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

Questions for dialogue are: 1) How do we effectively bring together skills and knowledge of MSP contributors (participants, implementers, evaluators and researchers, leaders) in order to strengthen our contributions to the knowledge base? 2) How do we facilitate and monitor the level of collaboration within and across teams? 3) What is the value added in the context of MSP goals when engaging in collaborative research? 4) How do we measure impact and culture change within the context of K-16 learning communities, higher education participation in work with schools, and school participation in a Public Awareness Campaign which emphasizes the importance of math and science education?

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

The *Partnership for Reform in Science and Mathematics (PRISM), Phase I*, a comprehensive MSP awarded to the University System of Georgia in 2003 was designed to test key strategies to increase student learning and achievement in science and mathematics (SM) in schools and colleges. The PRISM partnership, in its 1st Phase, analyzed evaluation data for indications of changed teacher and faculty behavior in school and college classrooms as well as the effects of these changes on improvements in student learning and has used lessons learned to influence statewide change in policy and practice.

From the original set of 10 interconnected strategies implemented through PRISM Phase I, three were selected for further study through the PRISM Phase II project. *PRISM Phase II: Research on Key PRISM Strategies* will capture evidence of strategy impact, including changed culture in K-16 STEM education in Georgia, through a partnership driven research project comprised of well designed studies of 1) K-16 professional learning communities, 2) higher education recognition and reward for involvement in efforts to improve K-16 teaching and learning in science and mathematics, and 3) the public awareness campaign. These three focus areas for PRISM Phase II were selected not only for their successful implementation and preliminary impact on K-16 STEM education, but also for the potential contributions to the knowledge base in these areas of STEM education. Preliminary impact of each of these strategies is given below.

**Learning Communities:** Reports from participants, PRISM leaders, and the PRISM evaluation team indicated that being a member of a K-16 learning community had a variety of positive
effects, including changes in teaching practices, enhanced content understanding, and, in some cases, improvement in student learning. Use of a quantitative instrument, *Inventory of Teaching and Learning*, showed that teachers who participated in a learning community involving a higher education faculty member reported greater use of inquiry based teaching and learning practices. Preliminary data also show greater improvement in Criterion Referenced Test Scores (State Accountability Test) in schools with learning communities.

**Culture Change in IHE:** As a result of PRISM Phase I, the Board of Regents of the University System of Georgia adopted in October 2006, a major policy change called “Work in the Schools.” This policy calls for administrations at institutions of higher education (IHEs) in the University System to advocate for faculty participation in work which improves teaching and learning in K-16 education and sets the tone and expectations for these institutions.

**Research on Public Awareness:** PRISM has been capitalizing on existing research to develop a Public Awareness Campaign to increase the awareness of parents and students of the importance of science and mathematics and the importance of taking rigorous science and mathematics courses. Market research findings have demonstrated that the Public Awareness Campaign has raised student and parent awareness of the importance of science and mathematics.

*PRISM Phase II: Research on Key PRISM Strategies*, extends and solidifies these initial results through the designs described in the following sections. The implementation of these three research studies, from design, through instrument development, data collection and analysis, as well as dissemination and transfer of knowledge to partners, is strengthened by the element of collaborative research. The PRISM Phase II Leadership Team is comprised of members of three separate research teams. The PRISM II research teams include Phase I implementers of the strategies being studied, social science researchers who participated in data collection and evaluation of that strategy for PRISM Phase I, as well as STEM and STEM education faculty, who were participants in the original project.

The collaborative research element is fostered and assessed by the PI, Co-PI and Project Coordinator. In a desire to promote open collaboration within and across teams and also to establish a mechanism by which the team would collectively address questions or issues (such as data sharing and decisions about publications), the team developed a *Principles of Collaborative Research* survey which is used by the research teams to challenge themselves to work collaboratively within and across teams.

