Program Title: MSP Math Connections

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Enter the amount of MSP funds requested: $139,739.33

Enter the number of teachers to be served: 40

Enter the number of Title I students affected: ~9271

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I. List the goals of the program:

Overarching Project Goal
The primary goal of the MSP Math Connections initiative is to provide the training and support essential for schools and teachers to meet the requirements of No Child Left Behind (NCLB) and Arizona Learns. The project targets teachers in need of focused professional development in the teaching of mathematics. The project will work with seven high need school districts and those with low student achievement in mathematics as measured by the AIMS in Coconino County.

The strategic goals of the project follow:

1. Prepare, train, and increase the number of Highly Qualified teachers of mathematics in the Coconino County.
2. Increase the level of content knowledge of the Arizona Mathematics Standards by Grade Level of program participants.
3. Increase the level of mathematics content and pedagogical knowledge of program participants.
4. Increase the participants' ability to implement the newly gained mathematics content and pedagogical knowledge understandings into classroom practice.
5. To improve student achievement in mathematics in Coconino County.
6. To test the notion that teachers involved in Lesson Study as a professional development model have a deeper, more substantive implementation of the mathematics content and pedagogical knowledge in classroom practice.

Should this grant be funded and go into a second and third year, we would add the following strategic goal.

7. To make a positive impact on overall school climate.

We do not feel it is reasonable to assume in one year a significant impact on school climate could be measured accurately and with precision. However, this is of our overall project goals that we will constantly be working towards.

II. List activities involved in the program:

The MSP Math Connections Program will offer a two week Summer College course MAT 598: Connecting Content with Pedagogy that focuses on connecting mathematics content with effective pedagogy. Over the following Fall and Spring semesters, we will provide on-going content and pedagogical support and mentoring to the participants through four follow up visits to reinforce that course understandings extend into the classroom and teachers are prepared for the AEPA examination. Teachers will also receive online support from project staff and university professors throughout the life of the grant. In the Spring, we will sponsor a mini-symposium where course participants will share and/or present the results of their new skills. In addition, through the AZRSC, course participants will receive periodic updates or good resources and optional training activities. Moreover, we are plan to pay for Middle School Principles/Administration and

Educational Services staff to take "Walk-Through" trainings to help support the development of a school climate for change. By providing a variety of support services, we are effectively setting up a learning community for those who took the course and helping to ensure the sustainability of the program.

In addition, this project will serve as an extension to a county-wide Lesson Study professional development (PD) plan aimed to build capacity to create a sustainable, region-wide professional development initiative where curriculum, instruction and assessment (CIA) alignment works in concert with teacher professional development (TPD) within the existing leadership and professional development structures to improve student learning in mathematics. Effective CIA, TPD and leadership are key elements identified by research in improved student and teacher attitudes and performance.

Course participants will experience the mathematical content as learners first through group and individual work using reformed based materials and other research base materials (i.e., Research Ideas for the Classroom: High School Mathematics, edited by P. S. Wilson and Research Ideas for the Classroom: Middle School Mathematics, edited by D. T. Owens.) After experiencing the content as learners, participants step back and analyze how the AZ and National standards are reflected, how the content supports both content and process standards and then begin to analyze what pedagogical content knowledge supports need to be in place for students to be successful learners-for example, what do teachers need to know about students' prior knowledge, common misconceptions, and other content connections to fully leverage the learning opportunity in their classrooms. Video tapes standards based classrooms incorporating the identified content will support this analysis.

As we have demonstrated the opportunity for teachers to learn key content and pedagogical knowledge is built within the project, as well as the prospect to implement the newly acquired practices and content knowledge within teachers' classroom in supportive settings. However, in some cases, new knowledge and practices are not integrated into the actual daily practices of teachers (Stigler & Heibert, 1999). Consequently, we propose to use a quasi-experimental research design to investigate the impact of reflective practice on the translation and maintenance of new teacher knowledge in classroom practice.

Stigler and Heibert, through their work in the TIMSS (Third International Mathematics and Science Study) video study (1999) found that in Japan teachers work to improve their teaching practice through a process called Lesson Study. Teachers work together planning, observing, analyzing, and refining classroom lessons referred to as research lessons. "Lesson study is widely credited for the steady improvement of Japanese elementary mathematics and science instruction: (Lesson Study Group at Mills College http://www.lessonresearch.net/)." Since 1999, Lesson Study has been adopted and modified across many locations in the United States. New Mexico's MathStar project (Hovermill, et al., 2003, MathStar, 2003) serves as an important example of the success of Lesson Study in communities and geographical areas similar to Northern Arizona. Teacher educators and researchers have indications of higher than expected student achievement in a 100% free lunch district with large numbers of ELL students. The

following data (see Table 1) documents the impact of full-school implementation of Lesson Study in two middle schools in New Mexico. Other schools in the district had teams implementing this reflective process as well, though not on the same full-scale level.

Table 1: Mathematics achievement gains in Gadsden School District Middle Schools (MathStar, 2003)

	2000 – Math Grade Median Percentages	2001 – Math Grade Median Percentages	Gains in Percentile Points
State-New Mexico	48.7	51.4	2.7
District-GISD	33.0	39.4	6.4
Gadsden Middle School	34.9	42.7	7.8
Santa Teresa Middle School	31.8	41.1	9.3

Arizona Regional Support Center (AZRSC) allocations supplement funds from the Department of Mathematics and Statistics at Northern Arizona University, and seven Coconino County public school districts, and the Arizona Teacher Enhancement Collaborative (AzTEC) to initially support 42 teachers from seven school districts to build capacity of mathematics education. We plan to conduct a quasi-experiment testing the effectiveness of Lesson Study as a professional development (PD) model. We propose that teachers involved in Lesson Study as a PD model have a deeper, more substantive implementation of the content and pedagogical knowledge in classroom practice. Long term goals will examine the overall impacts of Lesson Study on school climate and student learning in mathematics.

In an effort to investigate the impact of reflective practice, we will compare the impact of content focused professional development with and without a focus on reflective practice through Lesson Study. By pairing the two projects, we extend the opportunity for learning quality mathematics and supporting pedagogical strategies for the teaching and learning of mathematics within Northern Arizona AND gain the opportunity to sort out how systematically supported reflective practice impacts how teacher learning is translated and maintained in classroom practice.

Currently, we are sponsoring 42 students in the Lesson Study Process in a MAT 601: Seminar in Mathematics Education – Reflecting In/On Mathematics Education, a Northern Arizona University, Mathematics Education 3-credit hour college course. From this first cohort, we will have trained the potential summer participants for the Lesson Study subject group. The second subject group will represent county teachers in need of support and training in mathematics education to meet the Highly Qualified Teacher specifications. Our evaluation combines outcomes from Tucker's (2003) Professional Development Accountability Model, a local adaptation of Friedman's Four-Quadrant Accountability Model (Friedman 2000), and Guskey's Levels of Professional Development Evaluation Levels (Guskey 2000). Following Guskey (2000), data analysis

will include comparisons in each of five levels, with the expectation that levels 1 through 3 would be similar across the projects for shared elements with possible differences being demonstrated in Guskey's Levels 4 and 5 and Friedman's Quadrant's 4 and 5. Consequently, we will determine the overall quality of the effect/change that was produced in the ability of participants effectively applying the new knowledge and skills in the classroom as well increases in student achievement.

