitimacy, and
there is more buy-in among the individuals in the trenches.

There was general agreement among the respondents that the partnership has led to outcomes
that simply could not happen without the partnership. This is not to say that teacher workshops
and recruiting would not have occurred in lieu of a partnership, but that the large scale and
outreach of the partnership has made these efforts more successful. Furthermore, respondents
noted that the capacity and infrastructure that AMSP provides is the key to increasing overall
involvement compared to previous programs which were smaller and more piecemeal in nature.
Working in a large partnership enhances the ability of organizations to meet their common goals
compared to small islands of organizations working in relative isolation.

There is some trepidation concerning the identification of a solid link between AMSP activities
and outcomes, with one IHE faculty member noting that “we don’t have the experience yet to be
able to gauge effectiveness. There just has not been a long enough time frame to look at the effectiveness.”

Efforts early in the partnership to define the strategic needs of teachers and district personnel helped lead to successful outcomes because the programs and activities offered spoke straight to the needs of those involved.

There is general consensus that embeddedness and continued face-to-face contact leads to successful partnerships. Utilizing the PEP program was “slow to start because nobody knew each other…[but] these people are making gains based on more connections.” Embedded relationships make it possible to organize and act quickly as a group because of the “hundreds” of professional relationships among teachers and university faculty.

In general, respondents from all levels of organizations were quite optimistic about continuing the work of MSP as a sustainable project. Professional development and preservice teacher courses that have been developed are one way of ensuring mild levels of sustainability. Even if the partnership goes away, a number of IHEs have developed and adopted preservice curricula through the partnership that will be in place for some time to come. By bringing everyone together in such a large partnership, AMSP has enhanced the capacity of those in the region to identify potential partners and work with them to achieve common goals – something else that does not simply disappear when funding runs out.

With NSF funding almost to a close, efforts are being made to institutionalize AMSP and continue the project through other funding streams (state and local). In 2005, the University of Kentucky board of trustees approved $500k in funding for a free-standing institute which is what will become of AMSP after NSF funding disappears.

The PEP grant program and other proposal opportunities have enabled some partners at the local level to develop small subprograms and partnerships that create avenues of communication separate from the partnership as a whole. When asked about the conditions that might lead to partnership dissolution, one respondent noted that a more formalized, dictatorial form of decision
making and leadership cause the partnership to dissolve. This points to the idea that the equal balance of power in the partnership is crucial to its outcomes, and a different balance of power might lead to less successful outcomes.

There was very little evidence of organizational change as a result of partnership. In fact, when one IHE faculty member was asked if the partnership changed the way she did things, the reply was simply, “no.” The partnership has increased the number of inter-organizational relationships among partners. Organizations are more familiar with other organizations, and individuals have created innumerable personal and professional relationships. As one respondent put it, “now the faculty across the regions know each other.”
Appendix E: Duke TASC Targeted Math and Science Partnership
Teachers and Scientists Collaborating (TASC) Math and Science Partnership
Case Study

Summary of the Project

Teachers and Scientists Collaborating (TASC) is a targeted Math and Science Partnership (MSP) project grant funded by the National Science Foundation (NSF) in 2002 for a total grant amount of $5,528,333. Housed at the Center for Inquiry-Based Learning (CIBL) at Duke University, the TASC project’s focus is on inquiry-based learning of science for students in grades K-8 in North Carolina. Inquiry-based science learning involves students acting as scientists themselves by observing and questioning phenomena; posing explanations for what they see; devising and conducting tests to support or contradict their theories; analyzing data; drawing conclusions from experimental data; designing and building models; or any combination of these. The project is expected to serve 7,560 teachers and 352,800 students in four school districts in North Carolina.

The original goals set forth in the proposal for the TASC MSP are to 1) improve students’ thinking skills; 2) close existing achievement gaps in math, language arts, and science; 3) improve student readiness for high school science; and 4) raise math and language arts performance through inquiry-based science. These goals were to be achieved by establishing a cadre of scientists who provide ongoing teacher assistance in science content that is aligned with state and national standards. A second strategy to achieve the goals was to institute a professional development system to prepare teachers to use inquiry-based instructional modules and to benefit from scientist resources. The TASC project also created a fee-based lending library of inquiry-based modules available to teachers in the form of kits that include all instructional materials, supplies, and linkages to the North Carolina educational standards. Finally, the TASC project sought to institutionalize science education support through training teachers to use inquiry-based science education kits and the optional scientist support. The project also provides reimbursement for substitute teachers for trainings offered during the school day.

As of March 2008, the TASC project has worked with 11 school districts in North Carolina in providing curriculum units selected from an array of inquiry-based curricula, in-service professional development, and support from scientists. Partners in the MSP grant include the
Duke University Pratt School of Engineering which serves as the prime organization; 11 school districts; the North Carolina Department of Public Instruction (NC-DPI); the North Carolina Science, Mathematics, and Technology Education Center (NCSMTEC); and GlaxoSmithKline.

**Preconditions for the Partnership**

Public schools in North Carolina, as in most states, feel a strong pressure to perform well on subjects that are mandated for assessment. Historically, public schools in North Carolina did not require state testing of elementary and middle school students in science. Consequently, very few schools taught science in the elementary grades, let alone focused extensively on innovative curriculum models. Further, most school districts in North Carolina did not have a plan for science education in K-8.

However, all of this changed when the federal No Child Left Behind Act of 2001 required states to administer a science test, based on core science standards, to all students in at least one grade at the elementary, middle, and high school levels. States were given several years to implement the curriculum and required testing. While North Carolina already tested high school students, it did not have tests in place for elementary and middle school students. As a result, North Carolina planned for and mandated testing using the North Carolina End-of-Grade Tests of Science. These tests used the 2004 North Carolina Science Standard Course of Study beginning in the 2007-2008 school year for grades 5 and 8. According to the North Carolina Department of Public Instruction, these tests were:

> “Designed to require students to demonstrate knowledge of important principles and concepts, understand and interpret laboratory activities, and relate scientific information to everyday situations. In order to align with this curriculum's focus on inquiry, these tests have an increased focus on processing information and higher-order thinking skills.” (North Carolina Department of Public Instruction website)

With the NC-DPI’s curriculum and testing focus on inquiry-based learning, public school districts in North Carolina now had a strategic need to develop a strategy for meeting these requirements. As one school district representative noted,
While the public school districts in North Carolina were pressured from outside policies to increase the emphasis on science education for K-8, a group of science educators housed at Duke were already heavily involved in promoting inquiry-based science education in North Carolina. They were involved not because of outside forces – but instead because they were committed to improving science education and making it more meaningful for both the students and their teachers.

Prior to the grant, this group – Duke University’s Center for Inquiry-Based Learning – had been housed in Duke’s Department of Biology since 1997. CIBL is a group of scientists and science educators who develop exercises and train teachers in the use of multi-disciplinary, hands-on, discovery methods for teaching science. The goal of CIBL is to enrich science teaching in schools and to make science more accessible and interesting to a wide range of students of varying skill levels and educational backgrounds. CIBL operated primarily on grant funds and would hire consultants and sub-contractors to work on projects as needed when funds were available. CIBL would often work with the same consultants and sub-contractors over time as they became friendly with each other and interacted in the same science education community by providing workshops to teachers and enthusiastically promoting inquiry-based learning.

When the National Science Foundation issued a request for proposals for its Targeted Math and Science Partnership Program in 2002 along with the broader and larger-scale Math and Science Partnership Program, one of the consultants who worked with CIBL on a regular basis as an instructional designer approached CIBL about submitting a proposal. He saw the narrower focus of the Targeted Math and Science Partnership grants as a prime vehicle for obtaining funds to complete a large inquiry-based learning project in North Carolina. His colleagues at CIBL agreed and decided to pursue the grant funding. He acted as the lead author on the grant proposal for

17 Many of the respondents identify the CIBL group leading the TASC project simply as “TASC.”
18 For more information on CIBL prior to its formation as a non-profit organization, see the group’s previous website at http://www.biology.duke.edu/cibl/
19 The NSF’s Targeted Math and Science Partnership Program focused on improving student achievement in a narrower grade range or disciplinary focus in mathematics and/or science than the broader Math and Science Partnership Program.
Duke while hired as a consultant and coordinated the submission of the proposal with his CIBL colleagues.

However, the lead author could not serve as the Principal Investigator (PI) as he was not directly employed by Duke nor did he hold a doctorate degree, as stipulated by the NSF’s grant guidelines. A professor in the Pratt School of Engineering with ongoing NSF funding for the GK-12 Teaching Fellows program became the PI due to his interest in related activities and prior work with CIBL. His GK-12 Engineering Teaching Fellows Program, funded in 1999, had placed graduate and undergraduate student teaching fellows in seven elementary schools in four counties in the Duke University area. These Engineering Teaching Fellows aided teachers in the classroom in teaching math and science to elementary school students. This professor had received several other grants for Duke K-12 science, technology, engineering, and mathematics (STEM) outreach activities that inspired math and science learning in young people.

Once the grant was funded by the NSF, the consultant was hired by Duke to manage the TASC project full time as the director of the project. The grant was to be housed in the Center for Inquiry Based-Learning at Duke University. The TASC project received a grant in 2002 for a five-year Targeted MSP in the amount of $5,528,333. The TASC project was designed specifically with inquiry-based learning at its core.

**Partnership Formation**

Partners in the proposal included several organizations that fit the goals of the project. These included the North Carolina Science, Math, and Technology Education Center (NCSMTEC) and the North Carolina Infrastructure for Science Education (NC-ISE). NCSMTEC is a non-profit organization established by the Burroughs Wellcome Fund. It is dedicated to systematically improving student performance, grades K-12, in science, mathematics, and technology by working with education stakeholders including government, industry, education, community, and parents. The grant writer, the PI, and their colleagues had previous relationships with NCSMTEC through their work in K-12 science education in North Carolina. NCSMTEC’s Teacher Link program was included as a part of the TASC project to create meaningful, long-term partnerships
Alternative Approaches to Evaluating STEM Education Partnerships

among scientists, mathematicians, engineers and teachers. The professionals, called Teacher Link Program Fellows, were to serve as resources and mentors to K-12 teachers participating in the TASC project. The Fellows were to help teachers gain content knowledge and implement a nine-week, hands-on science curriculum unit. The Fellows were recruited by NCSMTEC from the STEM professional community and include working and retired engineers and scientists who would like to volunteer their time and expertise to K-12 education. NCSMTEC found that many engineers and scientists were interested in participating.

The second original partner in the TASC project – the North Carolina Infrastructure for Science Education (NC-ISe) – is a program of the North Carolina Department of Public Instruction, Elementary Science Division. Since 1999, the NC-ISe initiative brought teams from school systems to summer strategic planning institutes to develop five-year plans for science education reform. As a TASC project partner, NC-ISe was to contribute ongoing planning and coordination statewide, help CIBL recruit school systems to participate, and coordinate the subcontract with the North Carolina Department of Public Instruction (NC-DPI) for the TASC project evaluation through assessments of teacher and student performance.

In the way the TASC project was envisioned in the original proposal, NCSMTEC and NC-ISe would collaborate in providing the activities of TASC to K-8 teachers in North Carolina. The key activities of the grant were to be implemented by different partners. First, the use of science kits was a critical component of the project. A science kit is a box of resource materials for teachers that pertain to a particular grade and subject area, such as the human body in 3rd grade, the solar system in 6th grade, or the hydrosphere in 8th grade. The science kit would include all of the materials needed to provide a hands-on inquiry-based learning activity for students. Each of the kits was designed to be aligned with the North Carolina Science Standard Course of Study. In some kits, materials could be used only once and would have to be replenished for each classroom application. In order to help teachers understand the use of the kits, CIBL provided workshops to teachers on inquiry-based learning and trained them how to use specific kits in their classrooms. School districts would participate by paying a registration fee to CIBL for workshops and would have to commit to sending a certain number of teachers. Once teachers were trained in the use of the kits, they could request certain kits from CIBL. CIBL would mail
the kits out to the schools for use during a specific time period. At the end of the time period, the school would mail the kit back to CIBL to be refurbished with consumable materials and made available to another school.

A second integral part of the TASC project was to have scientists and engineers collaborate with teachers as they developed lesson plans and in classroom instruction by providing a real-world, expert insight into the science topic being taught. Scientists and engineers were to be recruited two ways: 1) through the Pratt School of Engineering at Duke where graduate and undergraduate students acting as Engineering Teaching Fellows were to act as mentors to teachers and 2) through volunteers recruited by NCSMTEC as Teacher Link Program Fellows. Ideally, the teachers would establish relationships with the scientists who would act as a mentor, answer any science content questions, and generally provide assistance to the teacher as the teacher implemented the use of the science kit and inquiry-based learning approach they learned at the CIBL workshops.

A third part of the grant was for the North Carolina Department of Public Instruction (NC-DPI) to help recruit school systems to participate and to provide evaluation services for the grant’s activities. The NC-DPI was to collect and analyze student assessment data for the schools participating in the TASC project to see whether any difference could be observed in students’ state-level test scores. NC-DPI was also to provide overall evaluation of the grant including evaluations of the workshops and other services provided to school systems.

Finally, the founders of the TASC project designed it to be self-sustaining after the MSP grant funds were to be fully expended in 2005. CIBL was to leverage the investment made by the NSF in purchasing the kits by providing an ongoing kit loan and renewal service as well as professional development to school systems. The school systems would contract with CIBL to provide these services. The vision was for CIBL to become a fully functioning non-profit organization.
**Partnership Operations**

Although the TASC project was officially managed by Duke University, most of its activities took place off of the Duke campus. CIBL was provided a generous space provided at no-cost by GlaxoSmithKline (GSK) in its corporate facilities in Research Triangle Park to implement the TASC project. The facilities provided to the TASC project include two large training rooms, office space, and a 3,500 square foot warehouse space with shelving and a forklift to manage curriculum units. GSK also provides phones, computer connections, security personnel, signage, and staging areas. CIBL estimates the value of the space provided at no-cost is $100,000 per year. GSK also pays for the shipping costs of shipping science kits to schools up to a value of $30,000 per year. GlaxoSmithKline benefits from this generosity by using the relationship for public relations campaigns that boast about the connection to helping teachers. This relationship came about through one contact at GSK who responded to CIBL’s informal discussions about needing physical space once the project got underway.

Many of the TASC project interviewees who managed the day-to-day operations of the project felt that Duke’s participation in the grant was more limited than was the original intention of the project. According to them, Duke was to have more participation in the form of faculty and student involvement as mentors to teachers by providing administrative support to the project and by providing more ownership over the TASC project. For example, the TASC project implementers at CIBL had expected the NSF-funded GK-12 Teaching Fellows (undergraduate and graduate students at Duke) to participate as Teacher Link Program Fellows (scientist and engineer volunteers) in partnership with NCSMTEC; however, Duke’s GK-12 Teaching Fellows had little involvement in the TASC project once it got underway. Instead what the TASC project employees emphasized is how independent they are from Duke. They made comments such as:

> “Mostly Duke is the umbrella that allows us to do our work.”

On the other hand, Duke viewed the relationship as a full partnership. Duke provides computer support to the TASC project; hosts its website to enable online enrollment and management of professional development and kit requests; and helped to raise a $50,000 donation from Progress Energy Corporation toward the purchase of curriculum units. Further, when a new Dean of the School of Engineering came to Duke, she wanted to support the PI’s interest in K-12 outreach.
activities. The Dean recognized that there was no regular rank faculty position at Duke whose promotion metric recognized excellence in K-12 outreach as a valid research activity. She valued the PI’s K-12 outreach activities and did not want him to face difficulties when he came up for tenure review by Duke University’s Appointments, Promotion and Tenure committees since much of his time was devoted to outreach activities instead of the traditional promotion metrics of publications and research activities.

The Dean established a cross-departmental faculty committee in the School of Engineering to determine if the school should establish a new faculty rank entitled “professor of practice” to oblige this new career direction. The faculty approved this new position, and the PI was hired as the first associate professor of practice in the School of Engineering. This represented a significant institutional commitment and change for a research-intensive university. Additionally, the Dean signed an agreement in 2003 to provide course credit in lieu of a stipend for both undergraduate and graduate Teaching Fellows that counts toward their graduation requirements.

CIBL had some difficulties with NCSMTEC’s involvement of Teacher Link Fellows to partner with teachers in a mentor relationship. NCSMTEC recruited scientists through the Sigma Xi fraternity in Research Triangle Park. Sigma Xi is an international, multidisciplinary research society with programs promoting the health of the scientific enterprise and honoring scientific achievement. Teaching Link Fellows were trained on the science content and pedagogical approach covered in workshops and how to assist teachers in using the kits. The Teaching Link Fellows received one to two full days of training in the NSF-supported curriculum units that the TASC schools used. The Teaching Link Fellows were to contact teachers at least three times during the nine weeks the teachers implemented the curriculum unit. Each Teaching Link Fellow was to support no more than 20 teachers per semester. The Teaching Link Fellows received a modest stipend for travel and the services offered.

During the one to two day trainings for the teachers provided by the TASC project at its GSK facility, approximately 20 minutes focused on ways to use a Teacher Link Fellow, including classroom visits, answering questions on science content, and help planning lessons. Teachers
received a list of the Teacher Link Fellows contact information tied to the unit they were teaching. A Teaching Link Fellow would attend the training to get to know teachers face-to-face. NCSMTEC developed a relational database of Teaching Link Fellows to connect supporting scientists and teachers electronically and in person that teachers could access over the Internet. However, teachers were hesitant to use the Teaching Link Fellows. One school system administrator explained that,

“TASC does a good job of promoting the use of the scientists but teachers are intimidated by the scientists and don’t want to make a mistake in front of them.”

The TASC project also tried hosting social galas to bring the scientists and teachers together informally but teachers still rarely availed themselves of the Fellows services. The TASC project staff cite several possible reasons, with the most common one being that teachers were not experienced in using outside scientists and were afraid the scientist would look down on the teacher for his or her less-extensive knowledge of scientific principles. It was a barrier that CIBL tried extensively to overcome by inviting scientists to more informal events to interact with teachers on a social level, but the majority of teachers did not avail themselves to the expertise offered by the scientists as often as CIBL had intended when it designed the program.

The TASC project’s relationship with NC-DPI was successful in recruiting additional school systems to participate in the project, but failed in relation to NC-DPI’s provision of evaluation services to the TASC project. NC-DPI’s Infrastructure for Science Education (ISE) program helped recruit three additional school systems since the proposal was funded. However, CIBL dropped NC-DPI as the evaluator of its TASC grant because their primary contact person at NC-DPI retired. Once she retired, CIBL found that the department had difficulty with its budgetary obligations to CIBL, had a lack of leadership involvement, and failed to meet its project obligations such as obtaining and analyzing student test scores. One TASC project staff member stated about this relationship:

“There is so much turnover at DPI that they do not know who we are. The people we started with left and the new people are not involved. They got some money from us but we broke the contract. They were doing some evaluation test development but once that was done they stopped. It is sad since we need the data to show results to keep going.”
CIBL replaced NC-DPI with faculty from the University of North Carolina at Greensboro’s Center for Educational Research and Evaluation to perform TASC’s evaluation.

The TASC project respondents indicated that the relationship with school systems was very positive. While some at CIBL may not view the relationship as a partnership, per se, they believe that it is a positive relationship in which all participants benefit. One CIBL interviewee stated that,

“None of the activities we do requires a partnership.”

Another stated,

“Basically we offer services. We sat down and tailored the services to needs. We can basically offer everything on the market.”

One CIBL staff member stated his view of how well the relationship between the TASC project and the school system was working by saying,

“School districts are involved because they are paying us.”

This arrangement seems to be one of school districts purchasing a service from CIBL. Another TASC project member saw the partnership with the school systems in a much more favorable light than the one with Duke,

“A partnership takes lots of time because it involves communication back and forth. In terms of what we are trying to do, a real partnership would have had much more back and forth involvement than we have experienced. For the partnership with Duke, we have had to instigate it. If we don’t, then nothing happens and that is not a partnership. The partnerships with the school districts are much more two-way. They have taken advantage in a good way, learning and taking what they can.”

Some TASC staff members found some difficulties working with the school districts. One found that:

“Some of the school districts offices are very poorly organized. They do not have clear scheduling and this limits or makes problematic setting up workshops. Poor communication is common. Many times teachers have no idea why they are coming to the workshop or they get word out about it right before it starts. Some systems are not very aware of what teachers are teaching and how the kits would be related to it.”
School districts interviewed had very positive things to say about their relationships with CIBL’s TASC project. One interviewee stated that,

“I do not know why TASC was chosen by my school district. I was put in this position by my superintendent, so here I am.”

Another point person interviewed at a school district stated that the district had no relationship with Duke or the other school districts prior to the TASC workshops. However, the Duke name immediately gave the TASC group legitimacy for this individual.

“Because of the Duke name, TASC immediately had legitimacy. Duke gave them a pedigree at the beginning. There is an assumption that Duke sent them out.”

Another school system person interviewed stated that,

“Duke sounds great but it doesn’t matter because the guys at TASC are first class. The people are more important than their affiliation. The guys at TASC all seem to like each other and work well together.”

Further, the school districts liked the ease of doing business with the TASC project. District representatives noted that,

“Vendors push themselves on you. TASC does not do this. They suggest multiple sources for any resources we need.”

“These guys are in support mode. They are very up front about the time and investment in work that it will take to gain improvements.”

District personnel felt they could talk to CIBL about any questions they may have. They said they never had any problems getting substitute teachers paid for by the TASC project. The teachers also felt they could keep in touch with the TASC trainers which were very different from their experiences elsewhere. Overall, their experiences with CIBL went well. However, one school representative noted that the relationship with CIBL is tenuous due to outside influences, given that,

“Money may be spent elsewhere at a school system as a new administrator comes in who may have different priorities.”

This individual felt that while the relationship with CIBL is going well right now, it may be sacrificed if a new individual comes into power who does have those established ties with the TASC project and chooses to obtain similar services elsewhere.
School system personnel identified a partnership in different ways. One respondent stated that a partnership to her is a little one sided:

“*A partnership means somebody I can call to ask for help.*”

On the other hand, another school district representative saw a partnership as being more equally distributed, even if the TASC-school district partnerships were not so evenly divided in terms of responsibilities:

“*A partnership is a give and take relationship. TASC has carried the burden of this partnership. This partnership is a give and take relationship but by no means is it a 50/50 share.*”

Overall, school systems were very positive about their relationships with CIBL and found the TASC project to be a highly contributing partner in the TASC-school system dynamic.

CIBL modified some of its implementation plans based on informal feedback from the school systems and teacher participants. School districts and TASC staff recognized the need to focus more on scientific content to bring teachers up to where they needed to be to fully realize the benefits of using science kits in their classrooms. This adaptation was based on feedback from both TASC trainers and teacher participants in the workshops. As previously mentioned, CIBL also tried to overcome the barriers to teachers availing themselves of the scientists’ expertise by providing more informal settings for the teachers to get to know the scientists on a more personal level.

