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Report of the

Teacher Academies: Math and Science (TAMS) Advisory Task Force

Submitted to

Commissioner Alice Seagren,
Minnesota Department of Education

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Introduction

The State of Minnesota has been engaged in a variety of efforts to ensure that students finish their K-12 education with the knowledge and skills to meet the demands of successful participation in higher education and the workforce, including focused efforts to improve preparation in mathematics and science for all students. All students need to possess the skills of mathematical and scientific literacy so that they can fully participate as citizens in an increasingly technical, knowledge-based society. A key strategy undergirding Minnesota's efforts to prepare students will be the development of regionally based centers that provide professional development and technical assistance to support K-12 teachers and schools districts in delivering high quality mathematics and science instruction.

In accordance with 2007 Minnesota legislation, Commissioner Alice Seagren convened an advisory task force to develop recommendations about the structure and programming to be supported by these regional Teacher Academies: Math and Science (TAMS). In light of Minnesota's recently revised mathematics standards and new graduation requirements in mathematics, the Task Force focused its attention on a design for providing professional development and technical assistance in mathematics to teachers across the state through June 2009. When the revision of the Minnesota science standards is completed, this model can be adapted to ensure that teachers of science will also receive the quality professional development required by their new standards.

The report begins with a summary of some of the key national and Minnesota trends reviewed by the TAMS Advisory Task Force during its deliberations, followed by specific recommendations about a proposed strategy for the Teacher Academies in their initial operation in the period of January 2008 through June 2009.

National Context and Trends

Demands for Science and Technology Innovation in the Global Economy

Over the last several years, a range of corporate, government and national leaders in science and technology fields have issued reports expressing concern that our nation's ability to produce the steady stream of scientific and technical innovations that are key to economic vitality is being threatened by an inability to produce a sufficient number of well-trained workers in the fields of science, technology, engineering and mathematics (STEM). For example, a review of research and trends in the United States and globally led the National Academies of Science to conclude that "scientific and technological building blocks critical to our economic leadership are eroding at a time when many other nations are gathering strength."[1]

In the words of Andreas Schleicher of the Organisation for Economic Cooperation and Development (OECD), "Skills are now a major factor driving economic growth and broader social outcomes, both in the world's advanced economies and in those experiencing rapid development. …Together, skills and technology have flattened the

world, such that all work that can be digitized, automatized and outsourced can now be done by the most effective and competitive individuals or enterprises, wherever on the globe they are located."[2]

The rate of employment in science and engineering in the United States is expected to increase approximately 70% faster by 2012 than the rate for all occupations.[3] Long-term growth in science and engineering occupations has far exceeded that of the general workforce—with more than four times the annual growth rate of all occupations since 1980.[4] In addition, the retirement of baby boomers is expected to deplete the current science and engineering workforce dramatically over the next 20 years.[5] The discrepancy between supply and demand is expected to become more pronounced given the declining interest and proficiency of Americans in science, math and engineering; United States efforts to train the next generation of scientific innovators is not keeping pace with efforts in other countries to develop their human capital. [6]

In addition, the saturation of technology and the explosion of knowledge in most fields mean that *all* students, not just those who plan to pursue a STEM profession, require a solid foundation in scientific, mathematical and technological literacy. This literacy is necessary for *all* students in order to be productive members of the workforce and engage in the analytic, reasoning and problem-solving tasks involved in an increasing number of 21st century jobs. In the third edition of *The World is Flat,* Thomas Freidman will add "math lovers who can think algorithmically" to his list of the job skills most needed in our world-wide economies. The ability to develop new algorithms, step-by-step procedures that will guarantee a predictable result, will be increasingly important to workforce success.[7]

Concerns About National K-12 Mathematics Performance

U.S. students are falling behind in math and science and the foreign competition is increasing. U.S. 15-year-olds ranked 24th out of 30 developed nations in the world in mathematics literacy and applied problem-solving on the Program for International Student Assessment (PISA) conducted in 2003 by the OECD. More than one-quarter of American students taking the assessment failed to demonstrate that they had acquired the most basic mathematical skills; only 2% demonstrated high-level thinking, reasoning, problem-solving and communication skills.[8] The percentage of U.S. high school students interested in majoring in engineering has dropped by nearly 35% between 1995 and 2005; China now graduates more than four times as many engineers as the United States.[9]

STEM achievement gaps persist by race, gender and socioeconomic status. On the 2005 National Assessment of Education Progress (NAEP), a significant achievement gap existed in both science and mathematics between groups of students based on race/ethnicity, gender and socioeconomic status. Black and Hispanic students, for example, were significantly more likely than white students to score below basic on math and science at all levels.[10] Achievement disparities appear before kindergarten, continue across grade levels and widen over time in most cases.[11] Given that students of color will make up an increasing proportion of U.S. domestic college attendees and the future

workforce, addressing these K-12 achievement gaps will be essential to preparing an increasing number of students to succeed in college and in STEM degree attainment.

The role of K-12 education in addressing the STEM talent gap. Many of the national proposals to address the talent gap focus heavily on the changes needed in K-12 education to create a pipeline of students interested in STEM careers and with the necessary preparation for the workplace and postsecondary education in science and math. Creating this pipeline involves a range of efforts including:

- Motivating U.S. students and adults to study and enter STEM careers, with a special effort geared to those in currently underrepresented groups;
- Improving K–12 mathematics and science teaching to foster higher student achievement and produce increased proportions of postsecondary ready high school graduates; and
- Expanding the kinds of course offerings and cross-disciplinary STEM collaborations in the K-16 system.

Minnesota Context and Trends

STEM-Related Economic Trends in Minnesota

Minnesota economic forecasts also suggest significantly faster job growth in scientific and technical occupations over the next ten years compared with the projected growth in all occupations. For example, the Minnesota Department of Employment and Economic Development projects a 33% growth in computer and mathematical occupations and a 20% growth in life and physical science occupations compared with a 15% growth in all occupations.[12] Despite the projected growth in these occupations, only 27.5% of 8th graders and 25.3% of 10th graders expressed interest in pursuing a career in the science, technology, engineering and math fields in a survey conducted in 2007.[13] The need to generate greater student interest in these careers is coupled with another urgent priority: the need to better prepare students for education and advanced training beyond high school.