References Cited

2000 Friedman, M. Results and performance accountability, decision-making and budgeting. Fiscal Policy Studies Institute, Baltimore, MD. www.resultsaccountability.org

2000 Guskey, T.R. Evaluating professional development, Corwin Press, Thousand Oaks, CA.

2003 Hovermill, J., Wiburg, K., & Jorgenson, K. *Using Lesson Study and Technology to Improve Teaching and Learning*. Paper presented at Society for Information Technology and Teacher Education Annual Meeting, Albuquerque, NM.

2003 MathStar. See the MathStar web site for Lesson Study tools (http://mathstar.nmsu.edu).

1999 Stigler, J. & Hiebert, J. The Teaching Gap: Best Ideas from the World's Teachers for Improving Education in the Classroom, The Free Press, New York, New York.
2003 Tucker, Katherine. Arizona's Professional Development Planning Guide, Professional Development Leadership Academy, Arizona Department of Education, PDLA Member Schools, Charters, Districts, and County School Offices.

III. Describe the expected benefits of the program:

We have targeted course content by using the Teacher Needs and Perceptions survey tool and results of 2003 AIMS test results. As a result, groups participating in both projects will receive two weeks of content and pedagogical instruction in mathematics focusing on connecting challenging mathematics concepts with the mathematics taught within their classrooms. All teachers will receive professional development focusing on the alignment of AZ curricular standards and objectives to instruction and assessment (NRC 2001a; NRC 2001b). Follow-up for individuals in one group will be site based support in content lesson planning (2 visits), observation/implementation (1 visit), and reflection (1 visit), whereas the follow-up for the Lesson Study project participants will consist of teams designing Research Lessons incorporating content and pedagogy lessons of the summer institute session and engaging in the Lesson Study process throughout the school year (2 planning visits, 1 observation/implementation visit, 1 reflection visit). Conversely, the Lesson Study group will be working in a collaborative team environment. We are also providing a variety of support services (email, administrative walk through training, Spring mini-symposium) to effectively set up a sustainable

learning community for those participating in the program. We will ensure that equal site time is spent in both projects.

Working towards becoming a Highly Qualified Teacher (NCLB) and/or retaining our Highly Qualified Teachers, course participants will receive 3 college credits in their content area, and 4 follow up site visits contributing to their PD activities related to content area. Participants (depending on level of engagement) could also receive points for service related to content through presentations at school/district level areas and/or points for professional presentations or publications. Through a one day mini-symposium in the spring, teachers will have the opportunity to present their work to fellow colleagues. In addition, the AZ MSP Math Connections Program will contribute to the base of scientific research regarding the effectiveness of Lesson Study as a professional development model to prepare, train, and recruit highly qualified teachers in a sustainable learning community.

References Cited

2001a National Research Council. *Adding It Up: Helping Children Learn Mathematics.* Kilpatrick, J., Swafford, J., Findell, B. (Eds.). Mathematics Learning Study Committee, Center for Education, Division of Behavioral and Social Sciences and Education. National Academy Press, Washington DC.

2001b National Research Council. *Educating Teachers of Science, Mathematics, and Technology: New Practices for the New Millennium.* http://www.nap.edu

IV. Explain the results of the needs assessment used:

Arizona's Coconino County is unique in its geographic and cultural diversity. It includes the Grand Canyon, Lake Powell, the San Francisco Peaks, and the western region of the Navajo Reservation. As the second largest county in the United States, much of it is sparsely populated and isolated. Many students begin their school days after lengthy bus rides, some as long as one an hour. The economies of these communities are based on tourism, with growth occurring in minimum wage employment. 58.74% of the students in the county receive free or reduced lunch with eight of the school sites over 80%. County wide, school districts serve a student population that is 42% Native American and 12% Hispanic with a couple districts serving greater than 70% Native American population. Twenty –five percent of the households speak a language other than English.

Together, the diverse cultures form more than 50% of the county's population, and by all accounts, these children are being left behind. Student achievement patterns in the county show significant gaps along ethnic and socioeconomic lines. More than 46% of Native American students, 40% of Hispanic students, and 29% of the African American students fell far below the average on the Math portion of the AIMS test for all grades. In addition, only 23% of Native Americans and a 28% of Hispanics met or exceeded the math standards for Arizona. A county wide initiative is needed to make

sure these children are not left behind. The partners in this proposal share the goal of improving student achievement and teacher effectiveness in mathematics education.

Seven schools in Coconino County are either in the Arizona Learns "Underperforming" category or have not made "Adequate Yearly Progress" as required by NCLB. Most of these schools show significant weaknesses in mathematics achievement at one or more grade levels. They are anxious to review and revise their School Improvement Plans, demonstrating to the Arizona Department of Education Solutions Teams who will be conducting site visits this winter that they have plans to address their weaknesses. This initiative supports that required improvement with training that is systemic, standards-based, and supportive of teacher empowerment.

As we consider how to achieve our goal of providing mathematics training and support to improve math education through the growth of teacher knowledge, particularly in high need school districts, we need to consider how teacher learning is translated *and maintained* in classroom practices which support improved student achievement. Research documents the impact of high quality teacher professional development on increased student achievement. Reports such as the U.S. Secretary's Annual Report on Teacher quality (U. S. Department of Education, 2002, p. 7) define these qualities: deep content knowledge, effective planning and implementation of instruction, ability to assess learning and create a positive learning environment, effective communication/ collaboration, and continuous professional development.

Fulfilling the "Highly Qualified" provisions of NCLB with teachers who are also highly effective instructional managers is an especially urgent need for Arizona rural schools with low student achievement. For the past several years, the number of Arizona teachers with substandard licenses, who are teaching out of their field or who are long-term substitutes has been about 10% of the statewide workforce. This number varies greatly across the state with high numbers in rural and poor districts. This proposal addresses both needs within a single system to build instructional effectiveness through focused and guided teacher-learner classroom investigation that builds mathematics content knowledge through intensive mathematics content PD, planning, observation, implementation, and analysis.

Currently the quality of schooling and teacher practice is not meeting our changing expectations about what defines student success. In an effort to first define our new expectations and redesign our educational system to provide teachers the training and support they need to meet these new expectations we have implemented both a quantitative and qualitative needs assessment. A quantitative examination of County AIMS results and a qualitative county-wide needs assessment, the Teacher Needs and Perceptions Survey, have been developed and administered, and is in the process of being analyzed through the Coconino County Arizona Regional Math and Science Support Center (http://www4.nau.edu/ifwfd/projects/techshare/survey/survey.asp).
AIMS data for the county suggest we have weaknesses in the all the mathematics standards in the middle school. However, the county schools' were consistently low in the following areas 1) Geometry and Measurement, 2) Structure and Logic, 3) Measurement and Discrete Math, and 4) Number Sense and Operations. The county middle schools were also low in Middle School Probability and Statistics and High School Patterns, Algebra, and Functions.