Laws at the federal and state level affected TASC’s implementation. Many of the participating school districts paid CIBL for its services using Title II (Preparing, Training, and Recruiting High Quality Teachers and Principals) funds from the 2001 No Child Left Behind Act. Additionally, during TASC’s implementation, North Carolina changed its textbook adoption law to allow all school systems to purchase instructional kits for classroom use in place of textbooks. In 2005, all North Carolina school districts were permitted to spend textbook adoption funds on the curriculum units that the TASC project was using. Several school systems stated that because of the TASC project, they did not buy the textbooks but chose to buy the kits for inquiry-based learning. One school system’s choice to buy the kits versus renting them from CIBL was
predicated on Title II money being available for the purchase of the kits associated with the training. They could not have bought them if CIBL had not provided the training because the school system would not have the funds.

**Outcomes**

The TASC project was funded in 2002 and will run through 2009 (through a no-cost extension granted by the NSF). Preliminary evaluation results from the TASC project indicate that the impact on teachers was notable regarding their comfort level in teaching science, attitudes toward science investigations, and classroom practices.²⁰

As a result of the school systems being able to purchase their own kits because of the North Carolina textbook adoption law as well as the result of a private vendor entering the market and beginning to lease similar kits to schools in North Carolina, CIBL shifted its focus toward refurbishment packages for the kits which CIBL provided training in for schools that purchased kits with monies from Title II or textbook funds. CIBL did not want to compete with the private vendor for leasing of kits but instead decided it would be more advantageous to offer refurbishment packages for kits.

The TASC project was designed to be sustainable and supported on fees after the five years of the grant (plus two additional years granted as no-cost extensions by the NSF). In early 2005, the TASC team incorporated a non-profit organization called the Center for Inquiry-Based Learning (CIBL) to provide training and curriculum unit refurbishment for North Carolina school districts after the end of the grant period. This non-profit formation was planned from the beginning of the TASC project as a means of sustaining TASC’s activities after the grant funds period ended. The non-profit acts independently from TASC grant funds, but it is a first step in sustaining the TASC project’s activities once the NSF funding runs out. Services will be offered to TASC project and other school districts for a fee. The new non-profit will leverage the $1 million worth of kits invested in by the MSP grant funds.

Conclusions

The Teachers and Scientists Collaborating grant from the National Science Foundation provided professional development and science kit loaning services to public schools in North Carolina. While the project was envisioned to work as a partnership among Duke University, school districts, the North Carolina Department of Public Instruction, and the North Carolina Science, Mathematics, and Technology Education Center, it resulted in a fairly independent non-profit organization with limited ties to the other partners. The TASC project team operated fairly independently from Duke University; the NC-DPI had issues of turnover that affected its participation, and teachers were hesitant to make use of volunteer scientists provided by NCSMTEC. The TASC project was successful in reaching beyond its targeted number of four school districts by working with seven additional districts for a total of 11 participating school systems. CIBL was also successful in establishing a non-profit organization with the same name to sustain its activities beyond the grant term by establishing a business model that seems to work.

What is questionable, however, is whether the TASC project represents a true partnership among participating organizations. The TASC project does not appear to be a two-way relationship in which all partners contribute and receive something in exchange. CIBL provides clear and definable services to school districts – professional development and kit loans and refurbishment – but what CIBL receives in exchange beyond finances is not clear. The structure of the partnership was very top-down and authoritative with CIBL at the top making most decisions affecting the TASC project’s implementation. It appears to be a business model that works for the participating organizations of CIBL and the school systems.
Appendix F: Jacksonville Urban Systemic Initiative
Jacksonville Urban Systemic Initiative - Case Study

On November 17, 2005 when the new superintendent of the Duval County Public Schools (DCPS) took office, he found a district that had already begun changing in positive ways. The previous superintendent, a retired U.S. Air Force General, had laid the groundwork for shifting the local education system toward greater accountability, improved communication, and a more rigorous curriculum. He quickly identified the Jacksonville Urban Systemic Initiative (JUSI) as the key catalyst for the changes that had begun. The following case study is the story of the development and implementation of JUSI.

The Jacksonville Urban Systemic Initiative was designed to drive comprehensive math and science reform in the Duval County Public Schools (DCPS). The Urban Systemic Initiative (USI) program (NSF 93-67) was developed in response to the United States Census of 1990, which had pointed out the large numbers of school age children living in poverty in many major metropolitan areas. In 1993 the National Science Foundation (NSF) began accepting proposals to stimulate change in the twenty-five American cities with the largest numbers of school age children living in poverty. When Jacksonville was identified as a qualifying city, DCPS began to develop a program to address the complex local problem of high poverty in the district coupled with low performance in math and science.

Combining the resources of Duval County, the University of North Florida, and others, DCPS is continuing a shift toward math and science education in the classroom that uses more inquiry-based methods. This inquiry model, one of learning by doing, is both taught to children in the classroom and is now utilized in many ways by the adults making plans for and running this very large school district. This case study uses a framework developed from previous work to explore the preexisting conditions in Jacksonville, the development of programmatic activities

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21 DCPS serves the combined City of Jacksonville, FL and Duval County.
Alternative Approaches to Evaluating STEM Education Partnerships

through three USI proposal attempts, implementation of the work supported by the $15 million NSF grant, and how the local environment, embedded relationships, organizational strategic needs, and elements of public policy impacted the development, implementation, and outcomes of the JUSI. In addition, it tells the story of how a shift toward learning from experimentation, evaluation, and further experimentation was accomplished in Jacksonville.

**Preexisting Conditions - Duval County prior to JUSI**

**Policy Pressures**
In the early 1990’s prior to the implementation of JUSI, the then sitting superintendent of DCPS was looking for any program that might help to alleviate the pressure he was feeling to deal effectively with minority issues in the district (primarily the large achievement gap and court ordered desegregation). From an organizational level he was responding to changes in national standards, local standards and a broader movement toward greater standards-based accountability in public education. As budgets are always of concern, the availability of outside monies would make a program particularly attractive. Because the county was struggling with large numbers of school age children living poverty, DCPS qualified for an Urban Systemic Initiative (USI) grant. This grant program required the school district to develop a strategy for catalyzing and implementing systemic change in math and science education. The USI program was particularly attractive to DCPS leadership because of the potentially large influx of associated resources and as an opportunity to spark needed changes math and science education.

In addition to a general trend in education policy prior to the JUSI, there had also been local efforts to improve literacy and later mathematics education in response to these national priorities. As the USI program started sending out requests for proposals, the district was also aware that new science standards were coming soon from the state\(^{23}\) and federal\(^{24}\) level. Like all

\(^{23}\) The Florida Sunshine State Standards were modified in 1999 expanding the recommendations for educational achievement benchmarks K-8. It was anticipated that these benchmarks would provide the basis for future statewide assessment tests.

\(^{24}\) The No Child Left Behind act of 2002
schools in Florida, Jacksonville schools had to conform to the Florida Sunshine State Standards.\(^\text{25}\)

**Environment**

In addition to the local and national policy pressures, the demographics of the City of Jacksonville and its student population provide additional stresses on DCPS planning. The combined city/county school district has high crime and poverty rates and a very diverse population. The school system, one of the twenty largest in the nation, includes over 160 schools and serves approximately 130,000 students. Additionally until 1999, DCPS was under a federal desegregation order and closing the achievement gap among races was and still is an important driver in the community. The most recent demographic statistics show the district wide diversity in the student population (White (43.6%), Black (42.7%), Hispanic (6.2%), Asian (3.6%), and Other (4%))\(^\text{26}\). Attention to issues of diversity is very important among district administrators who deal with multiple languages and cultures among the students. However, the sensitivity to diversity also impacts DCPS decision-making in other ways (e.g., Choices about which schools to enlarge or close, the kinds of support programs and local outreach needed).

From the federal level, NSF’s drivers for the USI program included a move toward increasing the rigor in the local curriculum but with a sensitivity to the competing need to avoid leaving anyone behind. These competing goals challenge all education initiatives especially in math and science. Within the district there is a recognized need for increasing rigor and expectations to improve student outcomes but the message within the district is also “don’t leave anybody behind.” This mixed message presents a real challenge in a diverse school system. Lower performing children and those from poorer households present special challenges to educators. For example, local teachers can expect 100% attendance at school meetings from the parents of

\(^{25}\) JUSI partner organizations included, the Alpha Kappa Alpha Sorority/FCCJ -- South, US Army Corps of Engineers, Bethel Baptist Institutional Church, City of Jacksonville, Duval County Council of PTAs, Duval County Teachers United, First Baptist Church of Mandarin, Florida Community College at Jacksonville, Intellicon, Inc., Jacksonville Chamber of Commerce, Jacksonville Children's Commission, Inc., JEA, Jacksonville University, Jacksonville Urban League, Johnson Controls, Inc., Junior Achievement, Mayo Clinic, NationsBank, St. Paul African Methodist Episcopal Church, St. Paul Missionary Baptist Church, University of North Florida, and WJCT Public Broadcasting.

\(^{26}\) These numbers are based on the 2005-2006 school year as reported by the DCPS website [http://www.educationcentral.org/dcps/facts.asp](http://www.educationcentral.org/dcps/facts.asp). The number of Hispanic and Asian students is increasing as a share of the local student population.
the gifted program while they rarely see parents of under performing children. This relative lack of participation on the part of some parents reduces the support for and impact of local education initiatives.

**Strategic Needs**

Strategic needs can be assessed at multiple levels including those of the local community, the organizations involved (e.g. DCPS, UNF), and the individuals involved in providing or participating in programs. Recognizing local problems (intensified by Jacksonville’s, poverty, high crime rate, and diverse population) may require help or resources from the outside, local administrators were and are on the lookout for any tools that might be used to address them. In addition, prior to the USI, the city had sponsored the New Century Commission, a research project that pointed out the need to strengthen local education and to take a more K-16 approach to developing the DCPS course curriculum. Making choices about what to confront and when was a matter of local leadership. Due to one specific local condition prior to the JUSI (the city being identified as in the top 25 in the nation with the most children living in poverty), the district was a potential recipient of funds under a then newly established NSF program. The decision was made by the top-level DCPS administration to focus on the funding the program made available.

With the decision to write a proposal for a USI grant that was made at the highest decision-making level within the district, the problems intended to be addressed by the USI program (e.g., math and science reform) became high priorities for the entire school district. The overlap between the local community’s needs and the school district’s constant search for additional funding provided the primary motivation for developing the JUSI. From the superintendent’s office on down, the school district knew that there was an opportunity and that they had to go for the initiative. This motivated a variety of individuals and organizations to become involved in developing an acceptable USI proposal for the City of Jacksonville.

**Embeddedness**

Implementation of projects like the JUSI requires the involvement, mutual trust and commitment of participants from multiple organizations at multiple organizational levels, including the
individuals in the top decision-making administration and those with the power and authority to make commitments on behalf of the sub-units of the institutions involved. As JUSI was being developed, the former President of The University of North Florida (the first African American President of UNF and a former president of the Jacksonville Chamber of commerce) and the then superintendent of DCPS had a longstanding interpersonal relationship. Their trusting interpersonal relationship, based on a prior history of working together, made it possible for their institutions to come together and was the key to moving the proposal stage of the project forward. At the institutional level there was also an ongoing history of DCPS and UNF working together on cooperative grants (now reportedly about 25 grants over the last 5 years).

The close ties among Duval County and its JUSI higher education partners did not happen overnight. DCPS and personnel at several local universities had been working together developing and implementing programs under other initiatives for many years. For example, UNF has had a long history of providing workshops for training of the DCPS in-service teachers, and it is also UNF institutional policy to spend money on weekend and summer camps for local children. However, program level faculty alone could never have moved the JUSI project proposal forward. Huge institutional commitments were needed, especially on the part of DCPS and such commitments could only come from the top-level administration. However, for the project to succeed, it also needed district participation at the program level (e.g., teachers and program administrators) and UNF faculty with some history with or who would be accepted by the district. Still, UNF involvement in the USI was assumed from the beginning because of the connections at the top.

The Grant - Jacksonville’s Urban Systemic Initiative is awarded

Building on National Science Foundation’s Statewide Systemic Initiatives, the Urban Systemic Initiative (USI) program was developed to meet math and science reform needs at a more local
and urban level\textsuperscript{27}. NSF included six primary drivers for systemic reform as the guiding principals for the program\textsuperscript{28}. These drivers focused on developing improved math and science curricula and teaching with the goal of improving academic outcomes in districts with high rates of poverty. Eligibility for USI was limited to the 25 cities with the largest number of school-age children living in economic poverty\textsuperscript{29}. Recognizing the value of the program (primarily the number of dollars involved) and how the increased funding could help to meet local needs, DCPS began applying for funding and was granted an award on its third application.

The $15 million grant to DCPS was awarded on May 7, 1998 in the first announcement of the third and final cohort of NSF funded Urban Systemic Initiatives\textsuperscript{30}. The project funding began on September 1, 1998 at the beginning of the school year and finally wound down on June 30, 2006. The broad purpose of the project from a federal perspective was to implement comprehensive plans to promote higher graduation rates and requirements, increase math and science course

\textsuperscript{27} The Rural Systemic Initiative (RSI) program developed separately and later to address the unique needs of rural communities.

\textsuperscript{28} 1.) Implementation of comprehensive, standards-based curricula as represented in instructional practice, including student assessment, in every classroom, laboratory, and other learning experience provided through the system and its partners.

2.) Development of a coherent, consistent set of policies that supports: provision of high quality mathematics and science education for each student; excellent preparation, continuing education, and support for each mathematics and science teacher (including all elementary teachers); and administrative support for all persons who work to dramatically improve achievement among all students served by the system.

3.) Convergence of the usage of all resources that are designed for or that reasonably could be used to support science and mathematics education--fiscal, intellectual, material, curricular, and extra-curricular--into a focused and unitary program to constantly upgrade, renew, and improve the educational program in mathematics and science for all students.

4.) Broad-based support from parents, policymakers, institutions of higher education, business and industry, foundations, and other segments of the community for the goals and collective value of the program, based on rich presentations of the ideas behind the program, the evidence gathered about its successes and its failures, and critical discussions of its efforts.

5.) Accumulation of a broad and deep array of evidence that the program is enhancing student achievement, through a set of indices that might include achievement test scores, higher level courses passed, College admission rates, college majors, Advanced Placement Tests taken, portfolio assessment, and ratings from summer employers, and that demonstrate that students are generally achieving at a significantly higher level in science and mathematics.

6.) Improvement in the achievement of all students, including those historically underserved.

\textsuperscript{29} This included children (ages 5 to 17) as determined by the 1990 U. S. Census.

\textsuperscript{30} For details see table #1.
participation and rigor, and to provide system wide teaching infrastructure improvements. The specific details of the plan were to be tailored to and modified within the local school district.

**Partnership Formation**

**Motivations**
The driving motivation for the creation of the JUSI was the availability of the funding from NSF. However, in the early stages of the JUSI this motivation was tempered and refocused by project staff who were focused on determining what helped children learn. The enquiry-based mindset developed among project staff during the process of developing the proposal carried over to their interactions with teachers encouraging them to explore learning. The focus on learning, so important to understanding the JUSI programmatically, has since crept back up from the JUSI staff to the broader DCPS administration. However, in the beginning of the proposal process, the focus was on getting the funding first and secondarily making real systemic reform.

**The Proposal Process**
The first attempt at writing a proposal in year one of the USI program was led and mostly done by the school system with the help of key university faculty. Initially DCPS was not sure how to approach writing a proposal for this initiative and so they and their university partners were learning from the experience of preparing each draft. The plan needed to reflect local needs even as it needed to respond to the USI program. However, in the early stages, some district people reported wanting NSF to tell them what NSF wanted so that they could then write a proposal based on that. USI had developed a proposal process that was very different from what the district had experienced in the past. Prior initiatives had specific programmatic intentions that needed to be closely followed. The grant writers were used to being told what to write. DCPS had no experience with a process that really asked them to assess and address local needs.

Over time it became clear that NSF wanted the potential grant recipients to really assess their local needs and to then explain in their proposal the plan for addressing those needs. The school system tried in many different ways to solicit input. For example, there was reportedly one meeting in the very beginning at Jacksonville University in which an entire cafeteria was filled...
with community partners trying to help draft the proposal. The result was that there was too much input and insufficient focus. The first draft proposal lacked sufficient cohesiveness among the various pieces to make it work and it was rejected.

When the first proposal was not accepted, DCPS brought in a team of professional proposal writers. The proposal they developed in year two of the USI was also rejected. The problem with this one was reportedly that the local people involved were not going to get what they really wanted or needed. The outside experts did not sufficiently capture local conditions or needs. Over time it became obvious that the local stakeholders needed to be more involved in the proposal, but a better means for assessing needs and developing a plan was required.

For the third and ultimately successful proposal, most of the writing was turned over to the local resource teachers. The USI was designed on a whiteboard by a small, knowledgeable local team with the goal of closing the achievement gap. This team focused on the 6 main drivers established by NSF. In addition, they paid attention to local needs and planned around local DCPS goals (e.g., Florida’s A+ plan at the state level and the report of the New Century Commission on Education from the community at large\(^{31}\)). For example, two components of the project were the use of summer and weekend camps and the development of teacher leaders in math and science. The university-based camps focused on under-performing students and combined the training of pre-service and in-service teachers with providing remedial help to the children. Thus small numbers of students were helped directly while the teacher training created a multiplier when they went back to their classrooms. Another component of the JUSI was the creation of a cadre of in-service teacher leaders to act as mentors and models in math and science. These teacher leaders were intended to improve student outcomes by improving math and science teaching ability and content knowledge.

The Partnership - How DCPS Made Links To Institutions of Higher Education

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\(^{31}\) Florida’s A+ plan for grading schools was implemented in 1999 and attempted to apply market pressures by allowing students from failing schools to receive vouchers to use at other private or public schools. The plan also ended social promotion and increased teacher standards. In 1998 the New Century Commission delivered 155 recommendations in its report on the state of education in Jacksonville / Duval County (www.jacksonville.com/special/ncr/summary.html).
The importance of certain individuals to the development and implementation of JUSI cannot be overstated. From the beginning, leadership at the executive level drove the formation of the JUSI while leadership at the program management level drove the operations. As mentioned, the relationship between the President of UNF and the original DCPS superintendent was the key to moving this project forward prior to the NSF grant. Individual teachers or faculty could have never developed the institutional commitment that drove three proposals and moved the project forward. About the time the grant was approved, the DCPS administration changed. The change in superintendents at the beginning of the funding in some ways reduced senior administrative support for the JUSI as the new administration pursued other initiatives. Still, the position of the JUSI director, within the DCPS administration and reporting to the superintendent, created a tacit authority for the JUSI.

The second superintendent of schools, a retired Air Force general, started a strong pro literacy movement (based around the success of the *America’s Choice* program). As schools were included it created a web of increasing interest, but poorer schools could not come up with the approximately $100,000 for the training and program-provided, professional development (they did not want to give up a teacher to get the training). The school district was interested in moving this initiative forward; however, many schools choose not to add the expenses of the America’s Choice program and instead learned the techniques with the help of local higher education faculty from seminars and books and then implemented them. They knew that they could learn what made America’s choice so good without having to go to the same expense.

Within the framework of this program DCPS developed a cadre of literacy standards coaches. The standards coaches were regular teachers pulled out of the classroom and given administrative duties, support and special status. Their task was to help provide professional guidance on how to improve literacy in the classroom. Originally, the school principals appointed the standards coaches; however, the positions are now applied for by classroom teachers. The JUSI programs started later, used a different model (teacher leaders), addressed different needs (math and science), and operated in parallel to the literacy standards coaches.

**Precondition Impacts on Formation**
Prior to the JUSI, there had been links across institutional boundaries between local executives (e.g., Mayor, Superintendent of Schools, University Presidents or Deans). In addition, there had been localized operational links among those who developed, implemented, or participated in school-related programs (e.g., some school district teachers and administrators had previously worked with a small number of higher education faculty). There was little to connect senior administration to the efforts of those who ran programs between institutions. JUSI changed all of that. The senior executives were aware of the large amount of money available to Jacksonville. This awareness translated into action as university faculty members were loaned to the district and internal DCPS staff members were tasked to developing and running the JUSI.

Prior experience with summer camps and other programs led to decisions about what kinds of programs would be included in the JUSI proposal. For example, many participants reportedly got very little from the school-business interactions of some earlier summer camp programs. Some businesses simply did not provide a high quality learning experience for the students. Program staff identified control of the qualitative differences in the experiences provided as a key reason for the decision to focus summer camp programmatic activities around new, more easily controlled, university-centered, engineering programs. By bringing engineers, teachers, and students together in the classroom it was possible to control the experience ensuring more consistent quality.

**Partnering Operations**

A number of programs were developed and implemented under JUSI. These included teacher coaching and leadership programs, professional development programs in math and science aimed at large numbers of in-service elementary and middle-school teachers (for details see table #2), as well as a variety of after-school, Saturday and summer enrichment programs aimed underperforming students.

**The Nature of the Partnership**

JUSI was closely aligned with the DCPS administration from inception to end. Within the district it is felt that the only way the district would own a reform initiative was if the initiative
was based within the district. Otherwise, it might amount to merely signing off on some
workshops of other interventions conducted by outside university or other experts. The current
superintendent says, “There might be some gain for a little while, but at some point the benefits
drop off unless they becomes a part of the work of the district.” The real systematic changes
would not creep into the school system.

An important characteristic of this case is, therefore, that it was not university owned or
operated. While most of the USI staff was located in various locations around Duval County, the
JUSI project director and her administrative assistant were employees of DCPS and had an office
located within the district’s central administration building (which also housed the
superintendent and the school board). Thus, the top management of the USI was in the main
DCPS building. Being “in the building” gave her office some credibility even as it made the
director subject to the beck and call whims of the superintendent. However, by being close to the
district’s control center, the superintendent (and school board) could ensure that the work being
done was aligned with district goals even as the project director could use the tacit authority of
being part of the administration to gain access to and acceptance from district schools.

The JUSI management structure (closely connected to the district) resulted from the first
superintendent’s involvement in initiating the proposal. It was carried through even when the
district’s top administration changed over time³². The close ties to the district might have
resulted in university partners who were only contactors doing what they were told but this was
not the case. Several UNF staff members were a part of the initial planning and proposal writing
and understood the necessity of keeping the project close to the district. For example, they
described a fact-finding trip they took with DCPS Staff:

Early on in the planning, we went to visit another USI project that worked with about three
school districts. It was clear from talking to the director there she sat in the ivory tower at the
university talking to superintendents and not to teachers. There was little involvement at the
grass roots level. The project director lacked legitimacy. She was not part of the school district

³² This may have been a case of inertia (not wanting to force the project manager out of one office) but the result
was that even when the new administration took a less active role in supporting JUSI the position of “being in the
building” added to the perceived legitimacy of the project.
from the perspective of teachers and staff and was seen as another outside expert trying to tell people what to do\textsuperscript{33}.

