Coherence is the idea that students learn skills in earlier grades and then build on them as they move forward

Wisconsin Mathematics & Science Partnership

THE LEARNING NETWORK CONFERENCE

2016
Moving Forward

WISCONSIN DEPARTMENT OF PUBLIC INSTRUCTION
Tony Evers, PhD, State Superintendent

DPI Contacts

Website: http://dpi.wi.gov/title-ii/part-b
Email: dpimsp@dpi.wi.gov
Phone: 608-267-9270
Fax: 608-266-1965

MSP Committee:

Kevin Anderson
Content and Learning Team
kevin.anderson@dpi.wi.gov
608-266-3319

Abdallah Bendada
Literacy and Mathematics Team
Abdallah.bendada@dpi.wi.gov
608-267-9270

Kenneth Davis
Literacy and Mathematics Team
kenneth.davis@dpi.wi.gov
608-266-9368

John Johnson
Literacy and Mathematics Team
john.johnson@dpi.wi.gov
608-267-3726

Paul Trilling
Teacher Education, Professional Development and Licensing Team
Paul.trilling@dpi.wi.gov
608-266-0933

Suzan Van Beaver
Special Education Team
suzan.vanbeaver@dpi.wi.gov
608-267-9168

Alfonso Zepeda-Capistrán
Title I team
Alfonso.Zepeda-Capistran@dpi.wi.gov
608-267-2287

Elementary and Secondary Education Act: Title II, Part B: Mathematics and Science Partnership Program

2013-2016	2014-2017	2015-2018
UW-Milwaukee/Cudahy (mathematics)	UW-Eau Claire/Clayton (mathematics UW-Eau Claire/Cornell (mathematics) UW-Oshkosh/Mondovi (mathematics) UW-Parkside/Kenosha (mathematics)	UW-Milwaukee/Milwaukee Public Schools (mathematics) UW-River Falls/ New Auburn (mathematics)

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Literacy and Mathematics Team

Wisconsin Department of Public Instruction
125 South Webster Street
Madison, WI 53703
800-266-1027
http://tepdl.dpi.wi.gov/

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Introduction

The reauthorization of the Elementary and Secondary Schools Act in January of 2002 (also known as the No Child Left Behind Act, NCLB) introduced the Improving Teacher Quality Grant Programs (Title IIB). These programs encourage scientifically-based professional development, as a means for improving student academic performance, in all 50 states.

Each state's department of education is responsible for administering the program on a competitive basis. The program is a formula grant program, with each state's funding determined by student population and poverty rates. The program is commonly known as the Mathematics and Science Partnership Program (MSP).

Wisconsin's MSP *strives to improve teacher quality* through partnerships between state education agencies, institutions of higher education, local and regional education agencies, and school districts; for the purpose of increasing *student academic achievement in mathematics and science*. The program supports partnerships between one or more of Wisconsin's high-need Local Educational Agencies (LEA) and at least one institution of higher education department of science, mathematics, and/or engineering.

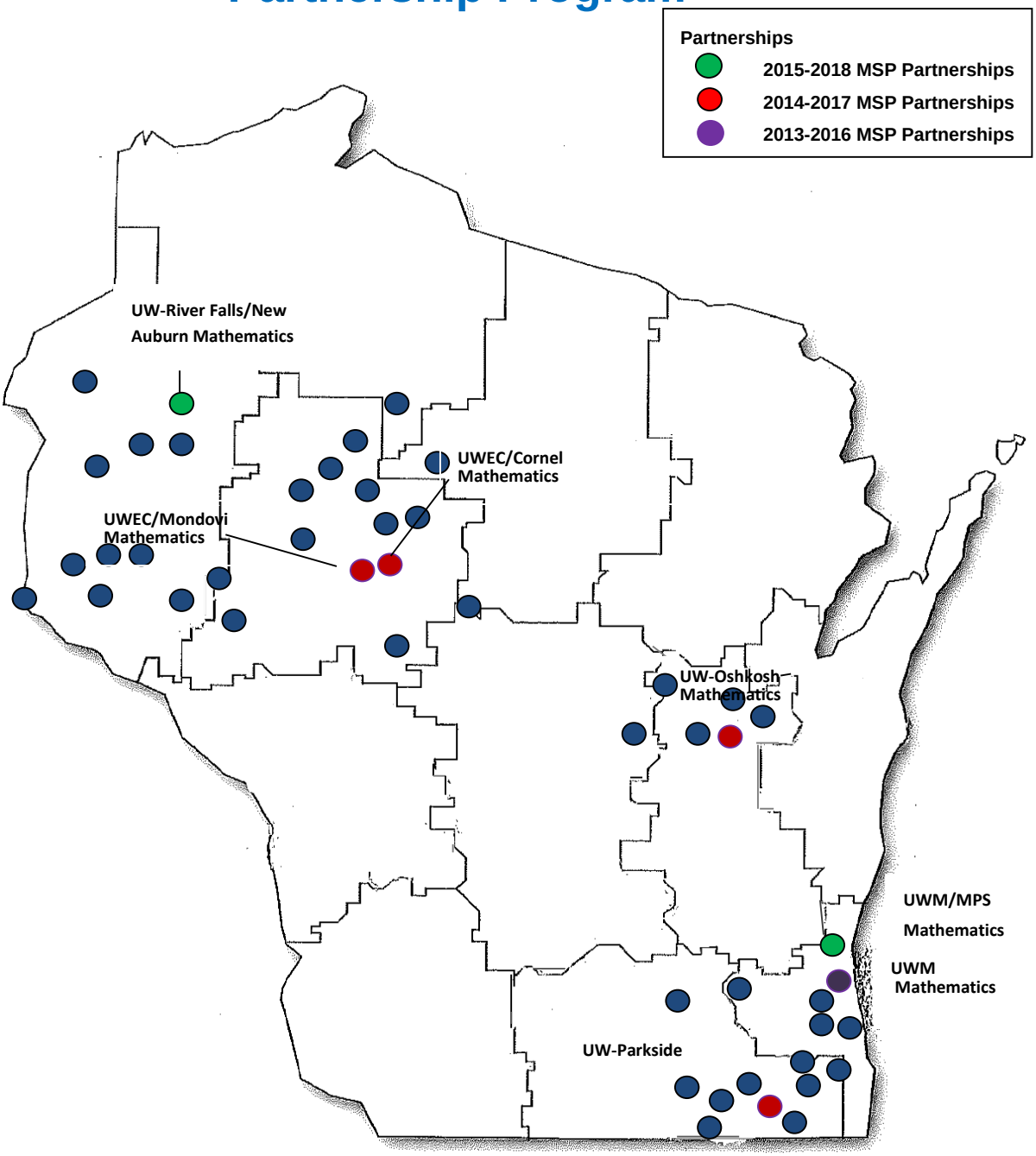
Partnerships between these high-need school districts and the science, technology, engineering, and mathematics (STEM) faculty in institutions of higher education, are at the core of each MSP. Each individual partnership focuses on increasing and enhancing the content knowledge and teaching skills of classroom teachers of mathematics and science. Partnerships are typically two to three years in duration, and include face-to-face instruction and continual electronic dialog between participants.

A high need LEA is any district where mathematics or science student proficiency scores do not exceed 65 percent, based on disaggregated scores, and where there is no currently active Title II, Part B grant, in the same content area, and one of the following:

1. At least 10 percent of the student population is from families with income below the poverty line as identified by the Census 2013, or
2. Schools/districts having Rural Education Achievement Program (REAP) or meeting local codes of 6,7, or 8

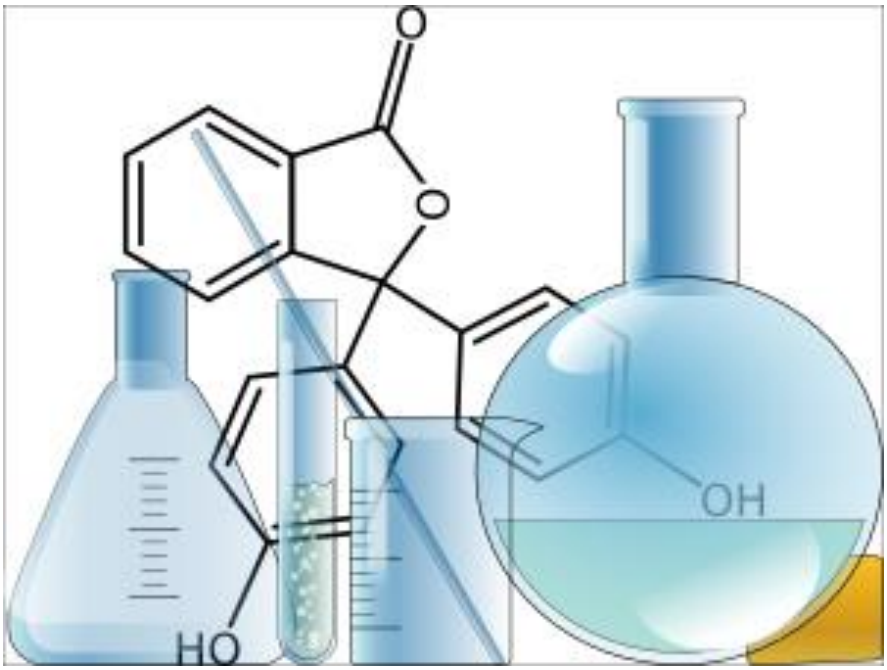
MSP Program Locations

Mathematics and Science Partnership Program



Mathematics & Science Partnerships

2013-2016 Projects



UW-Milwaukee/Cudahy
(Mathematics)

Project Title: Core Mathematics Partnership: Building Mathematical Knowledge and High-Leverage Instruction for Student Success

Principle Investigator: DeAnn Huinker

Project Leaders

- **Dr. DeAnn Huinker, Professor, Department of Curriculum and Instruction**
- **Dr. Kevin McLeod, Associate Professor, Department of Mathematical Sciences**
- **Karen Ebbers, Director of Instruction, School District of Cudahy**
- **Amy Paladino, Mathematics Specialist, School District of Cudahy**
- **Beth Schefelker, Mathematics Specialist, School District of South Milwaukee**
- **Joe Giera, Mathematics Specialist, School District of South Milwaukee**

Total Funding: $717,929

Participants: 40

Abstract

The "Core Math Partnership: Building Mathematical Knowledge and High-Leverage Instruction for Student Success" engages K-8 teachers across three school districts as a model of collective efforts in moving to common practice with the *Common Core State Standards for Mathematics* (CCSSM). The lead partners include the School District of Cudahy, a high-need LEA, and the University of Wisconsin-Milwaukee. Additional partners are the School District of South Milwaukee and the Milwaukee Public Schools. The project aims to: (1) deepen teachers' mathematical knowledge and understanding of content learning progressions; (2) strengthen teachers' instruction through the use of high-leverage teaching practices; and (3) increase teacher collaboration within and across schools for mathematics. Participants attend a series of UW-Milwaukee courses over three years, including three summer institutes and two school-year programs. Each year targets specific domains of the Common Core State Standards for Mathematics. Year 1 focuses on base ten number and operations, algebraic thinking, and expressions and equations. Year 2 addresses fractions, number systems, and ratios and proportional relationships. Year 3 focuses on geometry and measurement. The courses are led by university faculty in mathematics and mathematics education and co-taught with master teachers. Participants earn 13 university graduate credits, along with receiving professional memberships to the National Council of Teachers of Mathematics and the Wisconsin Mathematics Council.

