Partnership Needs Assessment

Tucson Unified School District (TUSD) is the largest district in southern Arizona and the second largest in the state, serving a diverse student population of 50,000 students. As a district, TUSD has not made Adequate Yearly Progress (AYP) for the past five years, with low achievement in math as a primary contributing factor.

The TUSD MSP High School Project (TMHSP) will focus on creating developing a cadre of high school teachers who have the content knowledge and instructional skills to explain mathematics clearly, facilitate activities that help students uncover key mathematical ideas, and assess student progress in order to inform future instructional decisions. Working collaboratively, teachers will be able to integrate mathematics standards and align site math resources so that students receive high quality instruction as they move through high school. The project will also provide an opportunity for teachers to form new relationships across grade levels. Participating teachers will bring the information back to their site and work through their existing professional learning communities.

For the TUSD MSP High School Project (TMHSP), teachers from five (5) District comprehensive high schools will be participating. All of the sites are “high need” as defined by the criteria specified under the Elementary and Secondary Education Act. Free and reduced lunch student eligibility is above 50% at each site; none of the schools met AYP in 2013; and the total percentage of students achieving mastery in AIMS mathematics in Spring 2013 across sites ranged between 25% to 43% (Appendix B, Partnership Needs Table 1 and Table 2)

The total number of TUSD students impacted by the project is 8057, representing 59% percent of the District's high school student population (Appendix B, Table 1).

Student Academic Needs at Participating Sites

The 2013 Spring AIMS data was examined to identify student needs in the area of mathematics (Appendix B, Table 2 – Percentage of students who achieved mastery). First-time passing rates on AIMS (10th grade) is a strong indicator of the successfulness of a school's mathematics program. As Table 2 shows, these rates varied from a high of 52% at Tucson High Magnet to a passing rate of 32% at Pueblo Magnet compared to a District average of 53%.

Disaggregating the 2013 AIMS data by grade level and mathematical concept reveals the areas where student skills are the weakest (Appendix B, Table 3). As presented in Table 3, the data shows that student performance is stronger in certain areas than others. The percentage correct by data analysis (statistics), for instance is consistently higher across all schools, while number sense and operations and measurement tend to be areas where students perform less well. Not surprisingly, there is a decrease in the percentage correct as students move from grades 10 to 12. Many 12th graders who have not yet mastered math after three attempts often have key gaps in their mathematical knowledge and become increasingly less confident in their mathematical abilities.

In conclusion, the student achievement data confirms that students at the participating sites need to improve their math skills and therefore need more effective and, perhaps differentiated, instruction in mathematics.

Relationship between Student Academic Needs and Teacher Content Knowledge

Spring 2013 student AIMS data in mathematics was also used to analyze the areas where teacher content knowledge might be insufficient (Appendix B, Table 4). Current teachers whose class averaged below a 75% passing rate in mathematics last year are defined as having insufficient mathematics content knowledge. As table 4 shows, the majority of the teachers at each site have insufficient knowledge. The relationship between classroom and student performance using ATI Galileo benchmark data is shown in table 5 (Appendix B, Table 5) This table shows the number of students who met ATI benchmarks in mathematics on the progress monitoring 1 test (December 2013) compared to the number of students who met ATI benchmarks on the pre-test (August 2013). As the table shows there is great variability across teachers within a school, suggesting that some teachers are better prepared to teach mathematics than others. If student achievement is related to teacher performance as both empirical and theoretical research suggest, improving classroom teacher knowledge and skills in key mathematical content areas should improve student's individual performance.

Teacher Preparedness and the Need for Professional Development

In addition to student academic data, survey data was collected related to teachers' credentials in mathematics and their individual participation in formal mathematics professional development workshops and courses. The on-line questionnaire was distributed to 124 teachers teaching or supporting mathematics instruction at participating sites (Appendix C, Mathematics Professional Development Needs Teacher Survey). Unfortunately, technological issues prevented many teachers from responding and only 19 high school math teachers were able to complete the survey (15 percent response rate). Although restricted, this group represented all

areas of mathematics, including exceptional education math classes and Advanced Placement calculus.

