Abstract Title: MC^2-LIFT: Teaming to Design Engaged Learning in Mathematics for Teachers and Their Students

MSP Project Name: Mathematically Connected Communities – Leadership Institute for Teachers

Author(s): Wanda Bulger-Tamez, Cathy Kinzer, Doug Kurtz, Janice Bradley, Patrick Morandi,

Presenter(s): Wanda Bulger-Tamez, Doug Kurtz, Cathy Kinzer, Sara Morales, Patrick Morandi

120 word summary:

The Mathematically Connected Communities – Leadership Institute for Teachers (MC^2-LIFT) project employs a team approach to designing and presenting an institute for mathematics teacher leaders to help them experience, implement, and study classroom learning environments that are linked to increased student achievement in mathematics. This presentation will describe how we coordinate efforts between our three main working groups – Course Development Team, School Support Team, and Research Team – to ensure a cohesive approach to improving classroom practice and increasing student mathematics learning. We will share resources for gathering teacher feedback, reflecting on classroom practice, and observing the impact of the classroom environment on students' learning of mathematics.

- Section 1: **Questions for dialogue at the MSP LNC**.
  a. What experiences do you have with an SBLE and what does it mean for your project? (Development Team)
  b. How is the learning of your institutes/professional development connected to classroom practice? What structures and process support teacher and student learning in the classroom? (School Support)
  c. What data and feedback are gathered from classroom practice? How does the data/feedback guide decision making about professional development (institute or courses) and project structures? How does the data/feedback guide support learning? (Research)
  d. How is data/information from research used to provide a lens to the classroom practice?
  e. How do we use data as a formative assessment to analyze students learning and modify instruction to improve student achievement? How do teachers use data as formative assessment to analyze students learning and modify instruction to improve student achievement?

- Section 2: **Conceptual framework**.

Subsection 2.1: Context of the Work

Teacher and Student Success

Research tells us that an important factor in children's learning of mathematics is the classroom environment in which they are learning. While establishing standards and adopting quality curriculum resources are important, the factor that has the greatest impact

on learning is classroom instruction. (Black and Wiliams, 2005). Another study (Tarr, etal, 2008) revealed that a standards based learning environment has a positive impact on student achievement on open-ended assessments that measure mathematical reasoning, problem-solving and communication.

Our definition of an SBLE is guided by the work of Tarr, J.E., Reys, R.E., Reys, B.J., Chavez, O., Shih, J., and Osterlind, S.J. (2008), "The Impact of Middle-Grades Mathematics Curricula and the Classroom Learning Environment on Student Achievement." The study describes observable attributes of classroom instruction that are linked to increase in student achievement: (1) provide opportunities for students to make conjectures; (2) foster the development of conceptual understanding; (3) require students to explain their solutions; (4) encourage multiple perspectives and strategies; and, (5) value student statement and use them to build understanding.

This study helps us define and quantify both teacher and student success in MC^2-LIFT. We define teacher success in the MC2-LIFT project as the ability of the teacher to create a classroom learning environment that exhibits high levels of an SBLE. Our project defines student success as the ability to problem-solve, reason, and communicate mathematical thinking of mathematics content appropriate to students' grade level. The grade level content is defined by our state mathematics standards. We are fortunate in New Mexico to have a state assessment that requires these same skills to show proficiency in mathematics.

Coordinated Effort to Supporting Teacher and Student Engagement/Success

MC^2-LIFT is comprised of three core working groups. The Development Team includes mathematicians and math educators who research and design the course content. The School Support Team partners with teachers in their school to implement the ideas developed in their coursework. These two teams provide a the context for the work and basis for our project research. The Research Team (which will be further described in section 3) gathers, analyzes, and shares data regarding the actual change in classroom practice and learning that results from the coursework and school-based support. The MC^2-LIFT team approach provides a coordinated effort to model an SBLE in our teacher-leader courses, support the development of an SBLE in our participating teachers' classrooms, and gather and share data regarding learning in our MC^2-LIFT institute. Below is a description of how each team contributes to the development of an SBLE, and, in section 3, how each team uses student data to reform and refine our project content and processes for mathematics learning.