This visit and others helped JUSI staff gain a clearer understanding of the kinds of working relationships and communication between institutions that seemed to work better or worse. The people involved in the JUSI were talking to each other more directly. They were working together to develop plans and solutions. NSF cited DCPS’s partnership with IHE as one of the most impressive characteristics of JUSI.

Higher education faculty were involved in the leadership of JUSI, the higher education consortium, summer and weekend camps, and in the professional development workshops for teachers. In addition, IHE faculty had participated in intensive sessions on coaching, adult learning and content development with DCPS Teacher Leaders. According to one senior IHE participant, “faculty approached their work with a collaborative mindset, often brainstorming with the Director and teacher leaders as they planned and delivered professional development”.

The original JUSI director (and this was continued by the later administrator) gave a substantial sub-contract to UNF to give the IHE’s money to work with. This contract arrangement gave the university some muscle and some flexibility. However, the relationship remained one of partners and not one of client to customer. The contract also gave the UNF the ability to recruit directly from other IHE’s (the UNF contractor’s intent was to represent all the local IHE’s to the JUSI and not just UNF or himself). While he was the primary point of contact and the manager of the sub-contract, he tried to be inclusive of the broader local IHE community.

Given the contractual arrangement, the partnering among the institutions might have been filtered through key personnel (e.g., the project director on the DCPS side and the holder of the sub-contract on the university side. However, the control structure of JUSI was very flat. For example, people running summer programs at the university called senior administration at

\textsuperscript{33} The site they visited is not one of our case studies, however, it involved a university led project. The USI director answered to a university grant recipient who spoke to school superintendents / decision-makers. Second-hand instructions were then repeated by the project director to staff who actually interacted with principals and teachers. According to JUSI respondents, their impression was that crossed lines of communication resulted in confusion about what was to be done and led to a lack of legitimacy for the project as a whole.
DCPS (and vice versa) as needed. When asked if the partnership was more like a contract, an organization or a relationship, respondents talked about the partnership as the totality of the intervention but attributed the successes to a personal relationship with the project director (and sometimes in spite of relationships with other people “in the building” [Duval Administration]). It quickly becomes clear that partnering in JUSI was very interpersonal.

There were many connections among the people involved in developing or implementing the programs. However, it is less clear that the participants regularly think about the entire intervention as a partnership. For example they say:

JUSI was by definition a partnership…. We could spend hours just talking about the different levels of kinds of partnerships. There was one in higher ed that responded to JUSI while part of it was doing other things. However, there were several sub-partnerships involved…. It depends on which aspects of the JUSI. Parts of the work were partnerships between institutions of higher education and the school system…. We created a higher education consortium that brought in partners specifically to work with the school system. In the process of doing the work there were other community partners.

The JUSI project director said of the institutional relationships that, “For us it [the partnering with IHE] was more of a collegial relationship, not a ‘here you are, here is your plan.’”

In addition to the JUSI project director, other individuals were identified as vitally important to the success of various programs. For example, when JUSI participants discussed the programs for at-risk students (e.g., Saturday Stars, Summer camps) one woman was universally mentioned for her extraordinary commitment to the work. She went out into the local community and recruited students at local churches, grocery stores, and recreation centers. Her efforts were cited as critical to getting community support and participation in the remedial programs supported by the JUSI. While many people contributed to the efforts of the JUSI much of the success was attributed to a small number of highly motivated individuals.

**Decision – Choice Making**
Decision-making was centralized around the DCPS administration. The JUSI director would have headed up any decision-making. However, decision-making did have a collaborative component. This was very closely tied to the top-down structure of the county school system. A decision by the USI had some of the weight of coming from the top administration but not all. USI programs were not always specifically pushed from the top of the school system, as the former superintendent did not support math and science reform in the same energetic way that he promoted literacy reform.

Under the USI one of the key initiatives was developing math and science ‘teacher leaders’ in each school. Similar to the literacy standards coaches, teacher leaders were tasked with helping other teachers improve their teaching ability (both in content knowledge and technique). However, from the perspective of JUSI participants, the math and science teacher leaders were less fully supported by the DCPS administration, operated from a different model, and worked in subjects where improving teacher content knowledge was as important as pedagogy. In addition to the softer support, the JUSI was just developing the teacher leader model when the original project director left.

While the jobs are similar (between teacher leaders and standards coaches) the teacher leadership model was reportedly never ‘sanctioned’ in the same way. For example, the teacher leaders were not taken out of the classroom. One reason for this goes back to the concept of the teacher leader according to the Katzenmeyer and Moller (2001) model\textsuperscript{34} that adds the skills of leadership to working teachers with the expectation that they will continue to work even as they provide an example to others. However, the resulting perception was that teacher leaders did not have the same status as the standards coaches (for whom coaching was the full time job). Many people wanted the teacher leaders to move out of the classroom because the work they do requires a great deal of extra effort and could be done full-time. The problems of status and how teacher leaders were chosen, trained and implemented created some problems in the beginning.

\textsuperscript{34} Katzenmeyer, M. and Moller, G. (2001). Awakening the Sleeping Giant. Helping Teachers Develop as Leaders. Thousand Oaks, California, Corwin Press. The recognition of the central role and importance of learning on the part of everyone touched by JUSI is a key feature of this project.
For example, one middle school principal in response to the literacy standards coach initiative added, on his own initiative, a math teacher and a science teacher as lead teachers in his school administration. The basis for his decision-making is unclear but can likely be attributed to people he knew and worked well with. One teacher he did not choose was an exceptional and nationally recognized middle school science teacher. She later became a teacher leader under the JUSI based on criteria that included extra training in content and pedagogy. However, after she became a recognized teacher leader, the principal choose not to include her in his administrative team even though she had great credentials and the endorsement of the JUSI. The teacher leader’s functional role and position in the school administration was not clearly defined by the DCPS administration reducing their perceived legitimacy.

Legitimacy
Symbolism is very important in Jacksonville. The Superintendent pointed out that even little details like which side of the river, and in whose building they hold meetings matters. In this context, the symbolism of various staff positions within DCPS takes on a great deal of significance. The idea that a new position was “sanctioned” by the superintendent (as the literacy standards coach was) has been an important theme in this community. Under the former superintendent, “a person was given a title, ‘standards coach,’ immediate recognition, immediate removal from the classroom… they were like an administrator.” At the time, the teacher leaders developed under the JUSI did not receive a similar blessing, thus weakening their status and in some cases making it more difficult for them to do their work. When the superintendent sanctions or publicly mentions a program, it greatly enhances its legitimacy (The current superintendent now publicly mentions teacher leaders and the program by name raising its legitimacy, something the former superintendent never did).

Turnover
Turnover in this program was fairly small among the program staff with two notable exceptions. First, the original project director left after the first year to be replaced by one who stayed until the funding ended. Also, the superintendent that drove the initial formation of the JUSI left before the funding started. The second superintendent left as the project was winding down. The current superintendent is now working to continue the work of the JUSI. The low turnover rate
among project staff and participants was attributed to a very dedicated and highly motivated team. There was also the feeling that turnover was low because people could see the “good results” up close. However, while the core of JUSI related resource teachers was very stable, there is considerable turnover at the level of the classroom teachers.

Preconditions impacts on Operations
Prior to the USI and the teacher leadership program that became a part of the math and science initiatives, the community had implemented another set of reforms based around improving literacy. These reforms were promoted and sanctioned from the top administration on down. However, the local barriers to teachers’ incorporating new materials or approaches in the classroom are enormous (school culture, supplies, time). Therefore, there was a perceived need for a resource teacher to support any new program. Individual schools have a much more narrow focus. The students and thus the schools have very immediate needs. Meeting these needs requires a great deal of time and effort thus limiting the amount of time that can or will be spent on looking at new methods. Occasionally, classroom teachers bring new ideas forward but they need the support.

In addition to local challenges, there was a perception that NSF shifted focus over time. NSF started with the state systemic initiatives but realized that they could not make changes on such large scales with $10 million. It is difficult to change states like Florida, and you can’t mandate changes with so little funding. NSF then shifted to the USI’s, which seemed like a good idea, but this kind of systemic change is very difficult in urban areas.

Partnership Outcomes
When asked about the impact of the JUSI on Duval County schools, the new Superintendent says, “If you walk into a high school classroom today I wouldn’t see as much engagement as I’d like to see. There are still not enough teachers who are teaching in an inquiry-based method even though that is our standard curriculum across the 4 content areas now. We’ve written everything [since the JUSI] to be used in an interactive way, engaging students in conversation and thinking. Much more the why, instead of the what, but it is still a challenge to get everyone to come to that
level despite the training, the support, the curriculum, and the assessment. We’ve built the foundation but still walking into every classroom everyday and seeing high level instruction we are no where near that now. But we do know that we are on the path towards that so I think we have put in place and USI helped us fund a lot of that.”

**Linking Outcomes**

One of the greatest challenges in partnered educational interventions is measuring the impacts to children. Measuring is a real challenge. On evaluator said, “It is hard to tell if you have some gains what to attribute them to.” In addition to the difficulty measuring and attributing changes to intervention, it is unclear what actions could or would be taken. Evaluation was reportedly done to pass the results back to NSF. One program manager said, “I don’t have the training to understand what the results [on the evaluation] meant. Therefore, we did not use them to change the program from year to year.” In some programs, the only thing that changed from year to year [operationally] was the food service or insurance provider.

**Organizational Change**

The current administration is transforming the central-office with respect to schools from a top-down bureaucracy to one of project-management through management charters in which the work is “bucketed” into service integration teams. Charters are the action plans. Even with the changes toward greater regional involvement and control, there are formal bureaucratic structures in place. These include a monthly meeting with all of the principals. In addition, some of the principals at schools in high poverty areas associated with the JUSI “come together around issues important to them.”

The leadership team is now made of four regional administrators (down from 6). Not everyone made the change when they realigned the organization this year. The new superintendent has purposefully stacked the administration, with people predisposed to working together. The district moved 40 out of 165 principals this year. The current superintendent says, “Those who are on the bus and in the right seat are predisposed to being open not closed, predisposed to being transparent not to being secretive. Changes will continue through changes in [organizational] culture.”
Changes in Organizational Capacity at DCPS

The individual programs were generally well supported from the district level during the JUSI. By the second year the teachers were starting to see the value of the teacher leader program and actively sought to get involved. What the USI provided was an opportunity to explore, learn, and demonstrate skills in front of peers while being critiqued in a learning community. Each of the team members in essence created their own job description. The superintendent says, “While we are going in the same direction, how they get there is up to them.” There are regular team meetings every two weeks to, “keep everyone on the same page. If someone goes off on a tangent they can be pulled back in.”

Since the beginning of the JUSI, DCPS has gotten involved with several other initiatives (often funded by NSF). Their explorations and the list-serves they joined in response to exploring new ideas have resulted in finding out about and ultimately getting involved with several other cutting edge intervention programs. For example, JUSI has led to DCPS becoming involved with TERC\textsuperscript{35} out of Massachusetts, which develops science and math curriculum and technology and developed \textit{Earth Science by Design} based on the \textit{Understanding by Design}\textsuperscript{36} approach to curriculum development. Duval became a one of eight field test sites for this program in middle schools. They proposed doing the same at the high school level and became one of four test sites. They learned that teachers can be immersed in a different content area to learn a process and then apply that process to their own content areas. Then they got involved with the Stanford research international and became the sole test site. All of these interactions can be traced to the USI.

In addition to greater awareness of national ideas, DCPS has become more involved in local efforts. There is wide recognition of the variety of challenges that face Jacksonville and Duval County (poverty, jobs, crime, education, immigration, and race relations). However, these problems are often approached as separate and distinct with various groups interested in different aspects or intervention approaches. The community often seems to be broken into rival camps that lack common identities or a clear recognition of the interconnectedness of local problems.

\textsuperscript{35} www.TERC.edu
The current superintendent of DCPS says, “We are going to organize communities through those camps where they have influence and try to get the others to stand down long enough or join long enough to build this capacity. We are trying to not make this super formalized because we think that will keep us from succeeding.” Their balancing act is trying to get people moving to build local capacity while limiting resistance to perceived intrusions into local power. For Example, the 32206 initiative in Duval County, “for the first time that we can remember, takes lower east community leaders, the faith-based community and three schools (the elementary, middle, and local high school) and puts them together with local government and educators to support kids and neighborhoods to build sustainable impacts to the child.” Their six-point plan is brining all of the players together to change all of the important factors to get to a tipping point that will sustain positive change.

The current DCPS superintendent further argues, “When a city will tackle all of the key levers, jobs, health care, education, crime, housing, etc., then you can truly make meaningful change that can sustain itself. If you just work one or two of those tipping points if you will, you get positive change. I can get positive change in the schools, we are already getting positive change in those three schools but it will not sustain itself unless we build capacity in the neighborhood around kids and families.” He is resists any attempts by local officials to study problems in, “silos (race stuff, murder rate, crime, housing). We need to study it all together, do it all together and change it all together. This [the USI] has caused the silo mentality to change.”

Precondition Impacts on Outcomes
The USI has taught the community about the importance of environment [e.g., crime, poverty, important adults, healthcare] to educational outcomes. A lot of research has been done in “silos,” looking for solutions to each problem or measuring local characteristics in isolation (e.g., crime rate, education, economic development). A more systemic approach like the that of the USI suggests that local leadership look at all of these in combination to leverage gains in some areas and to create momentum and sustainable outcomes. Ignoring one problem while addressing another will not result in sustainable change.
Student mobility is a critical problem within the district. Most of the mobility in Jacksonville is within the district (due in part to the large size of the school district). “We are not highly transient in and out of the county, they are in the county. However, this is skewed toward poorer kids.” He further notes, “the biggest problem is that they still have to get used to a new set of adults. That is so hard for kids and we take it for granted, we just don’t think about the trauma for kids and it is a silent trauma for kids. Not one that typically has them acting out.” According to the superintendent, because so much of the movement is within the district DCPS has more control making problems associated with mobility somewhat more manageable. He argues that to improve the experience of students DCPS has to codify and standardize the pacing and work for particular grades and courses across the district.

Summary and Conclusions

JUSI was created in response to a variety of local needs (e.g., poverty, achievement gap, low performing schools) and pushed forward by top-level local leadership. The federal funds provided additional capacity for locally developing systemic approaches to improving local conditions. The purpose of the USI program was to provide a spark that would initiate local change. In the case of Jacksonville, it seems to have worked at many levels. What developed was a centrally-run (managed within and reporting directly to the DCPS administration), K-12 district-centered, set of programs with IHE partners that was centered on learning.

The iterative proposal process for the USI required the district to focus on learning. In the past NSF created an outline for programmatic interventions and grantees simply proposed implementing those programs. In the case of the USI, the DCPS staff expected a similar process. They were initially confused by the notion of developing their own set of locally tailored programs to achieve the systemic reforms NSF desired. The process of developing and redeveloping ideas in the three proposals resulted in accumulated learning about the needs of the district and about the potential ways they could be met.

Organizations don’t make or keep commitments. People do. Without the leadership and commitment of individual actors, there are no institutional commitments. In the Jacksonville
case, we see that top-level administrators initiated and supported [drove] the proposal writing and initial organization of the JUSI. Once things got started, the role of top district and university administration fell off as those directly tasked to implementing programs started work. During the JUSI’s implementation, the leadership of the project director was critically important to moving the things along. This was aided by her positional embeddedness and prior working relationship with key personnel on the IHE side. She was closely aligned with the top DCPS administration even if the personal commitment of specific administrators was at times low.

There were direct impacts on participating teachers and students that should carry over into their futures. The teacher leader model was developed and implemented in math and science. Seen as a significant achievement, DCPS is the only school district in Florida that had no schools receiving failing grades in 2005 based on the Florida Comprehensive Assessment Test (FCAT)\(^37\). Several programs developed during the JUSI are continuing and the broader impacts have created momentum for system-wide changes in the Duval County public schools. One example of a joint initiative was the development of a course on action research at UNF, co-planned and facilitated by a UNF faculty member, the JUSI Director, and teacher leaders. JUSI paid the tuition of 4 cohorts of teachers who enrolled in the course. The course is now institutionalized at UNF as Action Research in Education, EDG 6911.

Also, a poster session held at the School Board building provided a significant experience for JUSI participants. School administrators and higher education faculty attended and interacted with the teachers. The focus of this meeting was, Action Research, which focuses on empowering teachers by having them decide on an area of research focus connected to improving student learning. They gather and analyze data collaboratively. Several teachers and faculty connected to the course later presented their work at National Science Teachers Association meetings and were featured as the "keynote" session at the "Teacher Research Day" in St. Louis in March 2007.

\(^{37}\) As Florida State Standards have increased in the years following JUSI the number of schools with failing marks has gradually increased (to 4 in 2006, and to 11 in 2007).
Reportedly, Jacksonville would not have moved forward in science without the USI grant, and JUSI was a driving force in other district-wide policy changes. The school district continues to partner with local universities (they are now doing gifted camps as a result of the work on the JUSI). These camps include current in-service teachers and UNF students working together to enrich the lives of students even as they learn skills that will make them better teachers. This is an important lesson to take from JUSI. The programs they are implementing serve many purposes at once. They directly impact the student and teacher participants. Students learn new skills even as in-service teachers (and pre-service student teachers) are learning better ways to impart information. By working directly with university faculty both have an opportunity to model successful academics. The teachers are co-instructors with the university faculty, making them all colleagues. This has helped to break down the potential for intimidation that teachers often report when working with university faculty.

In addition to the direct and indirect impacts on students brought about by the JUSI, there have also been wider impacts to the school system. The enquiry-based learning model implemented throughout the JUSI programs is based on learning by doing. This focus on learning has crept into and complemented the efforts of the new DCPS administration. The structure of the school system is changing to provide more opportunities for local assessment, learning and action so that plans can be developed and tailored to specific needs and then enacted. The local actions are then supported by the bureaucratic structures in the school district.

Changes in the school system may also carry over into the local community. The current DCPS superintendent has “done a ton of outreach” (though he says he has not managed it well as it is “eating me up time wise”). However, the superintendent is using his leadership position in Duval County to “help change the mindset” of the local community toward one that focuses on learning and then following that learning with decisions and action. He says, “Everybody has to have the attitude that we are not going to just walk into a meeting and trade ideas and not take action. Declarations of action need to be made. Problems include hiding problems (poverty, crime) from public view.” His purpose for the outreach is to try to overcome Jacksonville’s history of looking problems in “silos” by using the schools as a focus for dealing with local problems (including poverty, crime, race relations) in a more systemic manner. Just as the enquiry-learning model has
crept into the school administration in may now provide a tool to help shape the wider local community.

The Fit of Our Partnership Models

Our initial process model proposed two critical variables (embeddedness and strategic needs) that are hypothesized to impact partnership formation, operation, and outcomes. In the case of JUSI, the embedded relationship of very senior actors coupled with the strategic need for and availability of outside funding drove the formation of the partnership. The USI program provided an external stimulus that these senior actors reacted to by directing subordinates to develop the required proposal and application materials. This application process was carried on over three years and three different proposal attempts. The process could not have been maintained without the approval and support from the senior administrators. However, once the proposal was approved other operational actors became increasingly important to the activities of the JUSI.

During the Georgia Tech Delphi study, we added two additional variables (rules and environment) to our model. The outside stimulus that initiated the proposal process was the policy inducement to partner (PIP) included in the RFP for the USI program. This rule required applicants to act in a prescribed way. They had to develop a proposal based on local needs that would drive systemic change within the school district. This process took three tries to develop a proposal that met the specific requirements of NSF. Thus this rule, a variable not in our original model, was critical to the successful formation of JUSI.

The characteristics of the environment in Jacksonville provided a variety of challenges and constraints on activity within DCPS before, during and after the JUSI. The high poverty rate and lower-than-average levels of scholastic achievement in Jacksonville provide the background for the strategic need for outside resources. However, the environment had little further impact on the formation of JUSI.

The primary drivers for the formation of JUSI were much less important during the program’s operation and outcomes. The strategic need for outside money that drove the proposal process

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38 This summary outlines the significant results to be included in the cross case analysis.
and the formation of JUSI had little impact on the day-to-day operations once JUSI was created. Similarly, the senior actors whose embedded relationship provided the link that facilitated formation had limited impact once the activities of JUSI began. Most of the work was done by actors at much lower levels in their respective organizations.

A connection between DCPS and UNF to provide teacher professional development and some student programs previously existed at an operational level. Some district personnel had worked with some university faculty. However under the JUSI, DCPS created a whole new infrastructure to manage the interaction. This new infrastructure included a new program director within DCPS who answered directly to the superintendent. This structure was more important than interpersonal or professional embedded relationships to creating an environment conducive to work. The program director, who started in the position in year two, had a positional embeddedness that gave her legitimacy within DCPS and linked her to the IHE infrastructure through previous contacts at UNF. She was a key actor in everything that got done. Her position in the structure gave her sufficient status to forge the new and necessary relationships.

While the environment in Jacksonville was not critical during the formation of JUSI, it was very important during the operations. The population demographics of Jacksonville impacted who would participate in the programs and in how the programs were tailored to local needs. Language differences, struggles over race and politics, and widespread poverty place a constant drag on change in DCPS. If there had been greater resource availability, the efforts of JUSI might have been leveraged or further expanded. Environmental conditions also impact outcomes. The variance in starting points and characteristics of members from different populations can result in different levels of outcomes achieved.

Our model represents a process in which critical variables impact partnership formation, operation, and outcomes. Two primary rivals to partnership’s impact on outcomes exist. The first, that partnerships have no effect and any changes to outcome measures can be attributed to other factors, is not testable with the data we have in this case. The JUSI was so integral to everything that occurred in DCPS at this time that there is no way we could distinguish what happened from what would have happened without JUSI.
The second alternative hypothesis is that individuals who acted, as champions are critical to the changes in outcome measures, and, therefore, the partnerships are not the key driver of change. There is some evidence to support this hypothesis in Jacksonville. First, in the formation stage the senior administrators drove the process of developing the proposals. Without their prior working relationship and desire to pursue this initiative nothing would have happened. And, during operations the director’s leadership facilitated by a long-term relationship with key IHE personnel was noted as particularly important to all facets of JUSI. In addition, one individual was responsible for recruiting most of the students who participated in the summer and Saturday programs. Without her efforts much of the work would have been less effective.

