

Questions Regarding MSP Proposal 0832026
Mathematics Teacher Leadership Center – *Math TLC*
University of Northern Colorado (UNC)
Core Questions & Concerns

Institute Design

Q1: Please provide a detailed explanation why, given all the prior experience and research base upon which this proposal promises to build, the first classes for teacher participants will not begin until Summer 2010? Please provide more details of all the efforts and activities and who will be engaged in them in the time prior to the start of the Teacher Institute.

Immediately upon funding we will take action to make this project a success (see Timeline). It was our original intention to use Year 1 for establishing the institutional collaborative. Two substantial reasons lie behind that thinking. While our prior CLT experiences creating doctoral programs and conducting K-16 diversity and equity research provide a good foundation, we must adjust and adapt our experience to a new collaborative with different stakeholders. First, effective partnerships require significant time and effort for establishing a shared understanding and shared norms for collaboration. Second, we need to negotiate the affiliation between UWy, UNCo, and partner districts. UNCo has already negotiated such multi-year affiliation agreements with other Colorado universities and districts, so we are not starting from scratch. We also have extensive experience in establishing an affiliation drawn from similar efforts in the NSF CLT ACCLAIM program. However, *time and care are needed to give voice and power to all stakeholders in our inter-institutional collaborative*. Our CLT-West experience showed us that building trust and communication across K-12 and college requires the kind of Year 1 efforts we have proposed.

Nonetheless, in response to the concern about the Summer 2010 start for courses (and after significant discussion in the past two weeks among the leadership team, district administrators and classroom teachers) we believe we can initiate the Master's program in Summer 2009 and then add the Teacher Leadership Program to the *Math TLC* in 2010. In particular, J. Novak and R. Mayes will be charged with ensuring that the reasons for delaying the start until 2010 are addressed and do not become obstacles to the ongoing health of the *Math TLC*. We will retain a summer start date for both programs – the leadership team feels it is essential to begin both programs with face-to-face summer sessions to best foster the growth of community. So, we will plan to *start the Master's program in Summer 2009*. This will require a reallocation of budget resources as no resources were planned for teacher participants in Year 1.

Q2: Provide rationale/research to clarify what in the *Math TLC* is creating new and innovative elements, modifying of existing elements, continuing use of existing elements. The *Teacher Leadership Program is totally new and innovative*. It builds on what we learned mentoring one-on-one five high school mathematics teacher leaders over the past several years. This project extends those efforts to a full scale, 2-year, teacher leadership development program that will reach 30 to 36 teachers. Research supporting the need for leadership is given in the proposal. The Virtual Master's Program in Mathematics, Teaching Emphasis, builds on the best of the existing Master's Program in Mathematics, Teaching Emphasis at UNCo and the master's programs for middle school mathematics teachers at both UNCo and UWy. All mathematics content courses will be revised to include mathematical content from ethnically and culturally diverse origins to help address the diversity issues raised in section 3.3 of the proposal. Also, the *master's program is innovative and new in that it provides a virtual master's degree to teachers*

in rural places, including content courses offered on-line. On-line content courses in math for teachers are very rare.

Most of the courses in the master's program will be extensively restructured versions of existing courses in the UNCo master's program. The initial restructuring will (a) address the course design characteristics listed in Table 1, page 6 of the proposal; (b) be jointly conceived by math/math ed faculty from both universities; (c) be informed by focus group data from previous graduates on what was most valuable to them in the existing program as well as content they would like to see included that wasn't; and (d) take into account issues of online/virtual delivery systems. *Thus all master's courses will undergo substantial change before they are delivered for the first time.* In subsequent years, formative evaluation will be gathered from program participants and used to further restructure the course content and delivery to ensure that we are meeting the needs of the participants.

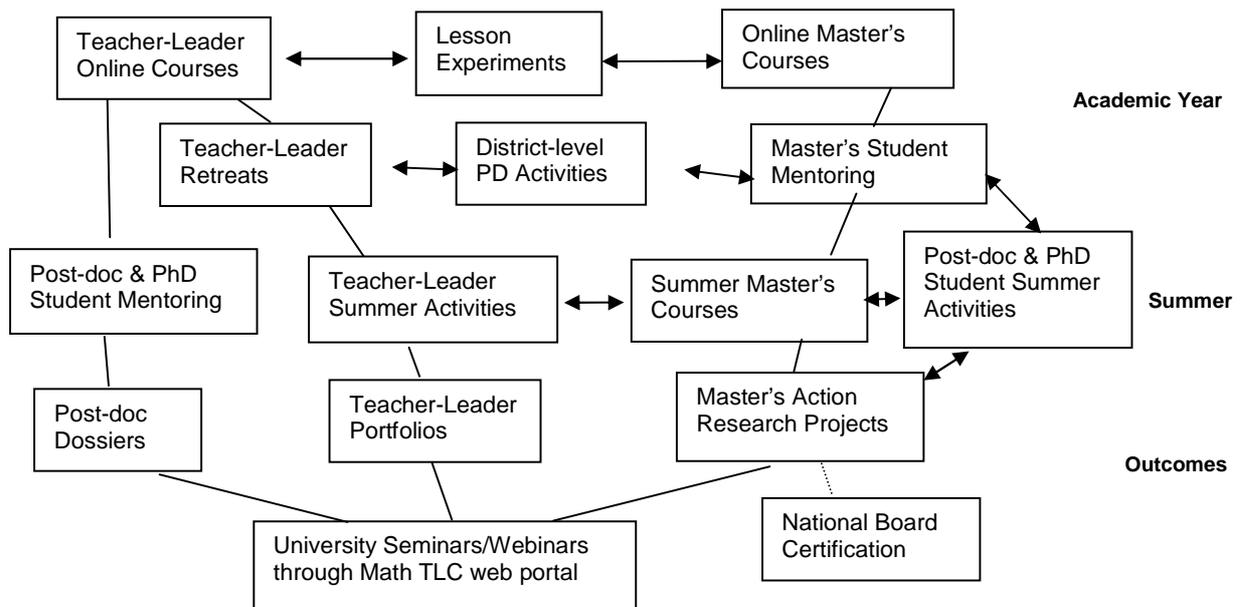
The exceptions are two new mathematics education courses, Assessment Practices in K-12 Mathematics and Teaching Mathematics to Diverse Populations which are being added to address concerns in Question 3, Challenging Courses and Curricula. Teaching Mathematics to Diverse Populations, will focus on (a) cultural differences in the way mathematics is taught and represented (e.g., in Mexico, the decimal point is represent by a comma instead of a period, the standard algorithm in Mexico for division is not the same as the standard algorithm in the USA for division); (b) alternative, accessible strategies that allow all students to access grade level content even if some prerequisite skills are missing (e.g., strategies for comparing and adding fractions without finding common denominators); and (c) culturally responsive teaching.

Q3: What criteria will be established to ensure that the courses will meet academic requirements and standards to be approved by the appropriate faculty committees at both institutions?

We will convene the *MA-UNCo and UWy Teams* (pg 13, proposal) to establish course criteria and academic requirements/standards so courses will be acceptable to faculty at both institutions. The work of this committee will be guided by existing course development rules at both institutions and by the criteria outlined in the original proposal (see Table 1 for research-based course design characteristics guiding master's and teacher-leader program offerings, pg.6; culturally responsive teaching criteria, pg. 3; goals of master's program, pg. 7). Course development activities include generating common syllabi, course materials, activities and assessments, and the online shell for distance delivery of courses. Each course will be jointly developed by a team of faculty from both institutions, further ensuring that courses will be acceptable at both institutions. The courses will be submitted to the Curriculum Committees of both universities for formal evaluation and approval. All courses will be assigned a permanent course number at each university.

Q4: Reviewers were not clear about the relationship between the master's degree program and the leadership program. To what extent is there overlap and to what extent are these separate entities? The master's degree program is a separate entity from the leadership program and is limited to secondary teachers while the leadership program accepts 4th to 12th grade teachers. The entry requirement for the master's program is a bachelor's degree in mathematic. Applicants for the teacher leadership program must have a master's in mathematics, mathematics education, or evidence of being a master teacher. We intend to identify and invite outstanding participants in the master's program to participate in the teacher leadership program. A teacher in the master's program need not participate in the leadership program. Teachers in the leadership program may

complete the master's program prior to enrolling in the leadership program, but are not required to do so. In addition, teachers in the leadership program may serve in a mentorship role and even apprentice as college instructors (e.g., as co-teacher) for courses in the master's program. The figure below shows how various elements of the *Math TLC* are structured (vertical arrows) and interact (horizontal arrows). The first and second row events happen during the academic year, the third row in the summer. The last two rows indicate outcomes of the project.



Q5: Provide the total number of individual teacher participants in both programs, the number of cohorts, and the duration of the Master's program. Indicate locations (UNC/UW) for course delivery.