Mathematics Performance of Minnesota Students

One of the most reliable predictors of student participation and success in college is their academic preparation in high school. Students who complete more rigorous courses in core academic subjects tend to score consistently higher on standardized tests and college entrance exams and to participate and succeed in greater numbers in college. Students who have completed a math course beyond algebra II, for example, are twice as likely to complete a bachelor's degree.[14]

Minnesota lags behind the national average in the percentage of 8th graders taking algebra, with only 32% in Minnesota compared to 41% nationally and 56% in top-ranked states.[15] In Minnesota, the percentage of 8th graders taking algebra from 1992-2005 increased by only 9 points, as compared to a 22-point increase nationally.[16]

The 2007 Minnesota Comprehensive Assessments-Series II (MCA-IIs) test results for 11th graders indicate that Minnesota high school students lack important knowledge and skills in mathematics. For example, only 32.3% of all students demonstrated proficiency, defined as meeting or exceeding the standards. Significant gaps existed among 11th graders with different demographic characteristics. Fewer than 15% of Black, Hispanic, or American Indian students demonstrated proficiency compared with more than 33% for white and Asian/Pacific Islander students.

Similarly, while 58% of ACT-tested 2007 Minnesota white high school graduates were ready for college algebra, this was true for only 42% of Asian American students, 37% of Hispanic students, 34% of American Indian students, and 16% of African-American students.[17]

Inadequate preparation of Minnesota high school students is also reflected in the fact that 36% percent of students entering public higher education institutions for the class of 2002 took at least one remedial/developmental course within two years of high school graduation. Of all remedial/developmental credits taken by the class of 2002, 56% were in mathematics.[18] The need for remedial work slows student progress in the completion of degree programs and contributes to increased costs for students and for institutions of higher education. Student weakness in math comprehension is also one of the principal reasons that students fail to persist in preparation for careers in scientific and technological fields.

Minnesota Efforts to Raise Standards and Improve Student Mathematics Preparation

Enhanced Graduation Requirements. In 2006, the Minnesota Legislature passed a law requiring that all students "satisfactorily complete an algebra I credit by the end of 8th grade." (Minn. Stat. § 120B.023, subd. 2(B)(1) (2006)) In addition, in order to graduate from high school, students must satisfactorily complete three years of mathematics, "encompassing at least algebra, geometry, data analysis and probability sufficient to satisfy the academic standard." (Minn. Stat. § 120B.024 (2006)) a Minnesota statute now also requires that all "students scheduled to graduate in 2014-2015 school year or later must satisfactorily complete an algebra II credit or its equivalent." (Minn. Stat. § 120B.023 (2006))

Development of 2007 Minnesota Mathematics Standards. During the 2006-2007 school year, a 26-member Mathematics Standards Revision Committee completed the legislatively directed revision of the state's mathematics standards to reflect Minnesota's changed graduation requirements. As required by Minnesota law, the committee also embedded two new components into the standards: 1) college and work-readiness skills, and 2) technology and information literacy skills.

With algebra I completed in 8th grade, time will be freed up to allow high school students to pursue additional and more rigorous kinds of mathematics, including:

- A more thorough approach to geometry;
- More focus on and a thorough approach to data analysis and probability;

- The completion of an algebra II credit or its equivalent (a graduation requirement);
- Core mathematics courses to maintain math skills into postsecondary education;
- Advanced mathematical topics in 12th grade; and
- Engineering and other math-related/integrated courses.

Other important changes in the mathematics standards revision include:

- "Math Reasoning" standards and benchmarks embedded into other content strands;
- Many examples cited in the benchmarks to provide greater clarity;
- Increased attention to appropriate uses of technology (such as calculators, spreadsheets and dynamic geometry software); and
- Greater content coherence within and among grade levels.

The next version of the MCA mathematics test that measures achievement against these newly revised standards will begin in the spring of 2011 for all students in Grades 3 through 8. As a result, students who are 5th-graders in 2007-2008 will be the first class tested on algebra I in 8th grade. The newly revised standards in geometry, data analysis and probability; and the algebra II requirement for high school will not be reflected on the state test until the spring of 2014.

Professional Development Needs Related to Minnesota Standards Revision

Raising standards for student achievement in mathematics has implications for the knowledge and understanding of content, instruction and assessment needed by Minnesota K-12 math teachers at all grade levels. According to the National Science Board, one of the elements of developing and retaining a high quality mathematics and science teaching profession is the provision of "quality, sustained professional development experiences for all K-12 science and mathematics teachers that will: increase and deepen content knowledge, promote a variety of pedagogical approaches, and develop questioning strategies which will advance high order thinking of all their students."[19]

Minnesota's new 8th grade algebra I requirement not only raises the expectations in mathematics for 8th-grade students, but it also impacts expectations for students throughout the elementary and middle grades. Expectations for teachers are also raised, requiring the use of the most effective instructional and assessment strategies for reaching a wide range of learners. Elementary teachers traditionally have not specialized in mathematics; yet content knowledge in algebraic thinking will be critical to the teacher's success in helping all students complete the algebra I standards in grade 8. The National Council of Teachers of Mathematics underscores the need for increased content knowledge by calling attention to the goal of "increased specialization in mathematics at the elementary level."[20]At the high school level, changes in the standards and graduation requirements require teachers to have the most effective instructional and assessment strategies for reaching a wide range of learners in geometry, data analysis, probability and algebra II.

TAMS Advisory Task Force: History and Process

Legislation Creating Math and Science Teacher Academies. In 2007, Governor Pawlenty proposed and the Minnesota Legislature approved the creation of regional mathematics and science teacher academies. The academies will provide professional development to K-12 teachers and technical assistance to schools so that all students achieve rigorous academic standards and meet state graduation requirements in mathematics and science, with an initial focus on mathematics. The appropriation for the academies is $1.5 million in each of two years (FY 2008 and FY 2009).

Math and Science Teacher Academies Advisory Task Force. In August 2007, Minnesota Department of Education Commissioner Seagren convened a 40-member advisory task force to recommend a framework for the provision of professional development and technical assistance through regional mathematics and science teacher academies in order to support implementation of Minnesota's revised mathematics standards and the new graduation requirements adopted in 2006. The advisory task force included representatives with expertise in K-16 mathematics, professional development and the design and implementation of large-scale education initiatives (see Appendix A for a list of task force members).

The Advisory Task Force met five times from August through November 2007. The Task Force reviewed the following objectives at its first meeting:

1. Given the revised math standards and new graduation requirements, identify potential concerns to be addressed through professional development and/or technical assistance (i.e., services to help schools such as curriculum alignment processes, development of instructional materials, clarification of state/federal policies, etc.).
2. Based on these concerns, analyze needs and identify resources to address those needs.
3. Develop guidelines or criteria for selecting professional development strategies, programs, resources, etc. aligned with state policy goals that will be featured at each math and science teacher academy.
4. Recommend a method for providing a statewide system of regionally based professional development based on a "train-the-trainer" model.

