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

The Math Teacher Leadership Center (Math TLC) project has undertaken the challenge of creating a collaborative innovative virtual Master’s Program for secondary mathematics teachers and a Mathematics Teacher Leadership Program that will serve 4-12 grade teachers across the Rocky Mountain West region. The focus of this presentation will be on the challenges, opportunities, and sustainability issues that we have faced in our first year of the Master’s Program. The specific issues that we will address include:

a. the challenge of establishing an online professional development program including issues of best technology and software platform for delivering courses at a distance;
b. opportunities to work collaboratively across two universities and multiple school district partners to create courses that will foster deep mathematical content knowledge, effective pedagogy, culturally relevant teaching, and teaching for mathematical understanding;
c. creation of an affiliation agreement between the universities which provides for a sustained program beyond the life of the grant.

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

The Math TLC project bases the development of the Master’s Program in research on effective professional development, online teaching, mathematical content proficiency, pedagogical proficiency, culturally relevant teaching, and teaching for understanding. The component which has been the most challenging to implement has been culturally relevant teaching in the mathematics classroom. Culturally relevant teaching involves using the cultural experiences, characteristics, and perspectives of the students in the room as generative sites for shaping teaching and creating opportunities to learn that are perceived by students to be opportunities (Gay, 2002). Implementing culturally relevant teaching in the classroom requires many strategies including: developing a knowledge base about cultural diversity, learning mathematical content from ethnically and culturally diverse origins, participating in and building a caring community of learners – this includes developing ways to calibrate teacher intentions with student perceptions, seeing personal communication patterns and using that awareness to learn to communicate effectively with diverse students, and responding supportively to socio-economic, cultural, and ethnic diversity in the delivery of instruction.

The other components underlying the Master’s Program have presented their own unique challenges. Mathematical content proficiency is addressed through incorporation of advanced mathematical content knowledge which provides an advanced perspective on concepts taught at
the high school level. Strategies to implement this component include understanding of the culture of mathematics as a discipline, extending and exploring mathematics with learners, connecting mathematics with and across domains, building on concepts to anticipate future topics, and organizing mathematics for teaching not only logically but also psychologically (Ball, 2003). Pedagogical proficiency requires pedagogical content knowledge (PCK), which is the collection of knowledge teachers have about the challenges learners encounter, strategies for helping students, ways to listen to hear not only learners’ thoughts but also their thinking processes, and skills for regulating one’s own practice. Teachers acquire PCK in many ways: grading, examining their own learning, observing and interacting with students, reflecting on practice, and discussing it with others (Ball & Bass, 2000). Teaching for understanding versus knowledge is fundamental to the pedagogical change we hope to bring about in teachers. Understanding by Design (Wiggins & McTighe, 2005) serves as an assessment framework that underpins course development as well as pedagogical change. Teachers work within professional learning communities to implement action research centered on lesson experiments within their classrooms. The lesson experiments engage teachers in development of content and anticipatory knowledge through individual planning, instructing, and reflecting activity along with the community-building dimension of co-observations. Lesson Experiment team members observe each of the other members teach a related topic allowing flexibility for responding to the myriad classroom demands of physically isolated teachers in rural areas.

The overall program structure has been a collaborative effort of faculty at both universities and the partner school districts, with the express purpose of providing teachers with high-quality professional development addressing the above goals. Course development teams for the Master’s Program consists of mathematicians, mathematics educators, and school district teachers from across the partnership working together to create relevant courses that meet the expressed goals. These collaborative efforts have impacted both high school teacher-participants practice as well as university faculty practice, especially around issues of cultural relevance and teaching for understanding. The affiliation agreement has provided a foundation for the two universities to sustain the program and has engaged all in a review of what is the best program for inservice mathematics teachers.

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

Our hypothesis is that to serve rural mathematics teachers in the expanse of the Rocky Mountain West we must provide quality professional development online. The Master’s Program must use the latest in technology and implement the best research based practices in online pedagogy. We hypothesize that the professional development must be focused on culturally relevant teaching, contradicting the often held belief that mathematics is culture-free. Finally we hypothesize that the program must promote and emulate a movement from teaching for knowledge to teaching for understanding. Our vision is focused on content proficiency, cultural competence, and pedagogical expertise for all Math TLC teacher-participants. We recognize the need to come to consensus on enduring understandings that are core to these outcomes.
4. Evaluation and/or research design, data collection and analysis:

The Math TLC project engages both an external evaluator to measure progress towards our five overarching goals and an internal research team to provide for research-based change in the Master’s Program. Data has been collected on the summer 2009 and fall 2009 courses from the course development teams as well as the teacher-participants. This includes data on course satisfaction with respect to our course goals, overall program structure, use of technology, online pedagogy, and recruiting and admission procedures. The analysis of this data has already been used to implement changes in the program summer course offerings, adjust the use of technology, and modify the admissions process. We will discuss what our preliminary data is indicating about the Master’s Program.