Total number of individual teachers in Master's program: 60 to 72. Total number of cohorts: 4. Total number of individual teachers in leadership program: 30 to 36. Total number of cohorts: 3. We will, of course, stretch the budget wherever possible to include more participants. In Year 1 of the master's program we start with a cohort of 15 to 18 teachers. We will admit 15 to 18 new teachers in each subsequent year's cohort to sustain an annual enrollment of 30 students in the master's program. Following a similar cohort plan in the teacher leadership program, we admit 10 to 12 teachers in Year 2, add 10 to 12 in Year 3, and add 10 to 12 in Year 4 (i.e., enough to maintain the annual participation of 20 teachers-leaders).

The courses will be divided between UNCo and UWy. Over a two-year period we will split course delivery either 50-50 at each a campus or 60% at UNCo and 40% at UWy (based on the larger population in Colorado). There will always be at least two on-campus summer courses: one taught at each campus. All courses during the summer will be shared with the other campus through distance delivery (e.g., via streaming video). As the *Math TLC* virtual teaching platform is established, we will explore better alternatives to streaming video to prepare for the transition to serving multiple states as we expand the program (see proposal, page 8).

Q6: How long is the negotiation procedure expected to take? How long will the affiliate agreement be in effect? What are the anticipated barriers in these negotiations?

First and foremost, an agreement on affiliation will be reached. We have a commitment from upper administration at each university to establish an affiliation for both the virtual master's and

teacher leadership programs. Both institutions recognize the need to serve secondary STEM teachers in the rural regions in which they live and realize the *Math TLC* supports that effort. The affiliation agreement for the master's program will be completed in May 2009 and for the teacher leadership program in August 2009. The affiliation will be for a minimum of 10 years with a clause that it be renegotiated, if needed, at that time. The expected barriers are agreements to approve and accept for credit at in-state tuition rates the courses in the programs. We are confident they will be overcome as they were with ACCLAIM and CLT-West.

Q7: What precisely is the knowledge that is needed about distance delivery that was not gained from ACCLAIM research? What are the specific research questions that need to be answered that were not studied in prior work? How long will this research take? Who will be responsible for carrying out this research and what is the evaluation plan to see if the desired results are achieved?

While our ACCLAIM experience provides the foundation for *how* to establish a common platform for distance learning and a research base supporting the decisions, technology is constantly changing so *what* is established must also change. We will need to update the literature review from the ACCLAIM program with new research published in the last three years. Because the *Math TLC* embraces culturally responsive instruction, the update will include research on distance learning pedagogy, technology advances, impacts on participant learning and affect with a focus on the area of STEM distance teaching and learning *for students who are themselves active as school teachers*. Based on this updated literature review and in collaboration with Instructional Technology offices at UWy and UNCo, we will determine an innovative combination of instructional platforms that fit the needs of the teachers, including those in the rural region we are serving. The platform will include VOIP and video streaming, as well as a shared course management package. We will also work with our respective Centers for Excellence in University Teaching and Learning to develop faculty guides for online teaching of mathematics and mathematics education *to students who are working teachers*.

The specific research questions we will address are:

- What are the unique aspects of teaching STEM online that must be addressed to ensure meaningful learning for 7th to 12th grade teachers?
- What technology platform provides the most flexibility and interactivity for teaching STEM online within the constraints of delivery within a rural region?

The research will be conducted beginning in October 2008, with intermediate reports to the Project Leadership and Course Development teams every 6 months. As they are finalized, reports and recommendations will be offered to peer-reviewed journals and conference outlets. The research will be conducted under the direction of R. Mayes, who conducted the original study on technology in STEM distance education for ACCLAIM. The research team will include Heng-Yu Ku from UNCo and graduate students supported by the grant. The evaluation plan will be by the external evaluator and will include data and analysis on meeting the research deadlines to inform practice for the online courses, review of the study by the National Advisory Board, and formative and summative evaluations of the impact and barriers to teachers' learning in the program courses due to the technology platform and online pedagogy.

Q8: What particular project management challenges or obstacles, if any, do you foresee in your proposed Institutes Partnership? What strategies do you propose to address these challenges? Once the affiliation agreement is completed, courses will be assigned to the partner universities and funding from tuition will be determined. Project management will focus on development of quality courses, many in a distance education format, that are accepted for credit in a virtual program across the partner universities. This will be a challenge but not an obstacle: we have

designed structures for course development (see Q3 this section) to ensure any issues will be addressed jointly. Courses will have to be assigned as being taught in load for the faculty, not as an overload course, a challenge faced by UWy. UNCo does not face this challenge as the courses in its master's program are already taught in load by faculty.

While the courses will be assigned based on the expertise of faculty across the institutions, faculty at both institutions must have ownership in all courses in the programs. The consequences of not addressing this issue are a disconnected program that leaves teachers and faculty confused about intended outcomes. The strategies we will use to address these challenges are addressed in Q3 and Q4 above. An additional strategy for dealing with the issue is to have classes taught by cross-university teams of professors (at least one person from each university faculty on a course team, with a lead-professor identified based on where the tuition goes for that course). We will assign courses to universities on a rotating schedule so that each university eventually leads all the courses. A course stewardship committee for each course will review the course content and materials, assess its success at meeting stated goals (e.g., student evaluations), and guarantee continuity of curriculum and goals over time.

The Partnership and Its Management/Governance Plan

Q1: Please describe how the University of Wyoming will play a leadership/management role in the project and how Wyoming schools will be partners; evidence that this project is "Partnership driven." The University of Wyoming will play a leadership and management role in the *Math TLC* project. UWy professors R. Mayes and B. Shader are Co-PIs on the project and serve as members of the Project Leadership team. Mayes will serve as lead of the affiliation team, a co-leader of the master's program development team and as a member of the teacher leadership program team. UWy will take a leadership role in establishing the common virtual learning platform. UWy will also take a management role in working with participating school districts and teachers from Wyoming. UWy will develop and teach a minimum of 40% and maximum of 50% of the courses in the project and receive tuition and fee revenues from courses it teaches (this distribution matches the anticipated 40% Wyoming, 60% Colorado teacher participation in *Math TLC* programs). While data from the two Wyoming core partner school districts was not included in the proposal submission, we do have data and a firm commitment from those school districts (Laramie CSD 1 data is attached). The school districts in Wyoming and the teachers from those school districts participating in the project will be equal partners with those from Colorado. Due to population considerations, the split among participants will be 60% Colorado and 40% Wyoming (i.e., about 12 of 30 teachers each year in the master's program and 8 of 20 teachers the leadership program each year will be from Wyoming). Wyoming and Colorado teachers will take part in the same programs, attend the same courses and seminars, and receive courses from both UWy and UNCo. Responses to the questions concerning Institute Design attest to the strong level of collaboration that underpins this project.

See Q2, under Institutional Change and Sustainability, for information about increased representation of school districts in Wyoming.

Q2: Please provide a detailed timeline that incorporates the work of project teams to indicate when activities will start and end.

See Timeline, Appendix 1. We are adding two new project teams, a District Math Team composed of a math curriculum coordinator/coach for each core and supporting partner and a District Curriculum and Instruction Team composed of representatives from each core and

supporting partner's curriculum and instruction office. The District Math team will meet quarterly with various *Math TLC* project teams to provide advice about how to best serve math teachers. The District Curriculum and Instruction Team will meet semi-annually with the Project Leadership Team to provide guidance on meeting district needs and to problem-solve about making the best use of the expertise of participants in and from the program.

- District Math Team, Core Partner members: M. Christiansen (Greeley District 6), K. Canine (Poudre School District), L. Frasco (Ft Morgan School District), K. Williams (Laramie County School District 1); others to be identified from each partner district.
- District Curriculum and Instruction Team: D. Selzer (Greeley District 6), J. Perry (Ft. Morgan School District), J. Parker (Northeast BOCES), C. DeWayne (Poudre School District), and others to be identified from each partner district.
- Except for the work of M. Christiansen and K. Williams on the Project Leadership Team, all work by members of the District Math Team and District Curriculum and Instruction team is part of the school districts' commitment of time and resources to the project.

Q3 AND Q4: Indicate the release time, support and resources that will be available to each master or leadership teacher when they return to their schools and districts to implement what they have learned. How will the career paths of the Math TLC program participants from each district be documented?

The District responses integrate answers to the following questions:

- Questions 3 and 4 in "The Partnership and Its Management/Governance Plan";
- Question 3 in "Teacher Quality, Quantity and Diversity";
- Question 5 in "Challenging Courses and Curricula"; and
- Question 1 in "Institutional Change and Sustainability."