Overall, the sample had formal credentialing in mathematics or related fields. Almost 57% of the respondents reported having 33 or more credit hours in mathematics. Fifty-eight percent had taken and passed the AEPA. Individual responses suggest that respondents fell into two categories – those with extensive training in mathematics and those with very little. At least 32% indicated that they had less than 5 math courses. In terms of recent professional development, the majority of activities noted were the annual MEAD conference and Advanced Placement Institutes. Only two reported attending multi-day workshops on the Common Core State Standards for Mathematics. Although limited, this self-reported data indicates that teachers at these sites would benefit from well-designed, high quality mathematics professional development to support the transition to the AZCCRS-M.

Prioritization of Professional Development Needs

Teachers were also asked to prioritize areas of mathematics in which they thought professional development was most needed (Appendix C. Mathematics Professional Development Needs – Teacher and Administrator Survey). Based on a 5 point scale, the teacher survey results show that Algebra and Functions are two areas rated most highly. Highly rated topics included building functions (3.53), exponential modeling (3.58), algebraic structure (3.53) and reasoning with systems of equations (3.47). Respondents rated Geometry as less important.

Site administrators (Principals and Assistant Principals) were also asked to complete an on-line questionnaire that asked them to prioritize areas of mathematics.

Seven (7) administrators out of 15 administrators responded for a response rate of 47%. All administrators rated Algebra as the most important priority (5.0) followed by Geometry (4.3) – an area that teachers had rated as being of lower importance. Functions were also rated highly (3.7). Administrators were also asked to rate the extent to which they had observed the mathematical practices in teacher classrooms. Administrators rated MP1, *Make sense of problems and persevere in solving them*, as the most evident in teacher classrooms (2.86) while MP6, *Attend to precision*, as the least evident (2.0). All were rated below a 3.0.

In conclusion, the student and teacher needs data shows that 1) improvement of student achievement in mathematics is needed, 2) teachers are insufficiently prepared to teach mathematics, particularly in the critical content area of Algebra, and 3) professional development opportunities have been limited. The proposed TMHSM project is designed to address these needs by offering teachers an integrated professional program that focuses not only on improving teacher math content knowledge, but incorporates mathematical pedagogy, and the use technological resources in instruction. In addition, it will focus on many of the areas of mathematics (e.g. Algebra and Functions) that they felt were of the highest priority.

Partnership Project Goals and Objectives

Based on identified needs, the goals of the TUSD MSP High School Math project are: 1) to develop a highly qualified cadre of high school teachers who are adequately prepared to teach mathematics at the high school level; 2) to improve student achievement in mathematics in participating teachers' classrooms; and 3) to support the

work of the professional learning community of mathematics teachers at each site to support student learning.

Goal 1: To develop a highly qualified cadre of high school teachers who are adequately prepared to teach Mathematics at the High school level by June 2014 and can serve as leaders at their sites

Objective 1.1 – By the end of the grant, all participating teachers and principals will achieve a normalized gain of at least 25% in mathematics content knowledge as measured by the Mathematical Meanings for Teaching Secondary mathematics (MMTsm) administered before and after the content course, in Summer 2014 and Spring 2015, respectively.

Objective 1.2 – By the end of the grant each participating teacher will increase the level of propositional knowledge s/he exhibits during the course of a lesson as measured by ratings on the Reformed Teaching Observation Protocol (RTOP) administered at the beginning and end of the project, in Spring 2014 and Spring 2015, respectively. The mean gain in participant scores will increase by 5 points. This section of the RTOP assesses teachers' conceptual understanding of mathematics content and their ability to help students make connections.

Objective 1.3 – Each participating teacher will develop two lesson plans that incorporate the use of technological resources to help students develop understanding of mathematical ideas and submit these plans for review by a group of peers by May 2015.

Objective 1.4 - Each participating teacher will develop two formative assessment instruments that will enable him/her to gauge students' understanding of mathematical ideas and attainment of one or more of the Standards for Mathematical Practice in the

context of a specific topic by May 2015. These instruments will be submitted for review by a group of peers.

Goal 2: Improve student achievement in mathematics in participating teachers' classrooms.

Objective 2.1 – Increase the percentage of 10th through 12th grade students who are proficient in mathematics as measured by the state assessment (currently AIMS) by 15% from their Spring 2014 baseline (pre) to Spring 2015 (post). Pre-program (2014) and post-program (2015) AIMS scores will be compared for each individual student.

