Abstract Title: Creating Awareness of the Importance of Science and Mathematics: The Georgia PRISM Public Awareness Campaign

MSP Project Name: Partnership for Reform in Science and Mathematics (PRISM) II

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120 word summary:

This study investigates the effectiveness of a public awareness campaign on parent involvement and student attitudes, perceptions and motivation in science and mathematics. The treatment includes Math/Science Family Nights (MSFNs), after school tutorials, outdoor campaign materials, and materials for teachers, parents and students. The design is experimental. The results show that parents and students value mathematics over science. The MSFNs have been and especially successful component of the PAC in engaging students and parents in science and mathematics activities. This presentation will include findings from the research, several of the PAC materials and a preview of a recently developed DVD demonstrating how to implement an effective MSFN.

Section 1: **Questions for dialogue at the MSP LNC**.

1. How can K-16 educators involve parents and the community in encouraging student success in STEM subjects and interest in STEM fields?
2. How can MSPs engage parents and the community in developing an awareness of the importance of STEM?
3. How can increasing the parent and community awareness of the importance of STEM influence students value of and confidence in their ability to perform in STEM
4. What lessons has PRISM learned that will help other MSPs as they work with parents and the community?

Section 2: **Conceptual framework**. This section should include your project's definition of "student success" and an explanation about your project's design for measuring student success.

Student success in this project is defined as the valuing of science and mathematics (SM), that is viewing SM as useful and important. The second part of the definition has to do with student confidence (self-efficacy) in their ability to do well in SM. This is the proximal dependent

variable in this research. (The distal dependent variable is student achievement in SM.) The intervening variable of importance is parental beliefs, attitudes and behaviors with respect to mathematics and science. The theory of action for this particular project is that creating an awareness of the importance of SM and engaging parents and students in doing SM leads to greater student valuing of SM and confidence in their ability in SM. The following summary of literature and theory supports this change model.

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.

The Harvard Family Research Project (Caspe, Lopes & Wolos, 2006/2007; Kreider, Caspe, Kennedy & Weiss, 2007) publishes summaries of research showing how family involvement influences student learning. They identify three processes by which the family involvement influences student outcomes: 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 the promote youth's social and academic growth.

Survey research conducted by the organization Public Agenda (Johnson, Rochkind & Ott, 2010) shows that only 3 in 10 parents feel that there is a demand for science and math focused jobs in the current economy but 84% agree that there will be a lot more jobs in the future that require science and math skills. Further, 90% of Americans feel that advanced science and math are important, even for students who don't pursue a STEM career, and that students who have advanced math and science skills will have an advantage in college opportunities. A survey of science teachers and parents, conducted by the National Science Teachers Association and Boehringer Ingelheim Pharmaceuticals, Inc. in March 2010 found that 98% of the science teachers surveyed agreed that parental involvement is important for children's interest in science while 51% of the parents say that they are "very familiar" with what their children are learning in science; this is compared to 71% in Language Arts and 69% in math.

In summary, the evidence demonstrates that family involvement in schools influences student learning and that parents see the importance of science and math for the future. The research supports a program that will increase the engagement of parents in their children's math and science.

The Partnership for Reform in Science and Mathematics (PRISM) was a comprehensive NSF-funded MSP project with state and regional K-12 and higher education partners (2003-2010). A major goal of PRISM was 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 two years of a three year investigation. The presenters will bring examples of the materials that have been used to share with the audience. Based on research from PRISM I and II, a MSFN DVD is currently being edited and it will be previewed at the LNC conference.

Following are the hypotheses examined in this project:

1. An effective PAC can increase parents' awareness of the importance of science and mathematics (SM) for their child's future.
2. An effective PAC can help parents understand how they can help their children value SM in everyday life.
3. Increasing awareness of the importance of SM and engaging parents and their children in SM activities can increase parents' attitudes toward, and appreciation of, math and science.
4. Increasing awareness of the importance of SM and engaging parents and their children in science and mathematics activities, through a MSFN, can lead to increased **student** awareness of the importance of SM and confidence in their ability in SM.

Section 3: **Explanatory framework**. This section should describe what you are finding, or are set up to learn, about student success, and how it is informing, or will inform, your MSP work.

Methods

Participants

The participating district has high minority and high poverty populations. The district did not make Adequate Yearly Progress in 2008, 2009 and 2010. The student population in fall 2008 (baseline year) was 24,642 students with 22% white, 73% African American and 4% other. Seventy-three percent of the students came from economically disadvantaged families.

Research Design

The research method used is an experimental design. A stratified random assignment procedure was used to assign schools that were matched on demographic characteristics (pass rates for mathematics and science on the Georgia Criterion Referenced Competency Tests, percent minority, and percent of students on free/reduced price lunch science) into the three treatment conditions. In order to encourage schools to participate in the data gathering, all participating schools are to receive all treatments over the project.