While the “champions” hypothesis, does receive some support from our JUSI data there are some outcomes that cannot be attributed to the efforts of any one champion. By definition, the purpose of JUSI was to drive systemic change. In the case of Jacksonville, new systems within DCPS were created and others did change. In addition, when the original director of JUSI was replaced the connection between UNF and DCPS continued despite the change in personnel. A champions hypothesis would suggest that specific individuals would be critical not the organizational position. Also later, when the superintendent of schools at DCPS during most of JUSI left and his replacement started, the new superintendent noted several programs and systems developed during JUSI and chose to have them adopted district wide. Had the outcomes of JUSI been the result of individual efforts, there would have been no systems or programs for him to adopt. Therefore, the Jacksonville case lends greater support to the hypothesis that characteristics of the partnership and partnering drove outcomes.
### Alternative Approaches to Evaluating STEM Education Partnerships

#### Table 1

<table>
<thead>
<tr>
<th>Urban Systemic Initiatives (USI)</th>
<th>Cohort I</th>
<th>Cohort II</th>
<th>Cohort III</th>
</tr>
</thead>
<tbody>
<tr>
<td>7. New York City</td>
<td>15. New Orleans</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### Table 2.

<table>
<thead>
<tr>
<th>Teachers Receiving Professional Development During JUSI</th>
<th>Year 1 98-99</th>
<th>Year 2 99-00</th>
<th>Year 3 00-01</th>
<th>Year 4 01-02</th>
<th>Year 5 02-03</th>
<th>Year 6 03-04</th>
<th>Year 7 04-05</th>
</tr>
</thead>
<tbody>
<tr>
<td>Elementary School Teachers</td>
<td>663 (22%)</td>
<td>1471 (48%)</td>
<td>1792 (58%)</td>
<td>1722 (54%)</td>
<td>1831 (55%)</td>
<td>1729 (50%)</td>
<td>1089 (34%)</td>
</tr>
<tr>
<td>Middle School Teachers</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Math</td>
<td>230 (77%)</td>
<td>291 (78%)</td>
<td>322 (97%)</td>
<td>270 (83%)</td>
<td>278 (100%)</td>
<td>292 (83%)</td>
<td>235 (77%)</td>
</tr>
<tr>
<td>Science</td>
<td>292 (80%)</td>
<td>261 (75%)</td>
<td>254 (83%)</td>
<td>283 (100%)</td>
<td>281 (100%)</td>
<td>293 (100%)</td>
<td>183 (56%)</td>
</tr>
<tr>
<td>Middle School Teachers</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Math</td>
<td>125 (34%)</td>
<td>241 (62%)</td>
<td>215 (61%)</td>
<td>141 (44%)</td>
<td>227 (100%)</td>
<td>253 (100%)</td>
<td>210 (67%)</td>
</tr>
<tr>
<td>Science</td>
<td>111 (32%)</td>
<td>202 (54%)</td>
<td>250 (72%)</td>
<td>200 (72%)</td>
<td>202 (100%)</td>
<td>212 (100%)</td>
<td>155 (59%)</td>
</tr>
<tr>
<td>Total</td>
<td>1358 (32%)</td>
<td>2466 (55%)</td>
<td>2833 (64%)</td>
<td>2616 (60%)</td>
<td>2819 (65%)</td>
<td>2779 (60%)</td>
<td>1872 (42%)</td>
</tr>
</tbody>
</table>

(%) Percent of total Teachers as reported by JUSI final report to NSF 2006
Appendix G: Rochester Local Systemic Change / Targeted MSP
Rochester Local Systemic Change / Targeted MSP

Introduction
When asked when she became involved in the MSP, the PI of the Rochester MSP seemed perplexed by the question and replied, "what do you mean the MSP?" Continuing, the Associate Professor and Director of the Warner Center for Professional Development and Educational Reform confessed that making a distinction between the MSP and previous work was difficult because she "[thought] of it more as continuing on a very long journey."

And the two cases at hand are just that, distinct parts of a continual effort toward professional development and reform in Rochester, NY and the suburban and rural communities that surround Rochester. With the Warner Center at the helm, the surrounding region received at least four NSF grants, including an LSC and an MSP grant, two state grants, and even leveraged corporate grant money in order to provide services in a fifteen year period.

While many of these grants serve unique audiences in distinct ways, they are all driven by a common vision that emanates from the Warner Center. The Warner Center’s mission is to “foster and support research-based innovative professional practice and systemic change in educational environments. This is accomplished through professional development and systemic reform initiatives informed by current research and collaboration with participants” (Warner School, 2007a).

In order to fund their various professional development and reform activities, the Warner Center secures funding from a variety of sources and often partially funds its general professional development workshops through grants designed to serve a more limited audience. For example, the Center will offer a number of summer institutes that are open to the surrounding educational community on a fee-based system while allowing certain participants to have their participation fees covered by various state and federal grants.

In addition to developing new materials for professional development, the Center will often build upon previously developed materials that are tailored to fit the requirements of an individual
grant. With this in mind, it is easy to see why the PI thinks of her work as one interwoven and continuous journey as opposed to separate grant events.

The goal of this case study is to tease out two distinct grants awarded to the Warner Center over a 10 year period and discuss these grants within the context of a partnership process model (used in all of the case studies developed for this RETA project). Both grants were funded by the National Science Foundation, one grant funding a Local Systemic Change initiative, while the other funded a Math and Science Partnership. Table 1 places the two grants within the context of other related grants being administered out of the Warner Center at the time. The table does not cover all of the grants that the Warner Center might have worked on during this period, but it does touch upon the grants led by Judy Fonzi (project PI for both grants) and ones in which the Warner Center played a major role.

While almost all the grants awarded to the Warner Center are aimed at funding professional development, the audiences are often limited in scope by the terms of the grant itself. For example, the Teacher Enhancement Program (TEP) is an early grant that focused on providing professional development to middle school level special education teachers, while the LSC focused on providing professional development to all middle school teachers in the four partner schools. While there is diversity in these grants, they all serve to fulfill the Warner Center’s desire to affect change through professional development, inquiry-based methods of teaching and a humanistic view of mathematics, the fostering of an education community in the region, and the lead teacher model of change. In instances in which large funding could be secured, the target audience was expanded to include all elementary and secondary levels of teachers (MSP), but when the scope of the grant was more restricted, administrators would simply use the limited funding to provide a mere piece of the puzzle.
### Alternative Approaches to Evaluating STEM Education Partnerships

<table>
<thead>
<tr>
<th>Name of Grant</th>
<th>Dates</th>
<th>Amount</th>
<th>Source</th>
<th>Lead Org / Org</th>
<th>Activities/Focus</th>
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</thead>
<tbody>
<tr>
<td>Project Radiate (#DUE-9254475)</td>
<td>1994 – 1997</td>
<td>±$890,000</td>
<td>NSF</td>
<td>University of Georgia&lt;br&gt; University of Rochester&lt;br&gt; Georgia State University&lt;br&gt; University of Michigan&lt;br&gt; SUNY/Buffalo</td>
<td>Development of preservice teachers at elementary and secondary levels</td>
</tr>
<tr>
<td>Supporting Middle School Learning Disabled Students in the Mainstream</td>
<td>??? (pre-TEP)</td>
<td>±$508,000</td>
<td>NSF</td>
<td>University of Rochester&lt;br&gt; SUNY/Geneseo&lt;br&gt; Twelve Corners Middle School (Brighton)&lt;br&gt; Merton Williams Middle School (Hilton)&lt;br&gt; Honeoye Falls-Lima Middle School (Honeoye Falls-Lima)&lt;br&gt; Ada Cosgrove Middle (Spenceport)</td>
<td>Preliminary research component to develop understanding of how an inquiry approach to math instruction can respond to call for reform and diverse needs of students&lt;br&gt; Year long professional development program for mathematics and special education teachers&lt;br&gt; Field experience component surrounding the implementation of one professional development unit</td>
</tr>
<tr>
<td>Making Mathematics Reform a Reality in Middle Schools - Local Systemic Change</td>
<td>June 1996 – August 1999</td>
<td>±$52,000</td>
<td>Phillip Morris Companies&lt;br&gt; University of Rochester&lt;br&gt; SUNY/Geneseo&lt;br&gt; Monroe Community College&lt;br&gt; Rochester City School District</td>
<td>Establish a forum where community can exchange views on teaching in urban schools&lt;br&gt; Development and teaching of undergraduate and graduate course on teaching in urban schools</td>
<td></td>
</tr>
<tr>
<td>Deepening Everyone’s Mathematics Content Knowledge – Targeted Math and</td>
<td>October 2002 –</td>
<td>±$2,426,078</td>
<td>NSF</td>
<td>University of Rochester&lt;br&gt; Greece School District (left partnership)&lt;br&gt; Penfield School District&lt;br&gt; Rush-Henrietta School District(entered late)&lt;br&gt; GVBOCES&lt;br&gt; Education Development Center&lt;br&gt; Horizon Research&lt;br&gt; WestED</td>
<td>Professional development through reform mathematics courses&lt;br&gt; Teacher leader program&lt;br&gt; Community engagement through evening chat program</td>
</tr>
<tr>
<td>Science Partnership Grant (#0227603)</td>
<td>September 2007</td>
<td>±$1,200,000</td>
<td>New York State&lt;br&gt; University of Rochester&lt;br&gt; Rochester City School District</td>
<td>Literacy and mathematics</td>
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</tbody>
</table>
The LSC Grant

The Local Systemic Change (LSC) grant was an NSF sponsored four-year project led by the University of Rochester in collaboration with SUNY/Geneseo. The grant focused on developing the inquiry-based pedagogical skills of 48 middle school math teachers in four suburban Rochester school districts. While limited in scope, the LSC project consisted of three major components: teacher enhancement and professional development, research in practice, and evaluation. The teacher enhancement component consists of professional development activities for middle school math teachers provided through various summer institutes and in-service training. In all, each of the 48 teachers received at least 140 hours of professional development, deepening their content knowledge while widening their pedagogical tool belt. The LSC also worked to develop a cadre of lead teachers, so eight teachers were given additional professional development and then asked to serve in leadership and mentoring roles at their various schools.

The research in practice component of the LSC involved an ethnographic study of the reform efforts made at the four participating middle schools, with a keen eye towards measures of successful reform. In addition to providing a better understanding of reform at the middle school level, the research in practice component sought to provide the schools with a set of applied findings and best practices for systemic reform at the middle school level.

As with all NSF grants, a project evaluation component was included in the grant to address the quality and effectiveness of the teacher enhancement component, the systemic outcomes at the participating schools, and how the research associated with the grant contributes to the larger body of research literature.
Preconditions

Prior to LSC formation, three local conditions were key to project formation: high levels of organizational and professional embeddedness, environmental pressure from the state to improve student test scores, and teacher autonomy. All four middles schools participating in the LSC were active in a previous NSF grant (TEP), which demonstrates the organizational embeddedness built through sponsored projects between the participating schools and the University of Rochester, and between the University and NSF. As the PD points out, “our LSC grew out of a previous 4-year NSF teacher enhancement/research project (TEP)” and many of the organizations involved have a history of working together (Fonzi 2001).

In addition to organizational embeddedness, there was a great deal of professional embeddedness between a number of individuals active in the project. “Our audience did indeed include a few ‘old friends,’ teachers who had volunteered to work with us in previous NSF teacher enhancement projects, but it also included a lot of new folks” (Fonzi, n.d.). It should be stressed that while preexisting collaborations between individual teachers did exist, they were quite weak as the education community in the region had yet to develop a strong collaborative culture. Thus, the ties did not constitute a professional network. As the PI stated after the project ended, “collaborative planning was not a part of the culture of any of these schools, and more of the teacher teams that had developed during our previous work had been disbanded because of grade level changes” (Fonzi, n.d.).

The environment in New York State at the time of formation is teeming with pressure to meet desired test scores and a push toward stateside assessments. The Board of Regents approved an overall plan for raising standards in 1995 and approved a completely new set of Learning Standards in July of 1996 (New York State Education Department, 2005). Along with more rigorous curriculum and testing requirements came a new reliance upon problem solving and inquiry-based models of classroom pedagogy (New York State Education Department, 2005; Hershenson, 1991).

The newly emerging state standards not only put an increased burden on teachers, but also came at a time in which professional resources for teachers were on the decline (Hershenson, 1991).
As an example of the state of education in New York at the time, despite warnings from education experts, the curriculum and standards changes of 1996 led to almost predictable results. In the 1997 pilot exam, 80% of students failed the new regents exam, including 74% of students in the state college prep program.

This highly pressurized environment is coupled with an almost antithetic level of autonomy amongst district teachers. While state and federal authorities could put pressure on teachers to improve test scores, they were unable to force feed curricula to teachers, nor were they able to mandate that they attend professional development activities. Teacher unions were strong, and in many local districts union leaders were resistant to reform. In this type of environment, reform and knowledge enhancement on the teacher level required full buy-in from the teachers themselves, or else reform efforts would surely fail.

**Formation**

The project was formed under the leadership of the PI and PD who sought out the LSC grant. In face of environmental pressure to improve the level of mathematics education in the Rochester area, coupled with the opportunities offered by professional and organizational embeddedness between IHE and district partners as well as the IHE and NSF, the PI served as a champion who pushed the local region to come together in pursuit of NSF money to help solve local problems in K-12 mathematics. While certainly not the sole force pushing toward formation, the partnership champion was still responsible for identifying funding opportunities and bringing partners together in pursuit of NSF monies.

As mentioned above, the region at the time of LSC formation lacked a strong collaborative culture, and the regional reform community was loose and unorganized. This fact was quickly identified during the proposal process, and early steps were taken to overcome this disadvantage and begin development of a collaborative culture within the context of the grant writing process. As the PI said, “we knew from the very beginning that we needed to develop some leadership and collegiality, and we used the development of our project proposal to immediately begin modeling such behavior. We included teachers and administrators in our planning meetings,
and, as a group, we discussed what we felt were crucial components to successfully fostering and supporting reform” (Fonzi, n.d.).

**Operations**

Partnership operations were influenced by environmental pressures and conflicting strategic needs which often led to issues of legitimacy. Beginning with environmental pressures, the push towards more rigorous standards testing in the state often led local administrators to focus on meeting their assessment needs as opposed to the systemic reform goals of the partnership. Because of the pressure to meet assessment goals coupled with limited opportunities to influence education, administrators often chose to focus on assessment efforts. This environmental pressure is easily translated into a strategic need to meet assessments for local administrators. With only so many hours in the day, efforts to meet assessment needs often trumped the need for systemic reform, and, “...new administrators who make mathematics their agenda but…are driven by test scores and a need to teach to the test pose a serious threat to sustainability no matter how far the faculty and program have come” (Fonzi, 2001).

In her reflections upon year one the PI noted that, “we also discovered that there were many ‘cultural’ and policy barriers that were influencing attendance at professional development initiatives. For example, teachers were free to use whatever instructional materials they wanted and teachers were expected to attend department meetings, but no one followed up if they did not…Teachers were not required to participate in professional development outside of the school day and principals were not requiring them to participate during the school day either” (Fonzi, n.d.).

While almost all teachers have a strategic need for more effective pedagogical skills, it was often hard for districts to secure the funding necessary to ensure the participation of teachers. For some district partners, participation in professional development activities as well as overall systemic reform was simply too burdensome financially and temporally. Professional development offered during the school day required a supply of adequate substitute teachers, and the funding of release time. Beyond professional development activities, the adoption of new reform curriculum required a large amount of spending on books and materials.
The need to replace teachers with adequate substitutes during their training, as well as time constraints upon teachers, often made it hard to ensure sufficient participation in professional development activities. In discussing the time constraints placed upon teachers, one report noted, “that math was only one of several subjects they must support so they didn’t feel they could give it all of their professional development time,” adding that it was, “difficult to devote the amount of time necessary to learn all these new things and still keep up with…day-to-day responsibilities” (Fonzi, n.d.).

The distinct strategic needs of different types of teachers also affected partnership operations. There was very little participation by special education teachers because the partnership failed to recognize that special education teachers have different needs than regular teachers. By designing a program that catered to the needs of regular teachers, the partnership was unable to meet the needs of special education teachers who then responded by not participating. “Our schools include sixth grade, so we also had several elementary certified teachers among our participants. The diversity among our districts and our teacher participants presented some interesting opportunities as well as some serious challenges” (Fonzi, n.d.).

Failing to adequately address the needs of special education teachers was problematic because the original proposal to NSF aimed at impacting teachers at all levels, including special education, elementary teachers, and certified mathematics teachers. Noting that “at the end of the first year…we noticed that special education teachers were not participating at the same rates as regular education teachers;” the partnership quickly moved to develop programs that would meet the needs of special education teachers in the partner schools (Fonzi, n.d.). In fact, partnership leaders were proactive in aligning their programs with the needs of all teachers and move in a new direction. In doing so, leaders took advantage of new resources, and the lessons learned through frequent engagement with teachers, administrators and professional development providers. As one lead administrator put it, “as the project proceeded and we learned more about where the teachers were in their thinking about mathematics, teaching and learning, and their abilities to put new ideas into practice, we found ourselves re-inventing our professional development program to better meet their needs.”
Conflicting strategic needs coupled with environmental pressure often meant a lack of legitimacy in the form of blessing from principals and district administrators. Because of the costs associated with participation, legitimacy is crucial to ensuring adequate teacher participation, and district and school administrators often failed to provide legitimacy to the LSC. During the life of the grant, leadership failed to secure the support of some key district leaders, which resulted in lower overall participation in those districts. While the final burden of teacher participation falls upon the teachers involved, success is often contingent upon strong leadership to show support for the program, free up teacher time, and arrange for substitutes.

The failure to secure legitimacy was often compounded by power struggles among teachers and administrators who were on board with the goals of LSC and those opposed. Not widespread, these power struggles mainly existed within one particular school district but were manifest in two distinct ways. First, a power struggle occurred between teachers and administrators as teachers pushed curriculum reform while administrators resisted. Second, a power struggle between teachers who are opposed to math reform and those who supported it led to operations problems as those opposed to reform resisted partnership efforts. This type of power struggle is most glaringly seen in the filing of a union grievance by a teacher who did not feel like she should have to partake in the additional professional development and training being offered by the LSC (Making Mathematics, 1998b).

Turnover of administrators also led to loss of legitimacy, as an incoming administrator failed to embrace the goals of the partnership in the same way as his predecessor. In a similar fashion, turnover amongst teachers often caused a reduction in “buy-in” as champions of the cause are replaced by individuals opposed to partnership goals.

When needed, the LSC was somewhat able to overcome this lack of legitimacy by high levels of buy-in amongst teachers and the development of a collaborative culture among participating schools. As the PD put it, “when the whole faculty had developed a common vision and a collaborative culture a ‘weak’ administrator did not inhibit continued work” (Fonzi, 2001). Even at the schools where legitimacy and buy-in was a major problem, many teachers were provided
professional development, albeit they often received half the hours of instruction compared to other schools.

**Outcomes**

Because of the legitimacy problems in some of the districts, partnership outcomes were somewhat limited in their success. Partnership leaders reported success in encouraging participation in teacher institutes and professional development activities and mild success in reform implementation, noting that a lack of support from local administrators often blocked reform efforts. The problems with legitimacy were further exacerbated by environmental pressure that often kept teachers from participating in the program as well as the inability of the partnership to meet the strategic needs of special education teachers.

Upon reflection, LSC leadership noted that a history of involvement made a school more apt to establish the collaborative culture that was key to reform efforts. “Two schools – those with a longer history of involvement in mathematics reform…have successfully developed a culture of collaborative practice…” (Making Mathematics, 1999). The partnership was also successful in establishing new relationships, as many of the actors involved continued to work together through additional funding streams (state Eisenhower grant, MSP, etc). In this respect, one of the strongest outcomes of the LSC was the further identification of strategic needs in the district. Needs surrounding better professional development for special education and elementary teachers, monetary needs, and the need for increased legitimacy and buy-in were all identified through the LSC program and addressed in future grants.

In achieving the long term goal of developing a culture of collaborative practice at the individual schools, some schools have been faster in their development than others. As discussed earlier, there was a lack of legitimacy attributed to the partnership at some member districts which prevented high levels of participation. In promoting the successful creation of a “culture of collaborative practice,” an annual report defines a culture where, “math teachers regularly engage in shared professional development experiences (especially peer-facilitated ‘study groups’), planning common units, and engaging in discussions about curriculum and/or teaching practices” (Making Mathematics 1999).
In collateral materials used to explain a distinct professional development program, LSC leaders noted that “evidence of student success in this project is a measure of student performance in classroom-based performance assessments”, and case study analysis has shown that inquiry-based lessons have been successful in developing students’ problem solving (Killion, n.d.). For example, the summary notes that mean test scores for twenty-three 8th grade students were 10-15 percentage points higher than previous tests. It also notes that the majority of students involved in a thirty-one day Tesselations Unit showed success according to classroom assessment measures that included a “variety of approaches to assessing students’ problem-solving” (Ibid).

Successful outcomes were also measured as successful PD programs. “One of the major accomplishments of the first 15 months of the project has been the design and implementation of a variety of complementary professional development initiatives” (Making Mathematics, 1998b). In this example, the partnership successfully offered a large 80+ hour leadership institute, two 40+ hour summer institutes, seven mini-series (10 hours each), and a few experimental study groups within the first 15 months of the project. Design alone was not enough to ensure success, as partnership administrators also tracked the number of hours of professional development each teacher received over time. This measure also showed success, as the average number of hours among participating teachers increased from 73 in the first year of the project to 126 hours in the final year of the project (Making Mathematics, 1999, 1998a). When the teachers from the school suffering from serious legitimacy problems are removed, each teacher received an average of 160-170 hours of professional development – further demonstrating the ways in which legitimacy problems can negatively influence outcomes.

Successful outcomes were also measured by the average number of weeks each school implemented innovative instruction curricula. For example during the year 1997/1998, the project reported success as teachers implemented an average of 12 weeks of innovative instruction, twice the level of the previous year (Making Mathematics, 1998a).

In year 3 the partnership undertook a change in their leadership training strategy to focus on helping the lead teachers and schools become independent after the partnership ran out of
funding. For this effort, the lead teachers were given leadership capacity training, professional development planning training, and help in navigating the possible streams available to each school for funding in the future (Fonzi, n.d.).
The MSP Grant

As proposed to NSF, Deepening Everyone’s Mathematics Content Knowledge: Mathematics, Teachers, Parents, Students, and Community (DEMC) is a targeted Math and Science Partnership project aimed at increasing mathematics knowledge in suburban and rural districts in northern New York. DEMC is comprised of key partners and collaborators who work together to achieve the goals of the MSP. DEMC is administered out of the Warner Graduate School of Education and Human Development at the University of Rochester. The College of Arts and Science Mathematics Department is another key partner in the program from the University of Rochester. In addition to those from the university, teachers, students, parents, and administrators from two suburban and twenty-three rural school districts are program partners. The rural school districts are further involved in the partnership through the Genesee Valley Board of Cooperative Educational Services (GVBOCES) consortium. Additional collaborators in the MSP include WestED, Horizon Research Inc., and the Education Development Center (EDC). Horizon Research serves as the external program evaluators while EDC and WestED develop and implement leadership training programs in support of district teachers.