Objective 2.2 – Increase the percentage of 9th through 10th grade students who reach mastery by 10% as measured by ATI benchmarks administered at the beginning and end of the 2014-15 school year, in August 2014 and May 2015, respectively.

Objective 2.3 – Reduce the number of students in participating teacher classrooms receiving tier 3 intervention support by 25% from the initial baseline (Summer 2013) to the end of the project (Summer 2014).

Goal 3: Support the work of the professional learning community (PLC) of mathematics teachers at each site to support student learning by Summer 2015.

Objective 3.1 – By the end of the grant, each participating teacher will increase the level of communicative interactions in his/her classroom as measured by the Reformed Teaching Observation Protocol (RTOP) administered prior to the start of the program, in Spring 2014, and near the end of the program, in Spring 2015. The mean score of the participant group will increase by 5 points. The Communicative Interactions (Classroom Culture) section of the RTOP assesses the ability of the teacher to engage students in discussions about mathematics and their strategies for problem-solving.

Objective 3.2 Each site will develop and implement at least 2 new formative assessment instruments in their classes to assess student learning and attainment of the Standards for Mathematical Practice and develop specific plans for intervention for at-risk students.

Objective 3.3 Teachers will develop and implement a Response to Intervention (RTI) plan for their site using the AZ RTI framework to frequently monitor student understanding of mathematics concepts, evaluate student response to intervention, and adapt instruction as needed by the end of the grant with plans to implement in 2015-2016.

The TUSD MSP High School Mathematics Project logic model links the identified needs, goals, activities, and outcomes of this project (Appendix D. MSP Logic Model). The underlying theory of change is that participation in well-designed professional development will increase teachers' mathematical content knowledge, improve instructional practices in the classroom, and expand teacher understanding of student mathematical misconceptions so that they can better implement student intervention strategies, thereby resulting in higher student achievement in mathematics supported within a site-wide mathematical learning community. The accomplishment of these outcomes will be assessed using a variety of pre-post measures, including AIMS, district benchmarks, the Mathematical Meanings for Teaching secondary mathematics (MMTsm) content assessment, and the RTOP (Appendix F – Collection of Evaluation Data).

Research/Evidence Base and Efficacy of Plan to Increase Student Achievement

Building on Prior Work and Research

The evaluations of previous TUSD MSP projects found that high-quality mathematics professional development can increase teacher content knowledge (Creative Research Associates, Evaluation: The Math Science Partnership Grant Tucson Unified School District 2006-2007; 2007-2008; 2008-2009; 2010-2012). Participants improved their content knowledge significantly as measured by the Learning Mathematics for Teaching test administered at the beginning and end of the course, and when compared to a matched comparison group. Preliminary results from our current MSP project also indicate improvements in teacher content knowledge as measured by the Intel Math Content assessment. For instance, the mean change in participant Intel Math scores rose significantly from 22 to 29 from pre to the end of year one.

The earlier MSP evaluations found, however, that improvements in teacher content knowledge do not necessarily transfer into classroom practice, nor translate into improved student achievement. Little change in participant RTOP scores was observed when post-course results were compared to pre-course results or to results from a matched control group. Pre-course and post-course changes in AIMS scores of students of participating teachers were also found to be insignificant.

Our empirical findings are supported by the scientifically based research of Weiss, Pasley, Smith, *et al*. Their report, *Looking inside the Classroom: A Study of K-12 Mathematics and Science Education in the United States* (2003), concludes that teacher content knowledge is not sufficient preparation for high-quality instruction to lead to increased student achievement. Teachers need expertise in helping students think about particular concepts, identifying individual student perceptions, and integrating

instructional resources to assist students in deepening their understanding. The study identifies a number of strategies to ensure that teacher content knowledge gains from professional development transfer to instructional practice, including providing opportunities for teachers to analyze lessons, examine student work, and reflect on instructional practices to positively impact student learning. A study by Baumert et al (*Teachers' mathematical knowledge, cognitive activation in the classroom, and student progress*. American Educational Research Journal, 47(1), 133-180.010, 2010), shows that skills like these, collectively referred to as *pedagogical content knowledge*, are empirically distinguishable from mathematical content knowledge and have a significant positive effect on student achievement. Work by Bransford et al (2000), Olson (2002), and Smith (2001) points to the need to link content-focused professional development with learning standards to facilitate discussions about how students understand, express, and think about mathematics. Based on experience and research suggest, our expectations would be that we will see similar increases with respect to teacher content knowledge and less impact on instructional practice. However, the PD program is designed to address this.