Introduction

The "Core Math Partnership: Building Mathematical Knowledge and High-Leverage Instruction for Student Success" engages K-8 teachers across three school districts as a model of collective efforts in moving to common practice with the *Common Core State Standards for Mathematics* (CCSSM). The lead partners include the School District of Cudahy, a high-need LEA, and the University of Wisconsin-Milwaukee. Additional partners are the School District of South Milwaukee and the Milwaukee Public Schools. Participants attend intense two-week summer institutes each year to study mathematics content, standards progressions, and high-leverage mathematics teaching practices. During the school year, participants meet monthly to continue study of mathematics content and to collaborate on the implementation of high-leverage teaching practices. The following quotes provide an illustration of some of the impact of the project on the participants:

"My participation in the MSP project inspired me to use more specific math language in my classroom, to take risks in letting kids work their way through problems without my assistance, take time to encourage kids with mindset lessons and activities, and intentionally plan lessons and examples using discourse/talk moves. All of these strategies and tools have allowed more students to gain a deeper understanding of the math concepts and improve their confidence with the math curriculum."

"My classroom has been profoundly impacted by my participation in the Core Math project. My classroom environment has become a much safer environment to learn in thanks to class discussion norms and the use of talk moves. Discussions, particularly math, are dynamic and exciting. Students are respectfully agreeing and disagreeing with each other and backing up their arguments with viable evidence. All students have various entry points into discussions and students are much less afraid to make mistakes. My students can be seen using multiple representations flexibly including area models and tape diagrams. They are using representations to help them make sense of problems."

Goals and Objectives

The work of the *Core Math Partnership* is framed by three project goals:

1. Deepen teachers' mathematical knowledge and understanding of content progressions aligned to the *Common Core State Standards for Mathematics*.
2. Strengthen teachers' instruction through the use of high-leverage teaching practices to increase student success in mathematics.
3. Increase teacher collaboration within and across schools in moving to common practice with the *Common Core*.

Program Plan

The *Core Math Partnership* engages teachers in professional learning through three project components: (1) summer institutes, (2) school-year project sessions; and (3) classroom-based support from district math specialists. The two-week summer institutes are held the last two weeks of July each year. A key feature of the institutes are the use of the *Common Core* progression documents. The daily sessions explore and deepen participants mathematical knowledge and model the use of the standards for mathematical practice and high-leverage teaching practices. Each summer institute targets a specific focus area: Year 1 focused on operations, algebraic reasoning, and number and operations in base ten; Year 2 focused on fractions, ratios, proportional relationships; and Year 3 geometry and measurement. The following participant comment provides a glimpse into the learning from a summer institute:

> *"In thinking about the past two weeks, it has been a tremendous learning experience. Coming in, I thought that I knew, somewhat, an effective way to teach mathematics. However, I now see that I had much to learn and understand. One major idea that I continue to think about is the idea of the distributive property.... Another specific idea that really struck me is the discussions around different representations. When teaching math, I would always have students come up and share their different strategies. But I NEVER thought that the students should be talking to each other, comparing their strategies, and talking about why those strategies work for them. This was huge for me to think about."*

During the school year, participants meet monthly on Tuesday evenings (9 sessions, 3 hours per session). They continue study of mathematics content and learning progressions and work toward implementation of high-leverage mathematics teaching practices. The core set of teaching practices are based on the recently released "Principles to Actions: Ensuring Mathematical Success for All" by the National Council of Teachers of Mathematics (2014). These include: (1) establish mathematics goals to focus learning; (2) implement tasks that promote reasoning and problem solving; (3) use and connect mathematical representations; (4) facilitate meaningful mathematical discourse; (pose purposeful questions; (5) build procedural fluency from conceptual understanding; (6) support productive struggle in learning mathematics; and (8) elicit and use evidence of student thinking.

Evaluation and Reflection

The evaluation of the *Core Math Partnership* utilizes a quasi-experimental, matched-comparison group design. The outcomes of participating teachers are being compared to those of comparison group of non-participating teachers after controlling for baseline performance. The specific outcome measures include: (1) mathematical knowledge for teaching, (2) knowledge of the *Common Core State Standards for Mathematics*, (3) mathematics teaching practices, (4) teacher collaboration, (5) student perceptions of mathematics teaching and learning, and (6) student achievement in mathematics. The following selected results

demonstrate some of the impact of the project.

Common Core State Standards (CCSSM Survey): Teachers completed CCSSM surveys prior to the summer 2014 institute and at the end of school year (May 2015). Teachers reported on their general knowledge of the CCSSM and on knowledge of standards for targeted content domains of number, operations, and algebraic thinking. Treatment teachers (n=27) increased from a mean of -0.18 (SD=0.86) to 0.45 (SD=0.64) and comparison teachers (n=22) increased from a mean of -0.07 (SD=1.15) to -0.69 (SD=1.10). Generalized linear modeling with robust standard error estimators compared post CCSSM scores of treatment and comparison teachers, while accounting for baseline scores. The project had a statistically significant positive impact and large effect (1.2 standard deviations) on CCSSM scores of the treatment teachers (B=1.2, SE=0.22, p<0 .001). As one teacher noted:

> *"I think the biggest impact has been that I am more knowledgeable about the progression of the standards and what my students are expected to know when they leave my class. I am much more equipped to plan a lesson that is aligned with a standard, and that has student learning targets to help students work towards this goal."*

Mathematics Teaching Practices Inventory (MTPI): Teachers completed a survey on their use of high-leverage mathematics teaching practices prior to the summer 2014 institute and again at the end of the school year (May 2015). Treatment teachers (n=31) mean score increased substantially from -0.38 (SD=080) to 0.19 (SD=0.86). Comparison teachers (n=18) mean score increased some from -0.14 (SD=0.98) to -0.65 (SD=1.10). Generalized linear modeling with robust standard error estimators was used to compare MTPI scores. The project had a statistically significant positive impact and large effect (0.98 standard deviations) on post MTPI scores of project teachers (B =0.98, SE=0.24, p<0.001). These teacher comments provide some illustration of the impact on classroom practice:

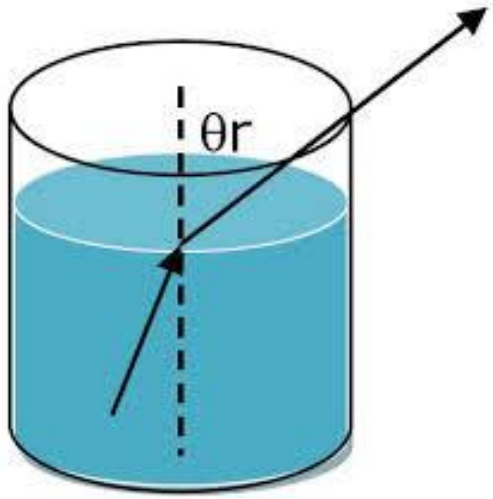
> *"Prior to this project, tape diagrams did not exist in my knowledge base, and therefore were non-existent in my teaching. Thanks to this project, tape diagrams are completely embedded in my daily lessons. My third graders use tape diagrams successfully every single day. They use them to set up problems, to 'see' what needs to be done, and they use them as a representation for their thinking! This has been the number one game changer in my classroom."*

> *"The greatest impact in my classroom this year has been the use of multiple representations. It has become second-nature to my students and myself. It is now the expectation that students explain their thinking in multiple ways. This has helped with differentiation for struggling learners by giving them multiple access points to solving a*

problem and with higher-level thinkers because I could challenge them to show their thinking in more than one way."

Student Perceptions of Mathematics Instruction: Student perception surveys were administered in May 2014 and in May 2015. This survey provides a glimpse into the teachers' classrooms by using students as informants on their experience related to high-leverage mathematics teaching practices. Responses were collected from 645 students in Grades 2-5 and 867 students in Grades 6-8 across 24 teacher classrooms. The baseline shows treatment and comparison teachers were rated as demonstrating roughly equal levels of instructional quality. However, at follow-up, the treatment teachers, especially middle school teachers, were rated significantly higher by students. Separate models were fit for middle and upper primary teachers and then the results were pooled to test the overall impact of the project. The results suggest that the MSP project had a statistically significant positive impact and effect (0.22 standard deviations) on the quality if mathematics instruction with greater impact on middle school teachers (z=0.35) than upper primary teachers (z=0.12).

2014-2017 Projects



UW-Eau Claire/Clayton
(mathematics)

UW-Eau Claire/ Mondovi
(mathematics)

UW-Oshkosh/Medford
(mathematics)

UW-Parkside/Kenosha
(mathematics)

Project Title: A^3 – Assess, Analyze and Address

Principle Investigator: Chris Hlas

High Need LEA: Mondovi School District, Cornell School District

Higher Education Institute: University of Wisconsin-Eau Claire (UWEC)

Project Leaders: Chris Hlas (UWEC), Ryan Harrison (UWEC), Lori Vetterkind (Mondovi), Ashley Rosentrater (Cornell)

Total Funding: $428,043

Participants: 42

Abstract: Through this grant teachers will develop and use a process to first diagnose and then address specific gaps in their students' conceptual and procedural knowledge, with a focus on those gaps that indicate a lack of readiness for high school mathematics. Participants will be selected from targeted districts and range from upper-elementary through lower high school levels. All work will be based on the Common Core State Standards for Mathematics (CCSS-M) documents: the CCSS-M standards, CCSS-M learning progressions and trajectories. The proposed process is designed to address the following three goals.