The Warner School and the Mathematics Department have a history of working together, having previously collaborated as part of an NSF Local Systemic Initiative, and a state Eisenhower grant. The Principal Investigator and Project Director have a history of working with the Greece, Penfield and Rush-Henrietta districts through a state funded Eisenhower grant, and have assisted their administrators and key teachers in a number of programs.

The program is administered by Judith Fonzi, Principal Investigator, and Cynthia Callard, Project Director. In conjunction with an administrative network composed of four Lead Teachers on Special Assignment (LTSA) -- a mathematics faculty member and mathematics directors and project coordinators from each partner district -- the PI and PD are responsible for the design and implementation of DEMC. In addition to the leadership team, an advisory board composed of expert researchers on mathematics reform and practitioners provides input on planning and implementation on a yearly basis.
Although DEMC has a number of targeted goals, its overarching goals are the improvement of student outcomes in mathematics, reduction in the achievement gap within mathematics, the enhanced capacity of districts by increasing the content knowledge of teachers, and encouraging reform and advocacy at all multiple levels within partner districts. In order to achieve these goals, DEMC undertakes three key initiatives: curricula reform, teacher training, and community building and engagement. The curricula reform and teacher training initiatives are addressed through various professional development activities developed and administered by math faculty. After gaining content knowledge, teachers implement the reform curricula at the local level. GVBOCES also assists in these initiatives by providing curricula, funding staff, and implementing reform at the local level. Community building and parent engagement activities are developed by LTSA and others at the administrative level and facilitated by Lead Teachers and university faculty involved in the program.

Preconditions

Many of the actors involved had an extensive history of working together prior to the formation of the MSP. The PI had been awarded a number of NSF grants in the past – so there was a history between the lead grantee and the grantor (Table 1). As the PI put it, [the Warner Center] “has had NSF funding since the late 80s.” The PI and PD had a long history of working together in many types of relationships. For example, the PD had served as a lead teacher during the LSC grant, while the PI served as dissertation chair for the PD.

The PI and PD had a history of embedded relations with the lead STEM faculty partner and many of the Lead Teachers on Special Assignment (LTSA), as well as the contractors hired by the partnership to provide professional development and evaluation. As the PI explains, “we all became professional friends during the LSC time. We got to know each other very well, and we got to know each others work. We got to know we were aligned in thinking and practices.” During the case study interview process, it was not rare to find two individuals who had known and worked with each other for well over 15 years.

There was also a fairly high level of individual embeddedness between district administrators and lead teachers prior to the formation of the MSP. For example, one administrator pointed out
that she had known one of the LTSAs since the 1980’s when they were both teachers in the same district.

At the organizational level there was a varied history of IHE and K-12 interaction prior to partnership formation. All of the urban school district partners had worked with the IHE partner in some capacity before, while the rural district consortium had no prior history of interaction with the IHE outside of some personal interactions between the PD and administrators. In fact, the rural districts had little history of collaborations at all. As the lead administrator from BOCES pointed out, “there was no history of this type of collaborative effort among the small districts that were spread out over 1800 miles.”

In examining the efforts of previous programs such as the LSC and state Eisenhower grants, many of the teachers who had worked with the PI and PD began to express that they had inadequate content knowledge to implement and teach according to the newly adopted inquiry-based curricula. As such, many of the teachers had a strategic need for content knowledge if they were to successfully implement the reform curricula.

As with many of these partnerships, there was a strategic need for funding amongst districts for the types of programs needed for professional development. Often the lack of adequate funding prevented collaboration despite the fact that many of the actors worked with each other in the past. As one district administrator put it, previous programs “created relationships among places but there was nothing to hold the balloon strings when that money was gone.”

Despite a statewide need for better mathematics education among K-12 students, the environment prior to MSP formation is one that reflects little support for mathematics curriculum reform. Instead of focusing on reform efforts, the state was putting pressure on educators to meet testing standards – demanding outcomes without really providing solutions.

In many of the local communities there was a formal and organized resistance to reform efforts, as community members felt that there was no problem with local math education and that a move to a more inquiry based model of pedagogy was a step in the wrong direction. As one district
administrator pointed out, the community has a “very affluent population, with many engineers and accountants who felt that math was the manipulation of numbers and computation” and was, thus, resistant to new forms of pedagogy.

This opposition group was found not only in the general community, but in the IHE mathematics department as well, as some senior faculty members loudly voiced concerned opposition to reform efforts. Additionally, many faculty members simply “did not care” about K-12 mathematics education, failing to “understand any responsibility for the next generation.”

This is not to say that the environment was one of sole opposition to reform; some administrators were finally becoming more aware of a “new” way to educate. As one respondent put it, successful change in reading reform began to springboard into new ideas about mathematics instruction.

**Partnership Formation**

The proposal was written by the future PI and PD, although many others were involved in the design and planning of the proposal. As the champion of the formation process, the PI played a crucial role by bringing the necessary partners to the table in order to define goals and flesh out the proposal. And while the proposal writing process was collaborative in nature, there is no denying the important role the PI played in bringing everyone to the table and getting everyone involved. Others were involved, but “the ship would sink without” the leadership of the PD and PI during the proposal process.

Coming, quite literally, to the kitchen table of the PI, a number of people were involved in the grant writing process, including teacher leaders from multiple districts, administrators, and IHE faculty. These players would often take a small piece of the proposal to work on by themselves, and then share their ideas with the PI and PD who would then synthesize this idea with the ideas of others in development of the proposal.

The PI leaned heavily upon her embedded relations in bringing together the potential actors and organizations that would eventually form the MSP partnership. On a basic level, embedded
relations made it easy for the PD and PI to identify potential partners and encourage them to sit at the table during the grant writing process. This idea was implicitly found in the PI’s description of how one district came to be involved in the partnership: “we had a project that was funded, and I got to know the Director of Math at [the district] who was two years into her position and trying to do some really important work and struggling to do it herself…because we think regionally and we don’t think this is anything anybody can do by themselves, we went back to the partners in that project, explained where [this district] was…and asked them if they would be willing to allow [the district] to join us as a fifth partner if they paid their own piece.”

Embedded relations between the PI/PD and the three outside contractors brought in for professional development were also important. As the PD put it, “being involved in other projects we got to know them and their work so that when we wrote the proposal we knew enough to fold them in to capitalize on the work they are doing across the country in our project.”

The motivations for forming the partnership came out of the needs identified through previous projects. While prior projects were somewhat successful in curricula reform, they had failed to adequately provide the teachers with the tools and skills needed to successfully implement the new curricula. This was best described in the PIs story of formation: “so at [the point of formation] we had already introduced teachers, districts, and communities to teaching math through inquiry and how the use of NSF curricula as a set of materials could support inquiry pedagogy. So teachers were now coming to us and saying, ‘oh my god, now that we are teaching this way it is clear that we need to learn more mathematics so we can teach some of the content we don’t know because it wasn’t there when we went to school, and also to make sense of the multiple ways that kids think mathematically’, so this proposal was a response to that.”

So, the desire to meet the strategic needs of teachers was a main force in the formation of the partnership, as the goals and activities of the partnership were tailored to specifically meet those needs. In fact, as one LTSA describes, proposal development began with the identification of needs and was followed by the creation of a project roadmap designed to meet those needs. As more teachers began to utilize inquiry methods, many of them were forced to respond to more
complex questions that teachers “themselves seek deeper mathematic understanding” (Warner School, 2002).

Across the board, respondents confirmed that the professional development and leadership needs amongst teachers were a driving force in the participation of teachers in the partnership – they participated and agreed to be a part of the partnership specifically because it met their needs. NSF signaled a strategic need for more minority involvement, which ensured the involvement of an urban district partner with a large minority population. It is interesting to note that the participation of STEM faculty met the needs of individual faculty members, and not the strategic needs of the STEM department as a whole. During interviews, STEM faculty supported this argument by agreeing that there was zero pressure from the department to participate in the partnership.

Because those involved in the grant writing process saw a strategic need in the region to deepen mathematic content knowledge for the entire community, explicit goals were included in the proposal to encourage parent and community involvement.

Another example of how strategic needs drove partnership formation was observed in the way that the rural district consortium – the only district that was not involved in the LSC and Eisenhower grant – was written into the proposal. According to the PI, “the proposal was specifically written for the BOCES districts to spend the first 3 years in a ‘get ready’ mode because they quite honestly didn’t know there was a math reform going on, and didn’t know there were such things as mathematic standards. They were in a different place than our suburban districts, so we know from our previous work that we needed to give them a get ready period to give us time to do focused work in the district. This allowed them to get the general population to a place where we could collaboratively look at, and discuss the issues, and they would be ready to have those discussions.”

The partnership administrators’ decision to include the rural consortium was guided by its desire to build upon the work of previous grants such as the LSC and continue efforts to build and expand a regional network of educators. The rural consortiums decision to join in the
partnership was explicitly driven by the strategic needs of the districts within the consortium. As a press release from the Warner School noted, “[GVBOCES] had been seeking a partnership that could help them meet their need to prepare teachers to help all children learn. They believed the mathematics partnership would help them reach that goal” (Warner School, 2002).

It is important to note that just prior to the proposal being written, opposition to reform efforts had begun to subside as districts became more willing to implement new curricula with new pedagogy. As the PI pointed out, what was interesting about the hesitation concerning reform in the districts is that “they were now ready because for the most part they were districts who had been implementing new curriculum with new pedagogy for 3 or 4 years before that, and now they were willing.” This reduction in environmental opposition helped spur the opportunity for a partnership to continue to push curriculum reform. This push toward reform was further spurred by a newly adopted set of state curriculum standards that placed a greater emphasis on inquiry based learning and problem solving exercises.

Just prior to partnership formation a number of local districts began to identify some front-line support for reform efforts where there was previously quite a bit of resistance from teachers. Looking at both teachers and administrators, it seemed like more and more people were beginning to align themselves with the PI and PD’s goal for curricula reform. As one local administrator points out, teachers were “often anxious to do something different with their kids. The pressure [from teachers] wasn’t so much to join this NSF project, but pressure was coming from them to do something different.” This change was not a result of turnover, and reflected the growing support for education reform in the region.

While there were certainly environmental pressures that pushed toward formation, outside of the new state curriculum and assessment standards there was little in the way of coercion in the form of local rules, inducements, and constraints that pushed toward formation.

**Partnering Operations**

There are two fields of decision making in the Rochester MSP, large-scale administrative decisions that affect the entire partnership and smaller scale micro-decisions about content and
professional development activities. In regard to the macro level of decision making, power falls upon the main administrative group made up of the PI, PD, LTSAs, and core administrators who meet on a monthly basis. Final decision lies in the PI/PD, but consensus is the norm and disagreements are few. The goal of the central decision makers is to balance the “goals of the grant and the needs of the teachers” with the administrator’s “commitment to NSF.” This commitment to the goals of NSF is directly seen in a comment made by an LTSA that, “a few times the PI has said ‘no that’s not the rules of grant, and we can’t do that.”

This is not to say that decisions are made without the input of others, but rather that the final informed decision rests in the hands of the administrative leaders. In some instances, the main administrative group has paid the price for making decisions without feedback from the partnership at large. In one case, a decision was made about lead teacher expectations for the upcoming year without consulting the teachers involved, an experiment that resulted in a need for the group to reframe their expectations and back down a bit.

On the micro level of decision making, the participating STEM faculty leaders are given autonomy to be “full fledged designers, planners, and implementers” of any programs directed at content. Here, the decision making process is much less formal and top-down, and the core administrative group shows much less influence. Nonetheless, these micro level decisions could also be described as heavily centralized, however they center around STEM faculty and not the IHE education faculty that dominates macro level decision making. These types of decisions are made on a less frequent basis than the macro level decisions, with more interactions among leaders during the development process, and less interaction in down periods.

LTSAs are given less autonomy in their provision of professional development, with the PI, PD and LTSAs involved in the planning and implementation of almost all professional development activities. This is largely to assist the PI and PD in the provision of guidance to the LTSAs, with the PI and PD being self described as “lifelines” to the LTSAs.

On both the micro and macro level, the highly centralized nature of decision making is somewhat of a remnant of the very modest size of the partnership. As the PI points out, “the PI and PD are
involved in everything because we are the smallest funded MSP and just don’t have the manpower.” With two STEM faculty participating in the partnership and two IHE faculty members from the Graduate School of Education, there is not a wide pool to choose from for various activities.

Despite highly centralized decision making, there has been little conflict among partners stemming from that power differential. This is mainly because of the open and consensual nature of the decision making process that governs by consensus instead of fiat. In the rare instances in which disagreements come to a head, mutual respect and open dialogue has led to peaceful resolution of differences. There is also a great deal of endorsement of the power given to the PI and PD by others in the partnership. Among teachers, the PD is respected for her previous career as a fulltime middle school teacher, while the PI is respected among the STEM faculty because of her content degrees in Mathematics.

There are conflicting reports of coercion. At least within the STEM department there was little to no coercion to participate in the partnership. Others have noted state pressure for reform in which the state “does everything in their power to get districts to consider using certain approaches.”

Within the interviews, two groups of people emerged as persons of note during operations. The first is the PI and to some extent the PD, who are responsible for identifying and seizing opportunities as well as leadership. Because of the small size of the partnership and the centralized structure of decision making, these two people participate in almost every meeting and activity held by the partnership. They are the “face” of the partnership and thus drive a great deal of partnership operations.

While not crucial to macro level decision making, another group that plays an important role in operations is the district administrators. As the PI puts it, “they literally move mountains out of the way.” Without the leadership team’s ability to locate funding or secure substitute teachers, a large amount of partnership activities would not be able to take place.
Operations are also driven by environmental forces, embeddedness and strategic needs/transaction costs. State standards serve as an environmental influence on operations. As one LTSA succinctly pointed out, “all of us are mapping using the standards,” adding that it is a “huge help to have work being done around standards about what we are doing.”

In order to influence reform on a community level, the partnership hosted a number of “evening chats” to inform and educate the community, and receive feedback from parents and the community at large. It was reported that large turnouts for evening chats are quite possibly the result of curriculum reform being so high on the radar screen for many parents and community members. This is an example of how environmental pressure can lead to interest and participation in partnership activities while “districts where newer curricula is being institutionalized, and people are not fighting against it and are pleased with how things are going, have had low turnout.”

Perhaps the most glaring shortcoming of this MSP is found in the absence of work participation from mathematicians, and the lack of interaction between IHE faculty and K-12 teachers and administrators. While a small number of STEM faculty has participated in some evening chats and contributed to curriculum, participation in the partnership has not crucially impacted their department or changed the way they go about doing business. This is likely due to the failure of the partnership to meet the strategic needs of individual faculty members, coupled with the high transaction costs associated with participation, and the fierce resistance to partnership participation by a number of vocal STEM faculty members. In discussing how the partnership fails to meet the strategic needs of the mathematic department, one faculty member noted that the mathematics department simply, “has no explicit interest in what goes on at the Warner School.”

Despite a lack of buy-in among the majority of mathematics faculty at the University of Rochester, administrators claim that “[it might not have hurt] the partnership because we continue to work with [those few faculty members who are well involved]. Since the partnership isn’t really systemic in terms of the math department, and it is more based on individuals, I would say it didn’t hurt the partnership because we continued to work with the individuals we have been working with.”
The inability to meet some of the strategic needs of districts (such as provision of substitute teachers when needed) has led to some changes in operations of the partnership as workshops and institutes are held during the summer and at night to save the need for substitute teachers. Of course, this tactic cuts into a teachers need for free time. This need for free time to devote to other commitments is also reflected in the comments of IHE STEM faculty who propose that the reason for the narrow involvement of their department is the limited time and other pressing concerns of non-participating faculty. Moreover, STEM faculty have also explained the limited participation of their colleagues by suggesting that participation not only limits some strategic needs (time), but also does little to provide for other strategic needs. In this example, faculty members are reluctant to identify the advantages they get out of participating other than inadvertently bettering the local education system for their children.

Because of their embedded position within the schools and school systems, the LTSAs play a key role in identifying both the strategic needs of teachers and the transaction costs that administrators are willing to bare in participation. This idea was echoed by an MSP administrator who pointed out that “what’s nice is our LTSAs are connected to schools which helps balance that with what teachers think they need, and then balance that with what administrators think they can support.” The identified strategic needs then drive operations as “decisions eventually get made by [the administrative team], but we try to balance that with out lead teachers and administrators and what we hear from them.”

Operationally the partnership has evolved to accept a very limited role from its advisory board – with the board never actually meeting during the span of the grant. This is largely due to the fact that the partnership administrators were never able to tailor the board in a way that would meet the strategic needs of those participating. As the PD put it, “the first time we were going to bring them together we couldn’t figure out what we would do and how we would do it so it would be meaningful to all of us. Nobody wants to be on a board that is not a professional opportunity for them.”

In addition to problems associated with unaligned strategic needs, partnership operations were also affected by transaction costs. One example of how transaction costs can shape partnership
operations is found in the design of the LTSA program. For some teachers, full time participation as an LTSA might lead to a loss of seniority or retirement benefits. In order to prevent a loss of benefits which would add unduly transaction costs to participation, “money for LTSAs was run through the districts so that teachers would continue to keep their full time employee status.” One STEM faculty member noted that one of the original school districts pulled out of the project because they felt that participation came at too high of a cost to teachers, and took up too much of their time.

Even among regular teachers, there were often high transaction costs associated with participation in professional development activities. For example, one district administrator noted that participation among teachers “has been a struggle to us because we can’t afford a substitute teacher. We were offered a great resource to be able to go to training, but couldn’t hire substitutes.”

High transaction costs associated with meeting on the University of Rochester campus drive the partnership to host many of its activities at the schools within the district. These costs are mainly derivative of long travel times for teachers to go to the University, as well as parking issues at the University that do not exist at the local schools. Without adequate buy-in from those at the district level, these meetings might not be able to occur, as hostile administrators might not be willing to provide the free meeting space needed to host professional development activities within the local schools.

Sometimes teachers are willing to overlook high transaction costs, as strategic needs outweigh transaction costs and lead to participation. A key example of this was found in a successful professional development program that was offered on a Saturday. Despite the high transaction costs associated with working on one of their two days off, only one teacher out of thirty did not attend this training.

Standard operating procedures for billing and reimbursement were designed in an effort to reduce the transaction costs associated with getting paid. Despite these efforts, three respondents complained of a complicated and often burdensome reimbursement system. However,
respondents did say that the procedures have gotten better over time, and that often the amount of money is so trivial that a small wait is not that big of a deal.

Well embedded and trusting relationships among actors in the partnership has helped build a number of effective relationships. For example, when asked to describe why their working relationship with one of the independent contractors was so successful, one LTSA said, “trust, and respect” while a local administrator noted that “the level of mutuality was helpful in making the working relationship effective.” A STEM faculty member further noted that he “always felt that we were all equals.” Shared interests, trust, and mutual respect were key.

The embedded relationships that help build effective partnerships are not necessarily formal. In describing the PD’s interactions with school administrators, the PI notes that “she defined it as ‘I drank a lot of coffee.’ She was literally calling up and shaking hands and meeting with administrators face to face [and just chatting informally about needs]…it has resulted in her becoming the facilitator for [another program] so she could get even closer to administrators, which has resulted in a few administrators asking us to provide additional professional development work.”

Within the Warner School, there is a large amount of legitimacy as the Dean of the school is in full support of the partnership, and embraces the program as an important part of the Warner School’s work. It should be noted that embeddedness almost certainly had a direct effect on the level of legitimacy in the Warner School, as the Dean and the PI were former research partners, having worked together on a variety of grants and research projects for over twenty years.

While there is a great deal of legitimacy at the Warner School, as noted earlier, there is a lack of legitimacy within the general mathematics department of the sponsoring IHE, as it relates to the MSP. This lack of legitimacy is clearly manifest in the low levels of participation among faculty members within the department.

In one instance a district underwent a loss of legitimacy when a new administrator chose not to support the partnership. In this case, the loss of legitimacy ultimately led to that partner no
longer participating in the grant. As noted earlier, legitimacy is crucial to a number of partnership operations, beginning with the provision of meeting space for professional development. Going further, support of local administrators also maintains operation by “letting the teachers out, providing the substitute money, providing space, pay for teachers to attend professional development, the use of copiers, and materials like chart paper and markers.”

In forming the partnership, some organizations offered more commitments than others, with these commitments often mirroring the level of legitimacy and buy-in coming from a particular organization. For example, within the Warner Center for Professional Development, the University of Rochester was fully involved in the partnership, providing the office and meeting space required to administer the partnership. Within the U of R mathematics department the level of commitment was much less, as only certain faculty members and not the entire department or the department leaders were committed to the partnership. As one respondent put it, “the partnership isn’t really systemic in terms of the math department, it is more based on individuals.”

At the local level, the districts had to agree to have a “cadre of lead teachers” and commit to supporting the professional development of those teachers through the provision of release time and substitute support. They were also committed to assist in data collection efforts and provide meeting space and materials when needed. While they were not required to commit to curricula reform, they were asked to be supportive of questioning how their math instruction happened, and investigate various reform solutions.

There are two types of turnover within the partnership that impacts the partnership operations in a number of ways. Turnover amongst administrators can have a negative or positive effect depending on the level of commitment to the partnership the incoming administrator has. As mentioned above, one instance turnover of a district superintendent who was supportive of the project led to that district withdrawing from partnership participation, which lead to organizational turnover. One LTSA reported that any turnover in the partnership can hinder operations because “building critical mass is so difficult.” Along the same lines a STEM faculty member noted that, “any time you have personalities change, you have issues.”
Turnover among IHE STEM faculty is bad for the partnership because of the non-systemic and individual fashion in which STEM faculty participate in the program. The partnership did experience STEM turnover when one faculty member left for a new position and was not replaced. This example of turnover was somewhat downplayed by the PD who noted that she was “not sure it hurt the partnership because we continued to work with [the other two STEM faculty members], but it defiantly hurt our partnership because she was so great.” With retirement rapidly approaching for one STEM faculty member, there is great concern among the STEM faculty and partnership leadership that there will be no one to step up and take his place.

After joining the partnership there was initially very limited involvement from the rural regional consortium because they were simply not prepared to jump feet first into full curricula reform. As the PI points out, these districts “were in a different place than our suburban districts, so we knew from our previous work that we needed to give them a get ready period to give us more time to do focused work…and get the general population to a place where we could collaboratively look at and discuss issues, and they would be ready to have those discussions.” Because of this, their participation has evolved over time as they become more and more involved in the partnership. This is another direct example of how program operations were shaped and evolved over time to respond to the strategic needs of particular partners.