Development Team: Modeling a SBLE

Like most MSP projects, MC^2-LIFT provides a hands-on approach to learning mathematics for teachers. Since our project works with K-12 grade teachers, we have the added challenge of simultaneously providing relevant learning experiences for teachers at all grade levels. When developing learning goals, we are conscientious of sharing goals for the whole semester to help all teachers see how the content they teach is related to the coursework. Our aim is to help our teachers: develop a deep understanding of the mathematics they teach; understand how the content they teach is connected across grade levels; develop the pedagogical content knowledge to effectively differentiate instruction as different learning needs arise; understand how their instructional decisions are based in different learning theories; and, conscientiously make instructional decisions to match the learning needs of their students.

We began each of our first two courses by linking our course content to student achievement data. We have student achievement data that teachers can analyze by content strand to see where students have strengths and weaknesses. For instance, during our study of geometry, teachers used their own student achievement data to analyze their students' strengths and weaknesses in geometry. Our development team considered student achievement data in choosing which areas of geometry would be most relevant for study in our course. As teachers learned about geometric concepts across the K-12 curriculum, they designed an instructional unit to address students' weakest areas in geometry.

Throughout the institute, teacher leaders are asked to provide feedback to the development team about teacher learning, engagement, and relevance to classroom practice. Essentially, we gathered data to ensure that we are providing a learning environment that ensures high levels of learning of every teacher. Strategies for feedback include the following:

- Providing Feedback on Mathematics Learning/Writing: Teachers receive feedback on their explanation of mathematical ideas through student to student peer review of written papers, as well as written comments from project faculty. The process helps teachers strengthen their mathematics and pedagogical content and helps faculty understand the knowledge and learning needs of teachers.
- Feedback Surveys: Feedback surveys were administered in the fall to gauge teachers' perceptions of the relevance of course activities to their own classroom practice. Teachers were asked to recommend how to strengthen connections between the coursework and classroom practice.
- Focus Groups: Three focus groups have been held with the internal evaluator to probe for specific strengths and weaknesses of the course design and requirements as they relate to teacher learning.

School Support Team: **Providing Classroom Support for Establishing a SBLE**
The main function of school support is to provide a supportive structure for teachers to enact instructional strategies to increase student learning, and to reflect on the effectiveness of those strategies. As part of school support, tools were developed and adapted for teachers to engage in self reflection. One tool we used is *the Cognitive Demand Classroom Self-Reflection*, adapted from Lincoln Achievement in Mathematics Partnership Project, U.S. Dept. of Education MSP Project. Teachers video-tape their classroom practice and use the tool to reflect on the strengths and weaknesses of their practice in relations to students engagement in doing mathematics. Another tool that was developed is the *Shared Classroom Experience Protocol*. This tool is used for teachers and project faculty to partner in classroom practice to study together student learning and reflect on strategies to engage students in the mathematics. A third tool we are developing is the *SBLE Classroom Reflection*. This tool is intended to help teachers clearly define a standards-based learning environment, reflect on the strengths and possible areas to improve in their own practice, and develop focus areas to strengthen in their practice. (All three tools will be shared as part of the presentation.)

We also have learned that teacher-to-teacher support is essential to foster long-term professional relationships. In the fall we adapted the "Teacher Learning Community" (TLC) model from Dylan Wiliam as part of school support. Teachers meet in small groups every two weeks as a learning community. In these groups, teachers share learning from practice. They set goals for implementing a change in practice and gather evidence of how their new instructional strategy

or activity impacted student learning. For instance, teachers enacted strategies to foster student-to-student classroom discussion that lead to shared understanding for the class. They shared strategies they used in the classroom to foster discussions, and brought evidence of how student learning was impacted. Teachers tracked their changes in practice over time (including strategies used and impact on students learning) on the TLC record sheet. (We will also share TLC Record Template)

Subsection 2.2: Claims and Hypotheses

MC2-LIFT project fully believes that coordination of the efforts of the teams is key to ensuring a coherent structure in which teachers can learn and implement their learning into classroom practice for increased student success.

Our presentation will highlight how the Development, School Support, and Research teams operate systemically and create coherence through cross team participation. For example, several members of the Development Team participate on the School Support and Research teams, and one member participates on all three teams to strengthen information flow and interconnectedness.

Our hypothesis and initial finding show that aligning teams' actions and behaviors to shared vision and goals, and creating and interconnected feedback loops for responding to teacher needs leads to greater impact on teacher and students learning.

