Session Title:
Project MAST's Science Teacher Professional Development Observation Protocol

MSP Project Name:
Project MAST (Mississippi Academy for Science Teaching)

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Project Session

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Summary:
This session introduces a professional development observation protocol that evaluators have developed for Project MAST (Mississippi Academy for Science Teaching), a program that prepares teachers from underperforming high schools to teach physical science. Observers take comprehensive notes on the PD sessions' content and pedagogy and then rate each session on 11 criteria (e.g., clarity of session goals; opportunities to engage in science inquiry) derived from past PD research. In our interactive session, we'll discuss why we developed the protocol and how we've used it, then give audience members a chance see it for themselves. We hope to give the MSP community an additional tool to monitor PD implementation and study its effect on teacher and student learning.

Section 1: Questions framing the session:
- What does "quality" science professional development (PD) look like in practice? What might be some definable and observable elements of science PD?
- How can professional developers, researchers and evaluators measure and monitor PD through an observation protocol? In particular, how can they measure the quality of PD implementation so that they can relate it to their intended and observed outcomes?
- How should the content and structure of a PD observation protocol change to accommodate multiple kinds of observers (e.g., program evaluators, Higher Ed STEM faculty)?

Section 2: Conceptual framework:
In this session, we'll share a professional development observation protocol we've developed for Project MAST, a program that prepares teachers from under-performing high schools to teach physical science. During four weeks of graduate coursework (three weeks in the summer, five Saturdays during the school year) teachers learn science content and pedagogy through lectures and high school-appropriate hands-on activities. Teachers learn from Jackson State University faculty and world-class instructors from other universities, businesses, school districts and federal agencies, and receive approximately $2000 worth of instructional materials to use in their classrooms. During the school year, teachers also receive three visits from Project MAST staff to either observe and support teaching, or bring instructional technologies (a portable planetarium, iPods with science podcasts) to the classrooms. The combination of graduate courses, instructional materials and classroom visits is expected to lead to improvements in teachers' content knowledge and teaching efficacy and, ultimately, to growth in student content knowledge and positive attitudes toward science.

Evaluators from Rockman et al, a San Francisco-based research and evaluation firm, developed an observation protocol to document the fidelity of implementation of the professional development sessions. Project MAST (Mississippi Academy for Science Teaching) as a whole incorporates five critical features of professional development for effective teaching: "(a) content focus, (b) active learning, (c) coherence, (d) duration, and (e) collective participation" (Desimone, 2009, p. 183). To see how instructors operationalized these elements in individual sessions, evaluators have asked observers to take comprehensive, low-inference notes on the PD content and pedagogy and then rate each session on eleven criteria derived from prior studies of effective professional development (e.g., connections to participants' prior knowledge and experiences; opportunities to reflect on teaching practices; opportunities to engage in aspects science inquiry such as collecting data and drawing conclusions) (Desimone, 2009; Penuel, Fishman, Yamaguchi & Gallagher, 2007). Observers support their ratings with specific examples from their notes. When they're done, they submit their observations to a password-protected online database.

Our LNC session will share the suite of observation tools and instructions we've developed in order to get feedback about the breadth and depth of the PD characteristics assessed (thereby gathering additional evidence for the measure's content validity) and to determine if the protocol could be of value to other MSP projects (thereby assessing the potential relevance and utility of this measure (Messick, 1995)). We will distribute the following four items:
        (a) an evidence log for basic note-taking;
        (b) a summary report to rate the entire PD session;
        (c) a glossary of terms; and
        (d) a tip sheet for observers

Section 3: Explanatory framework:
As we planned our evaluation of PD implementation, we operated under two assumptions. First, we selected observations as our method of choice in order to (a)

record nuanced examples of research-based professional development practice, and (b) link the instructional characteristics of the PD sessions to data about teachers' classroom practices. Second, we wanted to take advantage of the university physical science faculty members assigned to take notes at each PD session by training them to collect evaluation data for us.

We quickly realized that we couldn't simply take an instrument off the shelf, but instead had to construct our own tool. Existing measures such as the Professional Development Observation Protocol (Weiss, Banilower, McMahon & Smith, 2000) seemed too long and detailed for our intended observers. Hence, we decided to develop our own protocol to suit Project MAST's goals and setting. Working with the science faculty members who would be using the protocol, we decided what to measure and how to measure it, iteratively observing PD sessions and revising the measure to clarify terms, reduce jargon and improve rater agreement (Bass & Mushlin, 2010). In subsequent years we have continued to monitor protocol data and to give, receive, and respond to feedback on the observation process.