The qualitative assessment or Teacher Needs and Perceptions Survey focuses on the following topics: 1) identification of Highly Qualified Teachers and their areas of strengths and weakness, 2) teaching and assessment of Arizona Academic Standards, 3) instructional delivery, 4) classroom management, 5) K-3 reading instruction, 6) communication and collaboration, 7) school climate, and 8) the integration of technology into the classroom and curriculum. Items in this survey reflect current research on teaching practices that have a positive effect on student achievement (Achey Cutts , 2000; AASPA 1995; Bender, 1999; Burke, 1999; ETS, 1999; IETTI, 1996; Jones, 1995; Marzano, 2003; Neff, 2003; Redalen, 1998; Stigler and Heibert, 1999).

References Cited

2000 Achey Cutts, P. *Connecting Technology with Brain Research*. Cedar Falls, IA: Area Education Agency 7, Educational Services.

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1999 Bender, C., & Phye. G.. *Star Schools Engaged Learning/Technology Assessment Tools.* Ames, Iowa: Iowa State University.

1999 Burke, K. *How to Assess Authentic Learning*, Third Edition, Skylight Professional Development, Arlington Heights, Illinois.

1999 Educational Testing Services (ETS). *Components of Professional Practice*. ETS.

1996 Iowa Educational Technology Training Institute (IETTI). *Educational Technology Skills Inventory*. Cedar Falls, Iowa; University of Northern Iowa, IETTI.

1995 Jones, B. *Plugging In: Choosing and Using Educational Technology*. North Central Regional Educational Laboratory, http://www.ncrtec.org/capacity/plug/plug.htm

2003 Marzano, R. *What Works in Schools: Translating Research into Action*. ASCD: Washington DC.

1998 Redalen, E. *Elements of Instruction that are Correlated to Teaching Effectiveness and Student Learning*. Cedar Falls, IA: Area Education Agency 7, Educational Services.

1999 Stigler, J. & Hiebert, J. *The Teaching Gap: Best Ideas from the World's Teachers for Improving Education in the Classroom*, The Free Press: New York, New York.

2000 U.S. Department of Education. *U.S. Secretary's Annual Report on Teacher Quality*. http://www.ed.gov/offices/OPE/News/teacherprep/index.html

V. Explain how the goals and activities are related to the needs assessments:

The overarching goal of the MSP Math Connections Program is to target teachers in need of mathematics training and support to meet the new expectations of NCLB and the Highly Qualified Teacher specifications. The MAT 598 Connecting Math and Pedagogy 3-credit hour college course will provide college credit, PD and service in mathematics which is required by NCLB for our teachers who do not meet the Highly Qualified criteria. In addition, the course is designed around the Arizona Mathematics Standards by grade level and aims to connect content and pedagogy in an effort to meet a dual emphasis where teachers learn more math content and how their learning more math can help them to teach math better. The course content uses NSF-funded $(CM)^2$ materials and the Arizona State Standards articulated by grade level. In an effort to crosswalk our 2003 AIMS needs based on the new refinement and articulation of the Arizona Mathematics Standards by grade level each course workshop week long morning session will focus on 1) Number Sense and Operations, 2) Data Analysis, Probability and Discrete Math, 3) Patterns, Algebra, and Functions, and 4) Geometry and Measurement. Because Strand 5: Structure and Logic could be considered an extension of problem-solving (AZ ADE standards 2003), this strand will be interwoven into the other four strand workshop sessions through the development of algorithms and algorithmic thinking.

Afternoon workshops will focus on pedagogical topics identified by the Teacher Needs and Perceptions Survey administered through the Arizona Regional Math and Science Support Center. The Coconino County Educational Services Division and the AZRSC are currently analyzing the surveys with preliminary results and input from school and district administrative staffs. Workshop topics will 1) Using Student Achievement Data, both formative and summative, to plan and adjust instruction, 2) Literacy and Mathematics, 3) Technology Integration, 4) Classroom Organization and Management 5) Developing Relevant and Equitable Curriculum. Participants will also be given an overview of the Administrator "Walk-Through" Trainings offered to all building administrators, county-wide, to support the development of a school climate for change. Walk Through training gives observers specific skills to focus on how effectively an innovation or training method is implemented, looking primarily at student responses to teachers use of new strategies. It is an observation, not an evaluation tool that seeks to redirect administrative time and interest to classroom activity.

Taking this approach and using these materials ensures an increase in the level of mathematics content and pedagogical knowledge. Follow up site visits and a variety of other support services (online, mini-symposium, administrator walk through observations) and Lesson Study facilitation helps to guarantee an increase in the teacher's ability to implement the new skills and understandings in classroom practice. As a result, better classroom implementation produces the expected outcome of improved student learning and achievement.

Improved student achievement is tied to high quality, innovative and sustainable professional development in our districts and schools with the primary purpose focused on the improvement of the quality of teaching in mathematics. Consequently, we feel it is necessary to take our initial Lesson Study Pilot study to the next level of quasi-experimental research design to demonstrate whether or not it is a highly effective PD

model for the Coconino County specifically, and the state of Arizona, more generally. Through time we contend that our systemic approach to professional development will have a positive impact on overall school climate and student learning in mathematics in the Coconino County.

References Cited

2003 Arizona Academic Standards and Accountability, Mathematics Standards Articulated by Grade Level, Arizona Department of Education, www.ade.us.gov.

2001 National Research Council. *Adding It Up: Helping Children Learn Mathematics.* Kilpatrick, J., Swafford, J., Findell, B. (Eds.). Mathematics Learning Study Committee, Center for Education, Division of Behavioral and Social Sciences and Education. National Academy Press: Washington DC.

VI. Discuss and cite current knowledge relevant to the project (Literature Review):

The state of mathematics education has become a national challenge. We acknowledge the significance of mathematical literacy in the academic achievement and opportunity of our students, as well as the ability of our country to compete globally. However, this concern is often contradicted by an ambiguous cultural attitude. Math is often viewed as an "abstract, difficult, even esoteric endeavor ultimately reserved for a select few (Allen 2003:1)." As a result of this cultural barrier, U.S. teachers often reduce mathematical concepts to a series of procedures to solve a problem (Allen 2003). In higher achieving countries, teaching practice involves more time to puzzle through a complex math activity (Becker, 1999; Cogan & Schmidt, 1999; Kawanaka, Stigler, & Hiebert, 1999).

The TIMSS study deems this practice as the American way of teaching mathematics. TIMSS, the **Third International Mathematics and Science Study,** was the largest, most exhaustive, cross-cultural study ever carried out on mathematics and science education. TIMSS focused on school children ages 9 (U.S. 4th grade), 13 (U.S. 8th grade), and those in the last year of high school (U.S. 12th grade). TIMSS paid close attention to how the relationship between curriculum and teaching methods helped to determine what we learn. One of the most important results of the TIMSS is that curriculum materials alone do not ensure success for our students.