Smaller working groups addressed issues including math across the curriculum, K-8 mathematics content, 9-12 mathematics content, equity concerns and meeting the needs of special populations and the structure and design of the academies.

Task Force Recommendations

Key Concerns Identified by Task Force

After familiarizing themselves with the changes made in Minnesota's mathematics graduation requirements as well as the newly adopted mathematics standards, Task Force members identified the following key concerns to be addressed through the professional development and technical assistance to be offered by the regional Teacher Academies: Mathematics and Science:

- **Minnesota's new mathematics standards will require teachers at all levels to incorporate new mathematics content**—particularly related to algebra in grades K-12 as well as data analysis, probability and deductive reasoning in grades 9-12. University of Michigan researcher Deborah Ball and others have found that even in the elementary grades, the greater a teacher's content knowledge in mathematics, the stronger the student performance.[21]

- **Teachers will need the most effective instructional strategies to help students master this content as well as an ability to differentiate curriculum and instructional strategies to reduce the achievement gap and meet the needs of students of all backgrounds.** As part of this process, teachers' beliefs that impede the effectiveness of instruction for students of color, those living in poverty and English Language Learners will need to be addressed in order to ensure the achievement of high standards for all students.[22]

- **Ongoing, sustained professional development is critical to student achievement in the STEM disciplines.** The evaluation of the National Science Foundation's Systemic Change Initiatives has found that it took 30-80 hours of professional development in mathematics or science to impact classroom instruction. Overall, with high quality professional development of sufficient intensity, program quality and the quality of individual lessons improved significantly over time.[23]

- **A successful Minnesota effort to offer professional development to support the new math standards must help districts of a variety of sizes with a variety of needs to move forward in their own school and district cultures.** In order to design a cost-effective professional development structure reaching districts and teachers statewide, the Task Force initially looked to a "train the trainer" model. Such a model is one possible way to build capacity around the state that can be developed and shared over time with teachers of mathematics in many districts. However, Task Force members were cognizant that before educators could be expected to train others, those participating in the academies may need significant continued development themselves—development that cannot be expected to occur merely through a five-day summer experience. Ongoing support from regional and statewide experts from the Minnesota Department of Education, Regional Service Cooperatives and higher education institutions will assist in that ongoing development of members of the District/Consortium Trainer Teams as well as with implementation of the district/consortium improvement

plans to reach other teachers of mathematics. Participants in the summer academies will not be presented with pre-scripted training modules that they would be expected to deliver to their colleagues; rather they will be exposed to a range of content, professional development strategies, protocols and resource materials that they can continue to use to support their own changes in classroom instructional practice and to share with colleagues in ways that meet the unique needs of their schools and districts when they are ready. The toolkit provided to summer academy participants will, however, offer some consistency statewide in the content and instructional approaches that research has demonstrated are effective in changing teacher knowledge and practice.

- **Building connections to institutions of higher education will be necessary to support sustained systemic change and meet the needs of both the current teaching workforce as well as pre-service teachers.** While the TAMS Advisory Task Force was charged with designing professional development for current teachers of mathematics to be offered during this first 18-month phase of the initiative, sustaining the effort over time and ensuring parallel changes affect the education of pre-service teachers will require a close working relationship with postsecondary institutions of all types (public and private, 2-year and 4-year institutions). Professional development for current teachers and instruction for pre-service teachers need to be aligned with one another based on the demands of the Minnesota Academic Standards in Mathematics and Science; and the most effective curriculum, instruction and assessment practices must be shared and used to deliver those standards. Institutions of higher education can support the TAMS initiative through expertise provided in the following areas: 1) content knowledge (including both mathematics and statistics faculty), 2) school/organization change management, and 3) teacher preparation programs. After a review of the curriculum and learning experiences to be offered through TAMS, the Task Force expects that a number of institutions of higher education will be willing to grant graduate credit for those who successfully complete the experience.

- **Assisting teachers to implement the new mathematics standards will be a multi-year effort and requires a quality infrastructure.** Task Force members were concerned about designing an effort that builds an infrastructure that could sustain professional development efforts over time, provide a K-12 systemic focus and build regional capacity for professional development in mathematics throughout the state. What is learned from this first effort with mathematics could subsequently be used as the new science standards are promulgated.

- **Planning for the Teacher Academies: Math and Science should be closely linked to the work of the cohort of schools which will receive Systemic STEM School Redesign Grants in January 2008**. The Minnesota Department of Education defines STEM as "a course, program or series of linked learning opportunities that enable students to discover, explore and/or solve real-life problems through the integration of science, technology, engineering and mathematics content." Recipients of the Systemic STEM School Redesign Grants will integrate the state's recently revised math standards into new or existing

comprehensive STEM initiatives and will serve as models to other schools and/or districts by sharing information and providing technical assistance. The TAMS Academies will provide knowledge and strategies helpful to STEM cohort schools as they implement the plans they develop by June 2008, and participation by STEM cohort schools in the academies will provide examples of links between mathematics and other disciplines to guide other participants. In addition, problems in a range of STEM disciplines could be used as vehicles for teaching math content during the summer academies.

- **Designing and implementing a new model of professional development requires that significant resources be devoted to evaluating ongoing learning, supporting program adaptation and providing data to measure the accomplishment of project outcomes.** Following the National Science Foundation expectations for Math Science Partnerships, the Task Force recommends devoting 10% of the legislative allocation to working with an external evaluator. Because the time span covered by the initial legislative appropriation effectively covers one school year, the focus of the evaluation will be on documenting change in the leading indicators of teacher learning and instructional practice in mathematics that ultimately can be expected to improve student achievement. Even in its early stages, the evaluation should also include some focus on student engagement and samples of student work over time. The external evaluator will also develop a variety of tools and data collection processes to ensure the collection of good baseline data to support longer term longitudinal evaluation. The evaluator and Statewide Planning Team must work closely to ensure that the evaluation generates the kind of evidence about the impact of the model that could support applications for future funding. Lessons learned during implementation of this initiative will also be important in influencing the design for professional development efforts to support eventual implementation of the revised Minnesota Science Standards.