Lessons Learned
Our initial experiences drafting the protocol gave us confidence that it was possible to observe characteristics of effective professional development in the Project MAST setting. After generating a list of possible constructs from the PD literature, we reviewed videos of MAST PD sessions to see if we could find evidence of those constructs in actual practice. We found a range of examples to confirm that we could rate the constructs of interest on an ordinal scale.

Working with the university professors also reinforced our belief that instrument development can never be just a top-down, theory-driven process. Measures must also be sensitive to the background and skills of their intended users to ensure the collection of valid and reliable data.

Section 4: Discussion:
Value of findings and this LNC session to Project MAST
The principal investigator and project director have used the findings from the observation protocol to improve the structure and content of the MAST PD sessions. For instance, they've incorporated more opportunities for teachers to reflect on how they might use what they've learned from the PD in their own classrooms. This reflection often takes the form of a class discussion about how to use the materials in the classroom, or how to transform a hands-on activity to emphasize inquiry. Program directors have also made sure to give PD instructors more information about participating teachers' background and access to technology, thus helping instructors better connect their sessions with the contexts in which participants will be teaching (Bass et al., 2012).

We hope that the discussions in this LNC session will give us ideas for other ways we can use this protocol to monitor and improve program implementation. We've often debated the pros and cons of giving PD session instructors the observation protocol in advance. Would this cause instructors to "teach to the test" artificially, or could it provide

valuable guidance for session planning? We've also been thinking about how best to link the observation data with program outcomes and wonder how other members of the LNC community have addressed this issue.

Relevance of the findings to other MSPs
Now that we've been using this protocol for four years, we'd like to know if it could be of use to other projects. In our interactive session, we'll briefly discuss why we developed the protocol and how we've used it, then give audience members a chance see it for themselves. We hope to give members of the NSF MSP community an additional tool to measure program implementation and potentially gather a large, varied pool of observation data to validate the protocol with psychometric techniques such as Item Response Theory (Wilson, 2005).

We expect our session will be of interest to a number of MSP constituents. Evaluators, PIs and project directors will be interested in reviewing our PD observation protocol and discussing possible additional uses, customizations, or refinements.

We've also found that the higher education STEM faculty who have used our protocol at Jackson State University have benefitted greatly from the experience. While our original goal was to train the professors to be observers, the process has also affected their perspective on teaching science. We witnessed the professors analyze their own strengths and weaknesses as teachers. One professor reported that he was going to use the protocol's categories to influence the instruction of his professional development session that he was scheduled to deliver at the end of the summer workshop. Others told us that they would approach their own undergraduate courses with new eyes; they learned to see beyond the content they were teaching and understood the importance of delivery. Higher education STEM faculty at other universities might also be interested in reviewing and commenting on our protocol if they, too, would like to get more familiar with strategies for effective teaching.

Finally, K-12 administrators might be able to use our protocol to gather actionable feedback on the science PD they sponsor in their schools and districts.

Section 5: How will you structure this session? What is your plan for participant interaction?
We will divide our session into three segments and provide numerous opportunities for participants to share ideas in large and small groups. For instance, we'll start by discussing two questions "What terms or ideas come to mind when you think about quality science teacher professional development?" and "What would you expect to see in a quality science teacher PD session?" These two questions will give us ideas about the constructs the audience might want to assess in a measure of PD implementation and the indicators that would convince them that a PD session is of high quality.

Once we've tapped into some of the group's prior knowledge and experiences, we'll give a brief overview of our PD observation protocol and how it came to be. We'll talk about the purpose of our measure and our experience co-developing it with our observers. If

time permits, we may show a brief video clip of a MAST PD session to give the audience a better sense of the context in which we were working.

We'll then transition to the next third of our session in which we review the components of our protocol (evidence log, summary report, glossary and observer tips) and then have participants read and review the summary report and glossary. The summary report asks observers to rate the presence, absence or quality of eleven PD characteristics (e.g., clarity of goals, opportunities to engage in aspects science inquiry) in a given session, while the glossary describes those terms and provides examples. Taking a page from Keeley's (2008) formative assessment probes, we'll ask participants to review one or two pages of the protocol and record on index cards two strengths of the protocol and one question about it. After participants have done this task individually, they'll be asked to share their feedback with the rest of their small group and designate one person to share two comments with the entire audience.

During the final 10-15 minutes of the session, we'll discuss possible uses and adaptations of the protocol. We'll share how evaluators have used the protocol to assess Project MAST's theory of change and how university science faculty have used the protocol to reflect on, and improve, their science teaching. We will then ask the audience to share how they could use this protocol in their projects or why they wouldn't use it, even with adaptations. For those interested in continuing the conversation, we'll collect contact information and provide links where participants can download the observation protocol and supporting materials.

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