Stigler and Heibert (Teaching Gap) focused their research on the TIMSS videotape study of 8th-grade mathematics education in Japan, Germany, and the United States. In their research they found that most professional development programs do not impact teacher quality in the classroom. Current U.S. professional development (PD) programs do not recognize that the process of teaching is actually a product of our culture. Consequently, the current teaching methods occurring in our classrooms are an artifact of the ways our teachers were taught. As a result, the problem is not necessarily a result of having not highly qualified teachers. Rather, it is the culturally imbued **teaching practices** that need a closer examination.

With the No Child Left Behind (NCLB) initiative, our teachers face serious consequences if they are not deemed *Highly Qualified*. Teachers who do not currently meet the Highly Qualified requirements must obtain the sufficient content information to pass the Arizona Educator Proficiency Assessment (AEPA) through professional development and/or earn university content specific credit. Given the number of subject areas some of our teachers are charged to teach and their minimum amount of math training, the cultural ambivalence toward mathematics, and the poor performance of U.S. mathematics education programs internationally, we need to adopt a professional development model that will address all of these issues.

Recent standards-based reforms have increased the level of challenge for middle school teachers and students. Challenging content is no longer the realm of only the most able high school students. Middle school students are required to show proficiency in a much wider range of math content that the simple arithmetic of a generation ago. AIMS's scores in Coconino County support this conclusion (see needs assessment section). Our teachers are not ineffectual, but the teaching methods they were acculturated to use are extremely ineffective. Additionally, the American teaching has no system in place to help them increase their knowledge and teaching practice.

Superintendents and principals recognize the need for a professional development model that will produce a cultural shift in attitudes towards mathematic teaching practices, as well as ensure longevity and sustainability. Many education professionals are working to "develop high standards for what students should learn in school, along with the means for assessing students' progress" (Stigler and Heibert 1999:1). Conversely, educators also recognize that standards and assessments are not enough. We need to design and deliver effective learning opportunities for our students to reach the new high standards. *"Standards set the course, and assessments provide the benchmarks, but it is teaching that must be improved to push us along the path to success (Stigler and Heibert 1999:2)."*

2003 Allen, R. Embracing Math: Attitudes and Teaching Practices are Changing – Slowly. *Curriculum Update*, Fall 2003, ASCD: Washington, DC.

1999 Becker, J.P., Sawada, T. & Shimizu, Y. Some findings of the US-Japan cross-cultural research on students' problem-solving behaviors. In, International comparisons in mathematics education edited by G. Kaiser, E. Luna and I. Huntley, 121-139. Falmer Press, Philadelphia, PA.

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VII. Indicate what research was used to design the program and why (SBR level):

Working within their current PD structure, superintendents and principals are willing to adopt a new innovative professional development approach in their districts and schools. Educators want to improve the quality of teaching in an effort to ultimately improve student learning. Additionally, administrators recognize the need to retain and recruit highly effective teachers to serve as models to their less experienced peers. Consequently, teaching practice in the classroom needs to be front and center in any professional development model.

Through a two week 3-credit hour college course participants will receive mathematics content and pedagogical instruction focusing on connecting higher order concepts to the math taught in the classroom. Site-based, follow-up sessions will assist teachers in incorporating their new learning into classroom practice. All teachers will receive PD focusing on the alignment of curricular standards and objectives to instruction and assessment (NRC, 2001a & b). The morning workshops will use NSF-supported standards-based Connecting Middle School and College Mathematics $(CM)^2$ curricula. $(CM)^2$ curricula helps teachers to learn how to teach students how to develop mathematical skills, knowledge, and understanding along with the rich connections between the mathematical strands and other disciplines. Workshop activities will focus on mathematical communication and reason with a particular emphasis on the knowledge of and skills associated with mathematical vocabulary, modeling, materials, tools, strategies, and intellectual methods deriving from the discipline of mathematics. Teachers will explore how their mathematical foundation will help students to define and solve problems in an effort to allow students to use mathematics as a way of understanding the world around them.

The NSF-supported standards-based curricula explicitly support middle school teachers in better understanding 7^{th} – 18^{th} grade mathematics themselves, while at the same time immersing teachers in exemplary middle school curricula. This connection meets the essential mathematics teacher education goals recommended in Adding It Up: Helping Children Learn Mathematics (NRC, 2001a) that in order to improve teacher performance and student learning "teachers' need coursework that reflect a serious examination of the nature of mathematics that teachers use in the practice of teaching" (p. 375). Connecting Middle School and College Mathematics $(CM)^2$ authors, state through the process of investigating their materials mathematics teachers will "not only directly experience the concepts they themselves will be teaching, but will also have multiple opportunities to connect and deepen their understanding of these notions" (Papick, 2003:1). Numerous studies meeting SBR's gold and silver standards underscore the power of using exemplary NSF developed curricula for helping students learn mathematics, particularly for those students who have a history of poor achievement in mathematics (Hoover, Zawojewski, and Ridgeway, 1997; Ben-Chaim, D., Fey, J., Fitzgerald, W., Benedetto, C.,

& Miller, J., 1998; Lapan, Reys, Barnes, & Reys, 1998; Griffin, L., Evnas, A. and Trowell, J., 2000).

Fennema and Carpenter (1996) have studied the effects of programs designed to teach teachers about learners' thinking and how to use that information to design and implement instruction, using research designs meeting SBR's silver standards. Basic tenets that of their experimental intervention include: (1) Instruction must be based on what each learner knows, (2) Instruction should take into consideration how children's mathematical ideas develop naturally, and (3) Children must be mentally active as they learn mathematics (Koehler & Grouws, 1992).

Working from that perspective, we incorporate work concerning student learning for each of the content strands, identifying students' ways of thinking at the middle and high school with connections to teachers' learning within the content strands. Resources include Research Ideas for the Classroom: High School Mathematics, edited by P. S. Wilson and Research Ideas for the Classroom: Middle School Mathematics, edited by D. T. Owens.

The course meets this dual emphasis where teachers learn more math content and learn the value of this new knowledge in improving their teaching (CBMS 2001, NRC 2001a, NRC 2001b, Papick 2003) by using the NSF-funded (CM)^2 materials and the Arizona State Mathematics Standards by Grade Level.

2003 Allen, Rick "Embracing Math: Attitudes and Teaching Practices are Changing – Slowly," in Curriculum Update, Fall 2003, Association for Supervision and Curriculum Development.

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2001b National Research Council (2001b). *Educating Teachers of Science, Mathematics, and Technology: New Practices for the New Millennium.*
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1993 Patterson, J. "Leading Through Systems Thinking." In *Leadership for Tomorrow's Schools*. Association for Supervision and Curriculum development, Alexandria, VA.
1999 Stigler, James W. and James Hiebert. The Teaching Gap: Best Ideas from the World's Teachers for Improving Education in the Classroom, The Free Press, NY, NY.

