

No Child Left Behind Act 2001
Improving Teacher Quality, Title II
Grant Proposal

Metro's Mathematics for Rural Schools Program
Creating Highly Qualified Mathematics Teachers in Rural Schools

Submitted by

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2007-2008

In partnership with

Frenchman RE-3,

Valley RE-1,

and

Colorado League of Charter Schools

Abstract

The Metropolitan State College of Denver (MSCD) is currently finishing its second year of a web-based, distance education mathematics course designed to enhance the content knowledge of rural K-12 mathematics teachers, particularly those who are teaching out of area. Metro's Math for Rural Schools Program (MMRSP) uses web technology and distance education to make available a series of content-oriented courses specifically developed to model teaching practices which are directly transferable to K-12 mathematics classrooms, support development of mathematical proficiency, and foster a mathematical community among teacher-learners. The courses are available for graduate credit for practicing teachers and serve as a model for high quality, content-centered professional development for K-12 mathematics teachers in rural schools across Colorado. MSCD, together with Frenchman Re-3, Valley RE-1, and the Colorado League of Charter Schools, proposes a continuation and expansion of the previously awarded grants, specifically, the addition of a training component for Western State College faculty in order to widen the availability of MMRSP.

Project Description

The proposed project builds on the successful research, development and experience teaching online courses during the completion of the 2005-2006 and 2006-2007 NCLB Title II grants (CFAD# 84.367B05-06-16 & CFAD# 84.367B06-07-6). As a result of funding from the Colorado Commission on Higher Education (CCHE) and the expertise of MSCD's team of specialists in Mathematics, Mathematics for Teaching and Learning (MTL), and Teacher Education, we were able to conduct courses via distance technology which satisfied the stated grant objectives. The first grant, awarded for 2005-2006, provided funds to research and develop these courses and the effective use distance technology. The focus of the development centered on three crucial areas:

- (1) Implementation of distance and web-based instructional techniques for delivery of the courses which also modeled pedagogical practices directly transferable to the K-12 mathematics classroom;
- (2) Utilization of instructional approaches that engaged participating teachers in mathematical activity that fostered proficiency in various strands of mathematics. It is critical for in-service teachers to experience a

model of these pedagogical approaches that focus on mathematical understanding, so that teachers can see how to implement the model in their own classrooms.

(3) Development of courses for practicing K-12 mathematics teachers who needed mathematics content hours to achieve “highly qualified” status in rural school districts throughout Colorado.

The second grant, awarded for 2006-2007, continued the development of the courses and the distance technology while serving additional teachers. We were able to successfully split the courses into two levels, Secondary and Elementary, which resulted in an additional section per semester and a tighter focus on teachers’ needs.

Mathematics knowledge for teaching is specialized knowledge of the big mathematical ideas that underlie the school curriculum and of what it means to do mathematics—to solve novel problems, to explain or justify a solution or strategy, to extend or generalize a result, to unpack complex mathematical ideas, strategies and procedures (Ball & Bass, 2003). Our course designs are based on the principle that teachers build this specialized knowledge, in part, by doing significant mathematics in this way. These courses:

- Target mathematical ideas that are central to teaching standards-based K-12 mathematics;
- Use instructional approaches that engage teachers in mathematical activity;
- Meet the “highly qualified teacher” requirements of the state of Colorado.

Research indicates that classroom collaboration and the quality of the mathematics are among the most important aspects of professional development (LaChance and Confrey, 2003). For these projects, MSCD’s faculty team incorporated web and distance education pedagogy into a series of deep, content-focused mathematics courses which were already in existence within MSCD’s mathematics education program. We created a community of teacher-learners who were able to learn and do some very meaningful mathematics. For the first two grant periods we offered courses to teachers in south-central Colorado including Moffat Consolidated School District #2, Monte Vista C-8, and surrounding districts. Now we would like to offer our courses to groups of teachers throughout the state of Colorado, starting with the northeastern Colorado.

