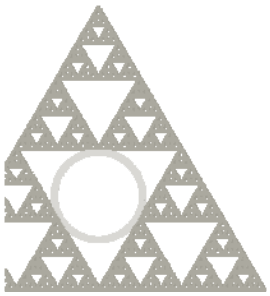

Math TLC

The Mathematics Teacher Leadership Center

MSP LNC Conference Handout

UNIVERSITY of NORTHERN COLORADO

UNIVERSITY OF WYOMING

Math TLC Vision

The Mathematics Teacher Leadership Center works to maximize K-12 student understanding of mathematics by developing mathematics teachers and teacher-leaders in Colorado and Wyoming with deep mathematics content knowledge that is culturally relevant and pedagogically effective, and to enhance the culturally competent pedagogical skills of university teacher-educators at the University of Wyoming and the University of Northern Colorado.

Math TLC Mission

Our purpose is to provide teachers and teacher-leaders with high-quality mathematics education within a collaborative climate that supports intellectual rigor, encourages innovation, fosters creativity and enhances cultural responsiveness in a way that results in self-confident K-12 students who understand important mathematics concepts and appreciate mathematics as a dynamic body of knowledge.

Project Description

The Mathematics Teacher Leadership Program (Math TLC)

The Math TLC is an integrated mathematics partnership of universities and school districts that weaves together current and new research, technology, mathematics expertise, and culturally responsive professional development in a virtual master's degree program (MP) for secondary teachers and a mathematics teacher-leader program (TLP) for 4-12 grade teachers. The Math TLC's ultimate purpose is to improve K-12 student mathematics learning. The project's primary strategy is to improve the effectiveness of mathematics teachers by focusing on content proficiency, cultural competence, and pedagogical expertise.

The goals of the Math TLC are to:

- Develop a shared vision of mathematics as a culturally rich subject in which K-12 mathematics proficiency is defined by shared community standards.
- Expand mathematical content knowledge in ways that broaden exposure to mathematical ideas and deepen understanding of topics that extend K-12 mathematics content.
- Increase pedagogical content knowledge by examination of how students think and learn about mathematics.
- Empower participants as lifelong professional learners who regularly reflect on themselves, students, and community context to improve teacher practice and student learning.
- Produce a research-based and tested model for master teacher development based on the above goals that improves mathematical achievement for all students.

Foundational Strategies

- **Separate development of Master Teachers and Teacher Leaders**

Master teacher and teacher leader development are distinct processes and programs. The Master's program focuses on developing master teachers by developing teachers' knowledge of mathematics and the teaching of mathematics, which includes pedagogical content knowledge (PCK) and culturally responsive pedagogy (CRP) for teaching students mathematics in diverse classrooms. The TLP program focuses on developing master teachers into teacher leaders by developing teachers' knowledge of leadership skills, PCK for working with math teachers, coaching and mentoring skills, CRP, and curriculum and assessment.

- **Development and documentation of PCK**

The development and documentation of PCK applies to both faculty and teachers. Via observation and interviewing, faculty's PCK is documented. Team meetings and seminars facilitate PCK development among the faculty. This helps to support the continuity and quality of the Math TLC programs. Teachers learn about PCK in their courses and conduct projects, such as action research, to develop and analyze their PCK, producing portfolios to document their learning and growth.

- **Collaboration in program management, design, and development**

Collaboration is implemented into every aspect of the Math TLC. Program management and course design are done in teams with representation from all interests.

- **Integration of culturally responsive pedagogy in the design, development, and delivery of all courses.**

Culturally responsive pedagogy permeates the development and implementation of the Math TLC programs under the belief that CRP is a necessary component to support the learning of *all* students in K-12 mathematics classrooms. Faculty employ CRP in their teaching methods and in the course content. This supports the teachers in the program to develop their skills and knowledge about CRP.

- **Use of technology to deliver courses to geographically diverse students**

To support the participation of teachers across Colorado and Wyoming, summer courses are offered in a hybrid format, allowing both face-to-face and video conferencing delivery. Students use synchronous and asynchronous course management software in the hybrid courses and the online courses offered during the school year.

- **Generate a body of research and evaluation that documents effective practices in developing master teachers and teacher-leaders**

Virtual Master's Degree Program (MP)

The goal of the Master's Program is to develop a highly qualified, culturally competent, pedagogically effective cadre of mathematics teachers who are equipped to improve student achievement in mathematics. The Math TLC is creating a rigorous master's program that includes courses at UNC and UW. The program will be sustained beyond the life of the grant through the establishment of an affiliation agreement. We are committed to ongoing development and research of the delivery methods for the program, including a determination of optimal online software platform, online teaching strategies for mathematics, and model course characteristics for the master's program, with a basis in current research.

The MP is offered to secondary mathematics teachers who have taught at least two years. It is a 2-year, 30-credit program consists of online and face-to-face courses. Of the 30 credits, 18 are mathematics courses and 12 are mathematics education courses. Mathematics education courses are paired with their mathematics counterparts so that teachers integrate their knowledge of mathematics content and pedagogy. For example, Modern Geometry, taught during the summer, is followed by Teaching Geometry during the school year.

Teacher Leadership Program (TLP)

The goal of the Teacher Leadership Program (TLP) is to develop a highly qualified, culturally competent, pedagogically effective cadre of mathematics teacher leaders who are equipped to work locally, regionally and nationally to improve teacher practice and student achievement in mathematics**.** The TLP is offered to 4^{th}-12^{th} grade mathematics master teachers and currently practicing teacher leaders. The TLP is a 2-year, 24 credit program consisting of two online classes and two weekend retreats during the school years and two week-long seminars during the summer. Teachers in the program are provided mentoring to help them engage in mathematics leadership in their school or district.

