

# **Tracing the Influence of Policy Inducements and Embedded Relations on the Formation and Operation of Partnerships**

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## **Abstract**

This paper presents a typology of education partnerships developed by considering the different kinds of outcomes of their activities. Outcomes at different levels of analysis are considered and classified into programmatic and transformational outcomes. Programmatic outcomes are defined as gains in performance or quality of a given activity carried out by the organizations, while transformational outcomes are defined as more fundamental changes in the normal patterns of work by individual participants and their home organization. Policy inducements, embedded relationships among organizations as well as attributes of the partnerships and the respondents are examined to consider whether or not these are related to achievement of outcomes, and if so how.

Data comes from a modified Delphi panel of 32 experts STEM and school-university partnerships developed to gain a better understanding on partnerships as an inter-organizational form part of a larger project on STEM education partnerships. Qualitative analysis was used to analyze and categorize responses to a series of open-ended questions that asked the respondents about their partnership experiences as well as opinions and judgments.

This paper was prepared for the 9<sup>th</sup> National Public Management Research Conference held in Tucson, Arizona on October 25-27, 2007.

# Tracing the Influence of Policy Inducements and Embedded Relations on the Formation and Operation of Partnerships<sup>1</sup>

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A growing trend in federal grants programs is requiring the development of interorganizational relationships (IOR) as a condition for winning an award. Underlying such requirements is a hypothesis about collaboration that has been adopted as a policy goal, i.e., by stimulating greater collaboration amongst targeted actors a desired policy objective is more likely to emerge.

In this study we examine a class of grant-induced IORs in the form of partnerships between institutions of higher education (IHE), K-12 schools, and other community stakeholder organizations. These partnerships are intended to stimulate improvements in science, technology, engineering, and mathematics (STEM) education through gains in teacher content knowledge, redesigns of curriculum, improving student engagement as well as the capacity of school districts and higher education through the development of new approaches for math and science education. The most recent grant-inducement aimed at this goal is the Math-Science Partnership (MSP), a federal program jointly implemented by the National Science Foundation and the U.S. Department of Education<sup>2</sup>. MSP is an initiative stimulated by the *No Child Left Behind Act*. Although there has been a long history of grant programs by both agencies that have attempted to stimulate more efficacious interactions between K-12 schools and IHEs in order to improve educational outcomes, what is particular about this program is that it involves STEM faculty. State governments, local school districts, and businesses as well as community-based organizations have all been involved in supporting and stimulating the creation of STEM

partnerships in the MSP program (NSF, 2006). K-12 schools have been receptive to such initiatives as they are under tremendous pressure to demonstrate improvements in test scores in mathematics and face quickly approaching deadlines for incorporating science into the high stakes accountability tests that their students will take.

STEM education professionals describe the policy goal of these grant programs as the generation of a learning community amongst educators at all levels of education (NSF, 2002). This is, in effect, the creation of a professional network amongst the faculty in K-12 schools and IHEs. Some of the members of these networks have a long history of interacting with one another. Schools and the education departments of universities and colleges have long been closely associated through pre-service education and through professional development and certification throughout a teacher's career (Sirotnik and Goodlad, 1988). However, the MSP program also mandates the inclusion in this professional network of actors that do not have a long history of interaction, namely, faculty from the academic departments of mathematics, natural sciences, computer science, and the engineering sciences. In making this requirement the MSP program is seeking to stimulate a transformational change in the network of professionals engaged in STEM education as a means of improving educational outcomes in math and science.

In this study we examine the capacity of partnerships to generate the types of transformational outcomes that are being sought through policy. In doing so, we explore the types of policy inducements that generate partnerships and whether these are important to the generation of desired outcomes. We also examine the embeddedness of the relationships amongst partner organizations. In evaluations of partnerships there tends to be a bias towards treating the partnership as a new relationship amongst organizations. However, many partnerships are long standing relationships amongst organizations. Such a history can have a

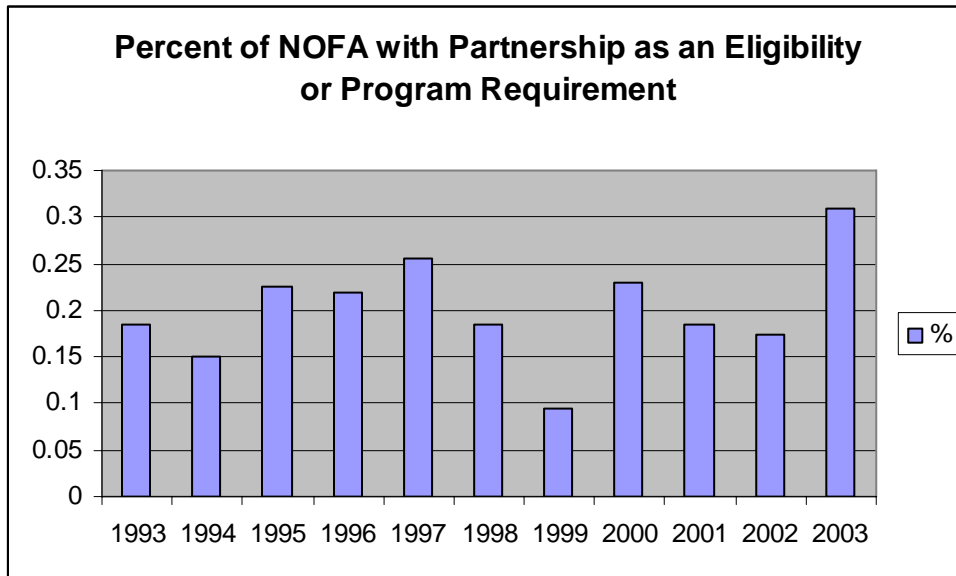
significant impact upon the types of costs and the level of trust experienced among partner organizations.