We propose adding a training component to the program. Due to the increased demand for and attention to MMRSP, other institutions of higher education have expressed interest in learning more about our program. We

have invited two faculty members from Western State College in Gunnison, CO to take part in the courses. These faculty members will work in an apprentice capacity for the first course, observing interactions and processes and gradually taking on key responsibilities as they become more familiar with the program. These faculty members will then conduct their own course in the Spring 2008, with support and guidance from MMRSP. This adds another complete course to our proposal, including the 2 faculty members and a teacher group of 10-15 participants. We hope this will put the Western State faculty in a position to apply independently for funding next year.

The data we collected during the previous grant was useful not only for evaluating the program, but also for improving our teaching and online techniques. A manuscript describing our initial research findings is currently under review by the Association of Mathematics Teacher Educators. A second manuscript is currently being prepared for submission to the Journal of Mathematics Teacher Education. We would like to continue the evaluation component of the project by allowing an outside, independent evaluator to assess the project via qualitative and quantitative techniques. Independent evaluation will help to improve the effectiveness of future courses and, ideally, provide evidence of the program's success which may help to persuade other colleges to offer similar programs.

Proposed Project for 2007-2008

MSCD's Department of Mathematics and Computer Science and Department of Teacher Education, in collaboration with Frenchman Re-3, Valley RE-1, and the Colorado League of Charter Schools, proposes to offer two 2-credit courses from a three-course series in the spring/summer and fall of 2008. The courses will also be offered to the surrounding school districts. These school districts were specifically chosen because their isolated locations make it difficult for teachers to enroll in courses that enable them to achieve "highly qualified" status. The districts were also chosen by region to maximize the interactions between teachers and MSCD faculty. In general, the districts are all high need, and in accordance with the grant guidelines, Frenchman Re-3 has a poverty rate of 20%.

The courses are sequenced as Course 1: Algebra and Patterns, Course 2: Geometry, and Course 3: Statistics and Probability. These courses are specifically designed to meet the needs of rural K-12 mathematics teachers, and to satisfy the requirements of NCLB. They carefully address the mathematics necessary for teaching K-12 mathematics while modeling the research-proven pedagogy that teachers are expected to use in their own classrooms. Also, the content will be presented in a way that encourages “sense-making,” sound mathematical reasoning, and the making of connections among the many areas of mathematics.

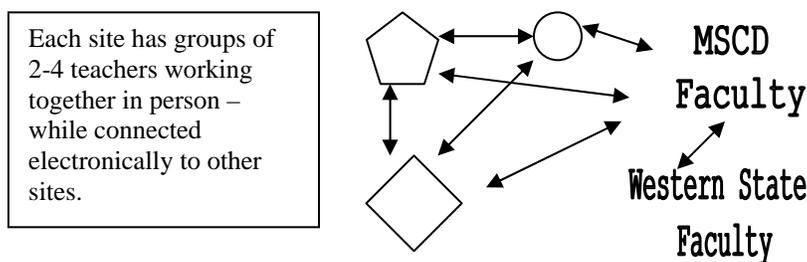
Under the previously awarded grant, Moffat Schools and the surrounding regions completed all three courses. If funded, we will offer two sections (Elementary and Secondary) of Course I: Algebra and Number Patterns to Frenchman RE-3, Valley RE-1, and surrounding districts in northeastern Colorado in the spring of 2008. For this course, we will invite our colleagues from Western State College to join us for the entire course. This will give the faculty the opportunity to learn about the courses and the technology. Then, in the fall of 2008, the MSCD group will offer two sections of Course II: Geometry to Frenchman RE-3, Valley RE-1, and surrounding districts. Concurrently, the Western State Faculty will offer Course I: Algebra and Number Patterns to teachers in the Gunnison area. The MMRSP faculty will join the Western State Faculty during their sessions to support them as needed.