The instruments used to collect data on the Master’s Program include: Application and Selection Process Survey, Application and Selection Process Interviews, Math TLC Seminar Survey (focus on Culturally Relevant Teaching and Understanding by Design), Course Design Survey (focus on incorporation of research-based characteristics that guide course design), Teacher Participant Course Surveys (focus on quality of course in engaging participants in investigations, PCK, projects, and extending mathematical understanding), Master’s Program Quality Survey (focus on course expectations, adaptability of courses to teacher input, and technology support), Research Team’s Technology Survey, and Technology Team’s Technology Survey.

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

The key insights about the Master’s Program to this point are formative, since we are in our first year of the project.

First, the implementation of culturally relevant teaching and teaching for understanding has been challenging, both at the university course level and the teacher-participant level. This is due in part to coming to a consensus about what it means to teach from a culturally relevant perspective, then developing a deeper understanding of what this means within both university faculty and teacher-participants. The Math TLC Seminar Survey found that the course development team members attending the seminars significantly increased their understanding of all five components of Understanding by Design and all four conditions necessary for culturally relevant teaching (p < 0.05). However the level at which these concepts were integrated into courses is still under study. We are addressing this issue through a series of updated online seminars and by providing more explicit expectations to the course development teams concerning integrating culturally relevant tasks into their courses. As the teacher participants implement action research projects in their classroom we will examine the impact of teaching for understanding and culturally relevant teaching on their practice. The Course Design Survey indicated there were concerns with the level of collaboration within the course development teams, however there were positive outcomes with respect to the implementation of projects eliciting understanding and culturally responsive teaching. We will learn more about the level of integration of the underlying themes of culturally relevant teaching and teaching for understanding as we complete evaluations of courses taught in Summer 2009.
Second, we have had to address teacher cognitive overload concerns and time issues in both the summer and academic year courses. This is due to the two-fold problem of widely varying teacher-participant mathematics backgrounds and ensuring that the advance content in the mathematics courses is connected to the mathematics taught on the secondary level. The Teacher Participant Course Surveys indicated that teachers found the courses challenging and the number of summer of courses where overwhelming for those with a middle school background. The teachers indicated that the mathematics course content was appropriate (85% of participants) and 92% said they were likely or very likely to recommend the courses to other teachers. Teachers liked being challenged to think in a supportive environment, class discussions that challenged ideas, the opportunity to think and analyze various points of view, explorations, time to ask questions, working collaboratively, and connections to real-life problems. They appreciated the instructors being flexible, understanding content from more than one perspective, having a sense of humor, showing passion for mathematics, and being patient.

Third, we have had to overcome technology and software platform issues across the two university partners. The use of television video networking between the two universities was problematic in the areas of compatibility between institutions, setting up virtual classrooms, and costs. There were also extended conversations about the use of online two-way video and audio options. We are still working through what will be the best platform and format to use for the second summer. The Technology Surveys indicated that the majority of the teachers felt the technology reduced interaction with course instructors and with teachers at remote sites. This problem was addressed early in the summer semester, with the addition of online video conferencing to support the video broadcasts. By the end of the summer the technology concerns had greatly reduced, though it was not eliminated (17% if teacher-participants still expressed concerns about the technology aspects of the program at the end of the summer session). The teachers were provided webcams, writing tablets, and microphones for participation in online video conferencing. Only 4% were not satisfied with the hardware they were provided. The summer program only used online video conferencing as a back channel to the video broadcast, so the teachers had limited exposure to the use of online video conferencing. The Fall 2009 course synchronous sessions were conducted using only the online video conferencing package Elluminate. Preliminary indications are that the teachers were satisfied with the hardware and software packages used in this course. The Technology Surveys also indicated a need for increased technology professional development for both the university faculty teaching the courses and the teacher participants; provide a common format for posting course materials in the Course Management Systems (Blackboard and Ecompanion) so that teacher participants can easily locate assignments.

Fourth, the affiliation agreement between the university partners and its impact on sustaining the program will be discussed.