Goal #1. To increase teachers' mathematics knowledge for teaching in three content areas: 1) statistics and probability, 2) measurement and geometry, and 3) the number system and algebra. To accomplish this, teachers will begin with a guided in-depth analysis of CCSS-M documents and exploration of research on mathematics content and pedagogy related to high school readiness. A key feature of this activity will be training on how formative assessment probes can be designed to align to CCSS-M content standards and used to differentiate instruction, assess students' depth of knowledge around a given topic, analyze trends in student thinking and assess effectiveness of instructional strategies.

Goal #2. To uncover student thinking in order to identify misconceptions, specific gaps, or weaknesses in conceptual understanding and procedural knowledge directly related to high school readiness. To accomplish this, teachers will interview students using proven probes and others that they have developed. They will compare and relate their students' responses to points along the mathematics progressions as described in CCSS-M documents. Key features of this activity include: collecting and evaluating data on student thinking, using appropriate interview protocols and statistical analysis to identify trends and commonly held misconceptions.

Goal #3. To improve teaching practices by employing and analyzing strategies that purposefully address previously identified student needs. Teachers, in a professional learning community made up of peers and university mathematics faculty, will use data analysis to identify student needs and define appropriate teaching strategies for addressing these needs. Key features of this activity include: Structured observations of the implementation of specified strategies with reflections on the use of those identified strategies and the collection of longitudinal data regarding student response to the teaching strategies used.

Participation in interactive workshops during the school year and attendance at summer institutes over a three year time period will facilitate attainment of all goals. Teachers will share specific probes developed and appropriate teaching strategies based on the student thinking data both during the scheduled interactions and eventually through a website model available to the public. All activities will take place under the guidance of university mathematics faculty and experts in the field of formative assessment.

Goals and Objectives:

Goal 1: To increase teacher's mathematics knowledge for teaching and develop research-based beliefs about learning mathematics.

Objective 1-1. In year one, teachers will increase their mathematics knowledge for teaching in the content area of statistics and probability, as measured by the Learning Mathematics for Teaching (LMT) assessment using a pretest posttest design.

Objective 1-2. In year two teachers will increase their mathematics knowledge for teaching in the content area of measurement and geometry, as measured by the LMT using a pretest posttest design.

Objective 1-3. In year three, teachers will increase mathematics knowledge for teaching specifically focused on development and understanding the number system and algebra (operations and algebraic thinking, expressions and equations, and functions), as measured by the LMT using a pretest posttest design.

Re: Objectives 1-1, 1-2 and 1-3: In the content areas identified, teachers in the project will show significant gains over teachers in the comparison group as measured by the LMT at the end of the third grant year.

Objective 1-4. In years 1-3, teachers will develop beliefs that are more aligned with a constructivist theory of learning.

Goal 2. To uncover student thinking in order to identify misconceptions, specific gaps, or weaknesses in conceptual understanding and procedural knowledge directly related to high school readiness.

Teachers will understand how formative assessment probes are used to make student thinking transparent, differentiate instruction, assess students' depth of knowledge around a given topic, analyze trends in student thinking and assess effectiveness of instructional strategies as follows.

Objective 2-1. Teachers will design and then administer formative assessment probes to their students. They will then use the data generated from these probes to classify students along learning trajectories as defined by CCSS documents.

Objective 2-2. Teachers will analyze student probe data to identify trends in student thinking as well as misconceptions and gaps that are commonly held across grade levels and content areas.

Goal 3. To improve teaching practices by employing and analyzing strategies that purposefully address previously identified student needs. (identified in goal # 2)

Based on the analysis of student probe data, specific teaching practices will be developed to aid students in overcoming the identified misconceptions and differentiate instruction.

Objective 3-1. Teaching strategies will improve so that students will address their misconceptions and gaps in learning of mathematics. This will be measured by student performance on formative assessment probes administered at the start of the project and at the end of each year.

Objective 3-2. Teaching strategies will improve so that student achievement on formative assessment probes will be higher for teachers in this project versus teachers in comparison classrooms.

Objective 3-3. Teaching strategies will improve student achievement. Using the 2014 WKCE* scores as baseline, by 2017 the percentage of grade 10 students scoring at the advanced and proficient levels in mathematics will increase.

Program Plan:

Year 1: September 1, 2014 through August 31, 2015

- Pre-October (2 hours). Identify teachers for participation and comparison groups. Administer pre-assessments on content and beliefs assessment for all teachers.
- October (12 hours). Participant teachers attend a training session focused on CCSSM documents.
- November (12 hours). Participant teachers will attend a training session on formative assessment probes and the formative assessment cycle.
- January–March (online contact). Participant teachers will use existing formative assessment probes to collect student-thinking data of 4th-9th grade students.
- April (8 hours). Professional learning groups.
- Summer (2 weeks for 80 hours). Summer institute focusing on statistics and probability. Initial stages of the online tool will be planned and implemented.

Year 2: September 1, 2015 through August 31, 2016

- September–October (online contact). Participant teachers will use self-made formative assessment probes to collect student-thinking data of 4th-9th grade students.
- Early November (8 hours). Professional learning groups.
- December–January. Teacher observations.
- February–March (online contact). Participant teachers will use self-made formative assessment probes to collect student-thinking data of 4th-9th grade students based on the mathematical focus for the grant year. Further, teachers will continue collecting data for the probe from Year 1 to make longitudinal comparisons.
- Early April (8 hours). Professional learning groups.
- April–May. Teacher observations.
- Summer (2 weeks for 80 hours). Summer institute focusing on measurement and geometry. Participant teachers will provide input for the design and use of the online tool.

Year 3: September 1, 2016 through August 31, 2017. We will use a similar structure to Year 2 with the following enhancements:

- September–October (online contact). Participant teachers will use the online tool of formative assessment probes to collect student-thinking data of middle school students.
- Early November (8 hours). Professional learning groups. Additionally, teachers will provide feedback for improvement of the online tool in terms of accessibility and desired features.
- December–January. Teacher observations.
- February–March (online contact). Participant teachers will use the revised online tool of formative assessment probes to collect student-thinking data of middle school students.
- Early April (8 hours). Professional learning groups. Additionally, teachers will continue to provide feedback for improvement of the revised online tool.
- April–May. Teacher observations.
- Summer (2 weeks for 80 hours). Summer institute focusing on the number system and algebra. An additional focus will be to finalize the online formative assessment. Finally, all teachers will take post-assessments on content and beliefs.

Evaluation and Reflection:

At this time we have started collecting baseline data. The table below highlights the planned evaluation measures.

Evaluation Measures/Procedures	**Intervention Teachers**	**Comparison Teachers**
Learning Mathematics for Teaching Assessment	Yes	Yes
Mathematics Beliefs Scales	Yes	Yes
Concerns Based Adoption Model	Yes	No
Observations (Danielson's Framework for Teaching)	Yes	No
	Intervention Students	**Comparison Students**
Wisconsin Knowledge & Concepts Examinations	Yes	Yes
Formative Assessment Probes	Yes	No

Project Title: Teachers Engaged in Authentic Mathematics (TEAM)
Principle Investigator: Jennifer Harrison
High Need LEA: School District of Clayton
Higher Education Institute: University of Wisconsin – Eau Claire
Project Leaders: Jennifer Harrison & Manjula Joseph
Total Funding: $383,885
Participants: 38

Abstract: The Teachers Engaged in Authentic Mathematics (TEAM) project has brought together a partnership between the University of Wisconsin - Eau Claire, the School District of Clayton, and 14 other northwestern Wisconsin rural school districts - Amery, Boyceville, Clear Lake, Elmwood, Grantsburg, Osceola, Plum City, St. Croix Falls, Shell Lake, Siren, Spooner, Turtle Lake, Unity, and Webster.

This project will provide the structure and commitment for regular and special education teachers to collaborate as they meet the needs of ALL students, grades 4-8 based on the local professional development (PLC) structures and coordination with the IHE. Districts participating in this project chose to support a grade 4-8 configuration. TEAM will develop a professional learning community locally and across our region to develop the leadership needed for all students to become successful in mathematics.

Introduction: To support teachers in implementing the CCSSM and the complex learning needs of students, professional development activities must incorporate both content standards as well as engage teachers in the Standards for Mathematical Practice (SMP) (Sztajn, Marrongelle, Smith, 2011). To ensure teachers grow their knowledge of the CCSSM content domains and the SMP, teachers need opportunities to make sense of the mathematics through active engagement in the learning process. Implementing such professional development involves "modeling the sought after practices and constructing opportunities for teachers to practice and reflect on the new strategies" (Shaughnessy, 2011). Furthermore, in review of nine studies, Yoon et al. (2007) found that student achievement gains were directly related to sustained and intensive professional development.

Many teachers feel overwhelmed by the challenges of CCSSM and the learning needs of their students. To make appropriate grade-level mathematics more accessible to ALL students, especially those with learning difficulties, regular and special education teachers need opportunities to plan collaboratively and proactively (Brodesky, Gross, McTigure, & Tierney, 2004).

Through the *TEAM* Project, regular educators and their special education partners will collaborate in learning together and planning strategies, bringing their combined expertise to strengthen each

other's teaching experiences, resulting in improved learning for ALL students. This collaboration will offer participants a sustained professional development opportunity whereby regular educators will expand their repertoires of content, practices, and differentiated strategies, and special educators will deepen their mathematics content knowledge and pedagogical content knowledge.

Goals and Objectives:

The ***TEAM*** project intends to bring together 60 teachers of mathematics in grades 4-8 and engage them in a sustained three-year professional development program centered on the mathematical learning of ALL students. Teachers will be recruited as school teams, each team consisting of 3-5 teachers of regular education and at least one special education teacher.

Goal 1: Strengthen the mathematics content knowledge of regular and special education teachers, grades 4-8

Measurable Objective: 1:1 Gain a deeper understanding of content knowledge for teaching mathematics as evidenced by growth on the Diagnostic Teacher Assessment of Mathematics and Science (DTAMS).