In the following section we review the nature of policy-induced partnerships and a discussion of the nature of partnerships in the STEM education community. This is followed by a description of the key variables and the methods employed in the study. Data used here comes from a modified Delphi panel of 32 experts (in the operations of) STEM partnerships developed to gain a better understanding on partnership. Here we examine the factors that influence the outcomes of partnerships and whether or not these achieve the transformational objectives of policy.

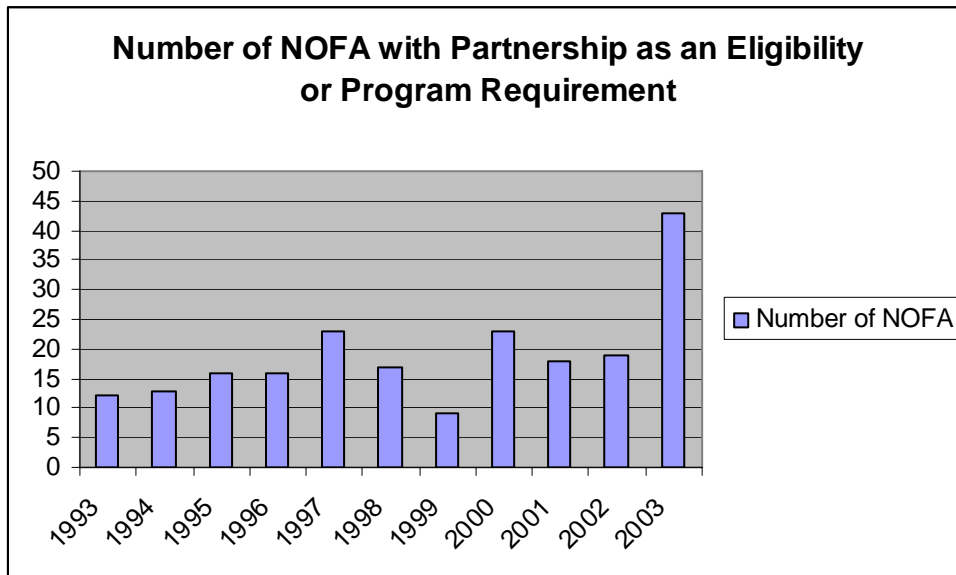
### **Policy-Induced Partnerships in STEM Education**

Policy inducements to stimulate IORs have steadily moved from being a rhetorical exhortation by sponsors to a requirement for funding. Tables 1 and 2 provide charts related to Notices for Funding Availability (NOFA) that appeared in the *Federal Register* from 1993 to 2003 in which some form of IOR is requested.<sup>3</sup> A NOFA is an announcement by an agency of a new source of funds usually in the form of a grant program. For purposes of this paper it is useful to note that the growing trend towards requiring applicants to either demonstrate the existence of an interorganizational relationship, such as a partnership, as a precondition for the grant, or demonstration that such a relationship will be formed and will be a considered in all evaluations of the grant activity. In Table 1 we see that by 2003 the percentage of NOFAs requiring partnership as an eligibility or program requirement grows to over 30% of statements for the year.

**Table 1:**



**Table 2**



One of the challenges in studying partnership is the lack of a common understanding of the term. The various literatures on partnership compound this problem by having little cross-pollination across fields of inquiry. Like blind men with elephants, each field has tackled different aspects of partnerships.

For example, in organization studies are primarily interested in trying to explain the reasons for cooperation and variance in the forms of organizational relations that fosters or hinders cooperation and coordination. This focus has a long history in the private management literature under the heading of inter-organization relations (IOR) which covers a broad range of relations of which partnership is but one form. In an influential work Oliver (1990) identified several distinctive determinants of IOR's (including partnerships) including the need for exchange, the need for knowledge and technical expertise, and the need for collaboration to secure strategic positions within a field of organizations.

This contrasts sharply from the public management literature where the term partnership is closely linked to various reform agendas aimed. Here partnership is an all-purpose remedy serving as the answer to many different reform movements (Osborne, 2000). Teisman and Klijn (2002) summarize three features of partnership for public management reform: 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. Most importantly, 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. Studies on inter-agency collaboration (Bardach, 1998) have considered the type of management and organization that arises in organizational structures that differ from the traditional hierarchical bureaucratic model.

