1. Questions(s) or issue(s) for dialogue at Learning Network Conference session:

- How can K-16 educators involve parents and the community in encouraging student success in STEM subjects and interest in STEM fields?
- How can MSPs engage parents and the community in developing an awareness of the importance of STEM?
- What lessons has PRISM learned that will help other MSPs as they work with parents and the community?

2. Context of the work within the STEM education literature and within your MSP project:

In recent years, there has been a great deal of emphasis on the importance of teacher quality on student learning (Darling-Hammond, 2007). An equally important line of research has been on the role that family and community play in improving the quality of schooling for students. Social capital, as defined by James Coleman (1988), refers to the features of social organizations such as norms and networks that that improves the productivity of individuals and groups. Braatz & Putnam (1998) argue that several forms of social capital can influence the educational process. These include: the family (both nuclear and extended), community engagement, parent-school engagement, and social capital within schools. Engaging parents and the community to increase interest and awareness in the importance of mathematics and science is the focus of this research.

NAEP studies show that changes in science over time have been mixed, with scores at grade 4 increasing, grade 8 remaining unchanged, and grade 12 declining (IES, 2005). While mathematics scores have been increasing in grades 4 and 8 since 1996 (IES, 2007), the results vary by subgroups. Recently the focus has been on improving the quality of teachers and teaching and the curriculum. While that is critical for student learning there has been less focus on the role of family and the community in schools. Coleman (1988) differentiated social capital from financial, human and cultural capital; he hypothesized that social capital is a result of social networks that create a sense of obligation and trust that supports social structures such as schools (Coleman 1991). Braatz and Putnam (1996) provide an extensive review of evidence suggesting that the family and community can influence education powerfully.

Investigations using national and international data sets have demonstrated that there is a relationship between parents’ involvement and students’ reading and mathematics scores although this relationship is mediated by race/ethnicity and family income (Desimone, 1995). A study by Sheldon and Epstein (2005), using longitudinal data from elementary and secondary
schools, showed that effective implementation of practices which encouraged families to support their children’s mathematical learning at home was associated with higher pass rates on standardized mathematics achievement tests.

The Harvard Family Research Project (Caspe, Lopes & Wolos, 2006/2007; Kreider, Caspe, Kennedy & Weiss, 2007) publishes summaries of research showing the how family involvement influences students learning. They identify three processes by which the family involvement influences student outcome: parenting, home-school relationships and responsibility for learning outcomes. The latter refers to the aspects of parenting that places emphasis on activities in the home and community that promote youth’s social and academic growth.

The Partnership for Reform in Science and Mathematics (PRISM) is a comprehensive NSF-funded MSP project with state and regional K-12 and higher education partners. A major goal of PRISM is to increase the quality of science and mathematics teaching and learning in Georgia. One of the major strategies implemented during PRISM was a Public Awareness Campaign (PAC). The PAC included advertising, parent guides, student posters, school banners, etc. Additionally, schools were given a small amount of funds to implement Math Science Family Nights (MSFNs). These materials have been well disseminated in the four regions of the state that participated in PRISM and nationally through NSF partners. As part of a PRISM II grant, we are conducting a research study to determine the effectiveness of the PAC in a district that did not participate in PRISM I. This proposal describes preliminary evidence of the effectiveness of the Public Awareness Campaign (PAC) after the first year of a three year investigation. The presenters will bring examples of the materials that have been used to share with the audience.

3. Claim(s) or hypothesis(es) examined in the work:

1. An effective PAC can increase parents’ awareness of the importance of mathematics and science for their child’s future.
2. An effective PAC can help parents understand their roles in helping their children recognize the importance of mathematics and science in everyday life.
3. Engaging parents and their children in science and mathematics activities, through a MSFN, can increase parents’ attitudes toward, and appreciation of, math and science.

4. Evaluation and/or research design, data collection and analysis:

*Research Design*

An urban school district was identified to participate in the PRISM II research. The participating school district was selected because it has a history of engaging in innovative reform efforts and because it was not part of PRISM I where the PAC had been pilot tested. Consequently, the district had minimal exposure to the PAC. The research method used is an experimental design. A stratified random assignment procedure was used to assign schools that were matched on demographic characteristics into the three treatment conditions. In order to encourage schools to participate in the data gathering, all participating schools will receive all treatments, but in a staggered fashion.
### Table 1. Treatment Groups by Year

<table>
<thead>
<tr>
<th>Group 1</th>
<th>Year 1</th>
<th>Year 2</th>
<th>Year 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Treatment 1</td>
<td>Treatment 1</td>
<td>Treatment 1</td>
<td>Treatment 1</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Group 2</th>
<th>Year 1</th>
<th>Year 2</th>
<th>Year 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Treatment 2</td>
<td>Treatment 1</td>
<td>Treatment 1</td>
<td>Treatment 1</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Group 3</th>
<th>Year 1</th>
<th>Year 2</th>
<th>Year 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control</td>
<td>Treatment 2</td>
<td>Treatment 2</td>
<td>Treatment 1</td>
</tr>
</tbody>
</table>

Treatment 1 includes all components of the PAC while Treatment 2 only includes some of the materials. See below for a brief description of treatments.

Schools were grouped regionally within the participating district and matched on pass rates for mathematics and science on the Georgia Criterion Referenced Competency Tests for Spring 2008 (grade 5 for elementary and grade 7 for middle school), percent minority, and percent of students on free/reduced price lunch. The groups were randomly assigned to one of the three treatment groups October, 2008. Each of the three treatment groups had five elementary schools and one middle school. The total number is approximately 6,000 students.