The proposed TMHSP project allows us to address these findings by providing a comprehensive and integrated professional development program that incorporates high level mathematical content with activities and strategies that teachers can implement in their classrooms.

Description and Schedule of Professional Development Activities

We propose to enhance teachers' readiness to teach secondary mathematics and raise student achievement by providing a course on concepts and problem-solving

in secondary mathematics and a minicourse on formative assessment of students' mathematical understanding and practices. Teachers will implement ideas learned in these courses in professional learning communities at their schools during the 2014-15 academic year, and then reconvene in March to share the results of the work they have done at their respective sites.

The first component of the project will be an 80-hour course on mathematics content at the secondary level, explored from an advanced point of view. Teachers will work on problems and activities that deepen conceptual understanding of key ideas in algebra, geometry, and functions, build connections among different areas of mathematics, and reveal the vast potential of mathematics to solve a variety of abstract and real-world problems. Areas of focus will include domains of Arizona's College and Career Ready Standards (AZCCRS) that constitute significant "stretches" from prior state standards, such as those that focus on algebraic structure (A-SSE), deductive reasoning in geometry (G-CO and G-SRT), and building and interpreting functions and equations that represent real-world situations (F-IF, F-BF, and A-CED). Problems will be posed at an appropriate level of rigor and challenge for teachers from a variety of backgrounds; tasks will be designed to be accessible to many teachers but also open-ended enough to challenge those who enter the course with strong problem-solving skills. Through these problems, teachers will demonstrate and enrich their own mastery of the Standards for Mathematical Practice; such opportunities will be discussed explicitly at various times throughout the course.

The second component of the program will be a 24-hour mini-course on formative assessment to be hosted during two Friday/Saturday sessions in August and

September. The formative assessment minicourse will explore different ways of assessing students' understanding of mathematical ideas and their mastery of the Standards for Mathematical Practice through the lens of content in the AZCCRS. The course will allow teachers to experience different methods of formative assessment, including ones that use technology to aggregate and analyze student responses. It will also focus on the use of data to inform instructional next steps. The minicourse will allocate a significant amount of time to allowing teachers to develop and revise formative assessment tools that they will use in their classrooms during the 2014-15 school year and discuss and develop further in professional learning communities that meet regularly at their sites. The goal of this activity will be to provide teachers with insight into students' mathematical practices and understanding that allows them to determine appropriate interventions to help students meet standards.

In March, participants will participate in a 6 hour Saturday workshop to share results and actions ensuing from the assessment tools they have developed and used in their classrooms. Teachers will have the opportunity to receive constructive feedback on their work from peers from different schools and discuss what they have learned from implementing their projects in the classroom. The remaining 6 hours will be used for homework assignments, reflection activities, analysis of student work and development of appropriate instructional interventions.

Activities Leading to Achievement of Goals

The logic model in Appendix D describes how the proposed activities will lead to enhanced teacher content knowledge, improved student achievement, and stronger community efforts to analyze student learning and plan instruction. The TMHSP project

will offer 116 hours of high-quality professional development over one year to better prepare teachers and site teams to facilitate student learning of mathematics.

The goal of the summer content course and the formative assessment minicourse is to develop teachers' understanding of the key ideas of secondary mathematics, with the specific goal of making this understanding transferable to classroom practice. The mathematics content in the 80-hour summer course will be linked to the mathematical ideas that are described in the AZCCRS and that high school students are expected to learn. These linkages will be made not only in the two 12-hour pedagogy minicourses, but also at regular intervals throughout the summer content course through problem sets and activities that focus on careful reading of standards and reflection on opportunities for mathematical practice. These activities will help teachers design assessments that are aligned to the full depth and rigor of the AZCCRS and respond effectively to student work so that they can assist students who show gaps in mathematical understanding. The improved clarity and coherence in lesson design and student intervention will improve student achievement and reduce the number of students who require Tier 3 intervention support.