In the STEM education literature the term school-university partnership is more closely related to the uses found in the public rather than the private sector. Relatively little attention is given to the factors that drive the creation of a partnership. Rather partnership is offered as a potential remedy for a class of public education problems. The focus in the public sector is upon

the implementation and outcomes associated with partnering. Consequently, the questions driving the interest in partnership in the public sector are evaluative in nature. This contrasts sharply with the private sector literature where the interest in partnerships is largely a strategic question of understanding when and how organizations partner.

Models of partnerships in the education community tend to be descriptive of programs being promoted or evaluated. Goodlad (1988) describes partnerships as collaborative events that grow out of networks of professionals creating a platform for programs, activities, and projects. For this author, school-university partnerships allow to carry out instructional, curricular as well as organizational improvements in schools and schools of education as well as the alignment among both types of organizations. Tushnet (1994) distinguished three types of organizational structures in educational partnerships: primary partner/limited partnerships, coalition partnerships and collaborative partnerships. Her examination of findings of education partnerships established with different types of goals concludes that there is not one single partnership form that could be applied across different purposes and contexts. . Tushnet and Firestone and Fisler all agree that education partnerships are best understood as platforms from which multiple activities are attempted as schools and IHEs attempt to develop innovations and improvements on the existing education system. Frequently, this requires significant tailoring to the local conditions of associated with students, parents, community, teachers, and governance systems. Firestone and Fisler (2002) apply a micro political perspective which allows to consider the interests and political resources of different groups of actors across and within organizational boundaries. They also apply the concepts of learning and professional communities to consider the learning and change that takes place within such contexts.

## **Programmatic and Transformational Outcomes**

One of the five main intended outcomes of the MSP program is institutional change at the K-12 level as well as at the college or university level. This is defined in the MSP program solicitations as improving the involvement of STEM faculty in the strengthening of K-12 math and science education, and at the level of school districts, the utilization of evidence based strategies to enhance teaching and learning of math and science (NSF, 2003: 5), as well as the improvement in the alignment among different organizations in the education system.

For both these sets of targeted actors participation in a partnership is additional work that requires release time or other forms of compensation or recognition. 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 make 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 a case that actors entering into a STEM partnership will be drawn into efforts to expand their professional networks, learn new approaches 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 a gain in the performance or quality of a given activity but a continuity of the normal activities carried out by the participating professionals and their organizations.

We examine several factors as determinant of *transformational* and *programmatic outcomes*. First, we examine the type of *policy inducements* that have been used to stimulate the partnerships in which respondents have participated. In particular, we examine whether there is a relationship among the multiple inducements, i.e. from both the state and federal level mentioned by the respondents, and the amount and type of *transformational outcomes* they mention. In the STEM education literature researchers have suggested that the likelihood of change is enhanced when there is an alignment of policies at the state and federal level (Webb et al., 2006).

Second, we examine respondent perceptions about the importance of previous working relationships for partnership formation, or the *embeddedness* of the actors participating in the partnership. 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), 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. These conditions are hypothesized to create a better environment for generating a transformational outcome.

Third, we examine the *partnership experience* of the respondent. The management of partnerships is a specialized set of skills requiring that managers to navigate the political and operating structures of multiple organizations in order to generate a program of activity. Our respondents are all experienced in managing STEM partnerships. We hypothesize that more experience in STEM partnering is lead to greater ability to articulate when a change is transformational and when it is programmatic.

Several researchers from different fields have found that a shared understanding of the roles and goals of partners, i.e. the *partnership definition*, is an important influence on the capacity of the partners to achieve outcomes and to build relationships. We observe in respondents using four distinctive understandings of what a partnership is, and we examine the relationship between these definitions and partnership outcomes.

We examine the structure of partnerships by asking respondents whether *administrative networks* are common in their experience. *Administrative networks* are core teams of participants that take on the responsibility for organizing and mobilizing the other members of the partnership in implementing the activities and pursuing the goals of the collaboration. Human and Provan (1997) observed this type of phenomenon in their study of manufacturing networks as an important factor in the effectiveness of the network activities. Similarly, we hypothesize that partnerships with an organizational pattern of *administrative networks* will be more likely to be associated with *transformational outcomes*.

The last factor that we examine is *partnership size* in terms of the number of participating organizations. This factor may work in two directions. The larger the number of actors the more likely the participants will encounter alternative approaches to teaching and new curricula. However, managing large numbers of actors also means that the partnership will need to be disciplined and focused in activities and the likelihood of coordination problems will emerge.

## **Research Methods**

The data for this study was compiled using a modified Delphi technique in which a panel of 32 experts was assembled with the goal of developing a model or group of models for the evaluation STEM education partnerships<sup>4</sup>. Over the course of four rounds panelists were asked to reflect on their own experience with partnerships (Round 1), react to key concepts concerning partnerships drawn from the research literature (Round 2), offer judgments on research proposals using partnerships (Round 3), and review major differences in findings from the earlier rounds (Round 4). The questionnaire included opinion questions measured on a five and six point Likert scales, as well as open-ended questions. Across the four rounds it included approximately a hundred questions. The data considered here comes only from open-ended questions. Following each round respondent had the opportunity to review the findings from co-panelists and react to these responses. The Delphi was administered electronically using the HERO system administered by Pennsylvania State University. This allowed for greater geographic diversity and afforded the panelists to answer questions from the comfort of their home or office. Nonetheless, the electronic administration of surveys entails some particular problems for data gathering and systematization such as the retrieval of duplicated responses.