Greeley-Evans (Weld County) School District 6 Response

Teachers from District 6 who participate in the Math Teacher Leadership Center will provide leadership in the district through: Participating in ongoing K-12 "vertical" curriculum alignment teams; serving on selection committees for instructional resource adoptions; participating in the review of existing courses and suggesting additional courses as necessary to provide challenging coursework for all students; working as math department chairs (grades 6-12) or building content leaders for math (grades 4-5); serving as grade-level representatives on the District Curriculum Council; peer coaching activities; facilitating elementary math trainings during the school year; and developing and facilitating professional development courses for teachers at the appropriate grade level. In addition, these teachers will be encouraged to apply for newly established instructional coaching positions in District 6. Individuals will receive compensation or release time as appropriate and necessary to complete the activities outlined above.

Poudre School District (PSD) Response

A PSD major initiative is to implement Response to Intervention by using Professional Learning Communities for school, feeder system, and district-wide collaboration. To improve learning for all students, the district will strive to answer the following four, guiding questions:

- What is it that we want all students to know?
- How will we know when they have learned it?
- What will we do when they do not learn it?
- What will we do when they already know it?

Thus, the master's and leadership teachers will be asked to participate in monthly District Content Team meetings after school and to attend and plan quarterly feeder collaboration

meetings to work on horizontal and vertical articulation; they will be compensated with after-hours pay or be given release time, appropriate to the meeting. As these master/leadership teachers work at their individual school level to answer the four questions, release time, support, and resources would be determined by the building principal. As this work progresses, additional responsibilities for the master/leadership teachers may emerge and the district is committed to providing additional release time, support, and resources to these teachers.

PSD seeks one instructional coach (master/leadership teacher) at each secondary school (14 schools) who will work within their school to answer the four guiding questions. Coaches would attend monthly as indicated above; once schools are working on the second guiding question, instructional coaches would help develop summative and formative common assessments. Once essential learning and common assessments are in place, PSD will work to answer the last two guiding questions above. Schools are, and will be, investigating intervention and enrichment options. The MSP *Math TLC* institute will help educate teachers in PSD about meaningful intervention and enrichment. The Institute participants will work with K. Canine and the Gifted and Talented Coordinator to meet the needs of all students.

K. Canine, PSD Mathematics Curriculum Facilitator, will act as a liaison to PSD administration (mainly reporting to J. Borman, Executive Director of Student Achievement and Staff Development, and C. DeWayne, Director of Curriculum, Instruction, and Assessment) and work with the district Mentor Coordinator, to set up new teachers with Institute participants as mentors. Institute participants will help plan and facilitate new teacher trainings as well as work as instructional coaches in their buildings.

Fort Morgan School District Response

Fort Morgan is in the first year of a focused three-year initiative to improve the mathematics education and achievement of all students and build the infrastructure to institutionalize this initiative. As a result of our commitment to improving mathematics teaching and learning district-wide, we are paying close attention to the implementation of our textbook adoptions in mathematics. Teacher leaders will have multiple opportunities to support courses and curricula that meet the needs of all students. Master teachers and teacher leader participants from the *Math TLC* will have ample opportunity to engage in the following activities.

- Plan, develop and deliver mathematics professional development during in-service days.
- Plan, develop and deliver summer math academies for teachers of all grade levels
- Work with district instructional coaches to facilitate professional learning communities
- Lead grade level team meetings in each building
- Serve as mentors to pre-service teachers and new teachers.
- Serve on the District Improvement Committee that develops and revises pacing guides for mathematics instruction and reviews curriculum
- Monitor consistent implementation of curriculum across buildings
- Suggest and implement intervention to meet the needs of all students
- Have a math master teacher/teacher-leader for each building (7 buildings).

Teachers will be compensated with stipends and release time, for engaging in these activities.

Northeast Board of Cooperative Education Services (NE BOCES) Response

The role of NE BOCES, a supporting partner in this project, is to provide support services to smaller districts that lack resources to fund these services themselves. While NE BOCES has

funds to support teacher leaders and many opportunities to use what they learned, in the end, it will be local district that benefits the most from the teacher participants. Part of the application packet for teachers from schools in NE BOCES will be a letter of commitment from the school principal or district superintendent to provide resources, release time and support to the teacher leaders to make use of their training. NE BOCES will:

- Call on teacher leaders to participate in Response to Intervention Training and take it back to their schools and districts
- Provide financial and training support for teachers to become math coaches.
- Involve master teachers/teacher leaders in induction programs and as host teachers for pre-service teachers. This will provide significant opportunities to use their knowledge and experience to support the growth of new teachers.

Member districts are currently looking for curriculum that will meet the needs of all students. Program participants will help identify appropriate curriculum and support an implementation of that curriculum and courses that meets the needs of all students.

Laramie County School District #1

Laramie School District will:

- Provide a substitute for teacher leaders to attend a retreat once per semester while they are in the *Math TLC*.
- Work with teachers in the master's program to use the district scheduled professional development days to attend professional development related to the master's program.
- Support teacher travel to attend program events and to present on the programs at state or regional meetings as a means of providing PD and disseminating what they learned.
- Encourage and support teachers to (1) develop professional learning communities and lesson study groups within their schools (2) offer summer PD for teachers in the region.
- Engage teachers in leading PD days for teachers within the district calendar.

We are currently using the professional learning community model, and leaders from these programs would be highly valued in buildings that are struggling for guidance in making the model work effectively. We have tried to find curricula that will address all students' needs. The *Math TLC* should help teachers find the confidence to use these materials more effectively and better address students' needs. A good opportunity exists for revising curriculum based on the research gleaned from these programs and to guide us in our future curriculum decisions.

Summary Remark. These represent a sample of answers to district focus questions. We expect similar answers from other districts that didn't respond (many are currently on summer break).

Career Paths. The career paths of the *Math TLC* program participants will be documented by the external evaluator with support from identified district personnel. In particular, we will (1) monitor their position title to track changes in their official role in the district; (2) conduct annual surveys of program participants asking them to describe the leadership activities they have participated in during the prior year and to reflect on how their role as teacher and as a leader may have changed as a result of being a participant in the *Math TLC*; (3) conduct annual focus group interviews with participants and graduates about their leadership roles; (4) ask district representative to document leadership roles they ask the program participants to take on; and (5) conduct observations of a sample of project participants in leadership roles such as leading professional development.

Q5: Qualifications, Experience and Responsibilities of the Project Manager:

Required Qualifications and Experience	Preferred Qualifications and Experience	Responsibilities:
Detail oriented	Experience with project management	Liaison to teacher participants
Bachelor’s degree in math or math education	Master’s degree in math education or mathematics	Recruit participants, oversee and coordinate recruiting
5 years teaching math (minimum) in public school; at least 2 years in CO or WY	Teacher-Leadership experience in mathematics/math education	Attend meetings of project leadership team as member and note-taker
Willing to travel in and around Colorado and Wyoming	Willing to travel to national meetings	Coordinate off site meetings for participants and advisory board
Outgoing, kind, and patient	Experience working with university and K-12 faculty and administrators	Assistant to PI and Project Leadership Team
Able to work year round		Other duties as required

Q6: Please provide details and describe the metrics that will be used to determine that the project infrastructure has been established and is effective.

We addressed the infrastructure required above, in Q1 under “Institute Design.” The external evaluator will interview the project leadership team, determine the degree to which the stated Year 1 goals for developing infrastructure have been reached, and seek formative feedback from the Project Leadership Team, the Affiliation team and the Math TLC Advisory Board on how to better reach any unmet goals. The external evaluator will debrief the advisory boards as to the effectiveness of the infrastructure. Our semi-annual progress check meetings (see Question 2h of Project Evaluation) will evaluate the effectiveness of our infrastructure and suggest adjustments as needed. Effectiveness will be measured by both quantitative and qualitative measurements. For example, the external evaluator will monitor how many of our objectives have been met and at what level they were met, and will include matrices that reflect project goal deadlines and at what level they were met.

Q7: To what extent will the proposed program reach the rural populations the PI's claim?

We have a plan to guarantee that 40% of teachers will be from rural school districts. First we will recruit from rural schools among our partners. The Carbon County School District in Wyoming represents four rural districts and Northeast BOCES represents 12 rural districts in Colorado. While we will give priority to participants from rural partner schools, we will actively recruit from all 116 rural districts in Colorado and 29 rural districts in Wyoming. According to NCES, these rural districts make up 65% of all districts in Colorado 60% of all districts in Wyoming, respectively.

Second, we will intensively recruit from rural districts in the following ways. The UWy SMTC and UNCo MAST Centers have extensive networks of teachers across Wyoming and Colorado and will serve as the recruitment arm of the project through list serves, websites, and personal contacts that have been developed over 40 years of working with STEM teachers in the region. The SMTC Coordinator, Sylvia Parker, will recruit rural teachers for the program through the

statewide needs assessment that SMTC conducts every year and will recruit face-to-face as she travels through the state of Wyoming to work with rural school districts. In Colorado, the program manager will personally contact mathematics teachers in rural schools. Fliers on the program opportunity will be sent to all rural school district superintendents, principals, and secondary mathematics teachers in Wyoming and Colorado both electronically and by mail.