The proposed professional development activities for the 2014-15 school year support the achievement of the goals and objectives of the project. The formative assessment minicourse will have the explicit goal of developing tools that teachers will use in their classrooms; the program will support teachers in this goal by providing regular peer and instructor feedback during work sessions. Teachers will return to professional learning communities at their sites and plan to implement these tools and collect data on student progress. The March workshop will celebrate the work of these

professional learning communities and give teachers the opportunity to present their results and conclusions. The group will discuss parts of the professional learning process that were effective and parts that could have been improved, and discuss next steps for groups at each site. This process will help each site's PLC through the process of defining a learning objective on which to focus, developing a tool focused on that objective, studying the tool's efficacy and students' progress toward the objective, and using the resulting information to make instructional decisions.

Alignment with Content Standards and Mathematical Practices

All components of the proposed professional development closely align with state content standards and mathematical practices. In particular, the 80-hour content course will be aimed at standards and domains in the AZCCRS that have been identified as critical areas for the development of teachers' mathematical knowledge, including A-SSE (Seeing Structure in Expressions), A-CED (Creating Equations), A-REI (Reasoning with Equations and Inequalities), F-IF (Interpreting Functions), F-BF (Building Functions), G-CO (Congruence), and G-SRT (Similarity, Right Triangles, and Trigonometry).

In addition, problems will be posed so that teachers must demonstrate or develop mathematical practices in order to succeed. Because administrators identified practice standard MP.6, *Attend to precision*, as a specific need area, instructors will encourage teachers throughout the course to support each other in identifying possible sources of error and correcting imprecise mathematical statements and uses of language. Instructors will make specific note of this instructional practice when appropriate during whole-class sessions to encourage teachers to implement it in their own classes. Many

problems will have a modeling focus, engaging MP.4, *Model with mathematics* while others will ask teachers to develop a sound argument to justify a solution or critique arguments proposed by others, engaging MP.3, *Construct viable arguments and critique the reasoning of others*. Many problems will require teachers to state and use insights about mathematical structure (MP.7) or notice when a computation or reasoning process can be generalized (MP.8). These practices will be explicitly called out when they are observed; furthermore, instructors will comment on features of the lesson design that helped elicit successful engagement with mathematical practices.

Alignment with Professional Development and Professional Teacher Standards

The proposed program is designed to align with the InTASC Model Core Teaching Standards and the Learning Forward Standards for Professional Development. In the 80-hour summer content course, teachers will have the opportunity to enhance their own content knowledge (InTASC Standard #4) and work with their colleagues to find opportunities to implement newly gained content knowledge in classroom practice (InTASC Standard #5). Some of these opportunities will be structured discussions that occur during the content course; others will be integrated in work to be done later in site-based professional learning communities. The minicourse on formative assessment will help teachers develop stronger understanding of purposes of assessment, how to align assessment to learning goals and standards, and how to marshal the resources of a learning community to act on assessment results (InTASC Standard #6). Teachers will use technology along with questioning techniques, well-designed tasks, and communication skills to adapt instruction to the needs of learners (InTASC Standard #8). The professional learning community component of the

program will foster in teachers a sense of ongoing professional learning and community effort around the common goal of meeting the diverse needs of learners (InTASC Standards #9 and #10).

The program is developed with principles of sound professional development design in mind. Through collaborative work in the mathematics and pedagogy courses and ongoing work in PLCs, the program will foster a sense of collective responsibility for teachers' as well as students' learning, and create accountability for both (*Learning Communities)*. Program coordinators will work with the external evaluator to collect data on the progress of the project and use findings to inform next steps (*Data*). Course instructors will devise learning designs that accommodate the varying needs of high school teachers from a diverse array of schools, and promote active engagement by participants with the material, with one another, and with their colleagues' ideas (*Learning Designs*) through problem sets that reward collaborative effort and critical thinking. The project is intended to help teachers meet the content knowledge and pedagogy demands of AZCCRS-aligned teaching; as such, the project is aligned to current content knowledge needs as well as to standards for teachers' professional practice (*Outcomes*).

Design Elements and Rigor of Professional Development

All components of this professional development program follow a specific structure of *Learn the Content, Reinforce the Content Learning, Consolidate the Learning, and Implement the Content*. The 80-hour mathematics content course will engage participants in accessible but challenging problem sets (*Learn the Content*). Teachers will work on these problem sets in small groups and then share their thoughts

and solutions with the whole group (*Reinforce the Content Learning*). Course instructors will help synthesize these solutions and lead teachers to discuss and crystalize the key mathematical ideas contained in these problems and solutions; teachers will practice writing and talking about these ideas (*Consolidate the Learning*). At intervals throughout the course, teachers will have the opportunity to connect what they have learned to the Arizona College and Career Ready Standards, analyze sample lessons for standards alignment, and analyze student misconceptions (*Implement the Content*).