Table 1. Treatment Groups by Year

	Year 1	**Year 2**	**Year 3**
Group 1	Treatment 1	Treatment 1	Treatment 1
Group 2	Treatment 2	Treatment 1	Treatment 1
Group 3	Control	Treatment 2	Treatment 1

Each of the three treatment groups had five elementary schools and one middle school.

The Intervention
There are several components of the Public Awareness Campaign:

- Funds to the school to support an after-school math and/or science program for students
- Outdoor Public Awareness Campaign advertising in the area surrounding the schools.
- Funds to the school to implement a Math/Science Family Night (MSFN)
- PAC materials that include parent guides, student posters, school banners, packets for parents who attend an MSFN and additional resources to help parents engage with their children.

Treatment

- Treatment 1: All of the above components
- Treatment 2: MSFNs and PAC materials
- Control: No treatment in Year 1

Because of the timing of the grant funding, the PRISM Public Awareness Campaign was introduced to the schools at the half-way mark Year 1. So, while schools were able to administer the pre and post tests, selecting the best time to conduct the MSFN and/or to implement an after-school program was challenging.

In Year 1, 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 and were moved to Treatment Group 2.

Table 2. Planned and revised treatment groups for Year 1.

Year 1 Treatment Groups	Planned Treatment Groups	Actual Treatment Groups
Treatment Group 1	5 elementary, 1 middle	3 elementary, 1 middle
Treatment Group 2	5 elementary, 1 middle	7 elementary, 1 middle
Treatment Group 3	5 elementary, 1 middle	5 elementary, 1 middle

Data Sources

Following are the data sources used in this research. Not all of these will be reported in the MSP LNC presentation.

*Student Motivation in SM***.** Student motivation is measured using subscales of the MSP-Motivation Assessment Project (MSP-MAP) scales designed by researchers at the University of Michigan (Karabenick & Maehr, 2008). The scales asked about students' perceptions.

- *Value* -- the usefulness and importance of SM in school and in later life.
- *Confidence/Efficacy* -- their ability to perform in SM.
- *Parent Involvement* –their families' confidence in their ability in SM.
- *Homework Monitoring* –parental support and assistance for homework.

These assessments were administered to students in grades 3-8 by their regular classroom teachers. Guidelines for administering the instruments were developed to standardize procedures. The response rates for the January and May 2009 and the May 2010 administrations ranged from 78% to 85%.

The Parent Beliefs and Attitudes Scales were developed to parallel the Student Motivation Scales and were administered in fall 2009 and spring 2010. The scales are:

- *Personal Value.* Parents' interest and confidence SM for themselves.
- *Value for Child***.** How important parents feel that SM is for their child.
- *Parental Involvement.* What parents' expectations are for their child and how these expectations are communicated to the child.
- *Homework Monitoring.* How parents support or help with homework in SM.

These assessments were sent home with children in grades 1-8 with an envelope for the completed survey to be sealed and returned in. Clear directions were provided for teachers and parents. Parents only completed the survey for one of their children. It is estimated that the response rates ranged between 30% and 60% for schools. We are currently gathering information on the number of *families* per school to use as the denominator in our response rate calculations to obtain a more accurate response rate for the parent surveys.

MSFN Survey. This brief survey administered to parents who attended MSFNs was used to determine parents' views of the MSFNs.

Observation. Each MSFN was observed by either the researcher or the treatment implementer using the observation instrument developed in an earlier study.

Documents. Event plans, budgets and copies of activities were collected.

Results and Lessons Learned

The year 1 student and parent motivation data have been analyzed and the results were mixed. The results from the student surveys and parent survey did not show any difference across treatments. Findings were interesting in that math was viewed as more important than science and, on the student surveys administered in January and May, the scores actually went down on the posttest. Year 1 was not an accurate test of the effectiveness of PAC because the treatments implemented mid-year and, in some cases, not fully implemented. Further, there is some evidence of *treatment bleed* because principals were moved around between Years 1 and 2 and the campaign materials, while located near the participating schools, were available for anyone driving through the neighborhood to see. In Year 2, the various components were implemented by all of the treatment groups. The surveys were administered again in spring of Year 2 and a spring to spring comparison will likely be more valid. Those data are still being analyzed.

Findings from PRISM I and II have consistently shown that the MSFNs have been successful in engaging students in SM activities and learning with their parents. A DVD demonstrating how to implement an effective MSFN is currently being edited and will be previewed during this session at the LNC.

The significance of this work lies in the fact that it will show the effectiveness of a parental involvement/awareness program designed to increase 1) the parental awareness of the importance of mathematics and science and 2) student motivation in science and mathematics. In the future, the impact of the program on student learning, using a randomized experimental design will be a further contribution to our understanding of how to engage parents and students in math and science.

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