- Section 3: **Explanatory framework**

Subsection 3.1: Research Design

Research Team: Gathering Data and Providing Feedback

The research team collects a large amount of data to help answer the three primary research questions and to provide continuous data feedback to the course development and school support team. The research questions for the LIFT project are:

1) How do teachers change as a result of participation in the institute in relation to the following areas: a)knowledge of K-12 mathematics; b) pedagogical practices and c) leadership in their schools and districts.
2) What is the effect of these teacher changes in math knowledge and pedagogy on student learning and achievement?
3) How is the institute developed and enacted and what can be learned from the implementation of this institute that can be helpful to the field of mathematics education?

This presentation will focus primarily on the methods used and data found so far in relationship to Research Question 1 and 2.

Measuring Baseline and Growth: The primary instruments we are using in addition to gathering student achievement data based on the New Mexico Standards Based assessment are the Mathematical Knowledge for Teaching (MKT) which assess teachers knowledge of mathematics for teaching (Ball, et.al) and two observational tools. The observational tools, the OLE (Observation of Learning Environments) and the Classroom Snapshot have been adapted from Horizon in more concise formats for observing the interaction of students, teacher, and content in relation to a standards based learning environment in the classroom.

Data Analysis and Feedback Loops: Twice each semester, trained observers with over two years of experience as teacher researchers observing in schools, go to participants schools to observe mathematics lessons. Scores on both the OLE and the Snapshot are compiled and analyzed by researchers to look for strengths and weaknesses in the classroom in criteria hypothesized in the literature to correlate with student learning and engagement in mathematics. After only one semester of data there has been a positive change in several aspects of the instruments indicated increased engagement in learning for many students. As observations are completed each semester, feedback is provided to the development and school support team to shed light on what aspects of the institutes and school support or being translated into classroom practice. The research team is also partnering with the other teams to design classroom reflection tools for teachers to assess their own classroom environments.

Subsection 3.2: A Few Key Insights

In our first nine months of working with our teacher cohort, we have gathered some initial insights on how to strengthen our work to ensure impact on classroom practice and success of teachers and their students:

1. We are finding through teacher feedback and reflection that developing interdependence between the three teams helps clarify our goals for the teachers and provides a better support structure for their learning. Comparison of classroom observations of cohort members from spring 2010 to early fall 2010 showed little change. However with greater collaboration between teams, we saw positive change in SBLE classroom ratings in late fall 2010.
2. We also found that we needed to employ intentional strategies to shape a K-12 mathematics professional learning community into a culture of collective trust. Elementary teachers often lack confidence in their mathematics abilities when paired with secondary math teachers. Secondary teachers also had a tendency to want to "rescue" the elementary teachers rather that help them develop their mathematical thinking. The interesting dilemma is that elementary teacher often were much better able to describe their mathematical thinking from a conceptual framework while secondary teachers often relied on memorized procedures as part of their solution methods. We had to employ strategies for classroom discourse in our courses to highlight the richness of elementary teachers' mathematical thinking.
3. Another interesting insight related to our project's "impact on student success" data is our research team data on "*missed opportunities"* or "*student's opportunities for learning*" from classroom observations. Although not yet fully analyzed, we have data noting teacher and student interactions, which were not errors, but where something was missing. We are considering how we can use this data as feedback for teachers and in helping to inform the development team of relevant content for teachers' mathematics learning.

References:

Ball, D. L., Thames, M. H., and Phelps, G. (2008). Content knowledge for teaching: What makes it special? *Journal of Teacher Education.* 59(5) 389-407

Black, P and Wiliam, D, 2005. "Developing a Theory of Formative Assessment." In Assessment and Learning, edited by John Gardner, pp. 88-100. London: Sage Publication.

Horizon Research, Inc. (1999). Local Systemic Change Classroom Observation Protocol. Retrieved August, 2000, from http://www.horizon-research.com.

Tarr, J.E., Reys, R.E., Reys, B.J., Chavez, O., Shih, J., and Osterlind, S.J., 2008. The Impact of Middle-Grades Mathematics Curricula and the Classroom Learning Environment on Student

Achievement. Journal for Research in Mathematics Education (JRME). Volume 39, Issue 3, pp. 247 – 280.