The formative assessment minicourse will follow a similar structure. Teachers will experience examples of effective formative assessment (*Learn the Content*); they will then have the opportunity to work together to develop formative assessment tools of their own (*Reinforce the Content Learning*). Teachers will then provide constructive feedback on their peers' work and help develop plans to implement these tools in the classroom (*Consolidate the Learning*). Finally, teachers will implement these tools in their own classrooms, record results, and eventually present their work at the Spring 2015 follow-up workshop (*Implement the Content*).

Partnership Evaluation and Accountability Plan

Quasi-Experimental Model

This project will use a "matched" quasi-experimental design with both treatment and comparison groups. Comparison teachers will be recruited from other District high schools having similar teacher and school demographics as targeted sites. School characteristics include the percent of students receiving free/reduced lunch, mobility rates, and student academic performance. Participating and comparison teachers will

be matched on key variables (e.g. grade level, years of teaching, educational degree obtained, and area of educational specialization). A Power analysis will be conducted to determine the strength of the match.

Attrition Prevention

Participant and comparison cohort sizes will assure a sufficient sample of size of approximately 30 teachers in both the treatment and comparison group for the year. Teacher retention will be closely monitored by the internal and external evaluator. The attrition of teachers will be reduced in the following ways: 1) providing a good financial stipend to both participating and comparison teachers, 2) ensuring that teachers are fully aware of what is required at the time of recruitment and finding any necessary replacements prior to the end of the Spring 2014 semester, and, 3) emphasizing the importance of being in a treatment or comparison group. To maintain the appropriate number of control teachers, ~~35~~ 40 comparison teachers will be recruited. Any attrition will be analyzed to determine if it is random or systematic.

Research Questions to be addressed

The research questions that guide the evaluation are directly related to the goals and objectives of the project. Specifically, 1) To what extent does the TMHSM Project increase the mathematical content knowledge of participating teachers, and in what areas? 2) To what extent does the Project improve student achievement in mathematics? 3) To what extent does the Project improve classroom instruction? And 4) To what extent has the project supported the work of the Professional Learning Communities at each of the schools?

Measurable Evidence

The evaluation will use several assessments to measure changes in content knowledge and teaching practices at the **teacher level:** 1) the Mathematical Meanings for Teaching secondary mathematics developed by researchers at the Arizona State University (MMTsm) and the 2) the Reformed Teaching Observation Protocol (RTOP), an observational tool designed to assess "reformed" math teaching strategies in the classroom. The same observer will conduct both the pre and post RTOP measures to ensure inter-rater reliability of measurement protocol. The MMTsm and the RTOP will be administered to both the participant and comparison teachers prior to the Summer workshops (pre-test), and again after the completion of all professional development activities in Spring 2015 (post-test).

Changes in **student achievement and proficiency in math** will be measured by 1) changes in standardized scores on the 2014 and 2015 AIMS test for students in grades 10-12; 2) 3) and 2014-2015 District benchmarking given primarily to grades 9 and 10. In addition, data from the ACT/ SAT for 11^{th} and 12^{th} graders will be examined.

Formative Evaluation

The formative or process evaluation will provide timely feedback, describe the integration of new or enhanced math instructional strategies, and measure how well specific activities are meeting their objectives. Assessments used for formative evaluation at the **teacher level** will include analyses of a Common Core (CC) assessment, teacher lesson plan, review of student responses to assigned probe, and participant PD surveys. Formative assessments at the **student level** will include review

of student responses of assigned probes and classroom observations. Monthly implementation meetings of MSP project staff, the External evaluator and Instructional Team members will ensure that the project is closely monitored. This information loop is critical for ongoing improvement in program activities, management, assessment, and communication.