Goal 2: Enhance mathematics pedagogical content and assessment practice to provide support for ALL students.

Measurable Objective: 2:1 Develop and use problem-based collaborative approaches that focus on the Math Progressions across the CCSSM targets as evidenced by Tier I lesson plan analysis, classroom observations, defined SBAC classroom activities, and performance tasks with writing rubrics/scoring guides.

Goal 3: Establish a relationship between and among participants and partners to sustain teachers' on-going professional collaboration, leading to instructional change and teachers' growth.

Measurable Objective: 3:1 Increase collaboration on mathematics instruction through a professional learning community design (PLC) between regular and special education teachers.

Measureable Objective: 3:2 Increase collaborative planning time as evidenced by PLC local documentation and MIST tool.

Goal 4: Improve student achievement in mathematics, grades 4-8.

Measurable Objective: 4:1 Improve students' ability to use their thinking and reasoning skills to solve performance-based tasks as evidenced by performance on pre-post assessments based on lesson plans developed by participants.

Measureable Objective: 4:2 Decrease gaps for students of economic disparity and special education in participants' classes as evidenced by improvement on pre-post performance tasks and SBAC.

Measureable Objective: 4:3 Increase math understanding in targeted content areas as measured by assessment procedures aligned with math "interactive" note-booking and reflective practices.

Program Plan: This project will provide systemic and long-term professional development for teachers. Our intention is to connect subject matter with pedagogy enhancing and expanding the repertoire of research-based instructional methods that support students in mastering new content and skills. Learning will be imbedded with opportunities for collaborative planning (PLC),

professional development in effective content unit planning and reflective math "interactive" note-booking practices, and developing a support network which connects teacher to university math personnel and other professionals within and beyond their school. Professional development will include directed practices in solving math content as an individual, as well as with a "team work" approach.

The program activities follow the recommendations of the National Research Council and the Learning Forward Council, www.learningforward.org, with professional development driven by data concerning what students need to know and are able to do. Professional development will be constructed around collegial conversations about student work and strategies to improve classroom practices and student learning with the CCSSM Targets and Practices, and the PI-34 WI Teacher Standards (WTS). Each of the ten WTS is addressed. Our model will consist of four components and will be evaluated for structure, content, perceptions, and participant learning, and impact that learning on their respective students. These components include –

TEAM* Visions Conference:** This conference will bring participants together in the Spring of each year of the project to actively engage in a PLC model that will support their ability and skill set to create and maintain supportive leadership and structural condition with their local PLC teams as students' interests and needs are addressed. Year one will introduce the objectives, structures and evaluations of the ***TEAM project and the PLC program elements and constructive modeling. A diagnostic content pre-assessment using DTAMS will be embedded into this structure so to give feedback to the IHE faculty as to following summer academy instructional needs and formative assessments. Each following year, participants will have explicit instruction on PLC as it relates to math content and instruction along with the diagnostic content assessment pre-test for the summer academy content focus. Participants will actively engage with the PLC Consultant in developing the PLC protocols and local student assessment needs. This conference will be targeted for math and special education teachers. The PLC design chosen will model the initiatives, strategies and practices of DuFour & Eaker (2006). All activities of the Visions Conference will be designed and facilitated by the IHE Faculty and PLC Consultant based on needs and data collected from the local PLC work and collaborations.

TEAM* Content Summer Academy:** This structure will provide participants with a two-week academy designed, facilitated, and taught by the UWEC Faculty targeted for grades 4-8 math and special education teachers. Each summer academy will provide participants with a reflective and collaborative experience grounded in content and math progressions knowledge, pedagogical content knowledge, assessment techniques, and content literacy, including Interactive Note booking - related to CCSSM. Each summer will develop as assessments of teachers' and students' needs are uncovered through yearly project evaluation and participant feedback. ***TEAM will be introduced to the formative assessment of Math Interactive Notebook design. This tool supports students as they identify the content they are learning along with a reflective component of "making sense" of the math in order to apply this knowledge. Culminating these summer academies, each teacher will be provided with a first-hand experience of ways to learn mathematics

that research suggests is effective for all students. The PLC structures, developed within the academy, will support teachers at their school sites as they work with peers to analyze artifacts from their own classrooms, evaluate instructional "next steps" and modify their own lessons based on their students' incorrect or partial understandings of the math, thus building their knowledge of teaching. As the ***TEAM*** participants develop the leadership skills for PLC collaboration and data collection procedures, the home grade-level or vertical teams will be impacted by the guiding PLC structures. Each district will also develop a District SMART Goal(s) in support of their intentional work.

Year-Long Follow-Up Assistance and Training Modules: ***TEAM*** participants will receive the following ongoing training, support, and technical assistance: **1) Winter PLC Assessment Workshop** – during the school year a workshop opportunity will be provided for content follow-up training and support on the material covered in the Summer Academy. Teachers will share progression and success with developed content progressions, instructional practices, and receive more training on PLC protocols using "authentic" student data, formative/summative assessment analysis and design, intervention/extension models and strategies, and collegial networking. **2) Classroom Observation** UWEC faculty will visit (once per year) the participants' PLC group to observe collegial conversations, student protocols and assessments, troubleshooting and provide feedback in support of the content developed in the Summer Academy, specifically the use of the Math Interactive Notebooks, Math Progressions, and Formative Assessment Practices. **3) Collegial Networking/Study Groups** – each district will host a bi-monthly study group for local PLC teams as a model for collaboration and district leadership. Facilitation will be shared by participants and video of these meetings may be developed. Participants will develop reflective journals to accompany these meetings. PLC videos will be shared on D2L for constructive support of cohort successes and needs. Other district personnel will be encouraged to attend along with the PLC Consultant and/or local principal. **4) Collaborative Exchange among PLC Participants** – School-based teacher teams participating on the PLC team will visit each other's classrooms in support of best practice, create formative assessment routines and needs, observe videos of PLC practices, develop literacy practices for math content, and high light strengths/needs in support of low achieving students. **5) Ongoing Electronic Community** – Throughout the length of this project, networking and support among project participants and the IHE partners will include sharing via online collaborative tools – D2L (used to host assessments, coursework, best practices, content, interactive notebook strategies, and project feedback components).

Evaluation and Reflection:

Evaluation: To assess teacher learning and practice with both formative and summative evaluation tools in order to identify measureable outcomes. These tools include:

- Diagnostic Teacher Assessment of Mathematics (DTAMS) assessment of Elementary/Middle Level Math Teachers
- Middle School Mathematics and the Institutional Setting of Teaching, MIST Instrument
- PLC process and reflection journaling and video in support of district team development

- Pre-post assessment of student target development
- Pre-post attitudinal surveys and exit slips.
-

To determine the impact of this project on student performance, each TEAM participant's respective students will complete pre-post assessments that will measure changes in their math knowledge and skills.

Expected Benefits: This project is designed to develop the content and pedagogical content knowledge of mathematics for both regular and special education teachers. The focus of the content development within the summer academy will develop and carry over those needed conceptual understandings as the teams develop the formative work of their PLC.

The PLC concept will create and strengthen the "learning conversations" needed for teaching teams to collaborate, coordinate and reflect on their own personal development as well as the academic development of their students. These professional learning communities promote efficiency for teachers, equity for students, strategies for determining whether the guaranteed curriculum and grade level targets and progressions are being taught, information and feedback for teacher practice, and most importantly provide a powerful tool bringing regular and special education teachers together with purpose.

Project Title: Making Mathematical Connections: Mathematics Knowledge for Teaching the Common Core

Principle Investigator: Eric Kuennen

High Need LEA: Medford Area School District

Higher Education Institute: University of Wisconsin Oshkosh

Project Leaders: Laura Lundy (Medford), Eric Kuennen (UW Oshkosh)

Total Funding: $297,941

Participants: 29

Abstract: We envision an environment where teachers prepare our students to think mathematically and be able to solve non-routine mathematical problems. In striving to realize this vision, teachers' reliance on prescriptive textbooks must decrease, and our reliance on teachers' own mathematical knowledge must increase. In order to develop strong district curricula and classroom instruction aligned to the Common Core, teachers need deep and flexible math knowledge and practices, and constant vertical collaboration between grade levels.

Our rural location limits our professional development opportunities. This proposal will bring these opportunities to our teachers' doorstep. Experienced and highly qualified mathematics faculty will provide two-week intensive summer workshops that infuse the Common Core practice standards while focusing on our weakest mathematical content areas: Algebra and Functions, Fractions, Probability and Statistics, and Mathematical Processes.

Introduction: A key feature of these workshops is Problem-Based Inquiry: teachers will be daily engaged in authentic mathematics problem solving on rich problems designed by the math faculty to elicit a deep exploration and discussion of the math content in the Common Core in grades 4-9, mathmatical thinking and the Common Core Math Processes, and connections among math concepts. By becoming active participants in the mathematics practices as outlined in the Common Core, teachers will better understand what is meant by these practices and how to implement them in their classrooms. A second key feature to the workshops will be a Focus on Children's Thinking: faculty-led workshop sessions that focus on children's misconceptions, thinking and learning of these math concepts and processes, and teachers will analyze videos of children doing mathematics and teachers implementing classroom activitiies from the mathematics education literature. The third key feature to the workshops will be Connections to the Common Core, where the math content and practices learned by the teachers are directly connected to the Common Core standards, and teachers design lessons and activities for implementation in their own classrooms.

During the academic year, participants will collaborate in teams on lesson implementation and evaluation. The key feature of the academic year follow-up will be that mathematics faculty will visit classrooms to coach each participants' teaching for depth and press for student understanding, and alignment with both the Common Core content and process standards. This one-on-one contact

in the teacher's classroom will allow for great immediacy of feedback, relevancy of discussion, and help to build a strong relationship for on-going collaboration between teachers and mathematics faculty.

Goals and Objectives: The project's **goals** are to deepen teachers' mathematics knowledge for teaching and to increase student achievement in mathematics. The **objectives** are for our teachers to (1) gain a deep understanding of the Common Core Mathematical Content and Practice Standards in order to effectively facilitate student learning of math concepts and processes; (2) effectively implement the use of rich and engaging mathematical problems in the classroom; (3) understand how students learn math content in order to diagnose and respond to students' mathematical misconceptions in the classroom; and (4) collaborate vertically between grade levels in order to develop a continuum of developing knowledge and skills.