One of the concerns that regularly arises when offering courses via web technology is the reliability of the hardware/software. We will address this concern before the teachers arrive for the course by hiring a technology specialist at each course site and meeting with them online before the courses are implemented. This will ensure that the technical issues are addressed before the teachers begin the courses. We have used this strategy for previous courses, and it has worked well.

Each course begins with an all-day, in-person kick-off session where participants solve math problems and present solutions to the whole class, modeling the exact process that will be used later in the on-line environment. Before day's end, participants practice communicating via the technology. After the kick-off meeting, teachers split into small groups by location and grade level to meet online in the appropriate section during the course. We will set up two sections taking place simultaneously for the online sessions, one for the elementary group and one

for the middle/secondary group. During this time the teacher groups are required to correspond online, in real time, with MSCD mathematics and mathematics education specialists.

A key component of the project is the small-group interactions. These interactions serve, not only as an example of research-proven pedagogical approaches, but also as a way to foster collaboration and communication within the mathematics education community within and across sites. These groups also have online access to and input from a mathematics education specialist, furthering this communication and collaboration (see Figure 1).



Similar to an in-person class with small groups, teachers interact in-person with their group-mates; they communicate electronically with the entire group and the MSCD and Western State faculty teams.

Figure 1

The course ends with an in-person closing session. At this session, teachers will conclude the course by coming to closure on the math content issues that have arisen, and to provide feedback for improving the “delivery” model. Modifications that result from feedback are integrated into the next course.

The MSCD faculty team proposes to continue offering the courses throughout the state of Colorado over the next three to five years. Due to the support of CCHE and the funding from this grant, these courses have proven their utility and serve as a model of high-quality professional development. Our vision for future funding is to offer MSCD administered courses and continue to invite other colleges and universities to join us for training in the program process and methodology so that other faculty may offer similar courses in their regions. This dual approach would increase access to courses needed by rural teachers to become “highly qualified” mathematics teachers.

Objectives and Project Activities

The objectives of the proposed project will be accomplished in two phases, as depicted in Figure 2 and described in the table that follows.

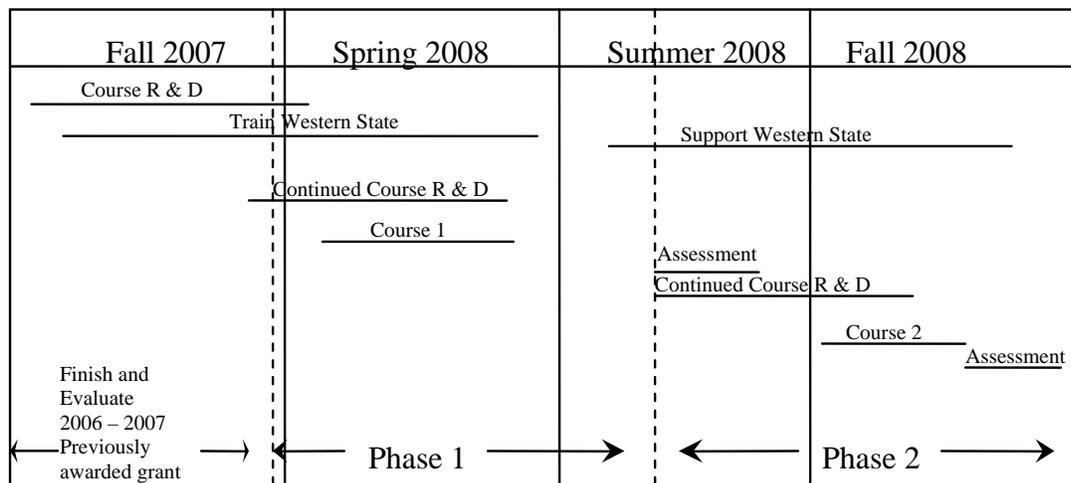


Figure 2.