VIII. If the project builds on prior work, indicate what was learned and how that was incorporated into the new project:

The Arizona Regional Math and Science Support Center has implemented a pilot study in the Lesson Study process working with all of the districts in Coconino County. For the Spring semester 2004, 42 math teachers and several professional development administrators are taking Northern Arizona University's MAT 601 course entitled, "Reflecting on/in Mathematics." Math teachers and professional development administrators will engage in the dynamic classroom reflection process otherwise known as Lesson Study. Lesson Study combines many of the existing PD models in the U.S. such as training, observation/assessment, development/improvement processes, study groups, and action research and has been proven effective in science and mathematics education across the county.

Several Coconino County districts have undertaken extensive curriculum mapping projects, but in some cases districts are finding that projects are not integrated into the actual daily practice of teachers. Conversely, we have found that in order to impact student achievement, teachers need to develop models of effective implementation through intensive study and reflective practice. The Lesson Study model is predicated on this process by empowering teachers to become the instructional leaders of their classes, not the passive presenters of "canned" curriculum. The model's emphasis on student behavior and outcomes provides the context for meaningful assessment of individual student progress and the motivation for teachers to adjust their instructional strategies to meet these needs. The Lesson Study model requires that teachers use the results of formative and summative assessments to select lesson topics, and the course content will reference state and national standards in reviewing curricular outcomes. These elements are the basis of lasting leadership from the content area teachers. This leadership is essential in Arizona's rural schools, where administrators all too often stay only a year or two at a single school or district, and teacher turnover is higher than urban districts. Consequently, the county and its districts have chosen to participate in a pilot study focusing on the Lesson Study process in mathematics education.

In an effort to substantiate the results of our pilot study, one part of this MSP Math Connections Project proposes to use a Quasi-Experimental Design comparing the effectiveness of Lesson Study as a professional development model with regards to the notion that teachers will gain a deeper, more substantive implementation of the content and pedagogical knowledge in classroom practice.

IX. List the responsibilities of each partner involved in the program:

The Coconino County Superintendent of Schools through the Arizona Regional Math and Science Support Center has partnered with the Department of Mathematics at Northern Arizona University, the Coconino County Educational Services, Grand Canyon USD, Fredonia USD, Flagstaff USD, Maine Consolidated USD, Williams USD, Tuba City USD, and Page USD in an effort to implement and manage a Mathematics Professional Development initiative across the Coconino County. Together we are working to devise an effective, proactive, long-term solution to the new expectations related to teacher quality and student success (Patterson 1993:74).

Principal Investigator Linda Neff will serve as the Project Director for the project. Working at 15 hours/week until June 30, 2004 and 20 hours/week thereafter, she will manage scheduling, team building, and coordinating the overall program development, marketing, registration, delivery, and site follow up visits. She will be responsible for the budget, time management, and coordination with the other three Co-PIs. She will work with each district representative to develop procedures and protocol for implementing the professional development initiative. Linda Neff will work closely with Co-PI Mary Nebel, Director of Educational Services for the Coconino County, in all phases of the project. Co-PI Mary Nebel will oversee and coordinate all the activities of the Educational Services for the Coconino County and ensure the professional development activities concur within the existing professional development structure of each district.

Co-PIs Dr. Jeff Shamantha and Dr. Carol Howald are assistant professors of mathematics education at Northern Arizona University. They bring their experience with mathematics curriculum, instruction, and assessment and teacher professional development (specifically Lesson Study) to this project. They will design and teach mathematics education courses, provide site-based support in curriculum content, planning, implementation, delivery and reflection, and they will be responsible for the final project evaluation and quasi-experiment reports.

1993 Patterson, J. "Leading Through Systems Thinking." In *Leadership for Tomorrow's Schools*. Association for Supervision and Curriculum development, Alexandria, VA.

X. Give a project timeline:

Phase I
Goals and Logistics
12/15/03 – 1/20/04

Description: Clearly define goals, objectives, and anticipated outcomes for ADE-MSP Grant Proposal, development of evaluation criteria, decide on time of workshop, select facility and dining arrangements, registration and budget costs, quasi-experimental research design
Staff: Linda Neff (10 days), Mary Nebel (5 days), Carol Howald (4 days), Jeff Shamatha (4 days), Charlene Wingo – admin. coord. (1 day)

Phase II
Program Development
1/26/04 – 3/19/04
Description: Complete the analysis of the Teacher Needs and Perceptions Survey, create timetable for workshop activities, select workshop instructors, make workshop agenda, make arrangements for refreshments, hotel, and transportation arrangements.
Staff: Linda Neff (15 days), Mary Nebel (2.5 days), Charlene Wingo – admin. assist. (5 days).

Phase III
Marketing
3/23/04 – 4/23/04
Description: Website and Program Design -- graphic layout, theme, target and invite high need schools and teachers for participation (recruit HQT), target and invite teachers already involved with Lesson Study (retain HQT), invite HQT teachers who are interested in taking the workshop (retain HQT).
Staff: Linda Neff (10 days)

Phase IV
University Admission/Registration
Description: Identify and guide teachers needing admittance to the graduate college, guide participating teachers in the registration process, make arrangements for room setup, order and prepare book and workshop materials, design data collection materials and observation criteria for experimental design and evaluation.
Staff: Linda Neff (4 days), Jeff Shamatha (1 day)

Phase V
Course Delivery: July 27, 2004 – August 6, 2004
7/20/04 – 8/6/04
Description: Make all final building and refreshment arrangements, prepare registration table, evaluation form distribution, name tags, refreshments, workshop delivery.
Staff: Charlene Wingo – admin. Assist. (5 days), Linda Neff (10 days), Jeff Shamatha and Carol Howald – teach course, Mary Nebel (5 days), 10 Workshop Consultants (5 days)

Phase VI
Individual and Lesson Study Follow up Site Visits/Spring Mini Symposium/Admin Walkthrough Training
8/11/04 – 6/1/05

Description: Collect and analyze all evaluation forms after workshop. Train administrators in Walk Through process and procedure as it relates to effective mathematics instruction. Plan for the 4 follow up visits -- 4 each Lesson Study Team and individual participants not in Lesson Study over the course of the Fall/Spring semesters. Plan and deliver a one day mini-symposium for teachers to share their work.
Staff: Carol Howald (11 days), Jeff Shamatha (9 days), Linda Neff (10 days), Deb Wolfe – Career Ladder Director (8 days), Videographer (40 days), Admin. Assist/Coord. (15 days).

Phase VII
Data Analysis/Final Evaluation/Report Write Up
6/2/05 – 9/30/05
Description: Analyze and disseminate program results.
Staff: Carol Howald and Jeff Shamatha (21 days), Linda Neff (7 days), Mary Nebel (7 days), Data Entry (10 days).

XI. Estimate the number, type, duration, and intensity of your professional development activities:

Arizona standards and assessments emphasize Number Sense and Operations, Data Analysis, Probability, and Discrete Mathematics, Patterns, Algebra and Functions, Geometry and Measurement, Structure and Logic. Needs assessments done with participating districts, schools, and teachers demonstrate particular room for growth in teacher professional development and student achievement in the areas of 1) Number Sense and Operations, 2) Data Analysis, Probability, and Discrete Math, 3) Patterns, Algebra, and Functions, and 4) Geometry and Measurement. Strand 5 Structure and Logic will be taught as an interconnection to all the other strands through the development and analysis of algorithms and algorithmic thinking.