The panel consists of 15 women and 17 men from 30 states. There were 29 white one African American, and two Native Americans 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. We were concerned about the diversity of the panelists. Further assessment of the source lists and nominations found that the respondents were representative of individuals charged with organizing partnerships. While the panel consisted of 32 participants, only 30-31 of them participated in any given round.

Qualitative analysis was used to summarize common themes across respondents as well as differentiate particular themes. This procedure was repeated several times, first across all the responses of one respondent and then across all respondents, constantly comparing the different themes that emerged in common and those that appear in particular. For the purposes of this paper, common themes were categorized and we compare their distribution across the different type of respondents, yet the analysis also includes the insights from the consideration of their particular responses and a consideration of each of them separately.

This procedure allowed to differentiate and summarize the opinions of the respondents and recollections on the policies that had influenced their partnership work, the importance of previous working relationships among organizations, as well as the attributes of the previous and current partnerships in which they work. These are considered here as shedding light into the understanding of the factors that are considered important to explain how their partnerships achieve different types of outcomes. We also examine *policy inducements*, *partnership goals*, *embedded relationships* among organizations<sup>5</sup>, *administrative networks*, as well as partnership attributes (size, length of formation phase) and respondents attributes as independent variables.

The typology of the partnerships was developed by considering the *transformational outcomes* and *programmatic outcomes* that the respondents mentioned. Responses to eleven

open-ended questions were used as the basis for assigning respondents to cells of the typology. There were seven different questions that asked the respondents to describe outcomes or impacts of their partnership work as they reflected on a specific partnership. The other four questions asked the respondents about their opinions on appropriate outcomes to be considered as a result of partnership work, asking them in particular to distinguish among partnership and program outcomes, outcomes particular of partnership and not their organization's normal work, or outcomes for a formative or summative evaluation.

Outcome responses were analyzed according to two criteria: whether the outcome was transformational or programmatic, the focus of the outcome in terms of the actors influenced, and the amount of evidence provided by the respondent. The first of these criteria resulted in the classification of 30 programmatic outcomes and 38 transformational outcomes at the most disaggregate level. Two tables in the Appendix provide a comprehensive list of all the types of outcomes identified. The second criterion was to systematize these outcomes according to the level of analysis at which they took place: we assessed whether or not the partnership generated outcomes that affected students, teachers, school districts, IHE, partnerships, and whether there were impacts at the policy level .

Outcomes were subsequently coded into two categories -high or low- in order to differentiate among outcomes that had taken place as a result of partnership activities in the experience of the respondent, and those outcomes that were intended or mentioned as part of the rationale of their partnership activities. In many cases, the latter include many outcomes that had not yet taken place due to the particular phase of their partnership activities. This categorization into high and low outcomes was a fundamental criterion for the construction of the typology, since respondents were classified according to types of outcomes they mentioned (i.e., it's level of analysis) and the amount of them that were mentioned as high and low. Although this classification presents still some

methodological problems in regards to it's completeness, exhaustiveness as well as definition, it allows to provide a synthesis of the main characteristics of partnerships.

The resulting typology consists of four cells organized in a 2X2 matrix (see Table 3 for the structure of the typology). The four types of respondents are: programmatic and transformational low, programmatic and transformational high, programmatic low and transformational high and programmatic high and transformational low. The typology does not attempt to assess the effectiveness of each partnership that the respondent has engaged in, but rather captures the different outcomes experienced by respondents over the body of their work with STEM partnerships.

**Table 3: Typology of Outcomes**

	<b>Transformational Outcomes</b>		
	<b>L</b>	<b>H</b>	
<b>Programmatic Outcomes</b>	<b>L</b>	<b>Cell 1: 5 Respondents</b>	<b>Cell 3: 12 Respondents</b>
	<b>H</b>	<b>Cell 2: 5 Respondents</b>	<b>Cell 4: 10 Respondents</b>

**Findings: Differences in Outcomes**

In analyzing the outcomes from partnerships we have observed differences between the cells. These are not limited to categorizations to that a respondent in one cell or another. In addition, we have considered the subject matter that the outcomes have sought to influence. Here we discuss the range of outcomes pursued within a cell and the types of outcomes that were considered highly transformational.

Cell 1 consists of five respondents that did not record high outcomes in any dimension. Respondents noted several types of outcomes were pursued through the partnership that most common of which were teacher training, school district development, and partnerships. This is not surprising as one of the most frequent goals cited by this group of respondents was curriculum and teacher development. All the outcomes listed by respondents in this category were programmatic in nature. But they provide limited evidence of the outcomes and impacts from the partnering.

Cell 2 respondents (n=5) record high programmatic outcomes but low transformational outcomes. Outcomes are reported in several categories with the most frequent occurring amongst teachers, students, and school districts. However, the high programmatic outcomes are being reported in teacher training, development, and increasing content knowledge. transformational outcomes were reported in this group but there is no consistent pattern in the type of outcome described.

