Abstract:

The Oregon Mathematics Leadership Institute (OMLI) research indicates that the degree to which schools implement specific practices promoted by the OMLI project is a significant positive predictor of student performance above and beyond what can be explained by the socioeconomic factor as indicated by the percentage of students who qualify for the free and reduced lunch program. We will briefly reference those research findings, including the challenges of sustaining positive results, and we will elaborate on new applications of OMLI lessons learned and subsequent new hypotheses and learning. A focus of this new work, supported by supplemental funding from NSF, is the development and study of the mathematics classroom “studio” as a self-sustaining and replicable structure that embeds and expands on those practices that the OMLI project found to be significantly positive predictors of student performance. We will provide examples and preliminary data to illustrate the elements and promise of the Mathematics Studio Program as context for the sustainable transformation of a school’s mathematics learning, teaching, and leadership, and as a model and greenhouse environment for seeding the transformation of a school system.

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

In addition to work with communities of teachers, work with their local school leaders is a critical component of our Mathematics Studio Program. The character of those leaders’ learning and involvement influences both the impact and sustainability of our work with teachers. However, while we are making every effort to draw on the latest work in the field to inform our work with school administrators, the challenges and obstacles are significant and we feel we are only in the early stages of learning what might be possible regarding the design, content, and impact of STEM-related learning for school administrators. Hence, during this session we will pose the following questions for dialogue:

What should characterize principals’ and district administrators’ initial and ongoing professional learning experiences in order to ensure the successful transformation and ongoing sustenance of the culture of mathematics professional learning in their schools?

How are other projects working with school administrators and what are they learning? What content, contexts, and delivery models are making a difference? Are there implications for new
2. Context of the work within the STEM education literature and within your MSP project:

In addition to drawing heavily on OMLI’s original research, the Mathematics Studio Program draws on extensive literature from the field. Some examples include:

**Professional Learning Community and Student Achievement.** Built into the design of each Mathematics Studio are evidence-based features of professional community that contribute to both teacher and student learning. (Boaler, 2006; McLaughlin & Talbert, 2001, 2006; Little, 1990, 2000; Louis et al, 1996; DuFour, 2009).

**Mathematical Discourse.** A central premise of the logic model for the original OMLI project, and again for the Mathematics Studio Program, is the notion that orchestrating productive mathematical discourse increases students’ opportunities to learn mathematics and in turn raises achievement and participation levels in mathematics. While simple to state, embracing that premise requires developing teachers’ knowledge, skills, tools, and disposition for building a community of mathematical discourse in their classrooms. (Leahy, Lyon, Thompson, and Wiliam, 2005; Yackel & Cobb, 1996; Hufferd-Ackles & Sherin, 2004; Stein, Engle, Hughes & Smith, 2008).

**Cognitive Demand.** Not all tasks are “discourse worthy.” In the Studio work, the Mathematical Task Framework (Stein, et al, 2000) provides a theoretical underpinning for identifying and designing high-cognitive tasks, and a basis for planning for and analyzing “live” studio enactments of those tasks. (Stein et al, 2000).

**Lesson Study.** The Studio model is designed loosely around the structure of Japanese lesson study, in that the studio “residents” collaboratively plan, observe/enact, and analyze a lesson. In addition, to provide focus and direction to this work, they identify an overarching instructional goal that they want to explore through the development and enactment of the lesson. (Stigler & Hiebert, 1999; Lewis, 2006; Watanabe, 2003).

**Generative Learning.** Through a mix of professional seminars, “live” classroom studio sessions, and applications in their own classrooms, teachers learn to attend more carefully to their students’ mathematical thinking, the details of mathematically productive pedagogy, and relationships between the two. Similarly, students in those teachers’ classrooms learn to attend carefully to their own understanding and to apply and question their understanding as it relates to new and unfamiliar problems/contexts. Hence, through this process, learning becomes self-generating and both students and teachers are able to continually add to their understandings. (Franke, Carpenter, Levi, & Fennema, 2001).