Just as one organization became more involved over the life of the grant, one partner decided to leave the partnership a year and a half into the project. This suburban district was not completely separating itself from the partnership and still works with the partnership in general, but felt that full participation was not warranted as they still needed to spend more time focusing on the survival stages of curriculum implementation. In other words, their critical needs no longer matched those of the entire group, so they left to pursue their needs on their own.

External environmental pressure has driven operational evolution. For example, the implementation of state testing in January and March has led the MSP to change the time that its algebra/geometry course is offered to teachers. As the PD stated, “with all the state testing that
happened, we were very concerned that we would not be able to get teachers to be out for six days [during the school year], so we didn’t offer it this school year and are going to do it in the summer.”

This is also an example of how the partnership administrators are being responsive to the strategic needs and transaction costs associated with participation – the implementation of state testing introduced a new strategic need that needed to be met during the school year, and increased the transaction costs associated with professional development activities also held during the school year. As a result, the partnership administrators decided to change the way this particular course was operated.

It was reported by both the PD and PI that the goals of the partnership have remained the same since inception. This is not to say that at times some goals were more stressed than others, as they “have worked on different ones at different points, but holistically they have all remained at the same level.”

While community involvement through evening chats has remained a goal throughout the partnership, evening chats changed over the course of the grant to react to the needs of those involved. For example, soon into the evening chat process it was determined that schools and districts found open ended dialogues with the community to be troublesome because of the anticipated negative reactions. Because of this, evening chats evolved into a more structured form that helped focus the conversation and reduce teacher and district anxiety.

In some instances, evening chats have not been well attended, and this is attributed to a belief among the community that there are no strategic needs surrounding mathematics education to drive community participation. As the PD points out, “I thought about this with my own kids, and if a flyer comes home to invite me to talk to social studies I am probably not going to come because I am not worried about their social studies curriculum.”
Outcomes

Annual reports and interview data shows that reform math courses and leadership activities have proved to be successful, while evening chats have not been a rousing success.

Multiple respondents said that the partnership held the most potential to influence an increase in content knowledge amongst teachers. While anecdotal in nature, one interviewee concluded that she could tell the professional development activities were working because of the informed reactions of the teachers compared to their reactions in the beginning. Others were more reserved, noting that while the content knowledge of teachers has defiantly improved there are questions about how this experience has been translated and transferred into the classroom.

Other respondents were able to link partnership efforts with outcomes by noting that little IHE/K-12 interaction or professional development would have occurred without the partnership.

When asked if the partnership has changed the way in which the Warner Center does its activities, both the PD and PI responded that it hasn’t had a drastic effect. It has had a slight influence in that partnership activities bring resources and experience to the Warner Center that can then be applied to other activities, but it did not fundamentally change it.

In order to ensure sustainability, administrative leaders have been making efforts to secure secondary funding that would go towards a continuation of the work being done through the MSP. It is hoped that the cadre of lead teachers being developed and the efforts in enhancing community involvement in mathematics education will develop district further develop district capacity to continue moving forward even if the money does run out.

Conclusions

A strong champion to align resources and form the partnership along with strategic needs are the two most important factors driving both the LSC and MSPs at hand. Partnerships are not simply formed out of thin air, and a strong champion was key to formation in both cases examined. Champions draw upon their interpersonal and organizational embeddedness in assembling their partnership teams. These champions not only build upon their existing relationships, but often
build upon their previous programs to identify the strategic needs of potential partners and the region at large.

The strategic needs of the Warner Center and NSF are the driving force during the formation phase. Without a vital strategic need for more grant funding, there is little incentive for the PI to even write a proposal. The strategic needs of NSF, as they are fleshed out in their calls for proposals, drive proposals which in turn drive subsequent partnerships. For example, NSF identified a need to harvest the knowledge of the U.S. STEM fields. This need was further expressed by MSP eligibility criteria that required STEM participation for funding. Ultimately, this need is met as all awarded partnerships include STEM partners. When the strategic needs of NSF are not met, the partnership simply fails to get funded.

This is not to say that the strategic needs of the other partners were not important, especially during the operations phase of the partnership. During formation, the needs of organizations other than the Warner Center and the NSF seemed to be taken into greater consideration during the MSP than they were for the LSC. This is because the LSC was awarded before the champions had a firm grasp on exactly what the strategic needs of region were. As discussed, the two partnerships examined in these case studies are only two pieces of the grant work that is administered out of the Warner Center. Written 6 years and many lessons later, the MSP formation team had a much better understanding of their terrain.

While the strategic needs of teachers and administrators can be overlooked during the formation process, they are the driving force during the operations phase of the partnership. In both cases, operational change occurred in response to newly identified strategic needs of teachers. With the LSC, the partnership changed their operations to meet the needs of special education teachers. With the MSP, professional development workshops were rescheduled to meet newly identified strategic needs.

We have seen many times that when strategic needs are not being met, participation will suffer dramatically. This was seen during the LSC, when participation of special education teachers initially suffered as their needs were not being met. This is seen multiple times in the MSP case,
as general STEM faculty and advisory board participation are crippled by the inability of the partnership to meet their needs.

Closely aligned with the key role of strategic need alignment in operations is the need for legitimacy to ensure successful operations. In both cases a lack of legitimacy in the form of blessings from administrators or union leaders drastically limited the success of partnership operations. In some instances these problems with legitimacy were overcome by turnover or a change in leadership; in other instances these problems were only exacerbated by a change in leadership.

While both the LSC and MSP suffered from problems of legitimacy, it seems that on the whole, the MSP had higher levels of legitimacy and less problems associated with buy-in than the LSC did.
Works Cited


Appendix H: SCALE Math and Science Partnership
SCALE CASE STUDY

System-wide Change for All Learners and Educators (SCALE) is one of the first Math Science Partnerships (MSP) funded by the National Science Foundation (NSF). Designated a comprehensive MSP, SCALE is designed to address both math and science education. This is but one of many ways in which the SCALE project is ambitious. The project brings together school districts representing a wide variety of size and ethnic complexity: Madison, WI; Providence, RI; Denver, CO; and Los Angeles Unified School District (LAUSD). The project also attempts to bring together powerhouses of education research, the Wisconsin Center for Education Research and the Institute for Learning at the University of Pittsburgh, working with local institutions of higher education. The size and complexity of the partnership is matched by the ambitious goal of these partners to “make it the rule for students of every grade level to experience high-quality teaching of, and achievement in, math and science.”

The SCALE partnership is a case study in success, failure, and resilience in a large partnership between universities and school districts. It provides an important example of partnership as an adaptive enterprise, fitfully and at times painfully struggling with the hopes and ambitions of the individuals and organizations that constitute the collaborative endeavor. This is also an important case because it demonstrates the difficulties associated with melding distinctive organizational structures and operational strategies of university centers and school systems into a program of intervention aimed at improving teacher content knowledge in science and math education.

SCALE is a large and complex project. This is a case study of partnering amongst the ranks of the senior administrators of SCALE. As such, the case study examines the impacts of partnering behaviors upon the organization and operation of the SCALE project. SCALE has an active research and evaluation team which has produced several studies addressing the outcomes and impacts of the SCALE partnership (see Research Papers at http://www.scalemsp.org). However, because the SCALE research and evaluation team is part of the partnership and within the management structure of SCALE, there was value in getting an outside assessment. The focus of our study was agreed upon as a condition of SCALE’s participation as a case site.
The case study is organized in a chronological fashion beginning with the preconditions associated with the SCALE partners. This section reviews the working relationships among the partners prior to the MSP solicitation. This is followed by a section in which the formation of the SCALE partnership is discussed covering proposal writing and the development of the strategic plan for partnership activities. The next section addresses the organization and operation of SCALE with a particular focus upon conflict and changes in the senior management team. Ultimately, this results in the departure of one of the major university partners. The following section examines the reconstitution of the SCALE partnership. In the final section, an assessment is offered of the factors that drive partnering behaviors in this case.

**PRECONDITIONS**

When NSF releases a solicitation announcing a grant proposal, it is sending a stimulus through a social network with varying levels of connectivity and varying levels of shared interests. It is similar to sending a signal into a network of neurons. The neurons will vary in the degree to which existing synaptic relays offer linkages into established ways of knowing and doing. When synaptic relays are established, then the body has a known way of responding and reacts in a relatively smooth manner. Absent such traveled relays, the brain must learn to establish new connections to cope with the new signal. The resulting behaviors require more effort and anxiety.

In a similar vein, we begin by examining the types of relationships and interests that existed amongst the actors prior to the stimulus of the grant solicitation from NSF. The first factor we examine is the level of *embeddedness* amongst the actors. *Embeddedness* is a measure of the history of connectivity between actors. To extend our metaphor, it is the number and types of synaptic relays that links the affected neurons. Our hypothesis is that the higher the level of *embeddedness* the more likely that the actors will be able to agree upon a course of action.

A second factor we examine is the *strategic needs* of the actors through which we observe the salience of the issues being addressed through the partnership to the network of actors. Again stretching our metaphor, neurons will vary in the degree to which a signal stimulates a response.
As the strategic needs are more salient to the actors in terms of (a) their level of personal interest in the issue and (b) their ability to contribute knowledge and resources, then the partnership will experience greater commitment to defining goals and pursuing outcomes.

A third factor that we examine is the policy inducement which serves as the signal traversing synaptic relays and generating varying levels of stimulus from a network of neurons. In this study we observe policy inducement through the eyes of those receiving the signal, setting aside for the moment the original intent of the policy-makers. The actors involved in a partnership will vary in their perception of what the policy inducement is telling them. The NSF MSP solicitation contained several eligibility requirements with regards to the constitution of the partnership. The solicitation was also prescriptive about the range of activities that would be funded and the desire that such activities generate transformative change amongst the higher education and K-12 partners. However, individual partners vary in the degree to which they view such elements of the policy inducement as a guide to their behavior.

Prior to the formation of SCALE, the individuals and organizations who led the initial partnership exhibited high levels of profession-based embeddedness but low levels of project-work embeddedness. Embeddedness is a concept designed to capture the nature and extent of relationships amongst actors over time. Individuals can have high levels of professional embeddedness when they share a common social network based upon their work lives that makes them aware of each others work and reputation. Stronger and more intense forms of embeddedness are formed when there is a history of working together which requires more frequent interactions and commitment to working towards shared or complementary goals. In a partnership, project-work embeddedness requires the collaboration of actors from two or more organizations whose efforts are bound, sometimes loosely so, in agreements between the actors home organizations.

The leadership for the initial cast of the SCALE partnership was comprised of the head of the Wisconsin Center for Education Research (WCER), an associate Dean of the Graduate School for the University of Wisconsin who was a conduit for scientists to become involved in STEM education and the principal investigator for SCALE, and the head of the Institute for Learning
(IFL) at the University of Pittsburgh. The head of WCER was the key link between these leaders. Between the head of WCER and the head of IFL there were high levels of profession-based embeddedness based upon years of following each others’ work through professional conferences and respect for each others’ quality of research. The head of WCER also had high levels of project-work embeddedness with his colleague from the University of Wisconsin based upon years of serving as senior administrators in the same organization and previous collaborations on research projects. Prior to SCALE, there were no ties of any sort between the head of IFL and PI for the SCALE project. This was to prove problematic over the first years of the partnership.

Each of the three leaders brought distinctive “networks of influence” to the SCALE partnership. In the early stages of proposal writing, the partnership was likened as a “loose confederation” in which each of the leaders contributed actors from their respective networks of influence with whom they had strong project-work embeddedness ties. However, there was little or no embeddedness across the three networks. Amongst these individual networks were working relationships with schools. The head of WCER brought research and evaluation staff and the school district for the City of Madison to the project. The IFL contributed research and evaluation staff as well as strong working relationships with the school districts of Providence, Denver, and Los Angeles. And the PI for the project brought scientists, engineers, and mathematicians from the faculty of the University of Wisconsin.

As the SCALE project evolved, another set of key actors emerged out of the California State Universities at Dominguez Hills and at Northridge. Like the relationship between the PI and IFL, there was no previous working relationship upon which to build. Like the IFL, the California schools had strong working relationships with the Los Angeles Unified School Districts (LAUSD). However, these ties were less with the LAUSD leadership and more with teachers and individual superintendents of districts within LA. Also similar to IFL, the California State universities had no embedded relationships working with the Wisconsin leaders. However, where relations with IFL grew to be contentious, the relationships with California schools were to prosper over time.
The leadership in SCALE shared a deep, even passionate commitment to the goal of transforming the classroom environment to a place where all teachers and students are engaged in significant and meaningful learning experiences. They also shared an ambition of producing approaches to teaching and learning that are scalable to the size of school and adaptable to the wide variety of social environments in which schools must work. Each of the leaders has a proven track record of success in their particular approach to the national challenge of transforming education.

Such shared values and ambitions did not provide sufficient conditions for a working partnership to emerge; though as will be seen in the sections on partnership formation and implementation, a good faith effort was made to do so. How is it that such strong leaders failed to find a common work plan? When we conducted our first interviews in this case, the partnership between IFL and Wisconsin was an on-going but troubled relationship. Many of the respondents were aware that the leadership of SCALE was no longer working in harmony. But there was some hope that such disagreements were contained and the working relationships were slowly being fashioned amongst senior and mid-level managers of the project. Other respondents saw the struggles as a clash of egos particularly amongst the PI and the head of IFL.

However, our findings suggest that the roots of the disagreement lay in the strategic and operational philosophies of the partnership organizations. In our earliest interviews, this was a view that was beginning to emerge amongst the respondents, and it became more pronounced in subsequent interviews. The partners devoted considerable time to building and developing the partnership. But as they searched for a common vocabulary to work with, they were more likely to achieve agreement on terms rather than the meaning of terms.

**Preconditions: The University of Wisconsin**

The strategic interests of each of the leaders and their respective networks of interest are best understood by examining the preconditions to the project. We begin first with the PI from the project who comes to the project with experience as a STEM faculty member. The University of Wisconsin had identified problems in the supply of students with adequate preparation in disciplines related to science, mathematics, and engineering. This problem was particularly
alternative for students from minority communities or from disadvantaged backgrounds. As the assistant Dean of the Graduate School the PI was particularly interested in getting STEM faculty involved in addressing this issue.

The PI’s commitment to addressing this strategic need is demonstrated through two previous projects in which the relationship between WCER and STEM faculty had been successfully built. The National Institute for Science Education (NISE) was a WCER-based project funded by EHR at NSF. NISE was created in the context of the systemic reform initiatives sponsored by NSF which was designed to explore the community of relationships influencing schools and the impact of these relationships upon school performance. The PI participated in this project by taking a leadership role mobilizing faculty from STEM-related disciplines to participate in the generation of professional development resources for teachers. Another dimension of the NISE project was to examine the experience of students in STEM fields in their first year of college to see if this experience acted as a deterrent to students pursuing further studies and careers in these fields. This was considered a successful engagement between the PI and WCER.

A second related effort was the K Through Infinity (KTI) project which was also funded through EHR’s GK-12 program within NSF. This project placed graduate students in math and sciences in K-12 schools to work with teachers. This was designed as a professional development experience for both students and teachers. The graduate students would learn better skills in communicating their discipline as well assist in developing and organizing and teaching resources for their field. For the teachers, they had access to a resource for improving their content knowledge of the field.

The PI’s experience in both of these projects confirmed that science and math education were a critical component of establishing equitable educational experiences for students from disadvantaged backgrounds and that this was an issue of high strategic importance for the university. One of the keys to addressing these needs was to focus on teacher content knowledge and provide the curricular and professional development tools to improve math and science instruction. However, rather than approaching teachers and school districts from an authoritative posture, the experience in NISE and KTI had convinced the PI that cooperative strategies of
developing content and professional development in concert with schools and teachers was more likely to be an effective approach to improving math and science education.

In both NISE and KTI, Wisconsin Center for Education Research (WCER) served as the administrative home for each grant and provided many of the key personnel from the University of Wisconsin. Created in 1964, WCER is one of the leading organizations for basic and applied education research in the United States. With an average annual budget of $25 million, it is the home to several centers and numerous projects at any one time which are sponsored through external grants and contracts. The range of work covers the full spectrum of the education enterprise.

When the Request for Proposal (RFP) for the Math Science Partnership program was first released in 2002, the director of WCER did not have a high level of interest. The solicitation struck him as being more about the implementation of a professional development program and not sufficiently oriented towards research. Not only was the strategic match between MSP and WCER a weak one in the director’s mind, but there was another solicitation for a large project out that seemed a better match for WCER resources.

However, the director had a good working relationship with the associate dean of the Graduate School, through the NISE and KTI projects, who was highly interested in applying for the MSP grant and willing to serve as PI on the project. The director was willing to be convinced that WCER could pursue both grants and that sufficient resources could be brought to bear if both were funded (which they eventually were). In part, this willingness was based upon previous successful engagements between the PI and WCER. Another important component of the SCALE project is that the team came to view the project as a design experiment in which they would study “learning in context through the systematic design and study of strategies and tools” (Millar and Clifford, 2003, p. 4). The research and evaluation goals of the SCALE project were organized under the leadership of the director of WCER. During an early interview, the now-former director of WCER identified numerous ways in which the project addresses issues of high salience for school transformation and the professional development of teachers, issues of
strategic interest to WCER, but continued to voice concern about the research product that would emerge from SCALE partnerships.

**Preconditions: University of Pittsburgh and the Institute for Learning**

The Pittsburgh team had also reviewed the MSP proposal and, like WCER, initially had decided not to respond to the solicitation. The personnel for the Pittsburgh team were mostly located in the Learning Research and Development Center (LRDC) and in the affiliated Institute for Learning (IFL). The MSP solicitation required partnering with school districts and also with STEM faculty. IFL in particular had established deep partnerships with several districts across the country. However, one of the reasons IFL and LRDC had not pursued the solicitation was that their efforts were mostly focused on the disciplines of reading, literacy, and math—all of which are subject to state standards and scrutiny by accountability systems. IFL had fewer resources in the area of science. The experience of the University of Wisconsin in forging a partnership between STEM faculty, education faculty, and social science faculty made cooperation on the proposal attractive.

The LRDC has built a reputation as one of the leading centers in the world for the study of cognition and learning. The basic research conducted in the LRDC had demonstrated the capacity for learning across all students and that most cognitive barriers to learning are related to limitations of institutions, communities, pedagogy, and curriculum. The director of the LRDC had been a leader of the early movement to create standards for education. Initially this reform movement was about establishing standards as a means of ensuring equity in education rather than devolving into testing. The IFL was born in the mid-1990s in response to demand from school districts with predominantly poor, minority students who were accepting of the need for standards and were searching for a strategy for school improvement.

One of the challenges that the IFL sought to overcome was the difficulty in establishing a partnership between higher education and school districts. School districts frequently view higher education as a service provider—often a haughty one mostly interested in promoting the latest curricular or pedagogic strategy developed by their faculty. The IFL was designed for engaging school districts in reform. Most of the senior personnel, called Fellows, have an
extensive professional history as teachers and school administers precisely so they can better serve as agents of change.

The IFL engages with school districts through contracts in which at least 35% of the grant presence is in the form of an IFL Fellow who serves as a district liaison. The Fellows work side-by-side with district administrators in developing strategies for administration, instruction, materials, and professional development that are designed around IFL’s Principles of Learning. Previous research has found wide variance within school districts on the type of instruction to which students are exposed. The IFL Principles of Learning are designed to create a set of standards across schools so that all students have equity in receiving high quality instruction that meets competitive standards. This requires a strategic and integrated commitment linking school district administration, school administration, and classroom instruction in a common strategy for quality education.

The IFL also draws upon the resources of the LRDC in developing curricular, pedagogic, and professional development tools that supports the IFL engagement and the school district’s strategy for attaining high standards of performance. Because the IFL seeks a sustained intervention, it starts by creating commitment from senior school district officials. By allowing Fellows to become a part of the district management team, the Fellow is officially an insider who can interpret the best tools, resources, and means for engaging with university faculty to adapt to the local conditions. In doing so the IFL pursues a whole-school system approach to reform that stresses buy-in from all actors in the value chain from senior management to classroom teacher.

**Preconditions: The School Districts**

Four school districts signed on to be part of SCALE: Madison School District, Providence School District, Denver School District, and the Los Angeles Unified School District (LAUSD). The differences between these school districts and their service region in terms of size, geography, and demographics are substantial. One SCALE project manager described the districts as a Russian doll with all of Madison being able to fit within Providence, and all of Providence and Madison being able to fit inside Denver, and all of three of these districts fitting inside LAUSD. Another SCALE researcher described it as comparing “apples, oranges,
bananas, and Volkswagens”. Ultimately, this diversity posed a serious challenge to SCALE in developing a common but coherent strategy of reform.

One other difference across the school districts is in the “network of influence” with which they were associated. The Madison school district was brought to the SCALE project through an invitation from the University of Wisconsin-Madison. In contrast, Providence, Denver, and LAUSD all had contracts with IFL and were invited to participate in SCALE by the director of IFL.

While the school districts may have been highly variable, and the needs that were targeted also have variance in grade level, subject matter, and type of intervention, there was considerable commonality in the strategic need to be addressed. Each of the school districts was searching for a way to strengthen math and science education. Each of the school districts was experiencing more intensive accountability pressures with regards to mathematics education as the national and state level tests had made this a priority. However, each of the school districts anticipated that the science curriculum would also be subject to accountability pressures and was searching for a way of addressing this need. Finally, the school districts shared a belief that there would be no off-the-shelf curriculum or professional development program that would be adequate to their needs. Respondents from each of the school districts noted a preference for developing programs that were tailored to the needs of their district, which the teachers and administrators would be more likely to embrace as relevant to their needs.

One of the interesting aspects of the SCALE case is that the strongest policy inducement reported by respondents was the MSP grant program. In other cases that we have examined, respondents often pointed to state and federal policies that were part of the rationale for participating in the project. In this case, respondents made very general references to the No Child Left Behind Act and to the upcoming inclusion of science on state accountability tests as a general motivator. These references in all cases came from the school districts. A more common description of the policy influence on behavior was for respondents to point to the requirements of the MSP solicitation. Left to their own plans, it is unlikely that either WCER or IFL would have generated a proposal for MSP. Each of the three “networks of influence” was
needed to create a proposal that answered the solicitation requirements for an MSP. To this extent, the behavior was opportunistic in nature.

One of the attractions of MSP to the principal leaders of SCALE is that the goals of MSP matched their own sweeping ambitions for education reform. Each of the leaders in SCALE is a major figure in education research or math and science education. They share a common value for pursuing programs that will have large impacts and which can be scaled up from small innovations to widespread application. MSP seeks to engender transformations in math and science education through the creation of learning communities anchored by partnerships between university-based STEM faculty and K-12 based math and science teachers and administrators. This is a large ambition. But it matches well the ambitions held by the each of the leaders in this case, which pre-date the creation of the MSP program. To this extent there is a contingent match between a key goal of the grant solicitation and the values of the leaders in this case.