We will actively recruit teachers from Native American school districts in Colorado (Southern Ute Indian Reservation and the Ute Mountain Indian Reservation) and Wyoming (the Wind River Reservation), through the methods outlined above. The UWy SMTC has an established partnership with the Wind River reservation school districts through two state MSP projects. UNCo math faculty have relationships with the two Colorado Indian Reservations. We will build on the work in STEM education already taking place and partner with the state MSP efforts.

Teacher Quality, Quantity and Diversity

Q1: Please describe the recruitment process, how will it be assured that there are enough teachers?

In addition to the information immediately above, our recruitment plan has two parts. In the first, we will use District and BOCES conduits for information flow to let teachers know about the opportunities to participate in the Master's program and the Teacher Leader program. Recruiting will continue year round with intensive efforts from November to April. Additionally, district and BOCES representatives will be asked to identify individuals with good potential for the leadership program and these individuals will be personally invited to apply for the program. Teacher Leadership candidates will also be recruited from previous graduates from the Master's (secondary and middle school) programs at UNCo and the middle school master's at UWy. We will also be identifying and recruiting outstanding individuals from the new virtual master's program. We will specifically target teachers in rural schools and high-diversity schools. The Program Manager will assist with recruitment by following up on email and phone inquiries and actively contacting identified teachers in rural schools.

The region to be served includes vast rural areas but also urban areas with larger concentrations of teachers. There is a sufficient pool of candidates for the programs, as is witnessed to by the current enrollment in master's programs for mathematics teachers at UWy (22 teachers currently in the middle level program) and UNCo (average of 50 per year). We have an aggressive and comprehensive recruitment plan (see question 7 in the Partnership section). Selection criteria for teacher participants from among those whom apply include:

- Meets minimal requirements in years teaching mathematics and mathematics content
- Fulfill 40% Wyoming teacher quota and 60% Colorado teacher quota
- Fulfill 40% rural teacher quota
- Underrepresented populations included at levels that represent state diversity
- First priority given to those in core partner districts, from rural schools, who enhance diversity of the workforce
- Second priority will be given to those from supporting districts
- Third priority will be given to those who are not in participating districts
- Within each of the above categories, priority based on the strength of application packet

Laramie County School District #1 has 13 mathematics instructional facilitators who would benefit from this program. We currently have 60 secondary mathematics teachers, some of whom would be very interested in a program such as this. We have a Title I junior high in Cheyenne, but we haven't attracted teachers to this school that match the makeup of the student

population. This would be a huge benefit to this school, as well as the new high school that will be opening in the fall of 2010, as it will be in the same geographic area.

District	Middle School Math Teachers	High School Math Teachers	Teachers Leaders
Northeast BOCES	15	12	12 (1 per district)
Ft Morgan	4	7	7 (1 per school)
Pourde	43	43	13 (1 for each middle and high school)
Greeley District 6	27	30	17 (1 for each of their middle and high schools and 7 for identified elementary schools)
Totals	89	92	49

While not all of the high school and middle school math teachers will want to pursue our master's degree, a conservative estimate of 1/4 of the high school teachers and 1/8 of the middle school teachers leads to a potential 33 teachers from the identified partner schools in Colorado alone. Add to that the corresponding number of teachers from Wyoming and those we will recruit from throughout the two states and we are confident that we will have enough qualified candidates for participation in our master's program. Historically, the yearly enrollment for UNCo's current master's program for secondary math teachers is 20-30 with half of that new each year. We are planning to admit cohorts of 15-18 teachers in the master's program each year, with the added enrollment from Wyoming. We expect to meet target numbers each year.

All together the partner districts in Colorado have an identified need for 49 teacher leaders; combining this with the needs from Wyoming partner districts and focused recruiting from rural districts in Wyoming and Colorado, we are confident that we will find enough qualified candidates for participation in our teacher leader institutes.

Q2: Describe briefly how the Institute program is intended to impact pre-service courses and programs, and other undergraduate courses/programs, at both UNCo and UWy.

Although the focus of the *Math TLC* programs is on inservice teacher leadership, the project will have impact on the pre-service programs in a variety of direct and indirect ways. Teachers in the leadership program will interact with pre-service teachers at UWy and UNCo through their instructional apprenticeship experiences in undergraduate mathematics methods courses. The apprenticeship experience may involve face-to-face teaching of components of the methods course or a virtual online interface with the pre-service teachers where the teacher leaders share real world classroom experiences. Indirectly the college faculty teaching the courses for the master's and leadership program will grow from their work with teachers in the field. This growth will be reflected in the content and pedagogy courses they teach. We will call on participants in both programs to serve as host teachers for student teachers and other pre-service classroom experiences. (UNCo and UWy require pre-service teachers to spend time observing and working in classrooms for 3 semesters before they student teach.) We also expect participants in both programs to serve as mentor teachers and to work with math teachers in induction programs. The application process includes an agreement to engage in these activities.

Q3: Provide details of the efforts that the Institute participants will carry out in their school district such that a more qualified mathematics teacher workforce will exist in the partnering school districts. The master's program is directly focused on enhancing the quality of an already qualified mathematics teacher workforce by increasing their content knowledge, pedagogical content

knowledge, ability to teach a diverse population and awareness of research in mathematics education, thus creating a more qualified mathematics teacher workforce. The teacher leadership program builds on the knowledge and experience of master teachers to develop a variety of leadership skills in K-12 mathematics education. While both of these programs start with qualified teachers, we expect that their work in districts, both individually and collectively, will result in a more qualified teacher workforce. In this program, we create a cadre of quality, qualified master teachers and teacher leaders to work with existing and newly hired teachers to be more effective mathematics instructors (where effective is defined as that which lead to increases in student learning), that is, to increase the quality of the teachers. If the existing and new teachers need appropriate content knowledge and pedagogical content knowledge, the teachers from this project will be in a position to support the improvement of their content knowledge and pedagogical content knowledge through individual mentoring as well as school and district professional development. The partner schools districts realize the value of our teacher participants and intend to provide multiple opportunities for these teachers to impact mathematics teaching and learning throughout the districts. See specific details provided above, under Q3 AND Q4 by some of our partner schools.

The external evaluator will gather data on mathematics teacher retention and work with district-maintained data to monitor retention. We will gather data on retention of all math teachers but disaggregate it to focus on retention of teachers who either participated in the program or were mentored in some way by participants in the program. We expect the retention rate for teachers who participate in the program to be higher than for those who do not. We also expect that teachers who are mentored by or see role models in our program teachers will have an increased retention rate. The teacher leaders will have a positive impact on mathematics teaching and learning at the school and/or district level, which will impact retention across the board. However, the reasons teachers leave a school or district are varied so it will be important for the external evaluator to contact a sample of those who leave (as well as those who stay) to determine reasons for leaving (staying) and track those who are changing teaching positions or moving to a leadership position in mathematics education.

Challenging Courses and Curricula

Q1: Provide details about the precise role played by UWy, particularly the faculty in the math department. The UWy Math Department has a strong tradition in teacher training and over the past 20 years has worked on several successful teacher training programs (e.g. NSF-funded Model Masters Program, the NSF funded Middle School Math Initiative, and the privately funded Wyoming High School Math Teachers' Summer Institute). These involved curriculum development of content courses designed specifically for math teachers, and some long-distance delivery of courses. The leadership/management and course development roles of UWy faculty were addressed above in the Partnership section. The mathematics faculty will serve as instructors of content based courses in the masters program and collaborate with mathematics educators at UWy and UNCo on integrating content and pedagogy across the courses in the programs. UWy math department mathematics educators will take a leadership role in developing the mathematics education courses for both programs. In addition the Chair of the Mathematics Department, Bryan Shader, is serving as a member of the Project Leadership Team and the Master's Program Team. The following UWy mathematics department faculty have a significant interest in professional development for mathematics teachers: David Anton, Michelle Chamberlin (ME), Farhad Jafari, Sylvia Hobart, Lynne Ipina (ME), Chanyoung Lee,

Greg Lyng, Eric Moorhouse, John Spitler, and Bill Weber. Over the course of the project, we anticipate that many of these faculty will participate in the program. The other mathematics educators (B. Mayes, co-PI, L. Hutchinson and S. Chamberlin) at UWy are affiliates of SMTC.