Summative Evaluation

Several sets of data will be examined for the summative evaluation (Appendix F. Collection of Evaluation Data). At **the teacher level**, pre-post tools including the RTOP and the MMTsm will be assessed. At **the student level**, standardized test scores on the student achievement assessments will be analyzed. These will include the AIMS and District benchmark data, and ACT/SAT scores. Preliminary analyses will be conducted to examine potential differences between students in treatment and comparison classrooms using Analysis of Variance (ANOVA) and other descriptive statistics. ANOVA will be used to look for interaction effects regarding group affiliation among students (being in a treatment or comparison classroom) and other student demographics. This comparison will determine whether or not there are differential program effects for students with particular characteristics such as free-reduced lunch as a proxy for low SES. These preliminary results will help statistically to control for pre-achievement differences. Student achievement data will be analyzed with Analysis of Covariance (ANCOVA) multivariate modeling techniques using SPSS programs. Using ANCOVA will reveal the unique effects of the program once other variables have been taken into consideration and will estimate the magnitude of effects.

Contribution to Research

Evidence from TUSD prior MSP grant evaluations has shown that the program has been primarily effective in increasing mathematical knowledge in teachers. What has been less clear, is how increased content knowledge is transformed into effective teaching.

The evaluation of the TUSD MSP High School project will be rigorously conducted using triangulation of multiple qualitative and quantitative data points from both teachers and students to ensure the validity and reliability of results. Triangulation is a powerful and cumulative methodology that facilitates the validation of data through cross verification and will include teacher content knowledge results, classroom practice observations, and student achievement data. Additionally, proven statistical methods will be used to analyze both teacher and student level data to detect changes over time and between teacher and control groups. Appropriate tests of significance, such as paired sample and independent t tests, will be used. The full documentation of this scientifically-based research methodology will result in a reproducible body of data that describes the efficacy of the delivery model. By adhering toto the research protocols, this data can be used by the State MSP to not only demonstrate that intensive professional development can improve classroom instruction and result in higher student achievement in mathematics but also to indicate which aspects of the program delivery model resulted in the highest impact.

The external evaluator for this project is Creative Research Associates, led by Dr. Stephen Powers. Dr. Powers has over 30 years of experience conducting evaluations. He has a Ph.D. in Education, and completed post-doctoral studies in advanced statistics and research design. He has been the External Evaluator on all

previous TUSD MSP grants, and was the Lead Evaluator for the 2012 Southern Arizona Math Initiative: Intel Math Project funded by the Arizona Board of Regents. Dr. Powers will provide an objective analysis of project data, design project instruments as needed, prepare reports, and participate in all monthly implementation meetings and state technical assistance workshops (Appendix J. Dr. Powers's vita). Dr. Juliet King, TUSD Accountability and Research Department, will support Dr. Powers as the Internal Evaluator. She has more than a decade of evaluation experience and has overseen the MSP project evaluations since 2009 (Appendix J. for Dr. King's vita). Dr. King will support the data collection activities, compile student data for external evaluation and monitor participant and control attrition. The Evaluators (internal and external) will complete the formal reporting requirements of the grant, quarterly progress reports, checklists, and Annual Performance Report (APR).

Commitment and Capacity of Partnership

All partners were included in the planning and development of this proposal and will continue to guide the project through its implementation and evaluation (Appendix G. Partner Contributions and Commitments). Meetings were held with Dr. Patterson (Project Co-director and Instructional Team) and Dr. Powers (External Evaluator) prior to submission of the proposal. Dr. Patterson designed and wrote the professional development components of the plan. Feedback was collected from high school mathematics teachers as well high school administrators on the professional development design and schedule. The LEA Project Co-director met with Creative Research Associates to review the proposed goals and objectives of the grant and refine the evaluation plan.

Teacher assurance forms and notification forms have been received from 27 teachers to date. The remaining teachers will be recruited from Cholla high school. (Appendix G. Teacher Assurance forms) Solicitations were sent out to all Title 1 private schools and three teachers from San Miguel High School will also be participating (Appendix H and I).

For the TUSD MSP High School Math Project, the District is partnering with the University of Arizona's Center for Recruitment and Retention of Mathematics Teachers (CRR). CRR has annual partnerships with ten school districts in the Tucson area and is recognized as a leader in providing support and mathematics content for teachers in southern Arizona. CRR faculty and staff will facilitate all the professional development activities for the project. Dr. Cody Patterson, the director of CRR, will be the mathematician on the project. Ginny Bohme, a CRR co-director, will serve as the mathematics educator.