Teachers will be immersed in learning more about specific strategies for improving student learning in these mathematics strands from 8 am – 12 pm each day for the duration of the two-week summer course at Northern Arizona University. Depending on the individual's areas of weakness, each teacher will work within one of these content strands for one full week and then within another strand for another week. Each strand, as mentioned above and emphasized in the Arizona State Mathematics Standards Rationale, will interconnect problem solving, reasoning, communication, connections, and technology throughout the content standards. Teachers will investigate as learners and as teachers within these content strand sessions.

Afternoon workshops will focus on pedagogical topics identified by the Teacher Needs and Perceptions Survey administered through the Arizona Regional Math and Science Support Center. The Coconino County Educational Services Division and the AZRSC are currently analyzing the surveys with preliminary results and input from school and district administrative staffs. Workshop topics will last from 1 pm. – 4 pm each afternoon and will include these topics: 1) Using Student Achievement Data, both formative and summative, to plan and adjust instruction, 2) Literacy and Mathematics

(Barton and Heidema 2002; Tovani 2000), 3) Technology Integration 4) Classroom Organization and Management 5) Developing Relevant and Equitable Curriculum. Participants will also be given an overview of the Administrator "Walk-Through" trainings offered to all building administrators, county-wide, to support the development of a school climate for change. Walk Through training gives observers specific skills to focus on how effectively an innovation or training method is implemented, looking primarily at student responses to teachers use of new strategies. It is an observation, not evaluation tool that seeks to redirect administrative time and interest to classroom activity (NSCI 2002).

Four site follow up visits will follow the course throughout the Fall 2004 and Spring 2005 semesters. Assuming we have 10 Lesson Study teams of three people (10 teams @ 4 visits/team = 40 site visits), and 30 participants not involved in Lesson Study (30 individual site visits @ 4 visits = 120 site visits), we will visit will plan four site visits for each Lesson Study team and four site visits for each course participant. Site visits for both groups will entail two lesson planning consulting sessions, one observation/implementation/demonstration session, and one reflection session. Data collection will be ongoing and analysis and write-up will occur during the summer of 2005.

References Cited

2002 Barton, Mary Lee and Clare Heidema, Teaching Reading in Mathematics, 2nd Ed., McREL(available through ASCD) Alexandria, Virginia.

2002 Classroom Walk Through with Reflective Feedback, Training program by Learning 24/7, National School Conference Institute, Phoenix, Arizona.

2000 Tovani, Chris. I Read It but I Don't Get It: Comprehension Strategies for Adolescent Readers. Stenhouse, Portland, Maine.

XI. List the specific Arizona Academic Content Standards in mathematics that your professional development focuses on:

Number Sense and Operations

- **Number Sense** The concept of understanding and applying numbers, ways of representing numbers, the relationships among numbers and different number systems.
- **Numerical Operations** The concept of understanding and applying numerical operations and their relationship to one another.
- **Estimation** The concept of using estimation strategies reasonably and fluently.

Data Analysis, Probability, and Discrete Math

- **Data Analysis (Statistics)** The concept of understanding and applying data collection, organization and representation to analyze and sort data.

- **Probability** The concept of understanding and applying the basic concepts of probability.
- **Discrete Mathematics: Systematic Listing & Counting** The concept of understanding and demonstrating the systematic listing and counting of possible outcomes.
- **Discrete Mathematics: Vertex-Edge Graphs** The concept of understanding and applying vertex-edge graphs.

Patterns, Algebra, and Functions

- **Patterns** The concept of identifying patterns and applying pattern recognition to reason
- mathematically.
- **Functions & Relationships** The concept of describing and modeling functions and their relationships.
- **Algebraic Representations** The concept of representing and analyzing mathematical situations and structures using algebraic representations.
- **Analysis of Change** Analyze change in a variable over time and in various contexts.

Geometry and Measurement

- **Geometric Properties** The concept of analyzing the attributes and properties of two and three dimensional shapes and developing mathematical arguments about their relationships.
- **Transformation of Shapes** The concept of applying spatial reasoning to create transformations and use symmetry to analyze mathematical situations.
- **Coordinate Geometry** The concept of specifying and describing spatial relationships using coordinate geometry and other representational systems.
- **Measurement** The concept of understanding and applying appropriate units of measure, measurement techniques, and formulas to determine measurements.

All four workshop sessions will integrate the process standards of communication, Problem-solving, Reasoning & Proof, Connections, and Representation throughout the teaching and learning of mathematical the above mathematics strands. In addition, the structure and logic strand will be incorporated into the above four strands through algorithms and algorithmic thinking, as well as through the logic, reasoning, arguments, and mathematical proof (ADE Arizona Academic Standards articulated by Grade Level 2003).

XII. Explain how the submitting team has the ability to manage the project, organize the work, and meet all deadlines.

The AZRSC consists of a Director, Linda Neff (PI), who works for the Coconino County Superintendent of Schools, and a representative from each district in the County. Representatives' roles in the districts range from Career Ladder Director, Professional Development Coordinator, Principal, Superintendent, to teacher. The AZRSC

communicates on a regular basis to plan, coordinate, and deliver professional development support services to LEAs in the following areas: 1) recruiting and retaining highly qualified teachers, 2) plan, coordinate, and deliver support services to LEAs in implementing State Board-approved Arizona Academic Standards by Grade level, and 3) to assist schools in acquiring nationally researched, scientifically based subject matter and effective instructional practices in all K-12 critical content areas with a focus on mathematics and a subsequent emphasis on Science.

Linda Neff provides the leadership and management necessary to coordinate the county-wide PD efforts in mathematics and science as well as manages the funding opportunities for the Math/Science Support Center. She is familiar with several strategies to help facilitate communication between such a geographically distant group. She also has a strong background in professional development, curriculum development, and instructional design. She has developed, marketed, managed and instructed many professional development programs, workshops, conferences, and symposiums for a variety of audiences. Co-PI, Mary Nebel, provides the much needed long term perspective and experience working with the Coconino County and school districts to provide the framework, vision, and realities of the counties' needs. She is a former disstrictg level assessment corridinator and has maganged several professional development grants. Partnering with Co-PIs Jeff Shamatha and Carol Howald has resulted in a very effective, working relationship. Both have a strong background in mathematics education, professional development (Lesson Study), and evaluation.

Working as the Director of the AZRSC, Linda Neff is continually building the infrastructure to develop, support, and maintain a long-term solution to the systemic changes inherent in our educational system as well as to the immediate responses of NCLB. That infrastructure consists of a team management structure that emphasizes working toward a common goal in a collaborative and communicative working environment. Working closely with Mary Nebel, PDLA county coordinator and Educational Services Director, District Superintendents, Principals, Professional Development Coordinators, and teachers we can ensure the project will be held to high expectations and meet all of ADE's requirements.