Q2: Provide details to show that content courses for teacher participants focus on math beyond what learned in their pre-service preparation and beyond that of the grade level they will be teaching. Both UNCo and UWy math faculty have extensive experience teaching content courses for pre-service secondary mathematics teachers and are committed to expanding their content knowledge beyond what they've learned and what they will teach. Part of our approach to the content courses is to provide an advanced mathematical perspective on what is taught at the high school level. As described by Zalman Usiskin in his text, *Mathematics for High School Teachers – An Advanced Perspective*, this perspective is based on the following principles:

- Content will be rooted in the core mathematical content of high school mathematics
- Concepts emanate from the major concepts studied in high school mathematics, but extended so that teachers see the connections to collegiate level mathematics and understand more deeply central concepts and theories
- The concepts will be treated from an advanced mathematical perspective, but they will relate to what is taught in the classroom rather than an abstraction meant to prepare one for study in a doctoral mathematics program

The courses will provide teachers the opportunity to engage in concept analysis, problem analysis, and making mathematical connections. In addition to being a sound mathematical approach, this addresses the needs of adult learners for the content they learn to be relevant to their professional lives. Now we address some specific courses:

- The Modern Geometry course will focus on non-Euclidean geometries and modern applications of geometry. Most pre-service geometry course focus on Euclidean geometry and just touch on non-Euclidean geometries while the typical high school geometry courses focuses only on Euclidean geometry.
- The Continuous Mathematics is designed to provide teachers the theoretical background to teach calculus as well as introduce them to modern topics in analysis such as chaos theory. Many teacher prep programs (including the one at UNCo) do not include a course in analysis. Again, the typical high school calculus course does not address the theoretical underpinnings of calculus.
- The Applied Probability and Statistics course needs to be revamped in acknowledgement of the increasing number of AP Stats course being offered in high school. In particular, it needs to provide good theoretical groundings for the content in the AP Stats course, much as the Continuous Mathematics course provides grounding for the high school calculus course.
- An overview of content to be taught in the courses is presented in the appendix to the proposal – Supplementary Documents, page 9.

Q3: Comment on suggestion for changing course offerings from 4 to 2 methods courses.

The assumption of our program is that through the pairing of content and pedagogy courses the teacher has the opportunity to grow both in content knowledge and how to implement that knowledge in the classroom. It is essential that teachers experience the connection between advanced perspectives in content and how it can change teaching practice in the classroom. Too often teachers are provided more abstraction in the subject, with no idea how it relates to the classroom. The end result is no impact in the classroom. Our view is that the issues of cultural responsiveness, rural issues, and ethno mathematics must be embedded in every course to have

an impact, not taught as isolated and insular topics. Teachers will experience these as an underlying ethos of every course they take and as a part of every class they teach.

However, we see the value of the recommendation to have a methods/pedagogy course focused on issues such as cultural responsiveness, rural issues and ethno mathematics (see the description of the course Teaching Mathematics to Diverse Population in the answer to Q2 Institute Design). Consequently, we will explore offering three paired math content/math education course (Geometry with Teaching Geometry and Applied Probability and Statistics with Teaching Applied Probability and Statistics, with the third pair to be determined from the remaining two choices) and the just described mathematic education course. To make this decision, we will consult with the mathematicians and mathematics educators at both universities as well as our regional and national advisory board about what will best meet the needs of teachers. We expect such decisions to be made in Year 1 and revisited as courses are developed and implemented.

Q4: In what ways will the planned Teacher Institute enhance teachers' content knowledge and pedagogical skills to reach all students? To reach those who are traditionally underserved in mathematics/science and those who are mathematically gifted?

The focus on culturally responsive teaching in the programs provides a foundation for teachers to reach all students. Teachers will experience mathematics from different cultural perspectives and learn how to identify and incorporate such perspectives in their own teaching. Students from underserved populations will be given multiple perspectives from which to view mathematics including ones that appeal to their own experiences of community and culture. *Math TLC* programs will also provide teachers the opportunity to develop a deeper understanding of concepts central to the discipline; concepts that reoccur in mathematics and provide for a more comprehensive view of the subject. A deep understanding of central concepts is the most powerful tool a teacher can have in working with the mathematically gifted. It instills in the teacher the confidence to let students explore open-ended problems, make and test conjectures, and discover mathematics. All students need these opportunities but a teacher comfortable with these approaches is more likely to differentiate instruction and challenge gifted students in the moment instead of needing to have something prepared ahead of time.

Q5: Are there specific plans for curricular revision in core partner districts to meet the needs of particular groups of students? In general, what will be the "value added" of the proposed MSP Institute in curricular/course improvement in mathematics, grades 4-12 in each partner district?

See Q3 AND Q4 above under "Partnership" for district's responses to this item. Also, Colorado and Wyoming are currently revising their Mathematics Standards. As that process progresses over the next several years, we expect that the training our teacher leaders receive will prepare them for helping teachers, schools, and districts understand, implement and evaluate the new standards. The value added aspect of the master's and leadership programs is the development of teachers who are *ready* for change and capable of *leading* change. Curricular change with a focus on improving a student's abilities to apply mathematical concepts to interpret their world, to be a democratic citizen, and to develop mathematical understandings that lead to future opportunities, requires a teacher who has a deep understanding and confidence in their mathematical ability. The proposed master's program will provide such confidence and understanding. One key agent of change is a capable and knowledgeable leader. The leadership institute will provide such leaders. In meeting Goals 1 through 4 as stated on page 1 of the proposal, the *Math TLC* will have supported master teachers and teacher leaders to build the knowledge and awareness in ways that meet the needs of *all* students. In particular, the program

focus on pedagogical content knowledge, cultural competence and culturally responsive teaching will lead to changes in the classrooms of participants in our program and in other teacher's classrooms as teacher leaders engage in leadership throughout the school and district.

Institutional Change and Sustainability

Q1: What specific changes are proposed in organizational/institutional policies and practices to support improved math learning and teaching in (a) core higher education partners, and (b) core K-12 partners? An important part of this project is the focus on culturally responsive teaching and developing culturally competent instructors at both the university and K-12 levels. As faculty and K-12 teachers increase their cultural competence and become culturally responsive, their ability to effectively teach all students will increase and we will see improved mathematics teaching and learning. In particular, to measure the changes in practice, we are going to observe master's classes and evaluate the level of university faculty's cultural responsiveness. We have a feedback loop in place to bring formative assessment information from the teacher participants and the advisory board to the faculty instructors about the effectiveness of their instruction and the appropriateness of the course content. (See Evaluation, Q2.) Faculty will be held accountable for incorporating this feedback into subsequent course offerings in the program.

Examples of organization change.

- Mathematicians and mathematics educators will co-develop courses, substantially increasing their collaborative efforts as they develop integrated content and pedagogy courses.
- We are delivering virtual master's and teacher leadership programs that will take advantage of today's technology to provide access to all teachers. We are making it possible for teachers to pursue a master's degree or leadership training with minimal disruption to their professional and personal lives.
- We are sharing our expertise in mathematics and mathematics education across campuses for the good of improving mathematics teaching.
- Mathematicians and math educators will expand their instructional repertoire to include interactive technologies in course delivery, such as streaming video, VOIP, Web 2.0, etc.

It will require school districts to rethink their professional development models and reward structures for mathematics teaching; allowing teachers the time and support to create professional learning communities, conduct lesson and book studies, guide and even lead content-based professional development within the district. See Q3 AND Q4, "Partnership" section for more on district responses to this issue. In particular, Poudre School District (PSD) responded: "As Poudre School District learns more about what is required to educate all children to unprecedented levels of achievement, the district landscape is attempting to factor in parent, educator and community interests to prepare all students for the challenges of a global economy. In PSD, these forces for improvement are playing out in several ways. First, the district has four learning goals for system wide improvement: grade 3 reading proficiency, annual student academic growth, more students post-secondary ready, and successful transitions for all students. By focusing on these four goals and using these as the impetus for change, students will be on course to be prepared for the academic challenges that face them."

Q2: Please provide details of the plans/mechanisms for oversight of partner school districts. This is an oversight on our part. We will add a mathematics coordinator from Wyoming to work with the Colorado coordinator as part of the Project Leadership Team. Kristin Williams, Laramie County School District 1, will assume this role. See Q2 Partnership where we discuss

the District Math Team (DMT) , the DMT will meet quarterly with the Project Leadership Team (PLT) to address issues of coordinating efforts across states.

Q3: What are the incentives for recruitment and sustained involvement of faculty in the Institute, especially faculty in the mathematics departments of both UNC and UW? What criteria will be used by each university to assess a faculty member's contribution to Institute work?

In addition to the institutional vision and support for this project that was discussed in response to previous questions, we have commitments from the Department of Mathematics chairs as well as mathematicians and mathematics educators from both universities to support this project.

UNCo Mathematical Sciences has a long history of mathematicians and mathematics educators working together on program design in their existing mathematics education programs at the undergraduate, master's and PhD levels and to research in undergraduate mathematics education. Ten faculty from UNCo (see page 10, supplemental documents) are currently committed to our Master's program for secondary teachers and have indicated their support for this project. The department chair is committed to this effort and will help negotiate the affiliation agreements; input was solicited from faculty at several committee meetings and one department meeting to craft a proposal that included their ideas and addressed their concerns.