Description of Proposed 5-Phase Model

Overview

The model developed by the Advisory Task Force is designed to build capacity in regions across the state in order to provide sustainable, cost-effective, high-quality professional development in mathematics to K-12 teams. The model consists of five phases. The pre-program preparation phase requires that in the spring of 2008, each district/consortium of districts analyzes various types of its own demographic, achievement, program and stakeholder perception/satisfaction data. The academies begin with Phase 1, a three-day district/consortium leader academy to assure support for the ongoing work of mathematics improvement in the district/consortium. Phase 2, a five-day district/consortium trainer academy, will offer professional development in mathematics content, instruction and assessment; model a range of high-quality professional development strategies; and introduce a toolkit of resources and protocols for future use. Phase 3 provides ongoing technical assistance and support to the district/consortium leader and trainer teams during the 2008-2009 school year as they work to implement the

professional development strategies outlined in a math improvement plan. The details of that assistance will be identified during Phases 1 and 2 and will be customized to meet district/consortium needs. Phase 4 provides the opportunity for continued training, reflection on the process and results of district/consortium improvement plans and the dissemination of information learned through this process across regions. Figure 1 on page 15 provides a 1-page overview of all academy phases; more detailed descriptions of each phase begin on page 16.

Delivery Structure

The Academy structure would be based on 10 geographic regions: the 9 existing Regional Service Cooperative regions (entities formerly known as Educational Cooperative Service Units (ECSUs)); an extra allocation of resources would ensure that the large number of districts in the Twin Cities metropolitan area would be served. The model utilizes existing Regional Service Cooperatives as the administrative/fiscal hosts for the initiative in order to ensure the statewide reach of professional development efforts and to involve higher education and business resources throughout the state in the effort to support the delivery of the new mathematics standards.

Five districts or consortia of districts would be recruited to participate in each region. Each of the 50 proposed district/consortium teams would be responsible for approximately 2,000 K-12 students. For a large district, a team might draw from a single high school with its feeder elementary and middle schools; for a medium-sized district, a team might include all schools district-wide; smaller districts can form a consortium serving a similar number of students. Together, the 50 teams across the state would affect the instruction of approximately 100,000 students, or 13% of Minnesota's K-12 student population.

The initiative will be planned by a full-time MDE TAMS Supervisor and a Statewide Planning Team. The team would include experts in K-16 mathematics, professional development and curriculum development and would represent a mix of individuals with expertise in elementary, middle and high school settings—including a representative from a STEM cohort school—as well as higher education. The Statewide Planning Team would oversee the creation of specific professional development experiences to be offered at the summer 2008 academies as well develop a toolkit of resources upon which district/consortium Trainer Teams could eventually draw to design professional development experiences for other educators in their districts. (Appendix B includes Task Force recommendations about some of the issues that will need to be addressed by the Statewide Planning Team).

The Statewide Planning Team, in cooperation with the Regional Service Cooperative Coordinators in each region, would work to identify teams of 4-6 regionally based experts (the equivalent of .3 FTE per region) who would serve as faculty for the summer academies as well as providers of technical assistance and additional training for districts/consortia during the 2008-2009 school year. These regionally based experts could come from MDE, Regional Service Cooperatives, K-12, professional organizations, higher education and business. The Regional Service Cooperative Coordinators would also assist with recruiting districts and consortia to apply to

participate in TAMS; the MDE TAMS Supervisor would coordinate a rubric-based process to select the 50 participating districts/consortia.

Figure 1: Overview of Academy Phases

Pre-Program Preparation: Data Analysis in Preparation for Summer Academies
(Winter/Spring 2008)

In each of 10 regions across the state, 5 districts or consortia of districts will be selected to participate in the Math Academies. Each district/consortium team serves approximately 2,000 K-12 students. Prior to summer 2008 academies, District/Consortium Leader and Trainer Teams can choose one of several processes to review and analyze existing math data relating to district/consortium programs, demographics, student achievement and stakeholder perceptions.

Phase 1 (June 2008)
District/Consortium Leader Academies

Who: 5 teams from each of 10 regions attend 3-day summer academy offered in two locations (northern and southern Minnesota). Each 5-member team includes administrators, teacher leaders, professional developers and curriculum developers. Stipends available for up to 2 members per team.

What: Training includes understanding of new math standards and implication for building curriculum, key issues and research in math education, quality professional development strategies, strategies for STEM integration and methods for supporting Trainer Teams over time (see Phase 2).

Continuous Improvement Task: Based on district/consortium data trends and current mathematics program, develop framework for math improvement plan.

Phase 2 (August 2008)
District/Consortium Trainer Academies

Who: 5 K-16 teams with 10 members attend 5-day summer academy held in each of 10 regions. Each 10-member team ideally includes teacher leaders, administrators, member(s) of the Leader Team and a higher education representative. Up to 9 members per team may receive stipends.

What: Training includes understanding of new math standards; content focus on K-12 algebra, 9-12 data analysis, probability, and deductive reasoning; processes for sustaining professional development. Attention to research, technology, instruction, equity, STEM initiatives and assessment will be interwoven with content.

Continuous Improvement Task: Using the trends identified in the district/consortium data; identify possible root causes for achievement gaps. Identify professional development content and strategies most relevant for district/consortium needs. Add details to the improvement plan framework created in Phase 1.

Phase 3 (School Year 2008-09)
Ongoing Technical Assistance & Support

Who: Leader and Trainer Teams work to finalize and implement a data-driven, customized professional development plan in mathematics, with support from Regional Service Cooperative Coordinator, regional training/technical assistance experts and higher education resources. Based on current capacity, this plan may further develop the Leader and Trainer Team members and/or offer professional development to other teachers in the district/consortium.

What: Improvement plans will be reviewed and approved by the MDE TAMS Supervisor using a rubric-based process, based on the NSDC professional development standards. Up to $10,000 and up to 10 days of training/support/consultation from regional or state experts will be available to support plan implementation.

Continuous Improvement Task: Finalize, implement, monitor and adjust the improvement plan developed in Phase 1 and 2, with a goal of eventually impacting all teachers of mathematics in the district/consortium.

Phase 4 (June 2009)
Reflection & Dissemination Academies

Who: Five 5-member teams from each of 10 regions attend 3-day summer academy offered in two locations. The district/consortium chooses team members. Stipends available for up to 2 team members. Representatives of districts not participating in 2008-09 academies may participate at their cost.

What: Participants will reflect on the results of the professional development strategies they selected, the planned and enacted changes they experienced and contribute to discussions about sustainability and scalability of TAMS' professional development efforts.

Continuous Improvement Task: Reflect on and share the activities and results of Phase 3 improvement planning including implementation of plan, impact on teacher knowledge and practice and student achievement and implications for future improvement efforts.