Cell 3 respondents (n=12) record high transformational outcomes but low programmatic outcomes. Two-thirds of the 12 respondents in this category report multiple outcomes across the majority of the categories. Teachers (n=9), students (n=8), school districts (n=9), partnerships (n=12) and policy (n=7) outcomes are reported. However, the transformational outcomes are heavily clustered in reports concerning school districts. There are numerous programmatic outcomes reported amongst students, teachers, and policy but all with limited evidence.

Cell 4 respondents (n=10) report both high transformational outcomes and high programmatic outcomes. The highest number of outcomes are reported amongst students (n=10), teachers (n=7), and partnerships (n=9). High programmatic outcomes are reported most

frequently with regards to student achievement and teacher development. The highest transformational outcomes are associated with partnerships operations and continuity (n=6).

### Findings: Between Cell Differences

Considering all the outcomes mentioned by the respondents, that is including impacts at the policy level, there are 10 respondents in Cell 4 (the programmatic and transformational high type), 5 respondents in Cell 1 (the programmatic and transformational low type), 12 respondents in Cell 3 (the programmatic low and transformational high type) and 5 respondents in Cell 2 (the programmatic high and transformational low type). Table 4 provides a description of the respondents by organizational affiliation, gender, and cell.

**Table 4: Outcomes by Gender and Organizational Affiliation**

	Gender	Cell1: Programmatic low Transformational low	Cell 2: Programmatic high Transformational High	Cell 3: Programmatic low Transformational High	Cell 4: Programmatic high Transformational low	Total
University	Men	1	5	4	2	12
	Women	2	2	2	1	7
	subtotal	3	7	6	3	19
K-12	Men	0	0	2	1	2
	Women	1	1	1	0	3
	subtotal	1	1	3	1	6
Other org.	Men	1	1	1	0	4
	Women	0	1	2	1	4
	subtotal	1	2	3	1	7
Total	Men	2	6	7	3	18
	Women	3	4	5	2	14
	<b>Total</b>	<b>5</b>	<b>10</b>	<b>12</b>	<b>5</b>	<b>32</b>

There are some differences across the cells in regards to the attributes of the respondents. Most of the respondents of Cell 4 (programmatic and transformational high type) are affiliated with universities (n=7), while in the other cells they comprise roughly half of the respondents. The group of respondents in Cell 3 (programmatic low and transformational high type) has the

largest proportion of respondents affiliated with other type of organizations and K-12 institutions, in each case each comprise one quarter of the respondents (3 respondents). This implies that half of all the respondents affiliated with K-12 are included in this group (3 out of 6), as well as roughly half of those affiliated with other type of organizations (3 out of 7). In terms of gender, men comprise more than half of the respondents in Cell 4 (6 out of 10) as well as in Cell 2 (7 out of 12). In both cases, most of the men in these groups are affiliated with universities. Respondents in Cell 1 as well as those in Cell 2 present more equal distributions by gender.

**Table 5: Outcomes by Discipline and Organizational Affiliation**

<b>Affiliation</b>	<b>Discipline</b>	<b>Cell 1: Programmatic low Transformational low</b>	<b>Cell 2: Programmatic high Transformational High</b>	<b>Cell 3: Programmatic low Transformational High</b>	<b>Cell 4: Programmatic high Transformational low</b>	<b>Total</b>
University	Math or Science	2	5	6	2	15
	Soc. Science or Education	1	2	0	1	4
	subtotal	3	7	6	3	19
K-12	Math or Science	0	0	1	0	1
	Soc. Science or Education	0	1	2	2	6
	subtotal	0	1	3	2	6
Other org.	Math or Science	0	0	0	0	0
	Soc. Science or Education	2	2	3	0	6
	subtotal	2	2	3	0	7
<i>Total</i>	<i>Math or Science</i>	2	5	7	2	16
	<i>Soc. Science or Education</i>	3	5	5	3	16
	<b>Total</b>	<b>5</b>	<b>10</b>	<b>12</b>	<b>5</b>	<b>32</b>

More than half of the respondents of Cell 4 specialize in math or science (7 out of 12), while half of those of these are affiliated with universities (5 out of 10) and the other half (5 out of 10) specialize in social sciences or education and are affiliated either with another type of

organization or a K-12 institution. All of the 6 respondents affiliated with a university in Cell 3 specialize in math or science.

Respondents differ considerably in regards to their experience in working in a STEM related field. Three out of the five of the respondents in Cell 1 have a long experience in the STEM field (more than 11 years), and also have significant experience teaching; while more than half (6 out of 10) of the respondents in Cell 4 have an experience shorter than 10 years. The majority of the respondents in Cell 3 (10 out 12) have an intermediate or long experience in this field (6-20 years). Finally, three out of the five respondents in Cell 2 have a short experience in this field: less than 5 years. Most of the respondents have some experience teaching at the K-12 level with the exception of Cell 3 with only two respondents having extensive teaching experience and the majority of respondents having only very limited or no teaching experience.

Two thirds of all respondents considered partnership as a process, across all type of respondents (see Table 6). This does not differ across the cells as approximately half of each type of respondent also defined partnerships in terms of a process. A few respondents conceive of partnerships in terms of an agreement. A subgroup of the respondents of Cell 3 also hold the notion of partnerships as entities, which makes this group the one that has more diverse opinions on the nature of partnerships.