XIII. Show evidence that the project can continue beyond the life of the grant.

The Math Connections MSP Program will complement other comprehensive professional development projects underway through the Arizona Regional Math and Science Support Center and the Educational Services Department of the Coconino County Superintendent of Schools office. These staff developers are members of the Professional Development Leadership Academy (PDLA), and are committed to supporting projects that provide comprehensive, teacher-centered, intensive professional development throughout the county. All county initiatives arise from a commitment to the National Staff Development Council's Standards for Professional Development, which reiterate the Arizona Professional Standards for Teachers. Additionally, these principals are the foundation of the plans that all districts are completing for compliance with the

Professional Development provisions of NCLB. Both the survey and training provided to representatives from all districts are supported by the PDLA. This comprehensive approach supports the sustainability of this proposal, integrates these activities within the school community, and ensures student and teacher success.

In addition, the content and pedagogical course and follow up site visits will align with the Department of Mathematics and Statistics at NAU goals where teachers have the opportunity to learn more math content, become better teachers, help to improve student learning, meet the highly qualified status, and get started towards a master's degree. Our team is taking this comprehensive approach to support systemic change in mathematics education by integrating professional development activities within the school community in an effort to create a sustainable, region-wide professional development initiative where curriculum, instruction and assessment alignment works in concert with teacher professional development within the existing leadership and professional development structures in Coconino County to improve student learning in mathematics.

XIV. Identify the evaluation methods this program will use.

The project evaluation includes formative evaluations of trainings and implementation of content knowledge, on-going assessment of lesson study activities, and summative evaluations of the outcomes and impacts of the project for teachers and their students each year. This data informs stake-holders of the success of long-term project goals. Analysis of the quasi-experimental research will investigate how Lesson Study impacts the translation and maintenance of teacher content and pedagogy learning into classroom practice (Marzano 2003; Stronge 2002). Our evaluation efforts use the PD Accountability Model developed by Kathy Tucker and adapted from Guskey (Guskey 2000) and Friedman (2000) as well as the program evaluation process articulated in Joellen Killion's Assessing Impact: Evaluating Staff Development (Killion 2002). Strategic project goals and subsequent objectives to produce measurable outcomes within a given time frame are outlined below:

1. Prepare, train, and increase the number of Highly Qualified teachers of mathematics in the Coconino County.

Evidence, Assessment
Quadrant 1 Objectives (Did we say what we would do and if so, how much?)
Objective 1: Deliver and complete MAT 598 course, site follow ups, quasi-experimental design, analysis, and report in given time frame.
Objective 2: Provide 3 college credit hours and 4 PD mathematical content hours.
Objective 3: Enroll 40 teacher participants in the MSP Math Connections Program.
Objective 4: Increase the percentage of teachers receiving high quality PD.
Objective 5: Increase the percentage of specific subgroups receiving high quality PD (gender, ethnicity, ELL teachers, math teachers, principals, economically disadvantaged).
Quadrant 2 Objectives (How well did we do it?)
Objective 1: % and level of participant approval for the context of the PD
Objective 2: % and level of participant approval of the content taught and follow up support and level of difficulty.

Objective 3: % and level participant approval of the process and delivery of content and follow up support.
Objective 4: % of participants who found program content relevant to student achievement goals.
Objective 5: % of participants who considered stipends for their participation reasonable.
Quadrant 3 Objectives (How much effect/change was there?)
Objective 1: # of participants completing program.
Objective 2: # of participants completing program from specific subgroups (gender, ethnicity, ELL teachers, math teachers, principals, economically disadvantaged).
Objective 3: # of participants becoming "highly qualified"
Objective 4: # of students with teachers that are highly qualified

What methods and strategies of data collection will be utilized?
Sign-in sheets
Feedback Form
School/District Database
Questionnaire Survey

2. Increase the level of content knowledge of the Arizona Mathematics Standards

Evidence, Assessment
Did participants increase knowledge and skills?
Quadrant 4 Objectives: (What quality of effect/change was produced?)
Objective 1: % participants reporting they gained knowledge.
Objective 2: % participants reporting they will used knowledge.
Objective 3: % participants demonstrating increased knowledge
Objective 4: % participants demonstrating increased skill

What methods and strategies of data collection will be utilized?
Feedback Form
School Site Visits/Observation Checklists
Lesson Artifacts
Simulation/Classroom Demonstration

3. Increase the level of content and pedagogical mathematics knowledge of course participants.

Evidence, Assessment
Did participants increase knowledge and skills?
Quadrant 4 Objectives (What quality of effect/change was produced?)
Objective 1: % participants reporting they gained knowledge
Objective 2: % participants reporting they will use the knowledge
Objective 3: % participants demonstrating increased knowledge
Objective 4: % participants demonstrating increased skills

What methods and strategies of data collection will be utilized?
Feedback Form
School Site Visits/Observation Checklists
Lesson Artifacts
Simulation/Classroom Demonstration
Administrator "Walk Through" observational reports

4. Increase the ability to implement the gained content and pedagogical knowledge understandings into classroom practice.

Evidence, Assessment
Did participants effectively apply the new knowledge and skills?
Quadrant 4 Objectives (What quality of effect/change was produced?)
Objective 1: % participants who report exploration and practice of new skills
Objective 2: % participants who report implementation
Objective 3: % participants who report adopting
Objective 4: % participants who report participating in institutionalization
Objective 5: % participants submitting artifacts demonstrating use of new skills
Objective 6: % participants observed using new skills
Objective 7: % time participants spend collaborating with other teachers about new knowledge and skills

What methods and strategies of data collection will be utilized?
Questionnaire
Lesson Plans, Curriculum Maps, Classroom Management Plans
Observation/Evaluation Instrument
Administrator "Walk Through" observational reports

5. Improve student achievement in mathematics in the Coconino County.
Evidence, Assessment
What is the impact on student learning?
Quadrant 5 Objectives (What quality of effect/change was produced?)
Objective 1: % students increasing achievement levels
Objective 2: % students improving attendance
Objective 3: % decrease in dropout rate
Objective 4: % completing courses successfully
Objective 5: % of increased participation in math course offerings beyond minimum requirements

What methods and strategies of data collection will be utilized?
Standardized test results, school/district assessments, teacher made tests, grades
Attendance records
Dropout records
Student transcripts
Questionnaires
Financial Records, Achievement Records

5. To support the notion that teachers involved in Lesson Study have a deeper, more substantive implementation of the content and pedagogical knowledge into classroom practice.

Evidence, Assessment
Did participants effectively apply the new knowledge and skills?
Quadrant 4 Objectives (What quality of effect/change was produced?)
Objective 1: % participants who report exploration and practice of new skills
Objective 2: % participants who report implementation
Objective 3: % participants who report participating in institutionalization
Objective 4: % participants submitting artifacts demonstrating use of new skills
Objective 5: % participants observed using new skills
Objective 6: % time participants spend collaborating with other teachers about new knowledge and skills

What methods and strategies of data collection will be utilized?
Questionnaire
Curriculum Artifacts
Observation/Evaluation Instrument

If this grant is extended into a third year, we would add the following project strategic goal.