---

3. **Claim(s) or hypothesis(es) examined in the work (anticipating that veteran projects will have claims, newer projects will have hypotheses):**

The three PRISM Phase II Research Questions being examined in the work are:

1. What are the attributes of K-16 professional learning communities, how can they be measured and what is the relationship between learning community attributes and student learning, classroom teaching practices, and professional practice?
2. To what extent do policy change and incentive structures that reward higher education faculty to collaborate with K-12 schools and to strengthen their own teaching result in
sustainable changes in faculty attitudes and beliefs about the value of scholarship of
teaching and learning, changes in IHE classroom practice, and student achievement?
3. To what extent do schools that participate in the Public Awareness Campaign have
greater student motivation, greater parental involvement, and higher student achievement
in SM than non-participating schools?

The project is also less formally investigating the hypothesis that engaging in the Phase II work
through a multi-layered collaborative research project builds capacity for generating knowledge
within the context of MSP.

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

Each of the three PRISM Phase II studies relating to the questions above has a distinct design
grounded in the existing literature and current state of the research surrounding that particular
strategy. In the middle of the project’s second year, preliminary results have been generated
within each research question. As the results solidify in year three, each research team will
disseminate the research findings accordingly. In this manner, accountability and ownership of
the work is shared ensuring the participation in the generation of knowledge across the full Phase
II team.

Research Question 1 – Learning Communities

Sub-question 1: What are the attributes of successful K-16 learning communities and how can
those attributes be measured? This question focuses on identifying attributes of successful K-16
learning communities (LCs) and designing an instrument package to measure those attributes.
Successful PRISM LCs were defined by the following four criteria: sustainability, K-16
partnership, changed teaching practices, and improved student learning. Research tasks include:
1) sampling- identification of successful PRISM learning communities; 2) data collection-
learning community interviews; 3) data analysis- identification of attributes; and 4) design of an
instrument package to measure attributes.

Three sets of PRISM Phase I participants identified successful LCs in their regions. A total of 26
LCs met the criteria for success. The LC facilitators from each of these 26 successful LCs were
identified and invited to participate in the study. Thirty facilitators were interviewed using the
Learning Community Attribute Interview Protocol, which is based on attributes identified in the
broad learning community literature. Team members analyzed results from the interviews using
an analytical framework approach. Instruments to measure the attributes will be piloted using a
combination of new LCs and LCs from the original list of successful learning communities.

Sub-question 2: What is the relationship between learning community attributes and student
learning, classroom teaching practices, and professional practice? A stratified sample of 20
learning communities, not part of PRISM Phase I, and their members will be identified. They
will be stratified by discipline (science and mathematics) and whether or not they have higher
education participants in their learning communities. A variety of data will be collected for each
learning community and its participants, including data from the Learning Community Attribute
Instrument Package and a series of outcome measures for student learning data and, teacher
professional practices. For each instrument or type of data collected, a series of models using structural equation modeling (SEM) will be built with learning community attribute measures serving as the independent variables and the three categories of outcome measures serving as the dependent variables.

**Research Question 2 – Higher Education Culture Change**

Of primary concern is identifying and understanding personal and organizational factors that facilitate changes in departmental cultures that support, reward, and sustain faculty engagement in the scholarship of teaching and learning and meaningful partnerships with K-12 schools and higher education. Participants in the study will be faculty and key administrators in USG institutions representing four levels of engagement in PRISM and STEM. Research question 2 is divided into 4 sub-questions, each having its own methodology.

**Sub-question 1:** *Do the four types of IHEs with differing levels of involvement in PRISM and STEM differ on the Inventory of Teaching and Learning (ITAL) in the predicted (ordered) direction at the beginning (baseline), during, and at the end of PRISM?*

All science and mathematics faculty at 8 institutions defining the four institution levels have been invited to participate in the study. Changes in practices of STEM faculty are measured using the Inventory of Teaching and Learning (ITAL), a self-report measure of teacher and faculty use of standards-based, inquiry-based, and traditional teaching and learning. The ITAL database will statistically analyzed to determine if: 1) there are differences among the four levels of higher education institutions on the identified ITAL measurement dimensions; 2) the ITAL scores differ significantly between science and mathematics faculty among the four levels of higher education institutions; and 3) ITAL scores differ significantly between science and mathematics faculty categorized by selected demographic variables.