**Table 6: Partnership Definitions**

	All respondents	Cell 1: Programmatic low Transformational low	Cell 2: Programmatic high Transformational High	Cell 3: Programmatic low Transformational High	Cell 4: Programmatic high Transformational low
Process	20	3	7	7	3
Agreement	9	2	2	3	2
Entity	2	0	0	2	0
Entity/ venue	1	0	1	0	0
Total	31	5	10	12	5

Respondents in Cell 4 have, in comparison to the other cells of respondents, more experience working in partnerships. This group includes the two respondents that mentioned having worked in as many as 10 or more than 30 partnerships. In contrast, respondents Cell 1, as well as those in Cell 2 have only experience working in three partnerships or less. Two thirds of the respondents Cell 3 have experience working in 3 partnerships or less.

The size of partnerships varies across the cells and among respondents. Half of the respondents in Cell 3 have experience working in partnerships that involved more than 20 organizations (6 out of 12). The respondents in this cell work with the largest partnerships in terms of the number of actors. In contrast, three out of the five respondents in Cell 1 have experience working in small partnerships involving 4 organizations or less, and the same applies to respondents in Cell 2. Respondents in Cell 4 experience a great deal of variance in the size of partnerships.<sup>6</sup>

Respondents differed to some extent in the length of time of the formation phase of the partnership. Almost all (4 out of 5) of the respondents of Cell 1 experienced the formation phase taking less than 11 months to complete. In contrast, three out of the five respondents in Cell 2 considered it had taken more than one year. Most of the respondents of Cell 4, as well as those of Cell 3 considered it had undertaken one year or less (7 out of 10, and 10 out of 12).

Respondents of Cell 4 type have experience working in more partnerships than the other three types of respondent. Respondents of Cell 3 type have experience working in larger partnerships than the other three types of respondents. This experience in both cases may be a reason for why their partnerships achieved more transformational outcomes than the other types of respondents, or these types of respondents consider more important these types of outcomes as part of the rationale of their partnerships than the other respondents.

*Embeddedness.* The previous experience of the respondents in regards to the length of time it took to undergo the formation phase in partnerships differs somewhat from their opinion on the time it would take to establish effective working relationships with organizations with which they had no previous working history in a partnership. Most of the respondents Cell 4 believe that their organization would likely enter into partnerships with other organizations which they had no previous working history (7 out of 10). In contrast, most of the respondents in Cell 3 type consider that this would not be likely (7 out of 12) as do their counterparts in Cells 2 and 1.

*Policy Inducements.* Half of the respondents (n=17) indicated that the policy environment for their partnership included both federal and state policies. More than half of the respondents in Cell 4 (n=6) mentioned federal and state policies, all of them mentioning a particular policy. Approximately half (n=5) of the respondents in Cell 3 mentioned not only federal policy but also half (n=7) mentioned state level policies. Most of these respondents mentioned particular policies did not specify particular positive and/or negative influences. Finally, in Cell 2, 3 out of the 5 respondents of the mentioned federal and state policies, while 2 mentioned only federal policies. Most of these respondents mentioned a particular policy. Almost all (n=4) of these respondents mentioned particular positive and negative influences of such policies on their partnership work.

Table 7 provides a summary of the findings reported in the previous sections. The table is organized in the same way as the typology summarizing the major findings. These results provide a synthetic overview of the different types of partnerships and the different factors that were considered to explain or understand how they influence the types of outcomes they accomplish. We aggregate across a rich array of qualitative data to capture the main differences among respondents.

**Table 7: Typology of Outcomes**

	<b>Transformational Outcomes</b>		
	<b>L</b>	<b>H</b>	
<b>Programmatic Outcomes</b>	<b>L</b>	<p>Cell 1: n=5  <b>Outcomes:</b> <i>All programmatic</i>  <b>STEM Experience:</b> <i>16 years</i>  <b>Teaching Experience:</b> <i>6 years</i>  <b>Partnership Experience:</b> <i>3 partnerships</i>  <b>Partnership Size:</b> <i>Small, 4 organizations</i>  <b>Goals:</b> <i>Curriculum and Teacher Dev.</i>  <b>Embeddedness:</b> <i>High</i>  <b>Policy:</b> <i>High, Federal, Negative</i></p>	<p>Cell 3: n=12  <b>Outcomes:</b> <i>transformational-School District</i>  <b>STEM Experience:</b> <i>12 years</i>  <b>Teaching Experience:</b> <i>3 years</i>  <b>Partnership Experience:</b> <i>2 partnerships</i>  <b>Partnership Size:</b> <i>Small, 18 organizations</i>  <b>Goals:</b> <i>Student Achievement, Teacher Dev., Partnership Dev.</i>  <b>Embeddedness:</b> <i>High</i>  <b>Policy:</b> <i>High, 1/2 Feds, 1/2 Fed and State</i></p>
	<b>H</b>	<p>Cell 2: n=5  <b>Outcomes:</b> <i>Programmatic-Teachers</i>  <b>STEM Experience:</b> <i>12 years</i>  <b>Teaching Experience:</b> <i>5 years</i>  <b>Partnership Experience:</b> <i>2 partnerships</i>  <b>Partnership Size:</b> <i>Small, 6 organizations</i>  <b>Goals:</b> <i>Student Achievement, Teacher Dev.</i>  <b>Embeddedness:</b> <i>High</i>  <b>Policy:</b> <i>High, Federal, State, Negative</i></p>	<p>Cell 4: n=10  <b>Outcomes:</b> <i>transformational-Partnership Programmatic-Teachers and Students</i>  <b>STEM Experience:</b> <i>13 years</i>  <b>Teaching Experience:</b> <i>2.5 years</i>  <b>Partnership Experience:</b> <i>7 partnerships</i>  <b>Partnership Size:</b> <i>Small, 15+ organizations</i>  <b>Goals:</b> <i>Student Achievement, Teacher Dev., and Partnership</i>  <b>Embeddedness:</b> <i>Low</i>  <b>Policy:</b> <i>High, Federal, State Transformative Transformative</i></p>