Mathematical Sciences at UNCo already recognizes contributions by all faculty to teacher education programs in their evaluation, promotion and tenure processes. In particular, two mathematicians were recently promoted to full professor based partly on their significant contributions to mathematics teacher education. The criteria used by UNCo to assess a faculty member's contributions are the criteria currently used by the department and university since they already value and reward contributions to teacher education programs.

As the only state-funded 4 year university in Wyoming, the UWy Mathematics Department recognizes the crucial role that it must play in training math educators, and working with schools throughout the state. Therefore, the department values such activities of its faculty in the tenure and promotion process and in its merit system. Significant involvement in curricular development is indeed an expectation for our associate and full professors. One of the UWy Math Department action items in its 5-year academic plan is to play a central, supportive role in teacher training and mathematics education. The UWy Mathematics Department recently hired a mathematics educator into the department, evidence of support for mathematics education initiatives within the department. See Question 1 under Challenging Course and Curricula also addresses of UWy's Mathematics Department commitment to the project.

The criteria for assessing a faculty member's contribution to the *Math TLC* will include: number of courses developed for the program, number of courses taught in the program, evaluation of course success and impact on student learning, participation in Advisory Board meetings, and work on course and curriculum evaluation for the project.

Q4: How will the quality of this collaboration be evaluated? How will this institutional change be documented and how will it be sustained?

The development of online courses and integrated mathematics/pedagogy courses will require substantial new collaborations both within the universities and across universities. The program will track faculty development and implementation efforts, with a focus on identifying the most innovative components of the new courses. The quality of the collaboration on courses will be assessed by the *Math TLC* Advisory Board as well as curricular committees at each university.

Currently, mathematics and mathematics education faculty at UNC and UWy collaborate on program design for teacher education programs for pre- and in-service programs and we expect that to continue in this program. What is over and above are collaborations between mathematicians and math educators on the coordinated math and math education courses. In the past, there has been little communication between the instructors of these courses. In this project, instructors of these two courses will meet regularly to develop these courses and ensure that the content of the courses complement each other. We also expect research collaborations between mathematicians and math educators as we are conducting an extensive research component in this grant. For it to be successful, mathematicians and mathematics educators will be jointly investigating the research questions we've posed. See pg 10-12 of the proposal.

UWy mathematics and mathematics education faculty have collaborated on the development of the newly implemented concurrent majors program, requiring a much stronger content focus for secondary mathematics teachers. In addition, the mathematics and mathematics education faculty collaborate on outreach projects for mathematics teachers through the SMTC. Our focus on development of distance component across two institutions also requires fundamental change, resulting in collaboration not only across mathematics and mathematics education, but across universities. Sustainability flows from these programs becoming university program taught in load by both institutions. These collaborations will be sustained through the stewardship course committees discussed in Q8, Institute Design.

We expect many juried presentations and publications to result from these efforts. One way to measure the quality of the collaboration and document it is through the number of juried presentations and publications resulting from collaborative scholarly work. In addition, the project will be hosting a web portal to disseminate what we've learned in the project (see Proposal, page 14), providing another opportunity to share the results of collaborative work. To ensure the quality of materials posted on this site, a subcommittee of the advisory boards will serve as an editorial board for the website to evaluate material for posting. This will provide another venue for evaluating the quantity and quality of the collaborations, which will be documented by the external evaluator, including such measures as number of courses created and implemented and articles published on innovations in courses or in teaching online.

Q5: Provide evidence that the Partnership's plans are likely to foster institutional change that will sustain the Institute programs beyond the term of NSF funding.

In addition to the discussion in the previous four questions, the two partner universities have a long history of serving their respective states in the area of STEM education. This is evidenced by the success of their STEM education centers UNCo MAST and UWy SMTC. This regional effort to serve the needs of mathematics teachers is much needed and fits the mission of the two partner institutions. This proposal allows the two universities to share resources and human capital to serve a need that neither has the capacity to do on its own. A program so mutually beneficial to all its partners has an excellent chance of sustaining itself.

Evidence-based Design and Outcomes

Q1: This answer to this question is part of the evaluation plan and is included in that section.

Q2: Provide details indicating the plan to address the challenges associated with this commitment to school and districts in rural areas and how the proposed plan for implementation might need to be adapted.

Elements of the project design, such as offering courses using various distance technologies and reducing the amount of face-to-face time required in the summer, are our initial attempts based on our experiences with ACCLAIM and CLT-West to address the issues of distance for rural educators. As we implement the project, we will be flexible with respect to including online courses as we move to a more virtual format. Technology is the basic answer to the challenges presented by serving rural areas—technology allows us to overcome distance through discussion groups and VOIP, creating professional learning communities virtually. We will be working with H. Ku, professor of Educational Technology at UNCo, to research the effectiveness of our online delivery systems. Based on this research and feedback from formative evaluation and our other research efforts, we will adjust and adapt as needed to ensure access to rural educators. The external evaluator will make extra efforts to ensure that we receive enough information from rural educators to inform the formative and summative evaluation.

Q3: What is the proposed project's "value added" to any substantial, prior work in which you have been engaged? How will the "value added" of this Institute work over substantial, prior work be evaluated? The value added of this proposed project is using past experiences with ACCLAIM, CLT West, and RMSTEIN to create a virtual master's and leadership program that will not only serve secondary mathematics teachers in rural areas but also those teachers from more populated areas who for a variety of reasons need access to quality online mathematics education programs. We can evaluate this added value component by the number of teachers that participate in the two programs and their impact in their districts – creation of learning communities and lesson study groups, provision of professional development for the district.

In addition, the project lays the groundwork for several other projects including: (1) expanding the region served to the Rocky Mountain West, (2) expanding the content to all secondary STEM disciplines, and (3) expanding the partnership to include other universities. This project serves as a pilot program for these much bigger projects in the future.

Q4: In what ways is your proposed project innovative? In what ways will the proposed Institute add to the knowledge base on improving the teaching and learning of mathematics? What is the potential for dissemination of the proposed Institute model and why? The innovative aspects of the model include: creation of a virtual collaborative content-based master's degree in STEM education; creation of a leadership institute that builds on a master's degree; focus on culturally competent teaching; and a complex systems approach to learning in the classroom. The project will provide research on the effective use of technology in teaching mathematics online, including the teaching of mathematics content online. The project will provide research on the impact of a novel leadership program on district level leadership in mathematics education. The potential for dissemination is extensive; as we refine the program, we will disseminate it to a broader region with additional higher education partners. The program model can be expanded to other STEM disciplines, providing professional development for secondary science and mathematics teachers. Dissemination is possible due to the virtual and collaborative nature of the project. The whole purpose is to provide online programs to a broad audience by increasing human capital and resources by sharing faculty expertise across multiple universities.

Appendix 1: Timeline

Timeline—General

Time	Who	What
September, 2008 (at time of funding)	PLT	Meet to plan year 1 of <i>Math TLC</i>
September, 2008	PLT, MA UNCo, MA UWy	Determine course development teams
September 2008	PLT, MA UNCo, MA UWy	Decide which master's courses will be developed for implementation in Year 1, set up a timeline for development
September – December, 2008	MA UNCo, MA UWy	Conduct regular meetings to establish course criteria and academic requirements/standards
September 2008	PLT	Conduct conference calls with members of affiliation team, initiate affiliation agreement discussions
September 2008	PLT	Nominate members for National and Regional Advisory Board
September 2008	Novak	Advertise for Program Manager
September 2008	PLT, External Evaluator	Flesh out the fine details of our external evaluation plan with quarterly meetings thereafter
October, 2008 January, April and July 2009	PLT, District Math Team	Review <i>Math TLC</i> and make adjustments to best serve math teachers in this project
Jan –May 2009	Affiliation team (for membership and charge, see proposal Table 3, p. 13)	Convene regular meetings to negotiate affiliation agreement for <i>master's program</i>
January 2009	Course Development Teams	Develop syllabi for master's courses
January 2009	Program Manager, PLT, MAST, SMTC	Advertise summer offerings for joint master's program. Present on program at Mathematics and Science Wyoming Conference
January 2009	Novak, Mayes	Contact possible members of National and Regional Advisory Board
January 2009	Ku, Mayes	Begin investigating common distance delivery platforms
January 15, 2009	PLT, Novak	Hire Program Manager
February 10-20, 2009	National and Regional Advisory Board (membership finalized by Novak & Mayes by Feb.1)	Focus group meetings to review proposed master's course syllabi for the 3 Summer 2009 courses.
February 15, 2009	Program Manager	Process participant applications (due Feb 15)
March 1, 2009	Program Manager, PLT, MA UWy and UNCo,	Review applications and decide who will be accepted
March 1, 2009	Course Development Teams	Initiate course development cycle as laid out above for courses to be offered in Fall 2009 and Spring 2010.
March 10, 2009	Program manager	Notify participants accepted into program
March 31, 2009	Course Development Teams	Finalize course syllabi, curriculum, assessments, formats, and activities for master's program 3 courses to be offered in Summer 2009
April 1, 2009	Accepted Participants	Notify project manager if participating in <i>Math TLC</i>
April 15, 2009	MA UWy, MA UNCo, and Math TLC Advisory Board	Review Summer 2009 master's program materials for 3 courses
Mar –Aug 2009	Affiliation team (see Table 3, p. 13 of original proposal)	Convene regular meetings to negotiate affiliation agreement for <i>teacher-leader program</i>
April 1, 2009	MA UWy, MA UNCo	Course syllabi and related materials submitted for approval to department
May 2009-May	Teacher Leadership Team	Convene monthly meetings to plan implementation