7. To make a positive impact on overall school climate.
Evidence, Assessment
What is the impact on the organization?.
Quadrant 5 Objectives (What quality of effect/change was produced?)
Objective 1: % improvement in climate
Objective 2: % improvement in attitude towards change
Objective 3: % participants reporting sufficient support for implementation of intervention
Objective 4: % increase in funding to support intervention

What methods and strategies of data collection will be utilized?
Climate Survey
Financial Records

XV. Describe how the activities of the program will help the MSP build a rigorous, cumulative, reproducible, and usable body of findings.

The Coconino County MSP program design is the result of a comprehensive review of student, teacher and school needs and an extensive examination of research-based, practical and effective training programs that correspond to those needs.

Demographics of Coconino County teachers and schools mirror both the achievement profiles and professional development needs of rural schools throughout the state and region, especially those whose demographics are similar. The program activities focus on those needs with research-based training strategies and materials that are generally available and easily and practically implemented. Each step of the planning, implementation and evaluation stages will be documented with identified and verified tools and results. The program design reflects emphasis on comprehensive, inclusive planning, as well as systematic documentation and review of each stage of the process. This reflection and review includes all members of the implementation team, to provide multiple perspectives and well as more reliable documentation. All of these characteristics combine to ensure that the project is "rigorous, cumulative, reproducible and useable" for other LEA's.

XVI. List the measurable objectives and annual targets that reduce the number of staff who do not meet the "highly qualified teacher" definition under NCLB.

The percentage of teachers not meeting the Highly Qualified Teacher requirements is currently 18% in some of our districts. The MSP Math Connections Program intends to reduce that number to 0% of all continuing mathematics teachers over a two year period. The first annual target in meeting this objective is to reduce that number to 10% or fewer.

XVII. List measurable objectives and annual targets for improved student academic achievement.

Measurable Objective: Over the one and a half year period of the grant, student achievement of state standards as measured by the AIMS assessment will improve as follows:

1. The percentage of students who meet or exceed proficiency will increase by 10%. Increases shall be at the county, district and school level of reporting.
Annual Target: The percentage of students who meet or exceed proficiency will increase by 5%.

2. The percentage of students who place in the Falls Far Below category will decrease by 10%. Increases shall be at the county, district and school level of reporting.
Annual Target: The percentage of students who place in the Falls Far Below category will decrease by 5 %.

3. Achievement of the specific targeted mathematics content standards identified as low at each school will improve by 10%. (Example: If Geometry performance at a specific school is low in relationship to achievement of the Algebra standard, then student performance in that standard of the AIMS assessment will improve by 10% over a 2 year period.)
Annual Target: Achievement of the specific targeted mathematics content standards identified as low at each school will improve by 5 %.

4. The number of school sites in Coconino County identified as “Underperforming” and not making “Adequate Yearly Progress” as a result of low achievement in mathematics will decline.
Annual Target: Two school sites per year will move from “Underperforming” or not making AYP to “Performing” or making AYP, a 30% improvement.

XVIII. List measurable objectives and annual targets to increase the number of teachers who participate in content-based (mathematics) professional development.

Current participation in content-based professional development is not tracked by schools, districts or the county. We do have current, accurate data regarding the numbers and percentages of highly qualified teachers by site and district. We also have a vibrant network of mathematics teachers advising the Coconino County Regional Support Center (RSC) about local needs and programs.

Should this proposal be funded, we will contact the human resources/professional development departments of each district and the math faculties of each school, if necessary, to learn more about and document baseline information about the length, duration, and frequency of content – based training.

We can, however, set a target for the participation of Coconino County mathematics teachers in a summer training institute based on the district, school and individual teacher commitment to RSC training programs and the requests for additional training that the establishment of that network and initial training has produced.

Our annual target is to increase by 25% the number of teachers who participate in sustained and comprehensive mathematics-based professional development.

Budget Line Items

		Year 1	Year 2
Instruction 1000			
Salaries	6100		
Employee Benefits	6200		
Purchased Professional Services	6300		2100
1000-6300 Substitute Teachers (30 days)			
Purchased Property Services	6400		
Other Purchased Services	6500		
Supplies	6600		
Other Expenses	6800		
Subtotal for Instruction 1000			2100
Support Services 2100, 2200, 2600 - 2900			
Salaries	6100		
Employee Benefits	6200		
Purchased Professional Services	6300		
(Teacher Stipends 40@$300 Summer; 40@$200 Spring; 10 principals/admin @ $500			
Professor Consulting $5600; Professor Anal/Write up: $11760; Videographer 30 days @ $140 day)		16200	23160
Purchased Property Services	6400		
Other Purchased Services	6500		
2200-6580 Teacher Travel: Meals/Lodging ($750 @ 13 teachers)	6580	12552	966
(Summer Mileage: $2802; Spring Mileage: $966)			
Supplies	6600		
2200 - 6600 Teacher Supplies and Materials		3000	
(Course Materials $75 @ 40 people)			
2200 - 6600 Supplies and Materials			
2200-6632 Other Food		13500	1350
(Summer Workshop $13,500; Spring Mini-Symposium $1350)			
Other Expenses	6800		
2200-6800 Other Expenses	6800		
(NAU tuition $24,160; NAU Admission Fees $600)			24760
Subtotal for Support Services 2100, 2200, 2600 - 2900			95488

		Year 1	Year 2
Support Services - Admin 2300, 2400, 2500			
Salaries	6100		16000
Project Manager 10 hours/week matched with AZRSC funds			
Employee Benefits	6200		2400
Purchased Professional Services	6300	2400	800
(Admin. Coordinator 15 days @ $160/Admin. Assist./Data Entry 10 days @ $80/day)			
Purchased Property Services	6400		
Other Purchased Services	6500		
2300-6580 Admin Travel: Meals/Lodging			2283
(Cars $1400 for 35 out of town visits; Per Diem $883)			
Supplies	6600	5000	1000
2300-6600 Office Supplies (copier, research resources, postage, admin curriculum resources)			
Curriculum Materials			
Other Expenses	6800		
2300-6800 Other Expenses			
(NAU tuition 604)			
Subtotal for Support Services - Admin 2300, 2400, 2500			
Operation for Non-Instructional Services 3000			
Salaries	6100		
Employee Benefits	6200		
Purchased Professional Services	6300		
Purchased Property Services	6400		
Other Purchased Services	6500		
Supplies	6600		
Other Expenses	6800		
Subtotal for Non-Instructional Services 3000			0
Project Subtotal			
Max ADE Restricted Indirect Cost Allowed			
Indirect Cost			

Restricted Indirect Cost Rate 2%	6910		
Capital Outlay			
Property	6700	3000	
Purchase of mini DV video camera			
Total			
Instruction 1000			
Salaries	6100		
Employee Benefits	6200		
Supplies	6600		
Indirect Cost			
Restricted Indirect Cost Rate	6910		
Capital Outlay			
Property	6700		
Total			133637