Program Time Line

In the Fall 2007 semester, MSCD will be concluding the previously awarded 2006 – 2007 grant by offering Course III: Probability and Graph Theory to Moffat Consolidated School District #2, Monte Vista C-8, and surrounding region; continuing assessment of technologies, course materials, and pedagogies; and completing an assessment report.

Objective	When	Activities
1. Research and development of Course 1: Algebra and Number Patterns 2. Train Western State Faculty on the technology and course objectives. <u>Who:</u> Brooke Evans, Ph.D., Assistant Professor of Mathematical Sciences Jim Loats, Ph.D., Professor of Mathematical Sciences Don Gilmore, Ed.D., Associate Professor of Mathematical Sciences Patty McKenna, Ph.D., Associate Professor of Mathematical Sciences	Fall 2007 and Spring 2008	<ul style="list-style-type: none"> • Hire web specialist at schools to consult, install, and manage proposed technologies; • Contact District coordinators to plan courses; • Explore with state and local agencies how best to provide credit for proposed courses. • Finalize course. • Hire independent evaluator. • Invite Western State Colleagues to take part in course. • Begin training of Western State Colleagues.

<p>Dale Brunsvold, M.S., Temporary Full-time Instructor</p> <p>Lew Romagnano, Ph.D., Professor of Mathematical Sciences</p> <p>Angela Powers, Ph.D., Assistant Professor of Teacher Education</p>		
<p>2. Use the developed technologies and coursework to offer Course 1: Algebra and Number Patterns to rural teachers in Northeastern Colorado.</p> <p><u>Who:</u> Evans, Gilmore, Loats, McKenna, Brunsvold, and Western State Faculty</p>	<p>Spring 2008</p>	<ul style="list-style-type: none"> • Contact District coordinators to plan the details of the courses; • Create marketing and incentive strategies; • Conduct course.
<p>3. Continued assessment of the project</p> <p><u>Who:</u> Evans, Loats, Gilmore, McKenna, Brunsvold, Romagnano, Powers, Western State Faculty, and Independent Evaluator</p>	<p>Spring and Summer 2008</p>	<ul style="list-style-type: none"> • Assessment of technologies, course materials, and pedagogies will be carried out by an independent evaluator, the MSCD team, the Western State team, and the participating teachers; and • Write an assessment report. The assessment report will be put together by the independent evaluator and the MSCD team. They will consider the courses objectives and examine collected evidence (primarily students' written work and field notes), and determine the degree the objectives were met and make recommendations. These suggestions will guide the next course offering.
<p>4. Use the developed and researched technologies and coursework to offer Course 2: Geometry to Northeastern Colorado (MSCD faculty) and Course 1: Algebra and Number Patterns to Gunnison area teachers (Western State Faculty).</p>	<p>Summer and Fall 2008.</p>	<ul style="list-style-type: none"> • Contact District coordinators to plan the details of the courses; and • Create marketing and incentive strategies. • Support Western State Faculty with their independent course.

<p><u>Who:</u> Evans, Gilmore, McKenna, Loats, Brunsvold, and Western State Faculty.</p>		
<p>5. Assessment of the project. <u>Who:</u> Independent evaluator, Evans, Gilmore, McKenna, Brunsvold, Romagnano, Loats, Powers and Western State Faculty</p>	<p>Fall 2008</p>	<ul style="list-style-type: none"> • Assessment of technologies, course materials, and pedagogies will be carried out by an independent evaluator, the MSCD team, the Western State Faculty, and the participating teachers; • Provide an assessment report. The assessment report will be put together by the MSCD team. They will consider the course objectives and examine collected evidence (primarily students' written work). Evaluators will determine the degree to which the objectives were met and make recommendations. These suggestions will guide future course offerings and distance education experiences; and • Package the coursework in CD format so it can easily be used for future courses.
<p>6. Continue to offer Courses 1, 2, & 3 (and possibly others) in school districts throughout Colorado.</p>		<p>On-going, if funding allows.</p>