Details of Academy Phases

Each district or consortia of districts would participate in the following initiative phases:

Pre-Program Preparation Phase: Data Analysis (Winter-Spring 2008)

Before the summer 2008 training academies, each district/consortium will choose one of the following ways to analyze a variety of math-related data—program, demographic, student achievement and stakeholder perceptions—and will bring preliminary results of that analysis to the District/Consortium Leader Academy and the District/Consortium Trainer Academy. Possible options for completing the pre-academy data analysis requirements include:

- Using the district's existing process of data analysis; or
- Participating in MDE's Surveys of Enacted Curriculum (SEC) pilot project in January-February 2008. Districts selected to participate in the pilot project will have their costs funded by MDE. Districts not selected for the pilot project could also choose to use the SEC process drawing on their own funding; or
- Participating in a "mini" (one day) Math Data Retreat preceding the academy during May-June 2008. This option is not funded by MDE.

PHASE 1: District/Consortium Leader Academies (June 2008)

Districts will recruit a five-member ***District/Consortium Leader Team*** including district/building administrators, teacher leaders and curriculum/professional developers. At least one person on the Leader Team will also serve on the District/Consortium Trainer Team. Leader Team members would attend a three-day academy in June 2008. The District/Consortium Leader Academies would be offered in two locations in the state, one in northern and one in southern Minnesota. Approximately 25 teams (125 total participants) would participate in each location. Daily stipends of $125 will be available to support the participation of up to 2 members per team, based on the assumption that a majority of team members will be district employees already paid for summer work as part of year-round contracts.

The three-day academy for Leader Teams from each district/consortium will provide a foundation of understanding about the demands of the new mathematics standards and graduation requirements for students and teachers, high-quality strategies for professional development and curricular alignment in mathematics and ways of implementing a STEM approach to mathematics.

The 250 leader participants will receive information and strategies that will help them successfully support the ongoing work of the district/consortium trainers recruited to participate in Phase 2. Topics that would be addressed during the three-day Academy would include:

- A focus on state, national and international data trends: including MCA, SEC, ACT, NAEP, TIMSS and PISA data
- Minnesota's new mathematics standards and graduation requirements and their implications for district policy, curriculum alignment and professional development
- The latest research in mathematics education
- Improvement planning and making systemic change
- Models of engaging students of diverse backgrounds to reach high levels of achievement
- NCLB and NSDC definitions of high quality professional development
- The role of the Leader Team in supporting the TAMS process

Teams will also have time to use district data to generate an initial framework for a mathematics improvement plan and to consider the resources that will be necessary over time to sustain the district/consortium's professional development and improvement efforts in mathematics.

PHASE 2: District/Consortium Trainer Academies (August 2008)

Districts will recruit a 10-member, K-16 ***District/Consortium Trainer Team***. Ideally, the members would include elementary, middle school, and high school teacher leaders, an administrator with knowledge of curriculum and/or professional development, a principal, a representative of higher education and one or more members of the Leader Team. This team would attend a 5-day academy held in their region during August 2008 (50 participants per region). Daily stipends of $125 will be available for up to 9 team members (assuming that at least one team member would be a district employee on salary who would already be getting paid for summer work by the district). The Task Force deliberately chose to keep the size of the Trainer Team at 10 members in order to generate a critical mass of educators within each district or consortium of districts able to collaborate and support each other over time.

The academy will offer a set of experiences, protocols and knowledge to participants as well as a toolkit of materials and resources that can be drawn upon during the 2008-2009 school year. The academy will focus on content in K-12 algebra, 9-12 data analysis, probability, and deductive reasoning as defined by the Minnesota Academic Standards in Mathematics. Issues of pedagogy, research, differentiated strategies to close the achievement gap, STEM integration across the curriculum, technology and assessment will be interwoven with content. Attention will also be paid to using the math standards to build curriculum both in math courses and across content areas.

The five process standards defined by the National Council of Teachers of Mathematics will also be a prime focus of the academy:

- Problem-solving (the ability to apply and adapt a variety of appropriate strategies to solve problems that arise in mathematics and other contexts);

- Reasoning and proof (the ability to develop and evaluate mathematical arguments and proofs and select and use various types of reasoning and methods of proof);
- Communication (the ability to communicate mathematical thinking coherently and clearly to peers, teachers, and others and to use the language of mathematics to express mathematical ideas precisely);
- Connections (the ability to recognize and use connections among mathematical ideas as well as recognize and apply mathematics in contexts outside of mathematics; and
- Representation (the ability to create and use representations to organize, record and communicate mathematical ideas as well as to model and interpret physical, social and mathematical phenomena)

The academy will model the use of high quality professional development practices, facilitation skills, and adult learning principles. Participants will gain information about sustaining professional development through strategies including professional learning communities, coaching, lesson study, reflection and other designs (see page 17 for more information about the criteria TAMS will use for the selection of high-quality professional development aligned with the standards of the National Staff Development Council).

Using the trends identified in their district/consortium data and the initial improvement framework developed during the District/Consortium Leader Academy, Trainer Teams will identify possible root causes for achievement gaps and begin to identify the key content, equity, pedagogy and professional development strategies most relevant for district/consortium needs. Depending on their level of preparation, teacher leaders trained at the five-day summer academies would return to the district/consortium for further training and/or begin planning and delivering professional development to other teachers of mathematics within their districts (including non-math STEM teachers).

PHASE 3: Ongoing Professional Development, Technical Assistance and Support (2008-09 school year)

By September 30, 2008, each district/consortium Leader and Trainer Team will finalize a data-driven, customized professional development plan to support mathematics improvement, with support from Regional Service Cooperative Coordinators, regional training/technical assistance experts and higher education resources. Throughout the 2008-2009 school year and plan implementation, district/consortium Leader and Training Teams will continue to receive support from the Regional Service Cooperative who will broker services with regionally based training/technical assistance experts. The ultimate goal will be to impact the instruction of all teachers of mathematics in the district/consortium and eventually improve student achievement.

Criteria for high-quality professional development will be used by districts/consortia to select professional development designs and/or technical assistance strategies that will support the on-going development of district/consortium Leader and Trainer Teams and

other district teachers of mathematics. Professional development designs and strategies may include content, pedagogy, or assessment study groups; professional learning communities; lesson study; the assessment of student work and coaching. In addition, the Statewide Planning team should be encouraged to develop ways to provide electronic links within and across regions as another form of ongoing support.