Research Program

In the Research Program, research and evaluation is conducted using naturalistic/qualitative and quasi-experimental quantitative designs to investigate Math TLC participant knowledge around two key themes: (1) examining and using students' mathematical thinking to shape teaching and (2) strategies for generating culturally responsive teaching. Evaluation will analyze the impacts of Math TLC activities on the learning of participants and on the learning of their students. The research team activities include framing research implementation, gathering and analyzing multiple streams of quantitative and qualitative data, and generating reports for the Master's Program team, project leadership team, and more general dissemination. Data collection, analysis, and reporting is related in mixed-methods studies around the following goals and questions.

Research Goal 1. Advance knowledge about the content and impact of professional development of mathematics teachers by researching the mathematical understandings, pedagogical content knowledge, and practices among Math TLC participants (teachers, teacher-leaders, and university teacher-educators), as well as the achievement of K-12 students.

Question 1.1. *Teacher Change*.
What mathematical understandings, pedagogical content knowledge, and teaching practices do teachers, teacher-leaders, and teacher-educators have at the start and end of each year of participation in the Math TLC project?
Question 1.2. *Instructional Content*.
What mathematical and pedagogical content knowledge components are addressed in Math TLC courses and activities?
Question 1.3. *Student Achievement*.
What is the relationship among Math TLC participants' activities, teaching contexts, and student achievement?
Question 1.4. *Instructional Format*.
How do changes in mathematical understanding, PCK, practices, and K-12 student achievement correlate with aspects of Math TLC participation?

Research Goal 2. Advance knowledge of teacher leadership development by researching, through a design experiment, the Math TLC leadership development model. The goal of this model is to develop teacher-leaders who can facilitate professional development of other teachers in ways similar to what is offered through the Math TLC.

Question 2.1. *Teacher-Leader Content.*
How do the various aspects of the leadership development model contribute to the development of teacher-leaders?
Question 2.2. *Teacher-Leader PD Model.*
How are these aspects combined to create a successful leadership development model for mentoring teacher-leaders?

Successes

Math TLC Key Outcomes

The key outcomes for the Math TLC are:
Outcome 1. Establish a cadre of culturally competent master teachers and teacher-leaders equipped to work locally, regionally and nationally to improve teacher practice and student achievement.
Outcome 2. Generate a body of research and evaluation that documents effective practices in developing master teachers and teacher-leaders.
Outcome 3. Develop sustainable models for the virtual master's and teacher leadership programs offered jointly by UNC and UW.

Research Team Progress Towards Key Outcomes

The research team made progress towards the key outcomes by:

- Developing and using an observation protocol for visits to the classrooms of participating secondary teachers. The instrument, with minor modification, is also proving useful in documenting university teacher educator classroom practice. The protocol was based on one developed at the University of Michigan by Heather Hill and Deborah Ball for analyzing video recordings of K-8 teaching. We adapted the forms and the observation process to allow real-time documentation of secondary teacher's subject matter knowledge, pedagogical content knowledge, and responsiveness to student thinking.

- Developing the online *Teaching and Cultural Awareness Survey* taken by Cohort 1 teacher participants in the Math TLC master's program.
- Developing the paper-based *Test of Mathematics and Pedagogical Content Knowledge* taken by Cohort 1 teacher participants and graduate research assistants.

The research team generated several reports to inform the master's team and project leadership in their efforts to responsively adapt programs, processes, and decisions including:

- A report on the design, administration, analysis, and findings of the *Survey of Technology-Rich Instruction* (paper-based) taken by Cohort 1 teacher participants and graduate research assistant observers.
- The online *Follow-up Survey on Hybrid Learning*
- A report on face-to-face interviews with teacher-educators about teaching mathematics in a hybrid/technology-rich context.
- A report on focus group interviews with Cohort 1 participants regarding the structure and format of the Math TLC master's program.

Master's Program Progress Towards Key Outcomes

The Master's Program made progress towards the key outcomes by:

- Negotiating an affiliation agreement between UNC and UW that defines the parameters and responsibilities for program delivery and for sustaining the program beyond the life of the grant.
- Engaging mathematics and mathematics education faculty from UNC and UW and master teachers from the partner schools in the development and delivery of Master's Program courses.
- Researching, testing, implementing, and evaluating technology platforms for the hybrid and online course delivery. The technology team produced product reviews on webcams, headsets, writing tablets, tablet PCs, course management software, and online conferencing software.

Developing a *Master's Program Handbook* that provides information on program overview, implementation, curriculum summary, program evaluations, professional development, and program dissemination. The *Handbook* is part of the effort to document and sustain the program beyond the life of the grant.

Where Are We Now?

Master's Program

- The first cohort of 17 students has completed 12 of the required 30 credits.
- For the second cohort, we have fully admitted 11 students and conditionally admitted 6 students.
- We have established a course schedule and sequence.
- We have adapted the program based on instructor and student formative evaluation.
- We have implemented professional development for faculty involved with course development.

Teacher Leadership Program

- We designed and implemented an application process for identifying master teachers who have potential to be teacher leaders.
- We have admitted 8 students into the first cohort, which begins June 2010.
- We are continuing the recruitment process.
- We have a literature review and design principles to support the curriculum development, which is in progress.

Research Program

- We have a research plan and are primarily in the data collection phase of that plan. We have conducted some preliminary analysis, but do not have any final results.