Program Plan: Thirty-six (36) teachers in grades 3-10 will be recruited, with preference given to grades 4-9 teachers from the targeted schools in the needs assessment, and to creating vertical teams within schools. Participants will receive either graduate credit or a stipend. Credits offered will be eleven graduate credits over three years (3 the first year, and 4 each in years 2 and 3), are based on a total 280 hours, and 26 hours per credit. The stipend offered will be $1540 per year, based on the Medford teacher's contract stipulated rate of $19.25 per hour for the 80 hour summer workshop.

Every year of the program, each participant will attend two weeks of full-day intensive summer workshops on mathematics content. The workshops sessions will be taught using a student-centered collaborative learning model with participants working in small groups, and collaborating vertically between grade levels in order to develop a continuum of knowledge and skills that build from one grade level to the next. Teachers will be supported by five mathematics faculty members in order to maximize participant/ faculty interaction. Following small group work, the faculty will lead larger group discussions of the key content and math practice ideas generated by the problem-solving activities. Each day of the summer workshop will focus on a specific mathematics topic within the Common Core, via three types of sessions:

1. Problem-Based Inquiry (PBI). Participants will deepen their understanding of a specific content topic through problem solving in small groups on rich problems designed to spark and sustain conversation about, and exploration of, a specific piece of the Common Core. These sessions will engage the teachers in analyzing solutions and methods, exploring representations, communicating, and making mathematical arguments. These sessions will represent about half of each day's workshop.

2. Focus on Children's Thinking. In the afternoons, we will study children's thinking and misconceptions about the specific content topic that was the focus of the morning's problem solving. Participants will appraise children's methods and discuss whether they are correct and generalizable. We will view video clips of children thinking aloud as they solve problems in order to better understand the ways children reason mathematically. We will also discuss how to respond to common student questions (as established in the research literature) related to the content, and address how to assess student written work (constructed response) in mathematics.

3. Connections to the Common Core. Finally, each day participants will study how the specific content topic is treated in the Common Core and in classroom lessons. We will analyze lessons and activities, such as from the NCTM Navigations Series and Common-core aligned textbooks and discuss the underlying concepts and the purpose and motivation for their approach. Participants will collaborate in grade bands in vertical teams and present their ideas for how they teach the content in the classroom.

Coursework Details. While making connections to children's thinking, mathematics practices and to teaching strategies, the professional development workshops will be driven by mathematics content in the Common Core. Each year of the program there will be a different content theme. In year one (1) the theme will be "Numbers and Algebraic Thinking", with a focus on the Common Core content strands of Operations and Algebraic Thinking, Number and Operations in Base Ten, Number and Operations - Fractions, Number Systems, and Expressions and Equations. In year two (2), the theme will be "Geometry and Measurement" with a focus on the Common Core strands of Geometry, Measurement and Data, and Ratios and Proportional Relationships. In year three (3) the theme will be Probability and Statistics, with a focus the content strands of Probability and Statistics, Measurement and Data, and Ratios and Proportional Relationships. While each year will have an identified content theme, the Common Core mathematical practice standards will be specifically addressed and identified in the workshop activities throughout the three-year program. Furthermore, key concepts involving number and algebraic thinking from year one will reinforced throughout the program.

Daily reflections. At the end of each workshop day, teachers will be given time to write and submit online a reflection on what they learned that day. Questions to guide their reflections will include "What is the most important or useful thing you learned today?" and "What questions or confusions are you left with today?" These reflections will not only be a learning tool for the teachers, but also formative evaluation tool for the mathematics faculty, as the faculty will read and respond to these reflections by email nightly.

Academic Year Follow Up. During the academic year, teachers will be expected to collaborate in vertical teams to discuss mathematics lessons share data collected on their students. Specific objectives for this collaboration will be provided by the mathematics faculty in the form of "Classroom Projects". In one classroom project, teachers will be asked to select an upcoming unit from their curriculum and identify the key content and practice standards underlying the unit, and develop strategies and lessons to implement in the classroom that will have a high level of cognitive demand for student understanding. The participants will be charged with implementing these lessons in their classrooms and reflecting on the results. In another classroom project, teachers will be asked to pay particular attention to students reasoning and misconceptions and to collect and analyze examples of student misconceptions and common errors. Teachers will be expected to make use of an online learning community through UWO to facilitate this collaboration and to interact with mathematics faculty during the academic year. These collaborative classroom projects will take place primarily in the Fall in years 2 and 3, and represent 8 contact hours each of those years.

Content-Focused Coaching. Each participant will be observed in their classroom once in year 2 and once in year 3 by one of the mathematics faculty, who will coach for mathematical depth and

accuracy of the lesson, and level of cognitive demand and press for student understanding, and connection the Common Core content and practice standards. Each coaching session will include a group pre-lesson conference, a classroom observation of the lesson, and a group post-lesson conference to discuss suggestions. The participant will write both a pre-observation plan, outlining the goals and strategies of the lesson and identifying specific focal points of attention for the teacher and coach, and a post-observation reflection on the lesson. The Coaching component will represent 6 contact hours in year 2 and year 3 of the program. The goal of this coaching component of the program is to enrich and refine the teacher's mathematics knowledge for teaching.

Evaluation and Reflection: A group of 30 non-participating teachers and classrooms will serve as a comparison group for the various treatments. Although they will be compensated for the time required for data collection, these individuals will not be exposed to the concepts and methodologies contained in the project's workshops. Comparison group teachers and classes will be matched, as closely as possible, to the demographic characteristics of project participants and their classes. Teachers will be asked to provide professional biographical information, such as years of teaching and the number of mathematics courses taken in college.

Participating teachers' content knowledge will be assessed using the scales from the Learning Mathematics for Teaching (LMT) project, including Number Concepts and Operations, Patterns Functions and Algebra, and Rational Numbers, Geometry, and Probability and Statistics. A subset of items from the LMT will also be used to assess teacher's knowledge of common student misconceptions. A pretest-posttest design will be used with measures obtained from both the control and participant groups. Teachers' understanding of the Common Core content and practices standards will be assessed based on the external evaluator's observation and content analysis of the professional development sessions, pre and post surveys and interviews with participating teachers, and classroom observations of teaching by math faculty. A significant increase in student achievement on CCSS-aligned Smarter Balanced categories will also be an indication of an effective implementation of the Common Core.

Teachers' implementation of rich and engaging mathematical problems for fostering student engagement will also be evaluated using a pretest-posttest design. Items from the Surveys of Enacted Curriculum (SEC) or similar measures developed by the external evaluator will be obtained from all participating and control group teachers. Specifically, our target is to annually increase teachers' expectations of students in the areas of demonstrating understanding, conjecturing/generalizing, solving non-routine problems and making connections, increase the percentage of class time that students spend explaining their reasoning, solving mathematical problems that require novel or non-formulaic thinking, and justifying their mathematical thinking.

Improvement in student performance will be measured using two different techniques. Long-term classroom impact will be measured using the new Smarter Balanced Assessment in mathematics

and the individual standards performance data in mathematics. Furthermore, each district will conduct its own local assessments, such as through MAPs.

Project Title: Enhancing Teaching of Middle School Mathematics (ETM2)

Principle Investigator: Nancy Whitaker

High Need LEA: Kenosha Unified School District

Higher Education Institute: UW-Parkside

Project Leaders: Nancy Whitaker (UW-P), Jennifer Lawler (KUSD), Rosalie Daca (RUSD), Connie Zinnen (BASD)

Total Funding: $411,645

Participants: 42

Abstract: The Enhancing Teaching of Middle School Mathematics (ETM2) project establishes a partnership between the University of Wisconsin-Parkside, Kenosha Unified School District, Racine Unified School District, and Burlington Area School District, in order to deliver targeted professional development for middle school mathematics teachers. Our overarching goal is to equip teachers to fully understand and implement the Common Core State Standards for Mathematics (CCSSM), leading to improved student attitudes and outcomes in mathematics.

The project will serve a cohort of 40 in-service teachers for three years, with the following objectives: 1) Increase student achievement in mathematics; 2) Increase teachers' depth of mathematical content knowledge and pedagogical content knowledge; 3) Increase teacher leadership capacity related to Common Core State Standards for Mathematics implementation.

To achieve these objectives, ETM2 will offer nearly 350 hours (more than 100 hours per year) of professional development activities. Each year's activities will concentrate on a key set of middle school level mathematical concepts as outlined in the Progressions for the Common Core State Standards for Mathematics: Proportional Reasoning (Year 1); Expressions, Equations and Functions (Year 2); and Statistics (Year 3). Teachers will participate in content seminars during the academic year, led by mathematics faculty members and designed to deepen teachers' mathematical content knowledge by engaging them as math learners, and a two-week summer institute of content training and lesson studies. Throughout the program, teachers will participate in group and individual coaching sessions and observations, and online networking and reflection activities.

Programming will be complemented with leadership development activities designed to build teachers' leadership capacity in math instruction and development of Common Core implementation techniques within their schools and across school districts.

Introduction: Enhancing Teaching of Middle School Mathematics (ETM2) will develop and deliver targeted professional development for middle school mathematics teachers to implement the Common Core State Standards for Mathematics (CCSSM), with the ultimate goal of increasing student achievement in mathematics. The Kenosha Unified, Racine Unified, and Burlington Area School Districts (KUSD, RUSD, and BASD, respectively) will collaborate with the University of Wisconsin-Parkside to deliver a multi-phased educator development program to prepare middle school mathematics educators to enhance their instruction to align with the new standards. The need for professional development is particularly acute among middle school mathematics teachers because the CCSSM are substantially different from the previous expected outcomes in mathematics.

Goals and Objectives: ETM2's overarching goal is to prepare middle school mathematics teachers to understand and implement the Common Core State Standards for Mathematics. We anticipate that this experience will strengthen their teaching and, in turn, improve student mathematics achievement in high need areas.

Objective 1: Increase student achievement in mathematics.

- Indicator 1.1: Improved scores on student Measures of Academic Progress (MAP) Mathematics assessment, as measured by a) individual student performance and b) student performance compared to a control group of peers.
- Indicator 1.2: Improved understanding of and attitudes toward mathematics, as measured by pre- and post-surveys.