Additional funds (up to $10,000 per district/consortium) will be available through the TAMS budget to support implementation of the math improvement plan, funding items such as substitute costs, stipends for ongoing data analysis and planning and/or technical assistance beyond that offered by the regional experts. The MDE TAMS Supervisor will review and approve district/consortium proposals for the use of these funds to support implementation, using a rubric-based process.

PHASE 4: Reflection and Dissemination Academies (June 2009)

In June 2009, each district/consortium would select a five-member team to attend a three-day summer academy devoted to reflection and sharing of lessons learned during the 2008-2009 school year and creating future plans. The District/Consortium Reflection and Dissemination Academies would be offered in two locations in the state, one in northern Minnesota and one in southern Minnesota. Approximately 25 teams (125 participants) would participate in each location. Daily stipends of $125 will be available to support the participation of up to 2 members per team, based on the assumption that a majority of team members will be district employees already paid for summer work as part of year-round contracts.

These 250 participants share and disseminate the work of each district/consortium. Possible academy topics may include:

- Designs and strategies employed during Phase 3
- Impact on teacher practice and student engagement including diverse student populations
- Planned and enacted systemic changes
- Planned and enacted models of student engagement
- Impacts on local policy
- Specific topics identified from a needs assessment completed by district/consortium teams
- Suggestions for sustainability, scalability and ways to involve business/industry
- STEM integration successes

To begin the process of sharing lessons learned with a wider audience of Minnesota educators, representatives of districts not participating in 2008-09 academies may be invited to participate, but the TAMS budget would not be able to support their costs.

For further details about the proposed roles and responsibilities of the various participants in the Teacher Academies, please see Appendix C.

Proposed TAMS Outcomes

Outcomes for Leader and Trainer Teams Participating in the Academies

- Understanding of the various purposes and intent of the mathematics standards document.
- Development of leadership skills in curriculum, instruction, assessment and professional development in relation to the math standards.
- Deepened content knowledge in key content areas: algebra K-12, data analysis and probability 9-12 and deductive reasoning 9-12 as well as deepened understanding of how to convey that content to adult learners (teachers and administrators)
- Ability to help educators translate essential concepts into age-appropriate delivery for their classroom and provide relevant, engaging learning experiences in context with meaningful, cross-curricular connections and application.
- Use of instructional practices that integrate NCTM process standards and differentiated curriculum and strategies to engage all students.
- Increased knowledge of best practices in assessment at the classroom and grade level to inform instruction and evaluate student learning.

Outcomes for Schools and Districts Participating in the Academies

- Increased capacity to improve student learning, engagement, and achievement.
- Use of a process to support district development of a coherent, articulated curriculum that is vertically and horizontally aligned to the standards and is equitably provided to all students.
- Participation in a professional regional network that increases capacity, reduces isolation and allows for the exchange of expertise.
- Participation in a leadership network to share strategies that support systemic change specific to mathematics education.
- Development of leadership cohorts that are prepared to support the instruction in algebra K-12, data analysis and probability 9-12, and geometric reasoning 9-12 by means of curriculum redesign and/or realignment of scope and sequence as necessary.
- Collaboration with STEM cohort schools and districts.

Outcomes for STEM Cohort Schools and Districts (created for the RFP for Systemic STEM School Redesign Grants)

- Examination of mathematics data using an interdisciplinary district team, including but not limited to, looking at the statewide representative data collected from the Wisconsin Center for Education Research (WCER) Studies of Enacted Curriculum pilot this winter. Other data sources will also be included.
- Plan for increased participation and achievement of all students in rigorous and relevant STEM courses, programs or linked learning opportunities.
- Plan for increased student engagement in STEM-related content.
- Plan for personalized learning environments for all students, supported by parents/mentors.

- Plan to provide multiple pathways leading to postsecondary education or advanced training in STEM-related fields.
- Development of high-quality principal and teacher leadership that promotes and supports STEM education.
- Knowledge of student assessment and program data used to continuously improve STEM education.

Outcomes for Higher Education Institutions

- Increased recognition of teacher needs for professional development related to mathematical content, instruction and assessment.
- Plan for adapting higher education programs to increase knowledge of practicing and pre-service teachers in the areas of mathematical content, instruction and assessment consistent with state academic standards.
- Increased knowledge to support systemic change in schools and districts.
- Increased participation in a K-16 professional regional network.
- Provision of opportunities for TAMS participants to earn graduate credit for appropriate professional development and action research activities conducted as part of TAMS.

Outcomes for the Academies Regionally

- Development of a sustainable network that involves local mathematicians, educators, and practitioners from business, industry, K-12 education, and higher education.
- Creation of a mechanism to maximize resources, leverage expertise, and share best practices.

Outcomes for the Academies Statewide

- Increased capacity for Minnesota public schools to deliver standards-based curriculum, instruction, assessment and professional development resulting in improved student achievement and engagement in mathematics.
- Development and testing of a model for delivering professional development that may be replicated in other content areas.
- Mathematically prepared students, ready for college and the highly-skilled workforce.
- Recognition of mathematics as an essential literacy to promote civic participation.
- Increased ability of Minnesotans to compete in an economic environment that places greater demands on scientific, technological, engineering and mathematical expertise.

Criteria for Selecting Professional Development Strategies

The Task Force proposal builds on many of the key professional development standards of the National Staff Development Council (NSDC) and recommends the use of the

NSDC standards as the criteria to be used for defining high-quality professional development throughout the project.[24] Examples of NSDC standards (in italics) and Task Force efforts to incorporate the standards into its design follow:

- *Requires skillful school and district leaders who guide continuous instructional improvement*. The Phase 1 District/Consortium Leader Academies are designed to build the necessary leadership foundation to support ongoing professional development, curriculum redesign and/or realignment of scope and sequence to support the new mathematics standards and higher expectations in mathematics for all students.

- *Uses disaggregated student data to determine adult learning priorities, monitor progress, and help to sustain continuous improvement*. The Pre-Program Planning Phase requires participating districts/consortia to look at a range of data, including disaggregated student achievement in mathematics, before summer training academies take place. District/Consortium Leader and Trainer Teams will use district data to identify appropriate professional development content and processes for the district/consortium improvement plan.

- *Deepens educators' content knowledge, provides them with research-based instructional strategies to assist students in meeting rigorous academic standards, and prepares them to use various types of classroom assessments appropriately.* In the initial two years of operation, the academies would focus on enhancing content knowledge, instructional practice and assessment in three areas: K-12 algebra, 9-12 data analysis and probability and 9-12 deductive reasoning strands from the Minnesota Academic Standards in Mathematics.