**FORMATION**

The leadership of SCALE attempted to compensate for the low levels of embeddedness between the principals in the formation of the partnership. This process unfolded in two distinct phases which respondents tended to describe as the opening era of SCALE that extended from the announcement of the NSF RFP to the completion of SCALE’s 5 Year Strategic Plan at the end of Year 1 of the grant. The first phase was the process of writing the grant proposal, which was led strongly by the university partners. The second was the development of a strategic plan for the partnership, which, though still university led, exhibited greater balance in the contributions of the school districts.

Several key concepts associated with partnerships are examined in the formation phase of SCALE operations. When partnerships are formed in response to an external stimulus such as a grant, and particularly when actors have low levels of experience in working together, a key factor is the degree to which they exhibit *goal complementarity*. *Goal complementarity* is simply the degree to which actors view their goals as contributing to a common enterprise. Actors do not have to have the same goals; they merely acknowledge that each others’ goals are legitimate
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and can be pursued and accomplished through a plan of action. In the context of SCALE, we examine two dimensions of this factor: *project goal complementarity* and *operational goal complementarity*. The former refers to the combined goals of actors associated with the ultimate outputs and impacts from the grant project. The later refers to the combination of goals that actors have on how they will go about achieving results.

We also examine factors associated with the interaction amongst partners that may influence the capacity of partnership to function and prosper. A key factor is the *mutuality in exchange* that actors have in their communication patterns. One of the fundamental characteristics of partnerships is a willingness of actors to try and work together in pursuit of a common set of goals. A factor that may influence this is whether communication patterns are *mutual*, i.e. the flow of communication goes both ways and the actors perceive that their point of view is heard and understood by their partner. Another relational factor is *identity enhancement*, e.g. the degree to which a partner organization believes that its stand-alone identity is enhanced by participation in the partnership. An additional factor is the level of *trust* that actors in the partnership have in the intentions and behaviors of their partners with regards to collaborative work. A final factor for observing interactions is the level of *transaction cost* associated with the partnership. *Transaction costs* refer not only to monetary costs but also costs of time and effort devoted to maintaining and operating the partnership.

A final set of factors that we use to examine both formation and operation of the partnership are associated with the structure and leadership of the partnership. We examine the *administrative network*, i.e. the composition of actors responsible for the strategic and administrative operations of the partnership. Changes in the *administrative network* over time also signal changes in the goals and operations of the partnership. They also serve as an indicator of the types of adaptation strategies that have been developed by the partnership to accommodate challenges to the original strategic and operating goals. An important related concept is the *champions*, i.e. the number and types of leaders who view the partnership as an important element in their work life and are willing to exert influence in their own organization and across partner organizations in promotion of partnership goals.
Formation: Preparing the Proposal and the Strategic Plan

SCALE brought together a powerful team of researchers who were well-known within the education community. In the formation of SCALE these are the project *champions* providing the vision and drive that brings the partnership together. Members of the partnership team dubbed this group as the “Tomatoa,” a term of respect that refers to a decision making body of elder tribal chiefs which one of the project members first heard while doing anthropological field work. Naturally, this term quickly morphed into the “Tomatoes” among other senior and middle managers of SCALE.

The Tomatoa are seasoned professionals when it comes to the art of proposal writing for a competitive grant program. During the early months of 2002, they created the vision for the project and assembled the people and resources needed to create the proposal. Each could see the competitive value of bringing their respective networks of influence to the project. As such, each actor was recognizing the potential for *identity enhancement* that could be accrued to their organization. For WCER and the STEM faculty PI, working with IFL was seen as gaining access to a national network of partnerships between K-12 schools and a university. For Pittsburgh and the IFL, there was the hope that working with Wisconsin would broaden the range of their expertise by building valuable research and tools for science education.

As such, there is strong evidence of *project goal complementarity* amongst the leadership of SCALE at this early stage of the project (though this did not rise to the level of high goal agreement). Each member of the Tomatoa could see the value of the other in terms of the grant competition, as well as for the conduct of the project, and they communicated this to their network of influence. The Tomatoa were also attracted by the idea of developing a project that had a national scope of work. As they began to the build the proposal, the Wisconsin leaders were impressed by the IFL’s “Principles of Learning,” which it uses as a core values for engaging with school districts in system-wide reform. One of the senior SCALE managers describes this as follows:

“We adapted the Principles of Learning and incorporated them into the structure of the proposal and our plans. This meant we were trying to 1) develop a coherent and appealing model of instruction and learning, which would be 2) propagated through the training of
teacher coaches and teacher leaders, 3) enhanced by multiple tools of improved instruction, and 4) supported by actions of school district leaders trained in the model of instruction and learning as well as a system of reciprocal accountability for school districts, and 5) reinforced by selected policy instruments such as assessments of instructional quality in some districts.”

Respondents indicated that the school districts and STEM faculty were relatively passive in expressing their ideas on how the project should be organized during the proposal writing process, exhibiting high levels of trust in the judgment of the leader with which they were most closely associated. The head of IFL recruited LAUSD, Providence, and Denver because they had existing IFL contracts, they were willing to participate in the MSP proposal, and they had ability to participate in a national rather than regional MSP. The Wisconsin leaders recruited Madison into the project based off of their long history of working together. Part of the agreement was that the districts would designate someone with substantial authority in math and science education to participate.

In contrast, the three leaders exhibited a willingness to trust their partners but were too early in the relationship to have this be a strong factor guiding their behavior. It would be more accurate to say that they trusted each others’ competence for the grant competition and had high hopes that this trust would carry forward into the project.

Perhaps the best evidence of this hope was the degree of mutuality in exchange that was exhibited during the proposal writing process and in the development of a strategic plan for the project. The Tomatoa group brought in additional people from their respective networks to assist in the proposal development with 7 additional participants from the IFL and 3 WCER staffers. One member of the proposal writing team estimated that there were roughly 2,000 email communications, at least two trips between Madison and Pittsburgh for face-to-face meetings, and numerous telephone conferences over the three months that it took to get the proposal completed. Early on, SCALE proved willing to accept high transaction costs in the pursuit of building a partnership. Of the group participating in preparation of the proposal, eight came to be known as the Senior Management Team with four consisting of the PI and three co-PIs on the official proposal and four who were not listed as co-PIs but were regarded as having the same leadership stature within SCALE. The entire Senior Management Team served as the
administrative network during the formation of SCALE and consisted of two faculty from the University of Wisconsin, two faculty from the University of Pittsburgh, and one representative from each of the four school districts.

The SCALE project received notification on October 1, 2002 that they were being selected as a site for a comprehensive MSP award. The term comprehensive in this context means that the project addresses both math and science education. The project would begin on January 1, 2003, funded at the level $35 million (which was the largest award that NSF made in the original round of funding MSP projects), and would be organized as a cooperative agreement. One part of the agreement was that the SCALE project was to submit a 5-year strategic plan by March of 2003.

The creation of the strategic plan initiated another intensive pattern of communication across the partnership. At the heart of this communication was the eight members of the Senior Management Team plus several additional representatives from WCER, IFL, and the schools districts in Madison, Providence, Denver, and Los Angeles. Once again, the SCALE team exhibited a strong willingness to incur high transaction costs to achieve mutuality in exchange. Several meetings were conducted following the October notification in preparation of the strategic plan via teleconferences, unsuccessful attempts at conducting video conferences, and face-to-face meetings.

The first face-to-face meeting of the complete group was at a PI conference sponsored by NSF held in Washington, DC on January 30, 2003. At this meeting the group asked two fundamental questions: “What’s in it for me? What’s the quid pro quo?” The modal response was a strong commitment to the goals of the project. In the 5-year strategic plan, SCALE partners organized their work around five broad goals. The following excerpt from the plan gives voice to these goals (p. 2):

“To achieve its overall goal, SCALE is focusing on the following five action goals:

- **Goal 1**: Implement strategies to transform core STEM teaching system-wide in each of the four partner school districts so that every student experiences deep, conceptually based instruction on core mathematics and science concepts on a continuing basis.
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- **Goal 2**: Develop and implement immersion STEM learning experiences to ensure that every student in our partner districts experiences the process of engagement in an extended (e.g., four-week) scientific investigation at least once a year.
- **Goal 3**: Design a new environment for and implement new teacher preparation and development programs that give teachers a deeper grasp of STEM content and effective pedagogical strategies for engaging students in learning.
- **Goal 4**: Increase the participation of minority and female students in high school mathematics and science courses and send more of them to college as students of these fields, thus building a more diverse pool of potential STEM teachers.
- **Goal 5**: Ensure that a culture of evidence permeates all lines of work in the partnership through a program of research and evaluation.

Amongst the SCALE project team, each of these goals came to be known by the following shorthand with a rough initial assignment of tasks across the partners:

**Goal 1**: Disciplinary Literacy - IFL
**Goal 2**: Immersion – Wisconsin STEM & WCER
**Goal 3**: Teacher Training – IFL with Wisconsin STEM & WCER
**Goal 4**: Equity - IFL
**Goal 5**: Research & Evaluation - WCER

However, the bulk of the attention during the formation phase of SCALE was upon goals 1 and 2. Early meetings between university and school district partners had led to many questions about what the universities meant by terms like immersion or disciplinary literacy. The school districts were concerned that immersion had the potential to be yet another program that was largely unconnected with curriculum or the constraints of the classroom. In a similar vein, when NSF reviewed the strategic plan, the program officer raised questions about the linkages across the goals and whether or not there was a distinctive SCALE strategy that linked across each. One school district official from Madison suggested a “scaffolding approach” in which immersion units were integrated in with a larger plan for curriculum and teacher development. This suggestion was sufficiently impressive to the SCALE project team that the IFL representatives inquired whether the Madison official might have any interest in becoming an IFL Fellow.

Collectively, the suggestions from school district partners and NSF indicated a need for closer cooperation between the actions of goals 1 and 2. In interviews, all of the partners indicated that
they had anticipated greater collaboration across all of their activities but had gravitated towards some assignment of goal responsibilities based upon the mission and skills of the partner organizations. Initial discussions of the need for greater integration were viewed more as an opportunity rather than a threat.

However, even in these early stages there were signs that foreshadowed the difficulties that were to come. The research and evaluation team created a detailed chronicle of the launching of SCALE. In it is this passage concerning the capacity to collaborate across the goals (Millar and Clifford, 2003, p. 20):

“...on February 12 to discuss IFL’s disciplinary literacy (DL) work in the context of the IDT’s [immersion] activity. [IFL] expressed concern that immersion projects could overwhelm the IFL’s efforts to implement DL in the districts. [PI] suggested that if the IDT was sufficiently immersed in the DL approach, “Immersion teams could become deputized IFL people.” [IFL] conceded that it might work out that way, but was cautious on the whole. She warned that immersion units are exciting enough that they might distract district people from the very demanding work of thinking through what their core work (represented by Goal 1) should be. [PI] suggested the term attractive nuisance for this possible scenario. [Pittsburgh faculty] agreed with this point. [IFL] expressed concern about how immersion units might get implemented this spring in LAUSD, noting that there is a strong felt need for science resources there, and that the IFL fellow in LAUSD had not yet had enough time to begin addressing these needs using the IFL DL approach.”

This passage suggests that while the SCALE project leadership had high levels of project goal complementarity, they were in less accord with regards to operational goal complementarity. In other words, they shared a common vision of what the project might achieve but did not have common ideas for how this might be achieved.

**OPERATIONS**

As SCALE moved out of the formation phase, much of the consensus with regards to project goals broke down as plans were put into action. The SCALE partners had never come to a full agreement on how operations should be pursued. The pressures from NSF and from school districts for better integration between Goals 1 and 2 only served to heighten tensions with regards to operations. Pittsburgh/IFL and Wisconsin had very different ideas on how to proceed.
From the perspective of Pittsburgh/IFL the agreement was that IFL would serve as the conduit for interacting with the school districts. IFL had an established track record of building close working relationships with school district officials aimed at stimulating fundamental changes in education programs anchored around the Principles of Learning. The plan of action that IFL proposed for Goal 1 anchored disciplinary literacy in these principles. An IFL respondent explained:

“Goal 1 really amounts to a district design template. It has four dimensions:
Teaching – what are you going to teach and to whom, and who is going to decide;
Professional learning – if this is what you are going to do, how are you going to help people do it. We didn’t make the choices, but we made it clear what the choices were. We used this as a template at multiple meetings.
Monitoring system – how are you keeping track of who is doing what in your teaching system and how well they are doing it. The idea is that you have to measure everything, not just measuring kids test scores. If you just measure outputs it’s bad. You have to measure back into the box.
Accountability – this is not well defined but it had to do with what Roy Romer [head of LAUSD] said.
There is also a fifth dimension called the system dimension which examines what it takes to make all of these activities hang together.”

The IFL plan of action called for building close collaborative relations with the school district by having the IFL Fellows serve as an administrative insider. The theory of action is to build commitment amongst the leadership towards a plan of action appropriate for the school district. The IFL supports this commitment by working with the district to supply and adapt education tools and learning strategies consistent with their commitment. IFL then works with the administrators and teacher leaders and coaches within each school to provide the professional development needed to implement the plan of action. IFL provides Fellows to the district for a fee and also charges school districts for the education tools, resources, and professional development that it provides. These fees are not simply a way of recouping costs. They are an integral part of the strategy to build district wide commitment. One respondent associated with Pittsburgh/IFL explained that under the IFL theory of action, if a district pays for a resource or service, it is more likely to remain committed to that line of action.
From the perspective of IFL, the immersion units and other science education resources generated by Wisconsin would be implemented through the IFL plan of action for building partnership with school districts. IFL has a similar relationship with the Learning Research and Development Center (LRDC) at Pittsburgh. This was consistent with the original invitation to partner in order compete for the MSP solicitation; Wisconsin had better ties with STEM faculty, and Pittsburgh/IFL could deliver school districts. The districts that IFL brought to SCALE were ones with which they had existing contracts and working relations.

However, as Wisconsin began to engage with the school districts on immersion units, the IFL Fellows found that the level of engagement required to link STEM faculty with K-12 teachers was more extensive than anticipated. It demanded more attention of senior school district officials which meant Wisconsin personnel were interacting with the IFL Fellows and school district officials as equal partners rather than under the guidance of the IFL Fellow. It also represented pressure to engage with teachers before the planning for disciplinary literacy was sufficiently mature from an IFL perspective. While the addition of Wisconsin had the promise of expanding the range of subjects and services that IFL could offer the district, it was a subject matter that IFL did not have deep experience in addressing. More fundamentally it interjected a new voice in the relationship with the districts that was difficult to explain or coordinate with the larger relationship that IFL had with the district. Over time, IFL came to see this new voice as unruly and a threat to its working relationships.

Respondents from Pittsburgh/IFL noted meetings in Los Angeles and Denver when Wisconsin personnel were involved where the IFL Fellow was caught off-guard as to the scope of issues that were addressed and the number and range of people that had been invited. They also noted the necessity of waving off Wisconsin personnel from engaging with a school district when district leadership expressed confusion or concern about how the engagement on science and/or math fit into the larger plan of action. A Pittsburgh/IFL respondent described the situation as follows:

“A school district, especially a big district, is such a multi-faceted thing, and it has many heads and many arms. [IFL]’s strategy is to start with the top; starting with personal relations with the superintendent. [The IFL] staff works with the superintendent and the intermediaries (the chief
alternative officer, the heads of curriculum and instruction, the head of science, and the head of math). That’s where they spend the bulk of their time. … Wisconsin came from a very teacher-centric line of work. Individual teachers came to Wisconsin to work on lines of reform. … At various times, people at the top where saying they want line A [as a service], and people in the middle would name a different line of work that they wanted. So they were not in agreement with what the district wants.

One theory is that it will never work unless the people on top have a strategic plan. Another theory is that it will never work unless you have buy in from the people in the middle. The people in the top believe that power stems from them and are annoyed with outsiders who work at the middle and independent of them. If Wisconsin comes in a doesn’t pay attention to what the people at the top are saying, they are being persona non grata.”

The Wisconsin plan of action was built upon the formation of working groups. Like IFL the Wisconsin approach called for building strong relations with the school district official who had overall responsibility for math and science education. Unlike IFL this is not an engagement with the entire leadership team. This relationship was cultivated by bringing this district official into the discussions of the types of program activities that would be appropriate for their jurisdiction. This relationship is also a key means by which SCALE attempts to build “scaffolding” so that programs for teachers and coaches and teacher leaders are all in the context of acceptable curriculum and appropriate for district classrooms. To increase the attractiveness of the relationship, SCALE makes money, people, and research tools available as part of the engagement.

Working groups are formed to engage in activities that have been identified through the relationship with the lead math and/or science district official. Working group teams are highly adaptable to the needs of the school district and the task. They are normally comprised of SCALE project managers (drawing from Pittsburgh, IFL, and Wisconsin), STEM faculty for participating universities, school district officials, and teachers. Within SCALE, working groups meet the following criteria (Millar and Washington, 2007, p.3):

“• Is established by one or more people with leadership responsibility within SCALE in order to accomplish a SCALE task or tasks, which in turn are intended to help achieve one or more SCALE goals
• Is ultimately accountable to the PI or one of the co-PIs (bearing in mind that the group of PIs changes over time)
• Meets at least three times to make progress on its tasks
• Has at least two members
• Has one or more SCALE organizations act as a sponsoring organization ...
• Is referred to by SCALE participants by name, even if the name is merely descriptive and informal, and/or is worded somewhat differently by members."

From 2003-2007 there have been roughly 200 working groups formed within the SCALE project. The model working groups tend to be in operation for a bit more than two years. All working groups have members from at least one of the partner organizations but may also call upon participants from non-member organizations.

Partnership operations between STEM faculty and a school district would be defined by the types of working groups formed and the composition of working group membership. Thus, while partnerships are ostensibly independent of one another, there are important interaction effects in the work product of the groups. Any sequencing of activities of the working groups is usually organized through interactions with the district math and/or science administrator. For the most part the working group outputs are organized in a pooled fashion.

Another resource developed at Wisconsin and used in the organization of SCALE activities is SCALEnet, a commercial grade knowledge management that has been adapted to the needs of this project. One of the challenges of engaging in a project as geographically distributed as SCALE is keeping in touch with all of the key actors. SCALEnet was devised as a project management tool. It has the means to facilitate communication within and between working groups. Whenever a new working group is created, it is allocated space on SCALEnet so that partners have a means of working together electronically. However, there has been considerable variance in the degree to which working groups make use of the SCALEnet resource. Some groups make avid use of the resource recording all of their working documents and developing instructional products on-line. This then becomes a resource not only for the working group, but also for all other working groups participating in SCALE.

All of the SCALE engagements which involve interactions between STEM faculty and K-12 schools are built to some degree on these three elements. One consequence of the use of these resources is that SCALE encourages partnering behavior at many points in the value chain. Partnering with senior district math and science officials to shape programs appropriate for the
local context; partnerships with middle managers and school officials to create workshops and curricular tools that are germane; and partnerships with teacher leaders and coaches so that they have resources to disseminate in their home institution.

From Wisconsin’s perspective working with IFL was more like working with a consulting business rather than engagement on an education research project. Respondents report that it was very difficult to know when their actions would trigger negative, even angry responses from IFL personnel over intrusions into their way of engaging the school district. Over the course of the first two years of SCALE, the Wisconsin team grew to doubt that working through IFL would lead to the types of lower level engagement needed for building partnerships between STEM faculty and K-12 teachers. The following quote illustrates this point:

“They [IFL] had a game plan [i.e. a disciplinary literacy plan] for math and science [in Denver]. What happened was that this looked like one of the shining successes in the partnership. But when a new [school district] administration came in they decided not to take an IFL contract. ... A number of people including some of the IFL people, then said that it [the math and science plan] was over. What we were trying to do is gone. That was pretty scary to me. The idea that you could make all of this effort at the top organizational level with the superintendents and other leaders and when they turn over the new administration would reject the entire model; that was scary to me.”

“I believed that they [IFL] would be our troops on the ground and our institutionalization vehicle; that they would be our legacy vehicle. I no longer believe that.”

As tension mounted between Pittsburgh/IFL and Wisconsin, a model of operations developed that established clear spheres of influence. Instead of there being a division of labor by goals, the partners began to blend goals 1, 2, and 3 and pursue these within their sphere. For Pittsburgh/IFL, the major spheres of influence were Denver, Providence, and Los Angeles with the exception of science education. Wisconsin’s sphere of influence was Madison and science education in Los Angeles. When SCALE provided annual reports on activities, it simply pooled the combined effort of Wisconsin and Pittsburgh/IFL.

The boundaries between these spheres were permeable. Working groups continued to be formed, which included Pittsburgh and Wisconsin personnel engaged in assisting school districts across these spheres of influence. However, over time these became the exception rather than
Interestingly, respondents from both camps continued to acknowledge the quality of the work that was being pursued within each sphere of influence. But these engagements and levels of respect were insufficient building blocks for re-establishing partnership. Members of the Tomatoa had lost faith in one another and were no longer communicating effectively (if at all).

It is at this point in time that the label SCALE begins to be used to refer exclusively to Wisconsin’s sphere of influence. Because IFL had pre-existing contracts with the school districts, they emphasized this relationship and began to distance their identity from SCALE within their sphere of influence. By year two of the SCALE project, Wisconsin had also found a new partner on the west coast to assist in the relationship addressing science education in Los Angeles.

When LAUSD joined in as a member of the SCALE project, there was a minor accommodation required; LAUSD had small pre-existing contracts with the California State University (CSU) system that needed to be included. Initially, this was satisfied by awarding $92,000 to the School of Education at Cal State-Dominguez Hills.

As tensions mounted between Pittsburgh/IFL and Wisconsin, the SCALE PI was looking for a way to get more STEM faculty involved, particularly those engaged in teacher preparation. The CSU schools at Dominguez Hills and Northridge were good candidates because they train large numbers of teachers. The CSU schools also had the advantage of being included in the original SCALE partnership proposal. What was lacking was a match between the right personnel at Dominguez Hills.