**Participants**

The participating district has high minority and high poverty populations. The district did not make Adequate Yearly Progress in 2008. The Fall 2008 Student Population = 24,642 students. The demographic breakdown was: Asian=1%; Black=73%; Hispanic=2%; White=22%; Multi-Racial=1%, Economically Disadvantaged=73%; Students with Disabilities=12%.

**The Intervention**

There are several components of the Public Awareness Campaign:

- Funds to the school to implement a Math/Science Family Night (MSFN)
- Funds to the school to support an after-school math and/or science program for students
- Outdoor PAC advertising in the area surrounding the schools.
- Parent guides, student posters, school banners, packets for parents who attend an MSFN and additional resources developed during the pilot testing of the PAC.

**Treatment Groups**

- Treatment 1: Full treatment including after-school tutoring, Math Science Family Nights (MSFNs), PAC materials (parent materials, posters, banners, etc.) and Outdoor marketing
- Treatment 2: MSFNs and PAC materials (parent materials, posters, banners, etc.)
- Control: No treatment in Year 1

Because of the timing of the grant funding, the PRISM PAC was introduced to the schools at the half-way mark of the school year. So, while it was rather simple for schools to administer the pre and post tests, selecting the best time to conduct the Math/Science Family Nights (MSFN) and/or to implement an after-school program was not as easy.

In year one, 12 of the 18 schools (Treatments 1 and 2) were slated to participate in one or more aspects of the Public Awareness Campaign. By the mid-May 2009, all 12 schools had planned and implemented a MSFN, but only four of the six schools implemented an after-school program. Consequently, two of the elementary schools did not fully implement Treatment 1.
A great deal of information is being gathered in all 18 schools including:

- Student Motivation in science and mathematics using subscales developed by the MSP-Motivation Assessment Project (MSP-MAP) designed by researchers at the University of Michigan. These were administered in grades 3-8 in January and May 2009 and will be administered in Spring 2010 and Spring 2011.
- Parent Involvement in science and mathematics assessments developed by the PRISM researcher to parallel the MSP-MAP scales. These were administered in September 2009 and will be administered in Spring 2010 and Spring 2011.
- Participant information in MSFNs and After School Programs.
- Documents including flyers, agendas, instructional materials, etc.
- Observation data from MSFNs and After School Programs.
- An MSFN survey.

Results
The major results summarized here address the effectiveness of the MSFNs. Surveys for eight of the 12 schools that held MSFNs have been entered and those results are included here. The LNC presentation will include all 12 schools.

<table>
<thead>
<tr>
<th>Question</th>
<th># Yes</th>
<th># No</th>
<th>%Yes</th>
<th>%No</th>
</tr>
</thead>
<tbody>
<tr>
<td>Did you find this Math/Science Family Night useful?</td>
<td>268</td>
<td>4</td>
<td>98.5%</td>
<td>1.5%</td>
</tr>
<tr>
<td>Will you try to repeat any of tonight’s experiments at home?</td>
<td>254</td>
<td>15</td>
<td>94%</td>
<td>6%</td>
</tr>
<tr>
<td>Would you attend another Math/Science Family Night in the future?</td>
<td>265</td>
<td>5</td>
<td>98%</td>
<td>2%</td>
</tr>
<tr>
<td>Are you interested in receiving additional information to help you support your child’s math and science learning?</td>
<td>254</td>
<td>17</td>
<td>94%</td>
<td>6%</td>
</tr>
</tbody>
</table>

Several open-ended questions were also included. Parents were asked what they learned about the Georgia Performance Standards (GPS), an important goal of the PAC, at the MSFN. The responses to this question varied a great deal. Many parents left it blank or reported “nothing” which indicates that, at least in some schools, the link between the activities and the GPS was not made apparent. General comments were also frequent “They are required”, “standards are extremely high”. Finally, some parents noted specific content that they learned about, “shapes, magnets, and insects”.

Asked what they liked about the MSFN, parents responded that they like the activities, the opportunity to work with their child on science and mathematics and the opportunity to see children, parents and teachers working together. The presentation will include more detailed analysis of the qualitative results with illustrative examples from the surveys.
Observation and survey data, demonstrated that parents were actively engaged in science and mathematics with their children, that they found it a valuable experience and that they planned to try some experiments at home with their children.

Preliminary pre and posttest data on the MSP-MAP Motivation instruments will be available by the learning network meeting and those results will be included in the presentation.

5. Key insights (retrospective for veteran projects, prospective for newer projects) that have value for the Learning Network:

During a November 2009 press conference, President Obama cited the need to restore the United States’ leadership in math and science education, “… for decades we've been losing ground. One assessment shows American 15-year-olds now rank 21st in science and 25th in math when compared to their peers around the world. So, I'm here and you are here because we all believe that we can't allow division and indifference to imperil our position in the world. It's time for all of us – in Washington and across America – to take responsibility for our future. And that's why I'm committed to moving our country from the middle to the top of the pack in science and math education over the next decade.”

Already, our year 1 findings reported here show that the MSFNs have been successful in engaging students in science and mathematics activities and learning with their parents. This is valuable in its’ own right. Nonetheless, there are a great deal more data to be analyzed.

The significance of this work lies in the fact that it will show the effectiveness of a parental involvement program designed to increase the awareness of the importance of mathematics and science and, in the future, the impact of the program on student learning, using a randomized experimental design.

There were several lessons learned about effective implementation of MSFNs after Year 1 and they will be shared as part of the presentation.

References