**Discussion**

These findings offer insights into the capacity of STEM partnerships to generate the types of transformative outcomes desired by policy makers and program officers responsible for implementation. First, our findings call into question assumptions made about the importance of embeddedness for achieving partnership outcomes. A history of interactions among partners was hypothesized to be important to the creation of outcomes. In our data this turned out not be the case for transformative outcomes. The highest level of transformation (Cell 4) was associated with the lowest level of embeddedness. These respondents indicated that they did not prefer the same history of interaction and were quite likely to engage in a partnership with organizations

that they did not know well. One explanation for this pattern of behavior is that much of the transformative outcomes reported in Cell 4 stem concern the partnership itself and the capacity of partners to maintain and grow this IOR. Respondents in Cell 3 behaved more in accord with the hypothesis, valuing embeddedness and achieving transformative results. However, the greatest transformative outcomes are associated with school districts and the capacity of these organizations to sustain programs that are enabling teacher development and student achievement. At this point we cannot identify the crucial difference between the respondents in Cell 4 and Cell 3 as in most of the other factors observed here are similar.

Policy inducements demonstrated relatively little variance across the cells. Partnership is primarily a federal game driven by grants programs that provide the resources for educational organizations to explore alternative working arrangements and strategies for improving teacher and student performance. Across the cells there is little variance in this pattern where the federal government is the primary sponsor. State governments are also important actors for about two-thirds of the respondents but it is always (save one respondent) in conjunction with federal policies. However there are differences between those respondents that achieve transformational results and those that do not. In both Cell 3 and Cell 4 where transformational results have occurred respondents see federal and state policies as an important and mostly positive force. In Cells 1 and 2 there is a greater likelihood for a respondent to see policy influences as a negative force for the purposes of STEM education. The most common comments about policy in these cells referred to accountability requirements associated with high stakes testing.

Partnerships also have the potential to act as a change agent for policy. Respondents in Cells 3 and 4 both experienced significant transformational outcomes and both reported policy impacts as an outcome from the project. This distinguishes the respondents in these Cells from

their counterparts in Cells 1 and 2 who had greater impacts in programmatic outcomes and view themselves as constrained by policy.

The final pattern that we observe is the likelihood that achieving partnership outcomes becomes an end unto itself in the STEM education communities. In both Cells 3 and 4 partnership is identified as an area where transformational change has occurred. In Cell 4 this is highly pronounced with the majority of respondents citing these outcomes as a major source of transformation. In Cell 3, while only two of the 12 respondents indicated partnership as a source of transformational change, low levels of evidence regarding transformative and programmatic changes was noted with regards to partnership was provided by 10 of the respondents in this category. For many of our respondents achieving the capacity to engage in partnership and, at times, sustain partnership was seen as a significant outcome. Rather than being a means for achieving educational objectives the partnership becomes an end in and of itself.

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Appendix

Summary table of programmatic outcomes

	<b>PROGRAMMATIC</b> Gains in performance
<b>Teachers</b>	<b>Improved content knowledge</b> Improved instruction of teachers, considering quality of instruction they have received Improved teacher content knowledge, considering number of qualified teachers Impacts: <i>Improved amount of qualified teachers</i> , Improved instruction of teachers
	Number of teachers that attended their PD activities
	Teachers report PD as effective
	Teachers perform better on tests
	<b>Recruitment of new teachers</b> Diversity, recruitment and retention of new teachers students Retention of highly qualified teachers in hard to staff school districts Impacts : Improved recruitment and retention of new teachers
<b>Students</b>	<b>Student achievement</b> Improvement of student achievement in math and science, mentioned in general Improvement in student achievement, measured in standardized test or similar Improved student performance in classroom exp.
	Student enrollment in AP courses
	Decrease in achievement gaps
	Increase of college students
	Employment of students
<b>Schools / School</b>	Change in school curricula (content and pedagogy)
	Increase of number of AP courses provided
	Adoption and implementation of standards based curricula
	Discussion on standards for curricula
	(impact) School: Teachers on special assignment will re-enter with new skill and knowledge.
	(impact) Participation of a City Public School system.
	(impact) Support of goals of partnership/project at administrative and teacher level. Support of school boards.
	(impact) New technology to improve instruction.
	Changes in teachers work contracts and employment.
	Use of technology (software provided by the partnership) improves teacher's instructional practice
<b>IHEs</b>	(impact) IHE improved capacity / org. change at IHE (accreditation and new STEM program of study).
	(impact) Increase of college students in STEM area.
<b>School districts – IHEs</b>	(impact) School districts more aware of resources at IHE
<b>Partnership</b>	Process outcomes of partnership activities and formative evaluation outcomes (on partnership itself)
	Process outcomes (mentioned in general)
	Continuation of partnership
	Assessments of partnership activities
<b>Policy (impact)</b>	Local policy (City)
	State Education Agency Contributed to improving test scores in the State. Improved number of qualified teachers (pre-service, certified). Implementation of standards.