This problem was remedied by chance when, at a meeting for secondary math teacher preparation in California, the PI met a leading math education specialist on the Dominguez Hills faculty. SCALE’s PI was impressed by the Dominguez Hills faculty member. Unfortunately, this faculty member had no idea that Dominguez Hills was even involved in an MSP project. It took time and the departure of the Dean of Education under the cloud of scandal before the way could be cleared for an effective partnership to be born between SCALE and Dominguez Hills. Even then there was some doubt among SCALE partners about the value of this relationship.
“[The SCALE PI] explained to me that he wanted to go ‘retail’ and not be just a ‘boutique’ activity...But [IFL] doesn’t trust STEM faculty and for good reason; we haven’t done a very good job [of training pre-service teachers in math and science], people drop like flies when they have to take math classes here at Dominguez Hills....[The SCALE PI] and I saw what needed to be done was to build this partnership with the California state universities in the LA area with the LA districts. The vehicle for feeding the partnership has been things like the science immersion units and working with these people to get connections and collaboration between the districts and the institutes for higher learning. We recommend 2000 teachers for credentials at Dominguez Hills alone and 80% of those go to LAUSD. We have to be informed by that, but we also need to be the place that they turn first for professional development.”

Building a relationship with the CSU schools brought further tension to the relationship between Pittsburgh/IFL and Wisconsin. Meanwhile, the CSU-Dominguez Hills representative was becoming a champion for SCALE and an increasing part of the administrative network that organized and ran the partnership. A Pittsburgh/IFL respondent described some of the source of this tension as follows:

“School districts acknowledge that many of their staff come from the local IHE [institute of higher education] and they are annoyed that their teachers are not necessarily prepared. ... They see the local IHE not as a partner, but as a service provider....So [the SCALE PI] wants to come in and work with local faculty and co-develop a plan with them. He went out to meet with some people and hit it off with people like [the Dominguez Hills math education faculty member]. When that first started, the senior person at LAUSD said ‘oh, that person; we don’t like that person’ and made some vague reference to a previous problem. [IFL relayed to Wisconsin] ‘that’s what the district said’, being suspicious the whole time that that working with individual local IHE faculty wasn’t going to work out. [Wisconsin] was impatient and pushed ahead with [working with CSU]. If you were [the head of Pittsburgh/IFL] and this happened, you would also be annoyed.”

At the same time the Wisconsin team was trying to build on early successes with the science immersion units in Los Angeles by developing math immersion units. Both the PI of SCALE and the Dominguez Hills faculty member were mathematicians by training. The initiative in math immersion coupled with the growing relationship with CSU continued the negative trajectory of the original SCALE partnership. A Pittsburgh/IFL respondent describes it as follows:
“Science immersion was proceeding in part because the people at the top of the [LAUSD] didn’t care about science; they weren’t saying yes or no. With respect to math, it was very high stakes. Nobody agreed that math immersion made sense in the district, but [Wisconsin] wanted to do that with the IHEs in math. So in addition to bringing a person who was viewed suspiciously, he was bringing a program that was viewed suspiciously in an area that was considered very high stakes for the districts. So at the top there was heavy pushback about the topic and the person, yet [Wisconsin] moved forward with that. That’s where things started to get uglier and uglier.”

Working with Dominguez Hills and Northridge, SCALE began to leverage the immersion units and professional development programs with additional grants to create incentives for school districts and teachers to participate. One of the chief means for doing this was to assist in the grant writing by CSU schools and by partner school districts for Teacher Quality Enhancement (TQE) grants sponsored by the U.S. Department of Education (awarded in September, 2004). The Quality Educator Development program (funded by TQE) was aligned with SCALE goals. The SCALE PI also began reallocating SCALE dollars away from Pittsburgh/IFL to the CSU schools. This type of leveraging became an important goal as SCALE sought to institutionalize programs within LAUSD, Madison School District, and the pre-service and professional development programs offered through CSU partners. The PI of SCALE explained the strategy as follows:

“I have always said that SCALE is about leverage, leverage, leverage through partnership. We have to amplify the things that are already there. I grew up with the cathode tube radios. Well, we are not the cathode that boils down the elections in sending out a signal. In other words, we are not the $14.7 billion [the approximate budget for LAUSD]. We are not even a round off of that number at $7 million a year. We want to be on the control the grid that amplifies the signals that we want to amplify. That was the model that we had in mind. It was administratively light in that regard. I also figured, and I think this was shared in the leadership [of SCALE], that we weren’t going to be curriculum developers. All those things have been attempted. We were going to attempt new things, coordinate resources, and find new ways to coordinate. In some things we were going to have to actually develop materials, but with an eye towards sustainability and institutionalization.”

“At this point we had a $1 million a year, maybe $1.5 million from QED. I started shifting resources. I resist the term carryover, because carryover usually means that people own their carryover; we do not subscribe to that model. I moved money that hadn’t been used in previous years into the CSU-Dominguez Hills budget. The budget went from $92,000 to $500,000 and this year it went up to $600,000.”
The combined resources of SCALE/QED created professional development programs for teachers, teacher leaders, and teacher coaches that were grounded in inquiry-based approaches to education and using immersion units for science education (in LAUSD and Madison) and math education (in Madison). This continued the process of blending Goals 1, 2, and 3 from the original SCALE proposal. The CSU-Dominguez Hills website (http://www.csudh.edu/coe/qed/) describes programs aimed at pre-service development, alternative certification, and post graduate professional development:

“For Undergraduate Teacher Candidates

- Pro-active recruitment of freshman applicants and transfer students with strong math-science backgrounds
- Redesign of how crucial classes (e.g. calculus and physics) are taught to improve student success without compromising academic standards
- Formation of cohort groups to provide additional support
- Development of undergraduate science curricula that meet state standards for secondary teaching content standards

For Post Bachelor’s Credential Candidates

- Methodology classes in alignment with key components of SCALE and IFL
- DELTA field based cohort model for credential program

For Veteran Math and Science Teachers

- Summer institutes to pilot science and math immersion units which improve subject matter knowledge and teaching strategies in alignment with SCALE and IFL priorities
- Masters degrees that emphasize increased knowledge of mathematics and science as well as action research on teaching effectiveness”

Even after all of the conflicts at the level of senior management, there is evidence of Wisconsin and Pittsburgh/IFL personnel interacting through participation in working groups aimed at specific activities. The working groups provided a flexible operational strategy for adapting to new sources of revenues the changing constellation of partners. The SCALE PI describes the process as follows: “This was designing, building, and flying the airplane all at the same time. We just kept adding resources as it worked.”
However, it should also be noted that on the CSU-Dominguez Hills QED website there is a reference to both the SCALE and IFL (under *Post Bachelor’s Credential Candidates*) as separate rather than partnered sources of influence upon QED.

**Operations - The Breaking Point**

The growing tensions between Pittsburgh/IFL and Wisconsin came to a head over Goal 4 of the original SCALE proposal: “*Increase the participation of minority and female students in high school mathematics and science courses and send more of them to college as students of these fields, thus building a more diverse pool of potential STEM teachers.*” Through the early years of SCALE, there was consensus among all parties that something needed to be done about Goal 4. The IFL team took on this responsibility and began collaborating with a University of Pittsburgh faculty member in Industrial and Systems Engineering to develop models of equity-based performance systems.

In the fourth year of the project, Pittsburgh/IFL indicated that it would begin to shift resources away from Goal 1 activities towards Goal 4 activities. Prior to this time, the SCALE PI had indicated some nervousness with Pittsburgh/IFL’s ambitions for Goal 4 during an interview.

“*[IFL] said at a public meeting that the districts were pretty much over their Goal 1 work and [IFL] was now doing was Goal 1 integrated with Goal 4, i.e., a big systems model. The thing that makes me a little nervous about this, although I think it is a great idea and there is a lot of merit to it, is that it is a 20-year long project. We are talking about systems engineering, causal flow charts. Even once you get a model, you’ve got all these coefficients and transmission error that you have to determine empirically; you have to run it a zillion times. What you do is run simulations in order to tune them up and they are years away from that. They pitched that this is going to have some immediate benefit for Denver and Providence, which are the districts that they are working in at the moment. I am a little worried about it because I think that it is a little expensive and I am not sure that it is something that we should be doing; it is too far ranged. I don’t mind launching it, but I don’t know what I will think about it for year 5 support.”

As the year progressed the cumulative tensions between Pittsburgh/IFL and Wisconsin began to take their toll. The PI and the leader from Pittsburgh/IFL had learned that not communicating was easier than communicating. However, Wisconsin wanted to continue the engagements started in Los Angeles and Madison and, as the year progressed, became more resistant to
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Pittsburgh’s plans for Goal 4. The breaking point came when Wisconsin elected not to support the Goal 4 plans. The epitaph for the partnership appeared in the 2007 annual report (p.4):

“In particular, noting that STEM, STEM education faculty, and staff in the local IHEs in Los Angeles and Madison were helping SCALE achieve both its objectives and those of the NSF Five Key Features, they chose to respond to needs expressed by the district partners by directing more SCALE resources towards professional development and classroom implementation. This initiative resulted in a major disagreement among the partner universities over where to focus SCALE work and how to meet the priorities of each partner. At the start of Year 4, the Institute for Learning felt that it had met most of its objectives for Goal 1 in the Professional Development dimension of the Instructional System as articulated in the SCALE proposal. Although the IFL continued some work in professional development, it redirected much of its attention and considerable SCALE resources to other SCALE work it wished to pursue. This redirection did not appear to meet the identified needs of the districts, as judged by the PI and some other members of the leadership team. Moreover, the PI and other SCALE leaders saw little evidence that this redirection of SCALE resources would meet the objectives outlined in NSF’s Five Key Features. Extended and intense dialogue failed to resolve this impasse, and the University of Pittsburgh chose to withdraw from SCALE, effective September 30, 2006.”

The Reconstitution of SCALE

SCALE did not end with the departure of Pittsburgh/IFL. In fact, the foundations for the SCALE partnership had already been established through the sphere of influence that linked Wisconsin, the CSU schools, LAUSD, and the Madison School District. There were also continued engagements with Denver and Providence schools districts into Year 5 and with Denver in Year 6 (according to SCALE’s Year 6 Implementation Plan). The SCALE partnership also began a new collaboration with the Dana Center in Texas implementing the Agile Minds program in support of the science curriculum in Biology.

One of the clearest indications of the reconstitution of SCALE is seen in the dissolving of the Senior Management Team and the creation of the Senior Leadership Team in Year 5. Recall that at the inception of SCALE the Senior Management Team was comprised of two representatives from the University of Wisconsin, two from the University of Pittsburgh, and one representative from each of the participating school districts. The Senior Leadership Team (SLT) took a decidedly western shift being comprised of the following individuals and groups:
SCALE PI and Project Director
K-12 District Leaders: (one from each participating district)
   LAUSD
   Denver
   Providence
   Madison
University Leaders: (one each from participating campus)
   CSU-Dominguez Hills
   CSU-Northridge
Goal Leaders: (one from
   Goals 1 & 4 Leader from CSU-Northridge (former superintendent in LAUSD)
   Goal 2 Leader from UW-Madison
   Goal 3 Leader from CSU-Dominguez Hills
   Goal 5 U. Penn (this is the former director of WCER who had since moved)
SCALE Manager: UW-Madison

The constitution of the SLT marks an end to the struggles between an administration-centric model advocated by IFL in favor of the more teacher-centric model favored by Wisconsin. However, respondents indicate that the IFL model was important in shaping the SCALE strategies for aligning policies with practice. The following passages from the Year 5 Evaluator’s Report give evidence of the continuing importance that SCALE placed upon aligning policy and practice:

“One can reasonably ask about the unifying theory that ties together the separate dimensions of SCALE policy and the clusters of reform undertaken by SCALE districts. This synthesis will use the conceptual framework of adequate, complete, and operationally coherent support. The support must be adequate in pushing strong guidance and sufficient resources out to teachers and schools across the district. Curriculum guidance must be clear, authoritative, and specific. Professional development must be keyed to the curriculum and reach classrooms through a delivery mechanism such as instructional coaches. Monitoring and accountability must provide meaningful feedback about instructional quality for every teacher. The support must be complete as a coordinated package of curriculum, professional development, monitoring, and accountability, rather than omitting one or more of the key elements. And the support must be operationally coherent in that the policies are aligned and reinforce each other as they impinge on the operating level of classroom instruction, that is, they are coherent not just at the policy level but as they reach the ultimate targets of policy.” (p. 31)

“Note that external SCALE partners did not necessarily support every aspect of implementation of the policies or play a role in everything that was learned by district staff. The case studies followed the implementation of policies that SCALE had assisted at some point but not at every point, and most of the implementation and learning was done independently by district staff. It was explicit in the SCALE theory of action that the districts would do the ”heavy lifting,” and
SCALE would leverage (and leaven) these efforts with expert consulting, specialized tools, and other supports. The case studies looked at the end result regardless of the amount or quality of leverage provided by SCALE.” (p. 33)

The CSU schools, which are heavily engaged in teacher training and professional development, now have a much more central role in the decision-making processes of SCALE. It should be noted that while this is a marker of evidence, it does not represent new patterns of behavior. This group of leaders was already participating in SCALE working groups, project activities, and in strategic decision-making in Years 3 and 4. Thus, the SLT is less of a change in working patterns and more of a formalization of working patterns that had emerged within the Wisconsin sphere of influence.

There is also strong continuity in the way in which SCALE operations are conducted. The Wisconsin plan of action remains the backbone of the organizing principles: 1) having strong working relations with the science education (and math education where possible) leadership in the school districts; 2) conduct activities through working groups comprised of representatives of the partners most likely to participate; and 3) the opportunity to use SCALEnet as an anchor for information sharing and knowledge management within and among the working groups.

The overall number and intensity of working groups within SCALE drops off following the departure of IFL (see Millar and Washington, 2007). However, respondents in Los Angeles interviewed following the reorganization of SCALE have the impression that the working groups in their district are continuing to have a wide impact, are better coordinated across activities and have a better understanding of their plan of action. The following quotes from 2007 interviews illustrate this point:

“Let me contrast what we are doing with a previous experience in professional development. One thing we tried to do is bring in STEM faculty and education faculty from the university to be part of a summer institute and it never quite worked out because they just wanted to be there for a short time, inject their piece and then leave. A prof would come and lecture about great pedagogy. We could get them to talk about inquiry learning, but we couldn’t get them to model it. So it was never a real partnership; it was more like work for hire.

So, what is the key difference? I have never seen a partnership that involves faculty, the science education people, and the teachers, so it really has representatives from every aspect of...
education. When teachers come in, there is someone with on the team who is able to address them with their expertise. So the training is different.”

SCALE has developed over the first years of operation. There are now three levels of partnership associated with training in immersion units. The first level of partnering is in the development of an immersion unit (for example, on buoyancy or plate tectonics), which brings together subject matter faculty from Wisconsin and the California State schools with science education experts from the WCER, the California State schools, and LAUSD to work together to develop a curriculum plan and instructional materials. Immersion units are aligned with state testing standards and with instructional materials that are available to teachers in the district. The development team will often use SCALEnet as a resource for teaching materials and a conduit for communication when members are not meeting.

The second level of partnering occurs at the summer institutes where teachers work with members of the immersion unit development team to a) learn about the immersion unit, 2) provide feedback to the development team regarding the quality of the immersion unit and supporting materials, and 3) discuss adapting this unit for use in their own classroom. The guiding principal in these immersion units is to move from a concrete example or demonstration of the phenomenon to more abstract ways of understanding the concept. Here again, SCALEnet is used as a knowledge management resource for participants.

A third level of partnering is in follow-up and support when teachers attempt to use immersion units in the classroom. Teachers who have gone through summer institutes for training will continue to be able to draw upon instructional materials developed by the immersion team and to call upon teacher coaches and teacher leaders who have also gone through the training.

SCALE respondents from the California State schools report that they conducted roughly 30 summer institutes in 2006. Each immersion unit takes about one week to cover in a summer institute. Each institute has attracted approximately 20 to 30 teachers. In Los Angeles, science immersion units have now been developed for kindergarten, 4th-8th grades and 10th grade. The QED training takes similar approaches to learning as developed in immersion units and applies these to pre-service teacher development and other forms of professional development for
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current teachers. A CSU-Dominguez Hills respondent describes how faculty participate in SCALE and QED:

“Every year we release 17 STEM faculty for at least 3 units a year. As an example, the science faculty have regular meetings with [a faculty member] from the School of Education on how to change teaching practice. Through SCALE we have developed a facilitator series for summer institutes which partner STEM faculty, STEM education faculty, a district science expert who was a classroom teacher, and very often a classroom teacher who has implemented the immersion unit. To prepare for this we have facilitator training which was developed by Wisconsin with input from everyone. These people are voting with their feet because they are showing up for these things. And the summer institutes are getting better and better every year.”

The SCALE program has also won some support within the LAUSD as a program worth watching. This is because there are some indications that teachers are taking what they are learning in the summer institutes back to the classroom. Versions of the following quote were offered by several respondents:

“One of the PERB [Program Evaluation and Research Branch of the LAUSD] people spoke up at our meeting with senior LAUSD officials. It was quite amazing because it was unanticipated. PERB is tough, usually their relationship with the instructional people is very dicey because typically they come in and throw cold water and wet blankets because there was no change in classroom behavior. She said ‘Deputy Commissioner’ it is pretty amazing. We did a small study, and we have to be careful because it is a very small sample, but we find it interesting for two reasons. Number one ... we are seeing changes in the teacher behavior who are implementing the immersion units. The really surprising thing is we are seeing changes in the behavior of the teachers that are participating in the summer institute but did not implement the immersion unit.’”

DISCUSSION

In this case study we observe several important factors at work that inform evaluations of STEM partnerships. One of the first factors examined in this study was the embeddedness of the partners both as individuals and as organizations. SCALE is a case where the senior leaders have relatively low levels of embeddedness across the major participating organizations. As the case unfolds, we can also observe how specific types of embeddedness influence the outcomes. The Wisconsin PI and the leader of the Pittsburgh/IFL group had a good idea of how collaboration might benefit one another. But they had too little knowledge about the
organizational strategies of each others’ operations or how their individual approaches to project management would gel with one another.

The strategic needs of the partners are also an important factor that shapes the formation and operations of the partnership. There was a high level of project goal complementarity in SCALE amongst the senior management and later senior leadership team. However, in the first incarnation of SCALE, there were low levels of operational goal complementarity as IFL pursued an administrative-centric model of implementation while Wisconsin pursued a teacher-centric model. In the second incarnation of SCALE, there was greater agreement amongst the partners in pursuing a teacher-centric model that maintained sufficient buy in from school district administrators.

The findings concerning embeddedness and strategic needs point to a mismatch at NSF between the processes and procedures for securing an award and the time needed to develop a strategic plan of operations for a partnership. This is particularly true for an undertaking as large and ambitious as the SCALE project. In an odd way, it actually hurt the prospects of the partnership that the members of the Tomatoa were seasoned professionals at proposal writing, at fielding large programs, and at working with federal funding agencies. The SCALE team was quickly able to articulate complementary project goals and the ways in which their respective talents might be magnified in a cooperative venture.

However, there is little evidence that more time in the proposal writing process would have helped produce a more stable partnership. The SCALE team devoted much of the first year of operations in intensive discussions about what they could and would do in the field. However, it was not until they had experience seeing each other in action that a full understanding developed about whether or not operations and leadership could gel. If NSF is going to continue to set interorganizational collaboration as a condition of aid, it may be useful to develop a capacity for arbitrating disputes that develop amongst major partners. The leadership of SCALE spent several hard years trying to feel their way through difficult issues of collaboration which were ultimately settled through wrenching decisions made by the PI.
One of the interesting aspects of the policy inducements found in this case is how deeply they were integrated into the operations of SCALE programs. This is a little surprising because policy inducements were not a high motivator for most of the organizations involved. For the universities, the strongest policy motivator was the grant solicitation from NSF which created the opportunity for the project and to pursue lines of research and engagement with school districts. But even for the school districts, they report feeling much greater policy inducement on the math side rather than the science side of the project (where SCALE has arguably been most active). This is because, in most states, standards of high stakes testing in science are still sometime off in the future.

In spite of the relatively weak influence of policy inducements on partnership formation, it was a strong influence on policy operations. This was because, in both the disciplinary literacy work and in the immersion work, the project teams took great care to ensure that plans and education resources were aligned with existing state testing programs, curriculum requirements, and textbook resources available to the schools. All of these alignment actions were designed to increase the likelihood that teachers and administrators would use the programs and resources provided through SCALE. The working group structure of SCALE facilitated this by bringing the realities of the schools and the classroom to the design of the immersion units through teacher and district administrator participation in the immersion development teams, the professional development workshops, and the summer institutes.

Examination of the administrative network in the SCALE case proved to be a useful indicator of the partnership conflict and partnership change at the senior level. If one were to develop a network map of SCALE (as the Research and Evaluation team at WCER has done), there are clear indications of the spheres of influence between Wisconsin and Pittsburgh/IFL. At the senior level, the early years are marked by frequent and intense patterns of communication amongst the Tomatoa. However, by year three all evidence of mutuality in exchange, or identity enhancement, or trust had ceased. This was not the result of lethargy or poor performance, but rather stemmed from the passion and drive that the leadership brought to the project. In this case, the more these senior actors communicated the less they saw a way of successfully blending their approaches for math and science education.
In many ways SCALE is a successful failure. Even at the height of conflict between the principle universities, the IFL and Wisconsin teams were interacting with school districts and building successful engagements. During interviews the leaders of each sphere of influence continued to acknowledge that each approach was producing quality results. When the partnership collapsed, it had already laid the seeds of relationships from which it could be reconstituted. The leaders of SCALE were also able to use the project to leverage additional resources that fueled sustained engagement with the schools. SCALE demonstrated remarkable resilience in the face of adversity by all parties: both those that remained and those that left the partnership.

As with all case studies, there are limitations to our approach. By agreement, this case focuses in upon the partnering at the senior levels of SCALE. While this is the most dramatic part of the SCALE story, it is not the most important. The working group structure of SCALE has proven to be highly adaptable to the needs of the partnership and as a vehicle for linking STEM faculty and K-12 teachers. This is a model that deserves greater exploration not only as a best practice STEM partnership, but also as a phenomenon that may yield promise for advancing our understanding of models of interorganizational relations. This is an enterprise already begun by the Research and Evaluation team of WCER and one which our research team will watch with interest.

A second line of inquiry that we did not pursue was the differential between STEM faculty engagements at the various university partners. In interviews, faculty participants at Research I universities reported that engagement with K-12 schools was not an activity that was supported by their colleagues. As one junior engineering professor was told, SCALE was a nice way to do service, but even if one were to publish results from the engagement, it would not be considered in support of their research portfolio for tenure. Even science education faculty at CSU- Northridge who were hired in departments of the natural sciences explicitly to building stronger linkages between the university and K-12 schools were subject to tepid support, at best, and hostility, at worst, from their departmental colleagues. In contrast, STEM faculty at CSU- Dominguez Hills have received strong support for their engagements with the schools. The
faculty seem energized by their participation in summer institutes and the strengthening of science pedagogy that they have observed through QED. This, too, is a topic that deserves further exploration. The partnership between the resources of Wisconsin and CSU-Dominguez Hills seems promising for reaching the types of communities lagging the furthest behind in science and math education.
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