In addition to providing support for the evaluation activities, Dr. Juliet King will coordinate the grant and serve as designated LEA co-Project Director. She, along with Dr. Patterson, will be responsible for ensuring that all the elements of the grant are implemented.

The responsibilities of the project personnel are provided in Appendix J (Appendix J. Partner Commitment and Capacity). Effectively used in the past, an implementation meeting will be scheduled monthly with core team members (the LEA Project Co-director/ the UA Instructional Team, and the External Evaluator) to monitor progress of all grant activities, to assess participant formative feedback, to make modifications, and to ensure that grant requirements are met. The primary

responsibility for professional development will be the UA Instructional Team, the External Evaluator will monitor data collection and ensure that reporting deadlines are met, while the LEA project co-director/ internal evaluator will handle the administrative management functions of the grant.

Sustainability of Project

The MSP professional development model has been successfully implemented at the k-8 level in TUSD for many years and many past participants have gained new credentials and new positions. Teachers who have participated in past MSP grants have passed the AEPA, and become Nationally Board Certified. In addition, several past participants are now teacher-coaches, math interventionists, or PD providers in their own schools.

More recently, the MSP Intel Math Project Coordinator and Director have been meeting in the past three months with the newly appointed Assistant Superintendent of Curriculum and Instruction to bring forward recommendations and an implementation plan for our teacher professional development workshops in mathematics. Our proposal incorporates a great deal of the content, activities and resources developed in our MSP Intel Math grants as well as what we have learned from participant feedback and formal evaluations. As a result of our experiences with current MSP projects, it includes recommendations for administrator training as well. We expect that the results of the TUSD High School Mathematics Project, as the first formal comprehensive professional development program to support high school teachers in several years, will result in similar outcomes. The implementation of specific end-products, such as formative assessments, lesson plans, and the RTI Implementation plans will be utilized

by sites directly upon completion and disseminated to all schools for adoption. In addition, while the District already has an Intergovernmental Agreement (IGA) in place with the UA Center for Recruitment and Retention to provide professional development to District teachers, this MSP project raises that partnership to a higher and more sustainable level because the District will have a professional development program (content, activities, resources) based on the newest standards which can be adapted and extended to all high school teachers in the following year. It also sets the model for the types of workshops that CRR should provide for our K-8 teachers as well.

Partnership Budget

The budget was developed to meet the project goals and objectives. TUSD is requesting a total budget of $276,234. The budget includes the following expenditures for participant and comparison teachers: $116,000 in PD stipend support for– 40 teachers to participate in professional development and complete assessments; $$8000 to pay for substitutes on two Fridays; and $16,800 for 40 comparison teachers to complete 4 assessments (the pre-post MMTsm Content Assessment and pre-post RTOP).

The University of Arizona Center for Recruitment and Retention of Mathematics Teachers (CRR) will develop, plan and facilitate all the professional development for the project. Funds of $57,800 are requested to support: 1) the development of the 116 hours of professional development (80 hours of course content and 36 hours of follow-up); and the salary for the Instructional Team (consisting of the Mathematician (Dr. Patterson), and the Math Educator (Ms. Bohme). The Instructional Team will provide all instruction, score the MMTsm and attend all required meetings.

Funds for instructional supplies and resource material are included in the budget for a total of $2853. Instructional resources include 2 class sets of Algebra Tiles and the book *Common Core Mathematics in PLC at Work, High School*, edited by Kanold. This series of books about the new mathematical standards and practices have been used extensively and effectively with our MSP K-8 teachers. The mandatory MSP technical assistance meetings are also budgeted.

The budget includes $11,310 for an External Evaluator who will ensure that all formative and summative evaluation data is collected and analyzed in a timely manner (qualifications and responsibilities are detailed in Appendix J). A small amount of funding is requested for additional personnel to attend the RTOP training in March and to assist with the gathering of evaluation data. The total percentage for evaluation services is 5.5% of the total request. Finally, a 0.15FTE is requested to support the LEA Project Co-Director/Internal Evaluator who will be oversee all aspects of the grant, including administrative (purchasing, payroll, finance). This position will also be a part of the Evaluation team, serving as the Internal Evaluator.

This proposal is projected to impact 40 teachers and 8099 students at the sites for a cost of $6906 per site staff or **$34 per student.**