Session Number: **21**

Abstract Name:	**The Rice University Mathematics Leadership Institute/Houston Independent School District Lesson Study Project**
MSP Project:	Rice University Mathematics Leadership Institute
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1. Questions(s) or issue(s) for dialogue at Learning Network Conference session:

The goal of the Rice University Mathematics Leadership Institute (MLI) is to identify and support intellectual leaders, called Lead Teachers, at participating high school campuses in the partner districts, the Aldine Independent School District (AISD) and the Houston Independent School District (HISD). Lead Teachers are charged with providing instructional support to their fellow teachers by leading collaborative subject-level planning on their campuses and when feasible establishing model classrooms in entry-level mathematics subjects. However, after the inception of the work in the grant, it became obvious that many of the mathematics departments in the participating schools lacked the meaningful collaborative planning structures, knowledge, and skills necessary for preparing student-focused lessons. Prior observations of collaborative planning meetings by MLI Directors exposed weaknesses in the processes that were present. Some meetings exhibited a lack of structure that made effective planning impossible; while others were highly-structured yet lacked the content focus necessary to create meaningful lessons.

Concurrently, HISD was identifying weaknesses in Algebra I instruction across the district. At the start of the 2007-2008 academic year, administrators in HISD requested a comprehensive review of Algebra I instruction in the district. As part of this review, district mathematics specialists conducted walk-through observations of 279 Algebra I teachers in 39 high schools. Observations focused on student and teacher behaviors and the level of instruction according to the cognitive domain of Bloom's Taxonomy.

Results of the observations revealed that instruction in most classes focused only on lower cognitive levels with higher-order thinking questions not being asked in a majority of classes. In addition, students in most classes were not engaged in using hands-on tools for learning such as manipulatives or technology. It was noted, however, that in the classrooms of MLI Lead Teachers the desired teacher and student behaviors were more likely to occur. Overall the results indicated that an intervention was necessary to assist teachers in creating a more student-centered learning environment.

Lesson study emerged as an excellent model for providing a meaningful collaborative planning experience facilitated by MLI Lead Teachers that would have a direct impact on Algebra I classroom practice.

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

The Rice University School Mathematics Project (RUSMP) was established in 1987 in order to provide a bridge between the Rice University mathematics research community and Houston-area mathematics teachers. The theory of action that guides RUSMP's work is based on research which has led to such documents as the NCTM *Standards* (1989, 1991, 1995, 2000), the NCTM *Curriculum Focal Points for Prekindergarten through Grade 8 Mathematics* (2006), the NRC's *Everybody Counts* (1989) and the NRC's *Everybody Counts* (1989), *Adding It Up: Helping Children Learn Mathematics* (2001), and *Educating Teachers of Science, Mathematics, and Technology: New Practices for the New Millennium* (2001). This research indicates that active, student-centered mathematical investigations, group cooperation, and alternative assessments (such as holistic grading and portfolios) are more effective in reaching today's diverse student population than teacher-centered and passive-learning methods which have dominated mathematics instruction in the past.

Since its inception, RUSMP has worked collaboratively with HISD to improve mathematics instruction through a variety of extensive summer institutes, academic-year courses and specialized programs. One of the most recent collaborations among RUSMP, HISD, and the neighboring AISD is MLI.

Lack of success by ninth-grade students in Algebra I has been a concern of HISD for several years. Starting in 1996, HISD and RUSMP collaborated in a multi-year Algebra Initiative that provided extensive professional development and support for Algebra I team leaders and extra duty pay for all Algebra I teachers for the purpose of promoting collaborative planning of Algebra I instruction. The latest iteration is the current Lesson Study Project.

After the decision was made that lesson study would be an appropriate means for providing this assistance, the development of a lesson that effectively incorporated the components of effective instruction was needed. In addition, it was necessary for teachers to see their peers engaging students in this lesson as an exemplar for classroom instruction. To create this lesson and document the process for use with other teachers, it was decided to employ a lesson study model to create an exemplar lesson which would be taught and taped in a variety of classes and then shared with other teachers through a video produced by the district and disseminated to all high schools.