Objective 2: Increase teachers' depth of mathematical content knowledge and pedagogical content knowledge.

- Indicator 2.1: Increased mathematical knowledge for teaching, as measured by University of Michigan Learning Mathematics for Teaching pre- and post-assessments for teachers.
- Indicator 2.2: Increased confidence in mathematical knowledge and pedagogical skills, as measured by pre- and post-delivery of the Mathematics Teaching Efficacy Belief Instrument (MTEBI).
- Indicator 2.3: Enhanced classroom teaching performance, as observed and reviewed by coaches throughout the three year project.

Objective 3: Increase teacher leadership capacity related to Common Core State Standards for Mathematics implementation.

- Indicator 3.1: Increased demonstration of leadership, as measured by a) pre- and post- self-evaluation by teachers using PRIME Leadership Assessment rubrics and reflective tools and b) coach and peer feedback.

Program Plan: To achieve these objectives, IHE University of Wisconsin-Parkside and LEA Kenosha Unified School District will partner with Racine Unified School District and Burlington

Area School District to carry out professional development programming serving 40 middle school (grade 6-8) mathematics teachers. Through our recruitment efforts, we will aim to include 15 teachers from KUSD, 15 from RUSD, and 10 from BASD; if additional spaces remain they will be offered to other school districts in southeastern Wisconsin. Over the course of the three year project, teachers will receive nearly 350 hours of high-quality, content-specific professional learning opportunities.

Each year's activities will concentrate on a key set of middle school level mathematical concepts as outlined in the Progressions for the Common Core State Standards for Mathematics: Proportional Reasoning (Year 1); Expressions, Equations and Functions (Year 2); and Statistics (Year 3). Activities will include:

1. **Academic Year Content Seminars (24 hours per academic year):** Teachers will participate in three eight-hour content seminars during the academic year, led by mathematics faculty members from UW- Parkside, coaches, and adjunct instructors. Coaches and adjunct instructors will be licensed K-12 teachers, with a minimum of five years classroom teaching experience. Coaches will also have experience in some form of peer instructional teaching or coaching techniques. Focusing on one of three themes each year, content seminars will deepen teachers' mathematical content knowledge through modeling activities, development of mathematical content related to Common Core, and "Math Circles," a form of educational enrichment that brings mathematicians together to work on interesting mathematical problems.

In year three, an additional Coaching and Leadership component will be provided for any project participant interested in developing skills to encourage more school or district implementation of math strategies beyond the grant. These seminars will focus on three primary areas including "Coaching: What it is and what it isn't," "Core Competencies of a Coach," and "Coaching Strategies." Participants will meet three times for eight hours each (24 hours total) on one topic per session.

2. **Individual Coaching Sessions (4-6 hours per participant per academic year):** Between content

seminars, coaches will guide participants on instructional strategies related to their mathematical content. Each coach will be assigned up to 15 participants with the expectation that coaches will observe participants at least twice (minimum of one hour per observation) between Content Seminars. Observations may include videotaping for teacher and coach review and discussion. Feedback will be provided to the participant either face-to-face or via web based technology regarding positive teaching strategies and areas for potential growth. Coaches may recommend online resources, journals, or peer conversations to enhance participants' knowledge and pedagogy.

3. **Summer Institute: Content Training and Lesson Studies (80 hours per summer):** Each year of the project, participants will take part in two weeks of intensive summer institute programming (summer 2015, 2016, and 2017). Like the yearly seminars, these are built on

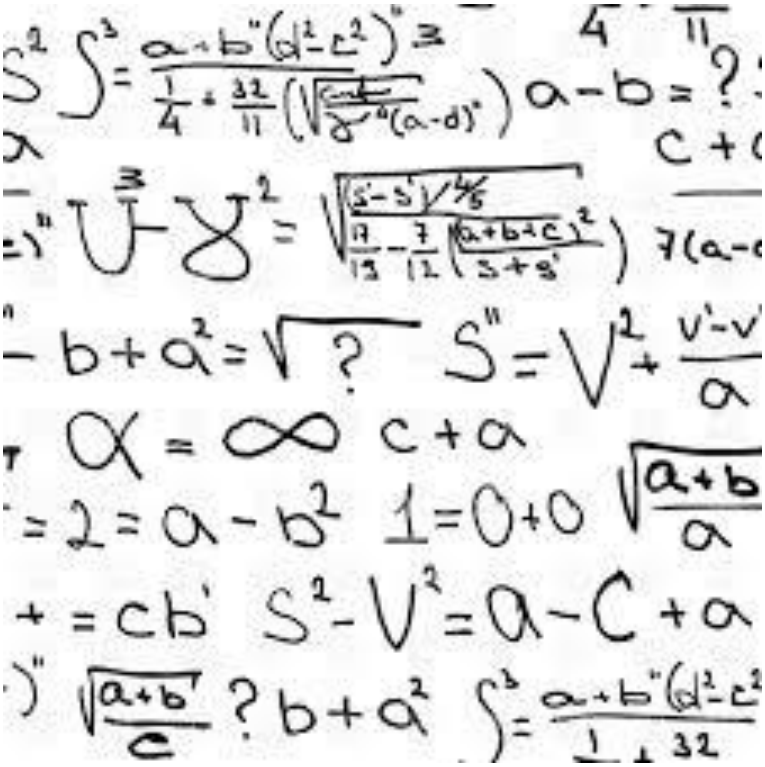
Common Core strategies and enhance the content and pedagogy learned during the seminars, coaching experiences, and online networks. Year one will concentrate on Proportional Reasoning, year two on Expressions, Equations and Functions, and year three on Statistics. Each summer institute will include content expert guest speakers, instruction from mathematics faculty, networking and lesson sharing/development at specific grade levels and across grades, and visits to regional partners to connect mathematics with relevancy and daily use.

4. **Online Networking and Reflection:** Between face-to-face activities during the academic year, teachers will participate in self-paced online networking and reflection. These monthly reflection prompts and webinars will provide added content resources while allowing participants to ask questions, share successes, and pose challenges to their mathematical content and teaching strategies. Participants, program faculty members, adjunct instructors, and coaches will contribute in an open format. The project will use LiveText as the platform for participants to upload reflection prompts, as well as videos and other resources to support professional growth.

Evaluation and Reflection: Ongoing review of MAP mathematics testing scores of students in mathematics classes taught by teachers participating in this project.

Individual student data will be reviewed to assess progress, and student scores will be compared to a Annual pre- and post-participation survey of students in mathematics classes taught by teachers participating in this project. The survey will measure changes in students' perceptions of their understanding of and attitudes toward mathematics, in hopes of correlating improved attitudes and improved achievement. Annual pre- and post-participation assessments will measure the development of teachers' mathematical knowledge throughout the project. LMT assessments will be tailored to address the mathematical content addressed in each year of the project. Annual delivery of the MTEBI to participating teachers. Each year's results will be compared to the first delivery, which will serve as baseline data. Coaches will conduct observations of participants' classroom teaching as an additional measure of their use of new mathematical knowledge and/or increased pedagogical skills. These observations will be shared with participants so that they can direct their focus to areas for improvement or enhancement as needed. Year 3 participant self-evaluations will measure the extent to which participants believe they have grown as collaborators and leaders in mathematics instruction. Participants completing the additional Leadership and Coaching track in year three will be assessed using a combination of self-reflection, feedback from project coaches and instructors, and interviews and assessments from peers within the project

2015-2018 Projects



UW-Milwaukee/Milwaukee Public Schools (Mathematics)

UW-River Falls/New Auburn School District (Mathematics)

Project Title: Starting Students Strong in Mathematics: Strengthening Teacher Mathematical Knowledge and Instruction in Grades K-3
Principal Investigator: Dr. DeAnn Huinker, University of Wisconsin-Milwaukee
High Need LEA: Milwaukee Public Schools
Higher Education Institute: University of Wisconsin-Milwaukee
Project Leaders

- **Dr. DeAnn Huinker, Professor, Department of Curriculum and Instruction**
- **Dr. Gabriella Pinter, Associate Professor, Department of Mathematical Sciences**
- **Steve Akin, Mathematics and Science Program Manager, Milwaukee Public Schools**
- **Michelle Douglas-Meyer, Mathematics Coach, Milwaukee Public Schools**
- **Nicole Hawkins, Mathematics Interventionist, Greendale School District**
- **Melissa Hedges, Graduate Teaching Assistant, University of Wisconsin-Milwaukee**

Total Funding: $445,302
Participants: 35

Abstract

The "Starting Students Strong in Mathematics" project is a three-year collaboration of the Milwaukee Public Schools and the University of Wisconsin-Milwaukee (UWM). Teachers participate as school-based teams with the goal of building a strong mathematical foundation for students in Kindergarten through Grade 3. The aim of the project is to ensure students are successful with the rigorous expectations of the *Wisconsin Standards for Mathematics*. This is accomplished by developing a highly qualified cadre of primary grade teachers with strong mathematical content knowledge, efficacy, and pedagogical strategies. The specific project goals are to: (1) Deepen teacher knowledge of mathematics concepts, connections, and progressions for teaching the Wisconsin Standards for Mathematics; (2) Strengthen teacher use of high-leverage mathematics teaching practices and research on children's learning of mathematics in classroom instruction; and (3) Build a strong mathematical foundation among young learners by developing understanding and fluency along mathematics learning trajectories. Participants attend summer institutes to study mathematics content domain progressions (Year 1, Operations and Algebraic Thinking; Year 2, Number and Operations in Base Ten; Year 3, Geometry, Measurement, Fractions), mathematical learning practices, and high-leverage mathematics teaching practices. During the school year, participants meet monthly to focus on implementation of state standards expectations and use of assessments to monitor student learning along developmental trajectories. Participants also receive support from mathematics coaches and host mathematician visits. Participants enroll in five university courses across the three years and receive a UWM "Graduate Certificate in Advanced Study of Teaching and Learning in Mathematics."