**Sub-question 2:** *Do the four types of IHEs with different levels of involvement in PRISM and STEM differ on the CBAM, Self-Efficacy, and Culture (CSC) survey in the predicted (ordered) direction at the beginning (baseline), during, and at the end of PRISM Phase II?*

The methodology for sub-question 2 is very similar to sub-question 1.

**Sub-question 3:** *To what extent do faculty tenure and promotion (T&P) decisions recognize and reward faculty for work in schools?* Random or representative samples of faculty dossiers (n=4 to 5) will be selected for review by the chief academic officer a teach of the 8 IHEs comprising the four institutional levels. The chief academic officer at each of the 8 IHEs will use the Documentation Review and Assessment Procedures to examine tenure and promotion materials. Both quantitative and qualitative analyses of the T&P dossier reviews will be completed.

**Sub-question 4:** *Are there changes over time in (among) participants in selected case studies and are these changes consistent with the goals of PRISM and/or STEM?* A variety of case studies will be included in the RQ2 team research efforts. These cases have been nominated, screened and selected for study using a Case Study Nomination Form. Data collection procedures include direct observations of teaching and learning using the Reformed Teaching Observation Protocol (RTOP), individual and/or focus group interviews using the standardized, semi structured interview framework, document analysis, and course grade distributions.
Research Question 3 – Public Awareness Campaign

To what extent do schools that participate in the Public Awareness Campaign have greater student motivation, greater parental involvement and higher student achievement in science and mathematics than non-participating schools? The participants in the research are students, teachers and parents in 18 elementary and middle schools in a district that has not been a part of PRISM. The design is a randomized control group design with three conditions. Schools were matched on demographic data (percent minority, percent on free and reduced price lunch and level—elementary vs. middle school) and randomly assigned to one of the three groups. One group is receiving the full treatment all three years, another group is receiving partial treatment during year 1 and the full treatment during years 2 and 3 and the third group is receiving no treatment during the first year, partial treatment during year 2 and full treatment during year 3. There are three dependent variables that are being measured: student motivation, parental involvement, and student achievement. Instruments measuring the dependent variables are administered in the spring each year of the project. Student motivation in mathematics and science are measured using subscales of the MSP-Motivation Assessment Project (MSP-MAP) scales. Parent involvement is measured by instruments developed by the researchers. Student achievement is measured using the state Criterion Referenced Competency Tests (CRCT) in science and mathematics. The mathematics CRCT is administered in grades 1-8 and science in grades 3-8. School level data will be used to compare the three treatments; it will be disaggregated by race/ethnicity and gender. Additional data will be gathered including observations of treatment activities, such as Math/Science Family Nights, interviews with parents and teachers and surveys that will be developed to evaluate parents’ perceptions of the effectiveness of the various components of the treatment. The qualitative data will be analyzed using the constant comparative method and quantitative data will be analyzed using Factorial Analysis of Variance (ANOVA).

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

Successfully implemented, the collaborative research model has the following strengths:

- Each research team benefits from the expertise and critical review of the Phase II Leadership Team
- Team members learn from one another
- The Phase II Leadership Team provides a range of insights to facilitate instrument design
- The connection between implementation and research of the three strategies is strong

There are challenges in successfully implementing a collaborative research model involving team members with different expertise. Ensuring each team member has a contributing role is key in conducting collaborative research. In addition, providing time for community building and understanding one another’s professional cultures is invaluable. Understanding these insights was made possible by the collaborative development and use of the Principles of Collaborative Research survey.