Prior to the start of a formal lesson study process to create the exemplar lessons, teachers were selected to participate. Due to their observed success through the walk-through observation process, it was decided, when feasible that MLI Lead Teachers would be included, and that an attempt would be made to ensure that the participating teachers represented the geographic and demographic diversity of the district. Ultimately eight teachers were invited to participate in the Lesson Study Project, seven of whom were MLI Lead Teachers, although two (both Lead Teachers) were not able to take part due to other commitments.

Although not clearly articulated at the start of the process for development of the exemplar lesson, it soon emerged that the process selected was a modification of the Lesson Study cycle described by Lewis, Perry and Murata (2006). Specifically the process involved four steps:

1. study curriculum and formulate goals,
2. plan,
3. conduct research, and
4. reflect.

A fifth step of the process, replication, involved all teachers participating in the study teaching a lesson modified as a result of the reflection process and having this lesson recorded for use with other teachers.

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

Although MLI has been in existence for four years, the Lesson Study Project is a newer initiative developing from Rice's collaboration with HISD. Thus it is too early to make any claims. However, two hypotheses are proposed through the work on this project, one relating to teachers and the other to students. With regard to teachers, the hypothesis guiding the work in this project is that a content-focused structure is an essential component for collaborative planning to be effective and that lesson study can provide the appropriate vehicle for providing this structure. With respect to students, the working hypothesis is that well-crafted student-centered lessons can only improve student achievement in mathematics.

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

Both qualitative and quantitative research techniques are being used to test the claims of both hypotheses. After the distribution of the video, Algebra I teachers embarked on their own departmental lesson studies. During these lesson studies, the four-step process, facilitated by MLI Lead Teachers at those schools that had Lead Teachers and facilitated by other teachers at schools that lacked MLI Lead Teachers, was followed as well. Departments selected their own lesson that met the curricular needs of their students at the time. One teacher in the department agreed to teach the research lesson a few days prior to the rest of the department, then after group reflection, the lesson was presented to all Algebra I students. Informal observations occurred in all phases of this development process from planning meetings to the presentation of the research lesson to both a trial group of students and then to all students. After the initial lesson-study experience, additional collaborative meetings and Algebra I classrooms were observed to determine if any behaviors carried over to collaborative planning meetings and to lesson delivery even when a formal lesson study process was not in place.

Quantitative data on student achievement is also collected each year as part of the normal evaluation process for the grant. These data include course grades and standardized test scores for students of both MLI Lead Teachers as well as for other teachers at schools participating in MLI. Although greater achievement levels as measured by these indicators are seen for MLI Lead Teachers and the teachers at their schools, MLI consists of a wide range of activities making it almost impossible to isolate the effect of any single intervention. Likewise as HISD has its own multi-faceted curriculum and professional development, the effect of this one intervention is extremely difficult to measure quantitatively.

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

The insights gained from this project focus on its impact on the district, on teachers, and on students. For the district, the Lesson Study Project provided valuable and tangible professional development to address the district's identified need to increase relevance and rigor in its Algebra I program. It provided the district with a model for professional development and collaboration that supported HISD's existing curriculum outline. The exemplar video created as part of this project, "Mathematics in Motion (Best Practices in Algebra I)," received a 2009 Texas School Public Relations Association Gold Star for excellence in school communications. For teachers, it provided a framework to foster reflective and meaningful collaboration that could be used to create additional meaningful lessons for students. For students, it provided improved lessons that incorporated manipulatives, technology, and higher-order questioning strategies.

Unfortunately it has been noticed that when some level of pressure is not placed on collaborative teams, they will quickly revert to prior behaviors in planning that focus on what is most expedient rather than what is best for student understanding. Time pressures placed on teachers make this expected. Although many teachers are provided with common planning time during the school day in addition to personal conference and planning time, observations from MLI Directors have indicated that increasing paperwork demands have forced planning meetings to focus on administrative issues rather than on instructional ones.

It is hopeful that the Lesson Study Project will continue and expand and that the instructional techniques honed by teachers through this project can be applied throughout all of the lessons that they teach in their classes.

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