Introduction

The "Starting Students Strong in Mathematics" (hereafter, the *Strong Start Mathematics Project*) is a collaboration of the Milwaukee Public Schools (MPS) and the University of Wisconsin-Milwaukee (UWM). The project aims to strengthen student learning in this high-poverty, urban district through enriched and powerful mathematical learning environments. To close long-standing MPS achievement gaps, it is imperative that students begin on a successful trajectory aligned to the rigorous expectations of the *Wisconsin State Standards for Mathematics*. Teachers, as members of school-based teams, study the standards for mathematical content in order to build a resilient foundation of conceptual understanding and procedural fluency. Teachers study the standards for mathematical practice in order to develop these habits in their young learners by creating an atmosphere of mathematical inquiry and sense-making.

Goals and Objectives

The overarching, long-term goal of the *Strong Start Mathematics Project* is to increase student achievement in mathematics. This starts by developing a highly qualified cadre of primary grade teachers with strong mathematics content knowledge, efficacy, and pedagogy. While deepening their own mathematical knowledge, the teachers also focus on the mathematical needs of their young learners and ways to ensure their students begin their own mathematics journey with a strong and robust foundation for progressing along a trajectory of success as learners of mathematics. The specific project goals are:

Goal 1. Deepen teacher knowledge of mathematics concepts, connections, structure, and progressions for teaching the *Wisconsin Standards in Mathematics* (CCSSM).

Goal 2. Strengthen teacher use of high-leverage mathematics teaching practices and research on children's learning of mathematics in classroom instruction.

Goal 3. Build a strong mathematical foundation among young learners by developing understanding and fluency along mathematics learning trajectories.

Program Plan

The *Strong Start Mathematics Project* engages 35 primary grade teachers (five-year-old kindergarten through third grade) in a sustained three-year professional development program comprised of intense summer institutes and a multi-layered school year component. Teachers participate as school-based teams. The professional learning of teachers occurs through four project components: (1) summer institutes, (2) school-year project sessions; (3) classroom-based math coaching support; and (4)

classroom visits by a university mathematician. Each component contributes to achieving the project goals to deepen teacher content knowledge, implement high-leverage teaching practices, and monitor student learning along development mathematics learning trajectories.

Each summer teachers participate in a two-week summer institutes to study selected mathematics content, mathematics practices, and learning progressions. The focus areas for each year are as follows: Year 1, Operations and Algebraic Thinking; Year 2, Number and Operations in Base Ten; Year 3, Geometry, Measurement, Fractions. Each day participants engage as learners of mathematics and as teachers as mathematics. First, they engage in mathematical tasks with emphasis on mathematics learning practices and content standards. Second, participants examine standards progressions, research on student learning in mathematics, and developmental learning trajectories. This also include study of mathematical tools, activities, and games appropriate for K-3. Third, the participants examine use of high-leverage teaching practices for mathematics. Fourth, the participants work as grade-level or school teams to consider curricular alignment or work on developing assessments to monitor student learning.

During the school year, participants meet monthly to continue study of standards progressions and developmental learning trajectories with focus on implementation of eight high-leverage teaching practices in mathematics (National Council of Teachers of Mathematics, 2014). These include: (1) establish mathematics goals to focus learning; (2) implement tasks that promote reasoning and problem solving; (3) use and connect mathematical representations; (4) facilitate meaningful mathematical discourse; (pose purposeful questions; (5) build procedural fluency from conceptual understanding; (6) support productive struggle in learning mathematics; and (8) elicit and use evidence of student thinking. Participants receive limited classroom-based coaching on implementation of specific project work, such as use of mathematical discourse (e.g., talk moves), using dot images to develop subitizing, or using ten frames to develop anchors to five and ten. Participants also host mathematician visits to their classrooms in which a university mathematics professor models inquiry-based and mathematically rich lessons with their young learners.

Evaluation and Reflection

The evaluation utilizes a quasi-experimental design to meet the standards established for rigorous program evaluation in terms of (1) teacher content knowledge, (2) classroom practice, and (3) student achievement. The outcomes of participating teachers and students are compared to matched, non-participating teachers and students.

Teacher mathematical knowledge for teaching (MKT) is examined through scales built from the pool of valid items from the University of Michigan, Learning Mathematics for Teaching project. The MKT scales are keyed to the content area developed each year. Classroom practice in mathematics is examined through analysis of digitally recorded mathematics lessons and teacher self-report surveys. The Mathematical Quality of Instruction (MQI) instrument is used to evaluate the digitally recorded mathematics lessons. Teachers complete the Mathematics Teaching Practices Inventory (MTPI) on implementation of high-leverage teaching practices in mathematics and the Mathematics Teaching Efficacy Beliefs Instrument (MTEBI) on their own efficacy related to classroom practice in mathematics. Student mathematics achievement is examined by results on district benchmark assessments and state

tests. Lastly, the evaluation examines the relationship between teacher metrics and student math achievement using Hierarchical Linear Modeling.

Project Title: Mathematical Progressions through Habits of Mind

Principle Investigator: Erick Hofacker, UW River Falls Erick.B.Hofacker@uwrf.edu

Main High Need LEA: New Auburn School District

Main Higher Education Institute: UW River Falls

Project Leaders: Erick Hofacker, Kathryn Ernie, Susan Ahrendt UW River Falls & Sherrie Serros, UW Eau Claire

Total Funding: $665.274

Participant: 58

Abstract: The Mathematical Progressions through Habits of Mind project is a partnership of the University of Wisconsin – River Falls, the New Auburn Public School District, University of Wisconsin – Eau Claire, and 11 additional school districts in Western Wisconsin.

We plan to provide three years of professional development for K-12 mathematics teachers in Western Wisconsin. The professional development will be provided through three different types of events, which will constitute over 110 hours of involvement each year. Districts involved in the project will represent both the River Falls region and the Eau Claire region of our state. The professional development will provide teachers an illustration of various content standards within the Common Core Mathematics Standards. Throughout the three years planned experiences will highlight the areas of fractions, algebraic thinking, and statistical reasoning. The project will also emphasize the mathematical habits of mind (mathematical practice standards), so teachers are empowered to encourage and develop them in their students. Our project will include teachers at all three grade areas: elementary, middle school, and high school. The idea behind this inclusion is to provide opportunitites for teachers to understand and appreciate the progression of the mathematics throughout an entire K-12 mathematics curriculum sequence.

While providing professional development, the program will also serve as a retention and professional growth program. Based on the high turnover rate in the teaching profession, learning communities like this project are needed to assist teachers so they do not feel they are instructing in isolation. Mentor teachers will be paired with participants, which includes novices, to provide support and guidance throughout the school year. Teacher candidates will be involved as apprentices, providing academic support to teachers in the field through the use of various technologies and models that promote the mathematical habits of mind with their students. Project Leaders will conduct field observations with all of the participants, providing insights into the ways mathematical habits of mind are being promoted and incorporated into the mathematical tasks they use in their classroom.

The anticipated benefit of the program will be effective modeling of the increased pedagogigcal content knowledge gained and techniques learned through development, implementation, and discussion of rich mathematical tasks in the classroom. Teachers will be empowered through the program by taking things they learn in the seminars back to their classroom to use with their students, and then return to followup seminars to share with the group the results of the task or activity.

Introduction: Our project finds support in the research of Hill, Rowan, and Ball (2005). Their 2005 study found that the specialized mathematics knowledge of teachers is significantly related to student achievement. Our project's intensive activities are focused on mathematical knowledge not imparted by lecture or walk through, but rather obtained through mathematics investigated and modeled by the teachers themselves in active inquiry and problem solving. Our professional development model is based on our work and lessons learned in two previous projects we have conducted entitled "Math Transition into the Common Core Era" and "Core Progressions through Fractions and Algebra" (Hofacker, Ernie, and Serros, 2014, 2015, 2016). The conceptual foundation of our project is a research based Core Conceptual Framework Desimone (2009). Critical components of effective professional development have been identified that reflect consensus on characteristics that are crucial to increasing teacher knowledge and practice, and thereby increasing student achievement. This project is based on the five Core Features and Conceptual Framework for Teacher Learning, Desimone (2009).

- Content Focus
- Active Learning
- Coherence
- Duration
- Collective Participation

Goals and Objectives:

- Increase teachers' mathematical knowledge and their ability to use it in teaching
- Develop teachers' productive habits of mind and assist them with encouraging and developing them in their students
- Assist teachers in developing an essential understanding within the areas of number and operation, fractions, algebraic thinking, ratio & proportion, functions, and statistics & probability
- Build teachers' capacity to conduct productive discourse within their classroom
- Assist teachers in developing and promoting productive beliefs about teaching and learning mathematics
- Develop a more thorough understanding within our teachers of the core progression of mathematics through the elementary, middle school, and high school levels
- Form collegial relationships among the participants and develop a wide network of math educators across Western Wisconsin

Program Plan: Our three-year project focuses on teachers actively engaged in doing mathematics grounded in the Common Core Content and Practice Standards as they prepare to impart this knowledge and experience to their own students.

Mathematics Content Focus by Year

Year 1

- Elementary: Number & Operations – Fractions

- Middle School: Ratio & Proportions
- High School: Functions

Year 2

- Elementary: Operations in Algebraic Thinking
- Middle School: Expressions & Equations
- High School: Algebra

Year 3

- Elementary: Measurement & Data
- Middle School: Statistics & Probability
- High School: Statistics & Probability

Scope of the Project – Throughout each Year

Just in Time Seminars

- These are two hour seminars conducted on 14-16 Wednesday nights during the school year at each of the four main hub partners. Each individual (7-8) seminar is split over two weeks so the Project leaders conduct the seminar at two locations one week and two different locations the next week. Approximately 10-40 teachers attend each hub. That way participants are able to attend the seminar at a hub near them, to minimize travel costs.
- Participants explore the Mathematical Practice Standards and best teaching practices as advocated by the NCTM's Principles to Action (2014).
- Participants engage in low-floor high-ceiling tasks that can be used at multiple grade levels. After participating in the task, the teachers take them back to their classroom and use them with their students. The teachers return to future seminars and share with the cohort what they learned by implementing the task.

Core Math in Practice Sessions

- These are full day sessions conducted on Saturdays in the fall and spring during the school year at each of the two universities. All participants attend the same event.
- Participants explore the Mathematical Practice Standards and best teaching practices as advocated by the NCTM's Principles to Action (2014).
- Mentors, participants, and apprentices present alongside the Project leaders at various breakout sessions that address how to use different representations and habits of mind to address specific grade level content standards.