- *Prepares educators to understand and appreciate all students; create safe, orderly and supportive learning environments; and hold high expectations for their academic achievement.* Throughout the academies, attention will be paid to the differentiated curriculum and instruction practices that effectively address the needs of diverse learners and assist educators to reduce the achievement gap.

- *Organizes adults into learning communities whose goals are aligned with those of the school and district.* The academies will be modeling and highlighting this strategy. The project also envisions the use of technology to support learning and connections across participating district/consortium teams (e.g., an electronic repository of student work samples, protocols for various professional development strategies, etc.)

NSDC has developed rubrics to help districts assess their level of implementation of the standards (Innovation Configurations). The standards for effective professional development will guide the application process, learning, implementation and evaluation at each phase and at the end of the grant.

The Task Force also recommends that the 21 strategies discussed in *Powerful Designs for Professional Learning*, edited by Lois Brown Easton and based on the work of Joellen Killion, would provide a good start in identifying research-based professional

development strategies aligned with the NSDC standards. The Statewide Planning Team could identify particular strategies with high effectiveness for mathematics (e.g., professional learning communities, standards in practice and lesson study).

Application Process for District/Consortium Teams

The Task Force recommends that the application process for districts and consortia interested in participating in the academies parallel the application criteria used for the National Science Foundation Math/Science Partnerships. Application materials would make it clear that the academies are looking to involve districts with a range of existing efforts in data-driven, high-quality professional development—from beginners to advanced implementers. The application materials should include the description of the five phases, the roles and responsibilities of all stakeholders and a description of the financial, time, and resource assets that will be available to and required of teams. See Appendix D for more details regarding applications.

Identifying Resources to Support Implementation of this Plan

Task Force members were surveyed to begin the process of identifying statewide and regionally based resources (human and curricular) that might support the implementation of the Teacher Academies: Math and Science. The Statewide Planning Committee will use the compiled results as part of its design and recruitment efforts.

Budget

Cost Categories	Cost	Notes
District/Consortium Leader Academies (2 locations) (Phase 1)	$154,500	Includes average per participant expenses (space, travel, materials, food) of $450 over 3 days for 250 district/consortium participants and 10 trainers; includes cost of stipend of $125/day for up to 2 district/consortium members per team.
Regional District/Consortium Trainer Academies (10 locations) (Phase 2)	$611,250	Includes average per participant expenses (space, travel, materials, food) of $600 for 5 days for 500 district/consortium participants and 50 trainers; includes cost of stipend of $125/day for up to 9 district/consortium members per team.
Funds to support implementation of district/consortium math improvement plans (Phase 3)	$500,000	Approximately $10,000 per district/consortium to support professional development based on a math improvement plan application reviewed and approved using a rubric-based process.
Reflection and Dissemination Academies (2 locations) (Phase 4)	$154,500	Includes average per participant expenses (space, travel, materials, food) of $450 over 3 days for 250 district/consortium participants and 10 trainers; includes cost of stipend of $125/day for up to 2 district/consortium members per team.
Stipends/salaries for statewide/regional personnel for 2 years	$1,150,000	1.0 FTE MDE TAMS supervisor (2000 hrs/yr); 0.2 FTE Regional Service Cooperative Coordinator in each of 10 regions (400 hrs/yr in each region); 0.5 FTE statewide planning team members (1000 hrs/yr); 0.30 FTE experts/trainers/technical assistance providers in each region (600 hrs/yr in each region)[1]
Administrative costs for Regional Service Cooperatives	$50,000	$5,000 over two years per region to support accounting services and other non-salary costs
External evaluation cost	$300,000	10% of the appropriation over 2 years
Other	$79,750	
Total	**$3,000,000**	

[1] Includes the cost of their time when serving as trainers during TAMS academies as well as time spent in providing customized technical assistance and additional training during Phase 3.

Appendix A

TAMS Advisory Task Force Members

Ellen Delaney, Spring Lake Park Public Schools, Advisory Task Force Co-Chair

Larry Gray, University of Minnesota School of Mathematics, Advisory Task Force Co-Chair

Mark Ahrens, Normandale Community College

Michelle Bacon, Minnesota Council of Teachers of Mathematics

Jim Bartholomew, Minnesota Business Partnership

Debbie Belfry, Bloomington Public Schools, Minnesota Association of Career and Technical Administrators

Liesl Chatman, Science Museum of Minnesota

Cyndy Crist, Minnesota State Colleges and Universities

Kitty Foord, Minnesota State University, Mankato

Garnet Franklin, Education Minnesota

Rose Gundacker, Rosemount Eagan Apple Valley Public Schools

Bonnie Hagelberger, Anoka-Hennepin Public Schools

Tim Harms, Minnesota State University, Moorhead

Karen Klinzing, Minnesota Department of Education

Joanne Knuth, Minnesota Association of Secondary School Principals

Dawn Koennicke, Fergus Falls Public Schools

Charlie Kyte, Minnesota Association of School Administrators

Mike Lindstrom, Anoka Hennepin Public Schools, SciMath Minnesota, MTEA

Brad Lundell, Schools for Equity in Education

Thomas Mans, St. Mary's University of Minnesota, Minnesota Private College Council

Les Martisko, South Central Service Cooperative

Michael Miller, Minnesota State University, Mankato

Mona Miller Harris, Minnesota Minority Education Partnerships, Inc.

Tamara Moore, University of Minnesota, College of Education and Human Development

Tom Muchlinski, Minnesota Council of Teachers of Mathematics

Jenni Norlin-Weaver, Association of Metropolitan School Districts

Nancy Nutting, SciMath Minnesota

Valerie Halverson Pace, IBM Corporation

Gretchen Peel, Osseo Public Schools, Minnesota Elementary School Principals' Association

Taylor Pettis, Minnesota High Tech Association

Judith Ramaley, Winona State University

Suzanne Riley, Southeast Service Cooperative

Kirk Schneidawind, Minnesota School Boards Association

Stacia Smith, Minnesota Chamber of Commerce

Wanda Sommers-Wall, South Central Service Cooperative

Sally Standiford, Winona State University

Fred Storti, Minnesota Elementary School Principals' Association

Patty Wallace, Minnesota Council of Teachers of Mathematics

Lee Warne, Minnesota Rural Education Association

Terry Wyberg, University of Minnesota, College of Education and Human Development

Pete Ziegler, Minnesota Association of Supervision and Curriculum Development

Appendix B: Issues for Consideration by Statewide Planning Team

The TAMS Advisory Task Force recommends that members of the Statewide Planning Team take the following issues into consideration as they design the initiative:

- Clear criteria must be established to guide the selection of the regional experts who will provide instruction during the summer 2008 and 2009 TAMS academies and will offer training, support and technical assistance during Phase 3.
- Design of the academies must reflect that participants will bring a wide range of knowledge and belief systems about mathematics and student achievement in mathematics.
- Because many elementary teachers do not currently see themselves as teachers of "algebra," the content focus on K-12 algebra will need to be defined for K-6 teachers in relationship to their standards and classroom instruction. Additional differentiation will be crucial for teachers at the primary and intermediate levels.
- In designing the academies and support resource materials, all five of the NCTM process standards (problem-solving, reasoning and proof, communication, connections, and representation) should receive attention.
- Those participating in the academies as part of consortia will face particular administrative challenges that should be addressed during the design and recruitment phases.
- A list of resources (people, organizations, materials, etc.) has been collected by the task force and will be provided to the statewide planning team.

Appendix C: Roles & Responsibilities of Academy Partners

Minnesota Department of Education TAMS Supervisor: The TAMS Supervisor will:

- Provide oversight of statewide implementation and coordinate the work of the Statewide Planning Team in design of academy curricula and Phase 3 technical assistance
- Coordinate planning meetings with Regional Service Cooperative coordinators
- Review and approve district/consortia math improvement plans, using a rubric-based process
- Work to involve higher education institutions throughout the TAMS process in an effort to ensure sustainability
- Work with the external evaluator

Statewide Planning Team: A team representing experts in K-16 math content, curriculum alignment and professional development will devote a total of 600 hours per year and will:

- Develop the design and content of the training academies to be offered in Summer 2008 and Summer 2009
- Develop a toolkit of resources and protocols available for the future use of participants

Statewide/Regional Training Experts: Regional and statewide experts from Minnesota Department of Education, Regional Service Cooperatives, higher education and K-12 who will:

- Serve as faculty for summer academy trainings
- Support district/consortium improvement plans through consultation, training, technical assistance, etc. during Phase 3
- Participate in evaluation and reporting activities

Higher Education Institutions: Higher education institutions will:

- Encourage and support faculty participation on district/consortium teams
- Adapt higher education programs as needed to increase knowledge of practicing and pre-service teachers in the areas of mathematics content, instruction and assessment
- Support systemic change in schools and districts

Regional Service Cooperative Coordinators: The Regional Service Cooperative Coordinators (.2 FTE per region) will:

- Act as the fiscal host in each region and provide administrative oversight
- Coordinate scheduling and arrangements for regional academies
- Act as the "broker" and identify appropriate resources to assist in the implementation of the improvement plans of each of the five participating districts/consortia in their region during Phase 3
- Identify higher education resources to assist district/consortium Trainer Teams
- Participate in evaluation and reporting activities

District/Consortium Leader Team: This is a 5 person K-12 team that represents the roles of building/district administrator, teacher leader, professional developer and curriculum developer. The District/Consortium Leader Team will:

- Provide oversight of the finalization and implementation of the math component of the school/district improvement plan
- Ensure that the improvement plan is incorporated at all levels impacting the 2,000 students by involving all consortium/district/school leaders, including those that are not a part of the Leader Team
- Support the work of the district/consortium trainer teams
- Use district data to identify specific areas of need at the district/consortium level
- Serve as instructional leaders to support classroom improvements
- Determine on-going professional development and technical assistance needs
- Continually analyze data to inform the improvement process
- Interact directly with the Regional Service Cooperative Coordinator
- Establish a culture of high expectations in mathematics for all students and a commitment to equity in education as an achievable goal
- Ensure that all members of the District/Consortium Trainer Team are fully aware of what has already been happening in their district and statewide
- Work with the Regional Service Cooperative Coordinator to identify a higher education resources who might be willing to serve on their Trainer Team

District/Consortium Trainer Team: This is a 10-person team that includes at least 1 representative from the Leader Team. The Trainer Team will:

- Work with the Leader Team by using district data to identify specific professional development needed at the district/consortium level
- Determine on-going professional development and technical assistance needs
- Implement components of the improvement plan
- Apply TAMS learning within the classroom by changing curriculum, instruction and assessment practices as appropriate

Teachers Delivering Math Standards: This is the entire group of teachers directly impacting the 2,000 students. The teachers will:

- Become knowledgeable about the 2007 Minnesota Academic Standards in Mathematics and the Frequently Asked Questions document that accompanies them
- Recognize that high expectations in mathematics for all students is an educator's responsibility
- Attend and be an active learner in professional development led by the District/Consortium Training Team
- Apply this learning within the classroom by changing curriculum, instruction and assessment practices as appropriate
- Collect and provide data as requested by the Leader and Trainer Teams to inform the district/school improvement plan and the TAMS statewide program evaluation

- Become a reflective practitioner as part of a Professional Learning Community
- Provide feedback to the Leader and Trainer Teams regarding continuing needs of the students and corresponding teacher professional development needs that are not currently being addressed

External Evaluator: The evaluator will:

- Create and implement an evaluation process that promotes reflection and continuous improvement throughout every phase of the initiative
- Work with the TAMS Supervisor and members of the Statewide Planning Team to refine and articulate the measurable outcomes of the initiative—both during the first 18 months and beyond
- Develop tools and data collection processes that will provide effective baseline data for the longitudinal study of the impacts of the initiative over time

Appendix D: Applications

Applications would solicit the following types of information from interested districts/consortia:

1. Information about the District/Consortium Leadership Team and Trainer Team
    a. Who will serve on the teams? (Names, titles, responsibilities of team members)
    b. How was the team developed?
    c. How were teachers involved in the application process?
2. What else is being done that aligns with or supports the work that may occur in the academy? (This would include a description of mathematics initiatives but should also discuss initiatives, efforts, practices, policies, capacities or infrastructure that the district/participating schools have been working on to improve student learning in general)
3. What are the assets/benefits and drawbacks/barriers that impact the district/consortium's current mathematics curriculum and instruction?
4. What partners or resources have been sought to address improvements in mathematics instruction? (Higher education, business, organizations, Minnesota Department of Education, Regional Service Cooperatives, etc.)
5. Districts would be asked to self-assess their current level of implementation on a number of elements that will be emphasized as part of the Academy design (e.g., use of disaggregated data to make instructional and professional development decisions, surveys or observations of instructional practices, use of student work protocols, use of teacher professional learning communities, etc.)

Appendix E: References

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