2010		of teacher leadership program
May 2009	PLT	Regional Advisory Board meeting
May 2009	Ku, Mayes	Recommendations to PLT about distance delivery Platforms
Summer 2009	PLT, Novak, Mayes	Ensure funding is in place to support master's course development over summer
July 15, 2009	Course Development Teams	Complete course development cycle for courses offered in Fall 2009.
August 2009	PLT, Project Manager	Prepare application materials for master's program and teacher leadership institute
August 2009	MA UWy, MA UNCo	Complete master's program description for UWy catalog
August 2009	Affiliation Team	Complete Affiliation agreement for teacher leadership program
August 2009	PLT, MA UNCo, MA UWy	Decide which master's courses will be developed for implementation in Year 2, set up a timeline for development, determine course development teams
September 1, 2009	Program Manager, PLT	Disseminate program information and solicit applications
September 26, 2009	Program Manager, PLT	Advertise program at Colorado Council of Teachers of Mathematics meeting
September 2009	PLT	National Advisory Board meeting
October 1, 2009	Course Development Teams	Complete course development cycle for courses offered in Spring 2010.
August, Year 2-5	Affiliation Team	Attend to implementation issues for affiliation agreement and make amendments to agreement as needed

This timeline represents most of the major activities the *Math TLC* will engage in. Most first year activities will be repeated in year 2-5.

Timeline—Cycle for research (including internal evaluation research) in each year. Hauk and Powers lead research team (pg 13, proposal) in the following activities.

Time	What
Fall	Recruit and advertise for Post-doc in Falls 1 and 3
Fall/Spring	Gather baseline info from applicant packages, including applicants' completion of culturally responsive teaching (CRT) survey
Spring	Conduct observations, interviews, and gather focus group data with master's students (and starting in Year 2, with teacher-leaders) in their local classroom/district environments using Horizon Research <i>Inside the classroom</i> protocol with CRT-informed enhancements; design and small-scale (re)pilot with current UNCo and CU Denver master's students, (n~20) for (a) culturally responsive teaching survey and (b) pre-test of content and PCK.
Summer	Gather data during master's courses (and teacher-leadership activities starting in Year 2), including math/PCK assessment at beginning of summer; data analysis of Fall and Spring data.
Fall	Gather baseline info from applicants (application packets) and continuing cohort (Lesson Experiment and math education course activities); administer CRT survey; math/PCK assessment for exiting master's and teacher-leader participants; data analysis of Summer data.

AdvB = Advisory Board
MA UNCo=MA Team UNCo
PLT= Project Leadership Team
TLT=Teacher Leadership Team
National Advisory Board

AT=Affiliation Team
MA UWy=MA Team UWy
RT=Research Team
Math TLC Advisory Board
Regional Advisory Board

While some of this work (mostly preliminary planning and initiating the affiliation process) will be conducted before funding actually commences, this work will be done by university faculty and staff and will count towards service for faculty members and be part of the normal business for university administrators.

Responses that address evaluation issues

Evidence-based Design and Outcomes

Q1: Please provide a plan by which baseline data will be collected after teacher participants have been selected, including a description of any instruments/metrics to be used.

Baseline data will be collected to document teacher qualification. Some of this information will be collected from all applicants as part of the application form. Specifically, the application form will include questions about degrees held and when received, teaching in or out of certification field, how long the applicant has been teaching. Those accepted into the program will be asked to provide transcripts for additional information about teacher training and degrees such as math grade point average and nature and number of mathematics and mathematics education courses taken.

Once participants are accepted, we will collect baseline student data for students of the participants. In particular, we will collect student achievement data from sources already in places such as state mandated test (CSAP-Colorado, PAWS-Wyoming) or test used by local districts (such as NWEA). For participants in the teacher leader program, student achievement data will be collected for all students from the school the teacher is in as well as data on course enrollment and completion rates, college matriculation rates. Other baseline data will be collected for purposes of evaluation. Additional questions will be asked on the application form.

Additional baseline data will be collected as part of the research and evaluation plan. In particular, as part of the internal evaluation and research, a question on cultural competence (see definition in Proposal, pg 3) will be included as part of the application form; as part of the external evaluation, Dr. Shaw, the external evaluator will administer an online survey on cultural competence (based on materials available from the Center for Culturally Responsive Teaching and Learning (culturallyresponsive.org)). To track changes in cultural competence over participants' involvement in the program, there will be two assignments a year (about every six months) in mathematics education master's classes and teacher leadership classes addressing issues of cultural competence. These assignments will become part of the data for the internal evaluation/research program. In addition, teachers in the masters program will be asked to address how the innovation (a lesson or pedagogical strategy) they are studying as part of their *Action Research Project* will reach all students. Similarly in the Teacher Leader program, teachers will be asked to document their cultural competence in their work with students and other teachers in their *Portfolio*. At the completion of their program, all teachers will be asked to again complete the cultural competence survey administered by the external evaluator.

We will collect additional baseline data on teacher participants. To measure changes in content knowledge and pedagogical content knowledge, we will administer a pre-test on the first day of each summer class composed of standardized items for ETS content and pedagogy exams. We administer the post-test at an appropriate designated time towards the end of each cohort's program. We will conduct in-the-classroom observations of a random sample of teacher participants (using Horizon Research protocols augmented by culturally responsive teaching items). To measure the influence of teacher leaders on a school, we will conduct interviews (focus group or one-on-one) of principals of schools from which teacher leaders are chosen. We will make use of structures already in place, such as leadership meetings in districts, to conduct focus groups and rely on cyber-infrastructure (telephone calls, video conferencing) for interviews

with principals at rural sites. We will also ask principals to complete the web-based cultural competence survey.

Project Evaluation

Q1: In what domains do you expect your project’s formative evaluation to be especially useful in guiding your decision-making? What kinds of data will you need to collect?

In this project, we are concerned with evaluation at three different levels: at the level of the *Math TLC* as an organization (1 and 2 in the table), at the level of communication and collaboration among university professors (3 in the table), and at the level of learning by teachers in the master’s program, in the teacher leader program and of their students (4 and 5 in the table below). At each of these three levels, we expect formative evaluation to be crucial in ensuring that we address issues as they arise and stay on track to complete the project as articulated. We will be collecting a variety of data as indicated in the proposal (pg 12-13) and the supplementary documents (pg 7-9). In addition, questions in the following table help guide the evaluation. In Year 1, we will focus most on 1, 2, and 3 and in later years, the focus will shift to include all with enough attention to ensure that the project functions smoothly.

Table 1. Formative and summative evaluation questions, data sources, and methods

Questions	Source of Information	Data Analyzed
1. Participation. Are all project members participating as planned? Are faculty from both institutions participating in course development and delivery? Are participants signing consent forms for research? Are we able to attract a diverse set of quality participants? Are we meeting our commitment to 40% rural teachers? Are administrative personnel at each institution supporting the affiliation agreement? Are districts providing needed student assessment data? If not, why not? What recommendations for improvement can be made?	Project manager and PIs; project reports; teacher participants; registrar's office(s); AdvB members.	Written records review; interviews (by phone or in person) with participants; researchers; course artifacts
2. Organization. Are the project teams organized, meeting, and reporting as planned? Is the affiliation agreement between UNCo and UWy in place and functioning? If not, why not? Are needed materials and resources available? Used? Are AdvB members actively engaged in advising project? Are the master’s program and the teacher leadership institute running smoothly? If not, why and in what way(s)? What recommendations for improvement can be made?	Project manager; PIs; all project teams; project funding records; local institutional records;	Interview project manager and PI; document review; departmental and project staff interviews and/or surveys, interview upper administration at UWy an UNCo concerning affiliating agreement, focus group with teachers.
3. Communication. How are project members communicating with each other? How is the project communicating with the teacher participants? How are faculty involved in the project communicating with each other and project personnel? How is the project communicating with its advisory boards? How is the project communicating with core and supporting partners? How often? Often enough? How effectively (e.g., full details sufficient for continued work, sketchy details requiring more effort, lack of needed details)? What recommendations for	Project Personnel; District representatives; AdvB members; teacher participants; faculty at UNCo and UWy	PLT monthly, formative (6-month) and summative (annual) reports; survey of project staff.