## Summary Table of Transformational Outcomes

	<b>TRANSFORMATIONAL</b> Change in practices and thinking. Qualitative difference in how they do their work. Different relationships among organizations.
<b>Teachers</b>	Teachers implementing changes in instruction in classrooms
	Teachers involved in improving instruction Teacher leaders involved in developing PD (content coaches).
	Changes in teachers "attitudes" Improved confidence in learning new material Teachers more aware they need PD (idem impacts)
	Improved teacher leaders skills
<b>Students</b>	Change in students attitudes
<b>School districts</b>	Systemic change in schools
	Common agreements across schools and school districts
	(impact) Improved communication across school districts
	(impact) Improved capacity of school district and/or education system
	(impact) K-12 administrators change practices.
	(impact) Partnership work is being disseminated in other schools in the district.
	(impact) Partnership is a resource for school district (information , employment).
<b>IHEs</b>	(impact) School districts know better what they want from outside providers (for teacher PD and student learning)
	Creation of fund in every school to invest in "teacher ideas for advancing STEM learning"
<b>School districts – IHEs</b>	Improvement in knowledge or understanding of IHE faculty
<b>Partnership</b>	Increase in number of SM faculty working in teacher preparation
	More collaborative research among IHE and P-12 SM faculties. Sharing of data with universities
	(impact) Change of culture at IHE.
	(impact) Improved relationship among different IHE depts (STEM and Education)
	(impact) Improved relationship among partnership and IHE
	Learning communities
	(impact) Improved relationship of school districts and IHEs (understanding and communication).
<b>Partnership</b>	Partnership culture: High: partnership has an own organizational culture. Low: collaboration, communication, trust Capacity Joint planning. Joint development of activities Inclusion of stakeholder feedback in design of partnership activ.
<b>Policy (impact)</b>	LEA Increased scope of academic reform.
	SEA Improved relationships and co-funding with SEA; ISI, State agency, and other org; SSI; State's Rural Education Assoc. Systemic reform
	Impact on State legislation (or Reservation)
	State policy funding and programs
	"Visibility" to State policy
	Impact on federal policy (BIA)
	Partnership is mentioned as model for other partnerships
	On Education policy in general
	Policy mentioned in general
	Improved stakeholder support (parents, etc.)
	Impact on public perceptions, agenda, opinion (on math and science education, standards reform or "cultural awareness").
	<b>Improved relationships with private sector</b>

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<sup>1</sup> This paper reports on findings from the National Science Foundation sponsored RETA project, *Alternative Approaches to Evaluating STEM Education Partnerships: A Review of Evaluation Methods and Application of an Interorganizational Model*, headed by Gordon Kingsley (NSF 02-061 Award #: 0231904 Award Group: Research, Evaluation, and Technical Assistance).

<sup>2</sup> 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.

<sup>3</sup> This time period is particularly useful when examining NOFAs. Prior to this time agencies were not required to post NOFAs in the *Federal Register*. After this time NOFAs begin to migrate from the *Federal Register* to Grants.gov. Thus, this 10 year window in which the *Federal Register* provides relatively complete view of the grant programs that are being issued. Our search of the *Federal Register* used terms such as partnership, network, cooperation, and collaboration to identify NOFAs that call for some for of IOR. We then scored these announcements distinguishing between those in which the call for IOR was largely rhetorical and others which were either program requirements or eligibility requirements.

<sup>4</sup> The sample frame for this study was 300 STEP education 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 STEP 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. Following qualification interviews the 32 final panelists were selected based on their level of experience, diversity, and availability for the entire course of the study.

<sup>5</sup> A series of different opinions to consider the importance of embeddedness: the amount of time that the formation phase of a partnership entailed in their experience as well as the opinion on the amount of time it would take to establish effective working relationships without previous shared working experiences, the opinions of the respondents on the likelihood of their organizations to enter into partnerships with organizations with which they have no previous working history, as well as their response to a composite statement that described a dynamic of establishing partnerships in which the previous interactions among the partners were as influential or more than policies and funding.

<sup>6</sup> This information is to be considered with some caution since the respondents may have considered and counted organizations differently. Although not completely accurate, this information is still indicative to some extent of the experience of the respondents in other partnerships.