Half-Day Observations

- Project leaders will conduct at least one observation with each participant throughout the school year.

- Project leaders will use the MP Look for Instrument to assess the implementation of the habits of mind in the classroom, on the part of the students and the teacher.
- Project leaders generate ideas for upcoming topics at the seminars and sessions based on these observations.

Core Content Workshop

- There will be two one-week workshops conducted during the summer at each of the two universities. All participants attend the same event.
- Participants explore different content standards at the various grade levels each year through active inquiry and engagement.
- Participants will learn to orchestrate productive mathematical discourse focused on content standards addressed within each year.
- Participants will engage in readings and conversations focused on the Progressions documents to gain a better understanding of how the mathematical content connects throughout the grade bands.
- Mentors and participants present alongside the Project leaders at various breakout sessions that address how to use different representations and habits of mind to address grade level specific content standards.

Evaluation & Reflection:

The program evaluation will include a quasi-experimental design involving a control group of teachers in demographically similar districts within the state. Analysis of content exams (lmt and dtams) with participant and control teachers will identify potential changes in knowledge associated with specific content domains throughout each year and throughout the duration of the grant. Student data will be collected from both control and participant districts to provide evidence if the project is having an effect on student achievement. Additional instruments and observations will be used to determine whether a change has occurred within participants, and their students, as it relates to the mathematical habits of mind being used and encouraged during instruction. Surveys and other qualitative data will be gathered to better understand if the program had a positive effect on collegiality across our region of the state, and whether or not the mentorship program had a positive effect on novice teachers continuing in the profession.

Partners:

UW-River Falls

UW-Eau Claire

UW-La Crosse (evaluation)

New Auburn School District (major hub)

New Richmond School District (major hub)

Durand School District (major hub)

Black River Falls School District (major hub)

Elk Mound School District

Glenwood City School District

Mondovi School District
River Falls School District
Eau Claire School District
Barron School District
Luck School District
Clayton School District

MSP Resources

U.S. Department of Education/MSP Program:

The website of the U.S. Department of Education offers background and legislative information on the MSP Program: http://www.ed-msp.net.

Teacher Education Materials Project (TE-MAT):

The TE-MAT site offers a database of resources to support mathematics and science professional development providers as they design and implement programs for in-service teachers: http://www.te-mat.org.

Horizon Research, Incorporated (HRI):

The website of HRI offers a wealth of information related to research and evaluation of mathematics and science initiatives. Some of its tools may be helpful in conducting a professional learning needs assessment: http://www.horizon-research.com

Learning Mathematics for Teaching (LMT) Project:

The LMT Project website offers information on the assessment instruments required by all funded mathematics MSP projects: http://sitemaker.umich.edu/lmt/home.

Project MOSART: Project MOSART's website offers thorough information, including a tutorial, on the required assessment instruments: http://www.cfa.harvard.edu/smgphp/mosart/.

Wisconsin Standards for Mathematics:

- http://dpi.wi.gov/sites/default/files/imce/standards/pdf/common-core-math-standards.pdf

National Council of Teachers of Mathematics (NCTM):

The NCTM is a public voice of mathematics education supporting teachers to ensure equitable mathematics learning of the highest quality for all students through vision, leadership, professional development and research: http://www.NCTM.org.

Wisconsin Mathematics Council (WMC):

The WMC was formed to lead in the development of, advocate for, and promote quality mathematics education for all students: http://www.wismath.org.

Wisconsin Society of Science Teachers (WSST):

The Wisconsin Society of Science Teachers was founded in 1958. Today it is the largest Wisconsin organization of individuals interested in the advancement of science education. WSST's purpose is to promote, support and improve science education in the state of Wisconsin by providing leadership, advocacy, and programs to enhance the teaching and learning of science: http://www.wsst.org.

Differentiated Instruction for Math and Science:

Differentiated instruction is used to adapt instruction to meet the individual needs of the learner. A differentiated classroom offers multiple ways for students to access content, to process and make sense of the concepts and skills, and to develop products that demonstrate their learning (Tomlinson, 2001). It is a process through which teachers enhance learning by matching student characteristics to instruction and

assessment. Differentiated instruction allows all students to access the same classroom curriculum by providing entry points, learning tasks, and outcomes that are tailored to students' needs (Hall, Strangman & Meyer, 2003).

Differentiation in science and math instruction provides students with varied experiences to engage in the content. The following resources focus on differentiating science and math instruction.

- Differentiated Instruction for Math
http://www.k8accesscenter.org/training_resources/mathdifferentiation.asp
- Differentiated Instruction for Science
http://www.k8accesscenter.org/training_resources/sciencedifferentation.asp

The National Science Teachers Association:

The NSTA website offers science teaching resources developed by Page Keeley and colleagues. To order Page Kelley's publications refer to the NSTA at: http://www.nsta.org

Vertical Teams

What is a Vertical Team?

Most commonly a vertical team consists of middle school and high school educators who teach in the same academic area. It may also include elementary teachers, school counselors, administrators, department chairs, or curriculum specialists. Through communication and cooperation, teams design curricular change and create support structures necessary to make high achievement by all students a reality.

Purpose of a Vertical Team

In vertical teams, teachers from different grade levels work together to develop a continuum of knowledge and skills that build from one grade level to the next. Team communication leads to a greater understanding of what is taught each year, which helps teachers organize strategies, plan introduction of concepts, and reduce repetition of content. As a result, student achievement and success is enhanced.

Goals of a Vertical Team

- To increase achievement of all students to close the achievement gap
- To bring about coordination and communication between grade levels
- To foster greater inclusion and to build enrollment in advanced coursework
- To introduce skills, concepts, and assessment methods to prepare students for success in advanced coursework
- To encourage innovation
- To stimulate enthusiasm for advanced coursework in the school, family and community

Benefits for Students

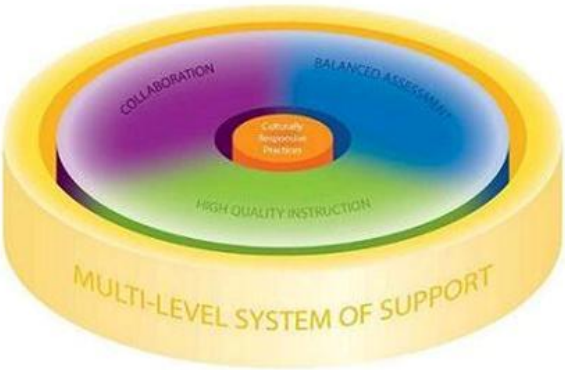
A successful vertical team will:

- Prepare students for the next level of challenge by developing skills and strategies necessary for success in advanced coursework
- Promote greater inclusion and progress towards closing the achievement gap
- Improve student achievement

Equity and Access

The concept of vertical teams is based on a philosophy of inclusion; on the notion that all students benefit from experiencing a rich and rigorous curriculum. Research shows that students of color and socio-economically disadvantaged students tend to be under-represented in advanced coursework. The goal of vertical teams is to prepare all students for success in rigorous courses at the secondary level, not only certain groups. This results in an organizational pipeline that promotes equity and access for all.

Wisconsin's Response to Intervention



Why RtI? Wisconsin's Response to Intervention (RtI) is a process for achieving higher levels of academic and behavioral success for all students. RtI is not distinct from a school improvement plan or a school-wide program plan; RtI is a school-improvement plan/School-wide program plan. Culturally responsive practices are at the core of the RtI process, to reflect the growing diversity in Wisconsin, and to ensure that Wisconsin educators are positively impacting each and every student through curriculum and instruction, assessment, and collaborative practices.

In thinking about RtI, your first thoughts might turn to interventions and the typical triangle model of interventions, but it is important to note that an RtI process is about more than providing interventions to struggling students. The first element of an RtI system must be effective, high quality instruction in the core program. High quality instruction is engaging, standards-based, data-driven, and research-based. All students, including Special Education students, should receive high-quality, culturally-responsive core academic and behavioral instruction, that is differentiated for student need, and aligned with the Common Core/State Standards. Implementing an RtI system may require professional development in providing differentiated instruction to all students. A guiding principle for high quality instruction is that RtI is something you do, not necessarily something you buy. Interventions, provided in addition to core academic instruction, are intended to increase student performance in the general curriculum for students who are not meeting benchmarks. Additional challenges are intended to meet the needs of students who are exceeding benchmarks. Interventions and additional challenges are the responsibility of both the Regular Ed and Special Ed staff.

We live in a data-rich world, but how effectively do we really use all that data? RtI is about being more mindful and systematic in our practices. Balanced assessment refers to a continuous review of student progress using multiple measures to determine the current skill level of a student or group of students; how students are responding to core curriculum and instruction, and how students are responding to interventions or additional challenges. No single test score should determine a student's experience at any phase of an RtI system. Data collected on students can be formal (quantifiable, norm-referenced tools) or informal (observations and/or teacher-developed formative tools) and can be implemented with individual students or an entire class. To get a complete picture of students, data such as teacher observation, family interviews, and student self-assessments should also be among data collected on students. Some components of an RtI system may also be used as a method for identifying students with specific learning disabilities (SLD). As a student moves further toward a process of a SLD determination, the criteria of progress monitoring tools becomes more stringent to ensure strict consistency, fidelity, and reliability across the state.

Collaborative protocols such as problem-solving processes and professional learning communities (PLC) can be used to systematize discussions of student, class, grade, school, district, and state-level data.

Wisconsin's Response to Intervention

The frequency and intensity of collaborative teaming should increase with student need. Including common time for collaboration, in school schedules can be a challenge, but many different models of incorporating cooperative effort into all types of school schedule structures currently exist. Collaborative time is not enough, however. It should be structured, and protocols should be established, so that the time is used efficiently and effectively.

The RtI process requires us to think differently about our students, our schedules, and our practices. That is no easy undertaking! Using a multi-level system of support, to identify and respond to student needs, can increase the success of all students. Implementation of a multi-level support system includes meaningful family involvement, data-based decision making, and effective leadership. Comprehensive RtI implementation will contribute to increased instructional quality, equitable access to high quality and effective programming, and will assist with the identification and support of learners with varied abilities and needs. Visit the Wisconsin RtI Center website at www.wisconsinrticenter.org for information on resources, tools, and professional learning.

Notes