improvement?		
4. Scope. Is the project achieving its goals? Is there evidence of an increase in teachers' awareness of the diversity of students and their thinking processes, as a result of project participation? Is there evidence of increased student learning as a result of teacher participation? Are the students of our master teachers and teacher leaders showing improvement in math content knowledge? Are the teachers implementing the differentiated, culturally responsive and research-informed instruction? Are the teachers themselves increasing their mathematical and pedagogical content knowledge? Are the teacher leaders effectively impacting the pre-service, induction and in-service teachers to improve student achievement, retention of teachers and teacher quality? Are project instruction leaders and courses responding to and meeting the needs of the master teachers and teacher leaders? If not, why not? What recommendations for improvement?	Project PIs; teacher participants; K-12 and <i>Math TLC</i> course observations; teacher and student achievement data; <i>Math TLC</i> course syllabi and materials	Semester evaluations, formative (6-month) and summative (annual) reports; teacher participant interviews; teacher participant focus group interviews; faculty interviews
5. Troubleshooting. Have problems arisen? What are they and what are project participants' suggestions for managing them? Should project format(s) be modified? Should affiliation agreement be modified? Should the budget be modified? Should research focus(es) be modified? How? Why? Other recommendations for improvement?	Project PIs; AdvB members; PLT, RT, MA UNCo and UWy, TLT, AT	PLT monthly, formative (6-month) and summative (annual) reports; survey of AdvB members, field-testers; focus group interviews with project faculty and project participants;

AdvB = Advisory Board
MA UNCo=MA Team UNCo
PLT= Project Leadership Team
TLT=Teacher Leadership Team

AT=Affiliation Team
MA UWy=MA Team UWy
RT=Research Team

Q2: Proposal presents a project-specific evaluation that addresses well some of the key features of Institute Partnerships. However more detail is needed. What instruments will be used to provide (a) an assessment of teachers' improved knowledge of mathematics; (b) an assessment of teachers' growth as intellectual leaders and accomplished classroom practitioners and their effects on their school environment, especially growth in the content knowledge of peer teachers whom they mentor; (c) data on mathematics achievement or other outcomes for the students of the institute participants (d) impacts on the instructional practice of higher educational faculty what are instructional leaders in the institutes, and evidence of (e) institutional change in both K-12 and higher education; and (f) the Partnership itself? (g) A plan by which the project will document the career paths of Institute graduates. (h) For replication/dissemination purposes, a plan by which the important variables that contribute to the success of the Institute will be evaluated and documented?

(a) We will use selected ETS items to create a test appropriate for high school mathematics teachers to assess their content knowledge and pedagogical content knowledge. Assessment will be created by Hauk who has several years experience designing and analyzing similar tests for state-funded MSPs. We can explore using pre- and post-assessments for each course and an integrated content-pedagogy assessment for each of the content-pedagogy paired courses as potential sources of information about content and pedagogical content knowledge.

- (b) To assess growth in content knowledge of peer teachers who they mentor, we will use as a proxy student assessment data. We will also use interviews, when possible with mentees to track changes in content and pedagogical content knowledge. We will also use classroom observations of master teachers and teacher leaders and those they mentor.
- (c) We will be collecting local state assessment data on student achievement in mathematics (CSAP-Colorado, PAWS-Wyoming, and any other standardized assessment given by districts such as NWEA) for students of institute participants. As part of the application and acceptance process, we will get permission from the school to have access to such data. We investigate the value of Lesson Experiments conducted by teachers to give us a local picture of student understanding and achievement.
- (d) Impacts on instructional practice of higher education faculty will be evaluated by classroom observations, focus group interviews, analysis of course syllabi and artifacts against the research-based course design characteristics (Table 1, Proposal, pg 6) and student evaluations.
- (e) Evidence of institutional change in K-12 will be evaluated by examining increases in the number of math coaches and specialists, tracking career paths of graduates of program and their impact on schools, how math coaches and specialists are being utilized, improvements in student achievement in disaggregated student data, increased participation of underrepresented and underserved students in secondary mathematics courses. Evidence of institutional change in higher education will be evaluated by examining increased involvement of faculty in teacher training, communication and collaboration among faculty, online surveys of all faculty and graduate students in participating department, website tab on web portal that indicates opportunities for faculty/graduate students to be involved.
- (f) Evidence of institutional change is Partnership itself and will be seen in the strength of the ongoing affiliation agreement, as well as the involvement of faculty in teaching in the master's program and teacher leadership program. A partnership matrix will be created that documents change in practice due to the affiliation agreement.
- (g) The tracking system will monitor career paths of graduates. Initial tracking data will be collected when participants are accepted into the program. Additional information will be gathered when they complete the program. The External Evaluator learned when doing tracking that it is very important to have: (1) a non-school/district email address, (2) a home phone number and (3) the participant's signature giving permission for us to maintain contact with them. Shaw's tracking system in CO LSAMP is *Staying in Touch* with the word tracking eliminated because of possible negative connotations to "being tracked" (e.g., Big Brother/Sister). The initial form will be available both on the web and in hard copy. Participants included in our tracking database will be contacted each fall to update the demographic and other information. This will be done by email. If the individual doesn't respond by email then the participant will be contacted by telephone. The purpose of the tracking will be to monitor career paths of graduates. Tracking will be institutionalized by the mathematics departments at both universities in the fifth year of the project.
- (h) For replication/dissemination purposes, a plan by which the important variables that contribute to the success of the Institute will be evaluated and documented. In year one, we will refine the initial model presented in the proposal, taking into consideration the constraints and affordances of the affiliation agreement achieved. Then semi-annually for the life of the grant, the project teams will meet for half-day retreat whose purpose is to evaluate the current iteration of the model and propose the next iteration of the model to

inform project activities for the next 6 months. At these meetings, future action will be informed by formative evaluation and research collected during the previous 6 months. These meetings will include a re-examination of the budget to realign the budget with implementation priorities for the next 6 months. When possible, this half-day meeting will happen just before an advisory board meeting so that the advisory boards can weigh in on the plans that are made. When not possible, this process will culminate with an online presentation to the two advisory boards, soliciting feedback from them on our adjustments. In any case, we will post on our web portal the next iteration of our plan for easy accessibility to all project participants. The elements of the project that will be reviewed include: course impact, integrated course development, collaboration on course development across universities and across mathematics and mathematics education, effective online courses in mathematics and mathematics education, technology platform impact on program, leadership program impact, etc.

Appendix: Laramie Data

Laramie County School District 1 Student Achievement Data on PAWS (Wyoming State exam)

District Elementary Math Adequate Yearly Progress, Percent Proficient and Above

	2002	2003	2004	2005	2006	2007	2008	2009
AYP Target Score	23.8	23.8	23.8	36.5	36.5	36.5	49.2	49.2
Total Group	32.2	34.9	35.8	38	74	85.6		
White	36.6	37.6	40.5	39.2	77.5	87.2		
Hispanic	18	23.9	21.3	35.7	60.5	79.5		
Native American		27.3	12.5	26.9	59	86.1		
Black	18.8	19.2	17	32.6	63	79.1		
Asian	47.6	81.3	29.4	46.7	85.2	91.4		
LEP	50	50	22.2	42.9	33.3	83.8		
Free/Reduced Lunch	19.2	25.3	25.8	31.7	65.9	79.4		

District Junior High School Math Adequate Yearly Progress, Percent Proficient and Above

	2002	2003	2004	2005	2006	2007	2008	2009
AYP Target Score	25.3	25.3	25.3	37.75	37.75	37.75	50.2	50.2
Total Group	31.6	32.9	32.4	28.9	49.8	64.8		
White	35.4	36.2	36	31.6	55.2	68.3		
Hispanic	18.5	18.9	22.8	22.7	30	52.8		
Native American	18.2	18.8		13.3	23.3	27.8		
Black	19.3	14.3	11.1	17	26.7	44		
Asian	33.3	75	31.3	30.8	76.3	80		
LEP		50	8.8			50		
Free/Reduced Lunch	11.6	15.9	18.6	15.8	29.6	51.4		

District High School Math Adequate Yearly Progress, Percent Proficient and Above

	2002	2003	2004	2005	2006	2007	2008	2009
AYP Target Score	35.8	35.8	35.8	46.5	46.5	46.5	57.2	57.2
Total Group	41.3	43	44	45.7	46.3	59.7		
White	47.4	47.9	47.6	50.6	49.9	64.3		
Hispanic	23.3	23.4	23.3	26.8	25	37.6		
Native American	20	33.3	40	60	55.6	83.3		
Black	11.5	24.1	20.8	27.9	31	39.4		
Asian	47.1	41.7	41.7	45.8	54.6	50		
LEP		27.3	38.1	25		44.8		
Free/Reduced Lunch	25.3	21.1	24.4	21.1	26.1	37.3		