**Specialized mathematics content knowledge.** While the primary focus of the Studio work is the development of mathematically productive pedagogy, embedded in and critical to the work are ongoing opportunities to develop participating teachers’ specialized content knowledge, i.e., “the mathematical knowledge ‘entailed by teaching’ –in other words, mathematical knowledge needed to perform the recurrent tasks of teaching mathematics to students.” (Ball, Thames and Phelps, 2008; Ball, Hill and Bass, 2005;).
High-yield/leverage teaching practices. Across a school year, work in a Studio classroom emphasizes the identification, design, rehearsal, and study of specific “mathematically productive teaching routines” that are selected because they emphasize: the everyday teaching of mathematics; the development of students’ mathematical reasoning, understanding, and identity; important mathematics content; one or more challenging aspects of mathematics teaching; mathematics learning and achievement by all students. Further, they are grounded by evidence from the field. (Franke, 2008; Franke & Kazemi, 2009; Ball, 2008; Marzano, 2006, 2009; Ghousseini, Lampert et al, 2008)

Effective professional development. The Mathematics Studio Program is designed to align with the latest findings on effective professional development as: intensive, ongoing, and connected to practice; focused on students’ mathematics learning; supportive of teachers during the rehearse teaching in “real time”; designed to align with local school priorities, goals, and other initiatives; and focused on the development of strong working relationships among teachers. (Darling-Hammond et al, 2009)

School Leadership. The Mathematics Studio Program fosters the development of a schoolwide community of mathematics teacher leadership, where all teachers of mathematics share in the right and responsibility to support one another’s learning and to teach all students in powerful ways. Focusing on the school as the unit of change and a distributed view of leadership requires specialized learning for the principal and district administrators. (Elmore, 2002; City, Elmore, et al, 2009; Nelson et al, 2005; Miles-Grant et al, 2009)

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

Findings from original OMLI data
- School-wide improvement in student achievement can be attained through a coherent professional development program that simultaneously emphasizes (1) the improvement of teachers’ knowledge of mathematics content and pedagogy, (2) increasing the quality and quantity of students’ mathematical discourse, and (3) changing the culture of mathematics professional learning across the school.

- The degree to which the teachers in a school implement specific practices (as outlined in the OMLI research) learned during the research-based OMLI professional development program is a positive predictor of student performance.

- Implementation of those practices must be sustained and supported over time in order for student performance to be similarly sustained.

Hypotheses for the OMLI supplemental Mathematics Studio Program
- Fidelity to the school as the first-order “unit of change,” implementation of those evidence-based practices identified in the OMLI project research, and other critical features of the Mathematics Studio Program correlate positively with the school-based institutionalization and sustenance of generative professional learning, increased student achievement, and decreased achievement gaps. Affirming/Determining all critical features of the Mathematics
Studio Program is a focus of our work for this project. During this session, we will examine those features currently surfacing as most critical and the subject of our continuing research.

- The Mathematics Studio Program provides a powerful platform for developing master teachers and a highly productive context in which a master teacher can, while remaining an active classroom teacher, facilitate the professional growth of her colleagues.
4. Evaluation and/or research design, data collection and analysis:

As was true for the OMLI project, the research aspect of the Mathematics Studio Program is guided by a program specific logic model (see below). This logic model shows how the project resources are used to carry out project activities that will produce the outcomes and intended impacts. The evaluation design addresses each of the logic model components in the outcomes and impacts portions of the model. Evaluation questions for each logic model component provide the basis and rationale for each evaluation activity. The data-collection process will provide both formative and summative information to the studio development team. Formative aspects of the evaluation will provide the project leadership with useful information to continuously improve the program and to assess the impacts of studio work at each individual school. Summative aspects will inform the body of knowledge in the field regarding the effective teaching and
5. Key insights (retrospective for veteran projects, prospective for newer projects) that have value for the Learning Network:

The development of local capacity and the infrastructure to sustain powerful professional development is a critical and ongoing challenge for the field. While large-scale projects such as OMLI can produce significant and life-changing impact on those teachers who participate, effecting sustainable school-wide transformation of learning, teaching, and leadership is more difficult. Preliminary data suggests that the Mathematics Studio Program will be a transportable, scalable, and sustainable application and extension of the professional development courses, seminars, tools, and structures developed for OMLI. We will highlight early results from three high needs districts involved in the studio work, two that participated in the original OMLI project and one that did not but is now involved in the Mathematics Studio Program.

References


Boaler, J & Staples, M. (in press). *Creating Mathematical Futures through an Equitable Teaching Approach: The Case of Railside School.* Teachers' College Record. [Download]


