MADISON METROPOLITAN SCHOOL DISTRICT

DEPARTMENT OF CURRICULUM & ASSESSMENT

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Lisa Wachtel, *Executive Director*

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Appendix MMM-12-2
June 27, 2011

June 6, 2011

TO: Board of Education

FROM: Lisa Wachtel, Executive Director of Curriculum and Assessment
Sarah Lord, Mathematics Teacher Leader (2010-2011)
Jeff Ziegler, Mathematics Teacher Leader (2011-2012)
Grant Goettl, Middle School Math Specialist Resource Teacher
Laura Godfrey, Mathematics Resource Teacher

RE: Math Task Force Update

Mathematics Task Force Update
June 6, 2011

I. Introduction

A. Mathematics Task Force Semi-Annual Report – Upon request from the Board of Education, the Curriculum and Assessment Department will provide an update twice annually on progress towards the implementation of the Mathematics Task Force Recommendations (Appendix C). The request was made at the November 2nd, 2009 Board of Education Meeting.

B. Presenter or contact person for the presentation –
Executive Director of Curriculum and Assessment, Lisa Wachtel
Mathematics Teacher Leader (2010-2011), Sarah Lord
Mathematics Teacher Leader (2011-2012), Jeff Ziegler
Middle School Math Specialist Resource Teacher, Grant Goettl

C. Background information – The Mathematics Task Force review was initiated in spring 2007, completed in summer 2008, and approved by the BOE in September 2008. An administrative response was created with input from teachers, administrators, and community members and approved in November 2009, contingent on the Curriculum and Assessment Department providing two updates to the Board of Education annually.

D. Action Requested – This is an annual update. No board action is requested.

II. Summary of Current Information

Provide a brief synthesis of the topic – During the 2010-2011 school year, the Mathematics Division of Curriculum and Assessment (C&A) focused on implementing recommendations regarding Middle School Mathematics Specialists. Additionally, progress has been made in working towards consistent district-wide resources at the high school level.

Recommendations #1 - #5:
Recommendations #1-#5 focus on increasing mathematical knowledge for teaching in MMSD's middle school teachers of mathematics. These recommendations address our work force, hiring practices, professional development, partnerships with the UW and work with the Wisconsin DPI to change certification requirements.

- The C&A Executive Director, C&A Assistant Director, Deputy Superintendent, Assistant Superintendent of Secondary Schools and Mathematics Instructional Resource Teacher met with Human Resources to discuss the implementation of the district-wide expectation for the hiring and retention of Math Specialists. This team created wording to be inserted into all middle school positions that state expectations for teachers involved in teaching mathematics.
- The Mathematics Instructional Resource Teacher from Curriculum and Assessment has visited middle schools across Madison to share information with teaching staff and answer questions regarding the Middle School Math Specialist professional development program and the associated expectation for middle school teachers of mathematics. The resource teacher has also met with the Middle School Math Leadership Academy, and the Learning Coordinators to share information and answer questions. A website was created to provide easy access to the needed information. (A copy of the website is attached as Appendix E.)
- The Middle School Math Specialist Advisory group that includes UW Mathematics, UW Mathematics Education, Education Outreach and Partnerships, and Madison Metropolitan School District has met throughout the year to provide updates, guidance to the development of the Math Specialist program, and continual feedback on the courses and implementation.
- The first cohort of classes in the Middle School Math Specialist program being offered at UW-Madison began in August of 2010. During the first year, the three courses were co-taught by representatives from UW-Mathematics (Shirin Malekpour), UW-Mathematics Education (Meg Meyer), and MMSD (Grant Goettl). A total of 22 MMSD teachers participated, with seven completing one course, two completing two courses, and ten completing all three offered courses. The topics of study included number properties, proportional reasoning, and geometry.
- The first cohort will continue into their second year with eleven participants. The topics of study will include algebra and conjecture. The first cohort will complete the five course sequence in the spring of 2012.
- The second cohort is currently being recruited. Advertising for this cohort began in March and sign-up began in April. This cohort will begin coursework in August of 2011. In the first year they will participate in three courses including the study of number properties, proportional reasoning, and geometry. This cohort will complete the five course sequence in the spring of 2013.
- The tentative plan for facilitation of the 2011-2012 courses is as follows:

Course	Cohort	Dates	Instructors
Number and Generalization	2	Fall Semester 2011 August-October	2 instructors
Rational Number and Proportional Reasoning	2	Spring Semester 2012 October-January	2 instructors
Geometry, Measurement, and Trigonometry	2	Spring Semester 2012 February-May	2 instructors

Course	Cohort	Dates	Instructors
Algebra and Functions	1	Fall Semester 2011 August-November	3 instructors
Experimentation, Conjecture, and Reasoning	1	Spring Semester 2012 November-March	3 instructors

- The Mathematics Division of Curriculum and Assessment has worked with the Wisconsin Center for Educational Research (WCER) to adopt the Learning Mathematics for Teaching Assessment from the University of Michigan to use as a program evaluation tool. A math resource teacher and WCER researcher administered the assessment to gather baseline data regarding mathematics content knowledge for teaching of current staff during the spring of 2010. The assessment will be given again in the spring of 2012, at the end of the first cohort, to determine growth of teachers and the effectiveness of the program that was created. The targeted teacher participants are all teachers assigned to teaching a section of math, all teachers that support a math classroom, and any other middle school teachers interested in teaching mathematics in the near future. Information regarding the assessment can be found at: http://sitemaker.umich.edu/lmt/home.
- Exemptions to the five course sequence provided by the UW-Madison are being discussed by the Middle School Math Specialist Advisory group. An exemption procedure is being developed and will include a committee of UW and MMSD personnel to evaluate the strength of the exemption requests.
- MMSD personnel and the UW-Educational Partnerships and Outreach Department are building a recommendation to encourage the Wisconsin Department of Public Instruction to change certification requirements surrounding the middle grades. This recommendation is centered around having middle grades teachers be specialist in a few areas of study instead of generalists. We see this as the long-term solution to the concerns presented in the Task Force Executive Summary.

Additional Recommendation #3 Initiatives:
Make a much larger commitment to mathematics professional development than has been possible in recent years.

- The primary focus for professional development at the elementary level in 2010-2011 has been literacy. Professional development has continued for math-specific IRTs. A number of building-based IRTs continued professional development around mathematics in their buildings. Summer institutes in number and operations will again be offered in summer 2011.
- We have identified that there is a teacher desire for professional development to increase the fidelity of implementation of our standards-based curriculum to increase student learning. Classroom teachers have expressed the desire for content specific professional development in this area.
- Much of the work taking place at the high school level has been in connection to the REaL grant. The professional development connected to this work has been driven by individual building goals and for the most part generalized, not math specific. A small group of high school math teachers did receive math-specific professional development as part of the HS Math Academy. There are also two institutes for high school math teachers being offered during the summer of 2011.

Recommendation #6:
Give serious consideration to selecting a single textbook for each grade level or course and to requiring a common core sequence across all high schools.

- A considerable amount of time, effort, and money was expended during the 2009-2010 school year to prepare for the implementation of the Lenses on Learning professional development program. Lenses on Learning is a comprehensive professional development program designed to enhance the capacity of principals and teachers to improve the learning outcomes of all students. Components of the program include: developing an understanding of what constitutes a rigorous mathematics program and how to implement it for all students; effective use of data and formative assessment to guide instruction; and how to relate a school's mathematics initiative to the wider context of the district's priorities. District personnel attended conferences, principals were introduced to the program in meetings, and a consultant was brought in to facilitate a two day workshop in order to lay the groundwork for implementation in 2010-2011. An implementation plan was developed and presented to the board. In late May of 2010 district administration made a decision to not go forward with this implementation. Nevertheless, the work with Lenses on Learning during the 2009-2010 school year informed the work of the High School Math Academy during 2010-2011.
- The High School Math Academy consists of a representative group of math teachers from the four comprehensive high schools and alternative programs that met seven times during 2010-2011. The academy focused on building a shared understanding of the Standards for Mathematical Practice of the Common Core State Standards and the role of cognitive demand in student learning. Cognitive demand means the kind and level of thinking required of students in order to successfully engage with and solve a task. The level of cognitive demand plays a critical role in what students learn. The teachers also enhanced their knowledge of how formative assessment can be used to improve student achievement. In addition to improving student success, this work is intended to lay the groundwork for the work of developing a common scope and sequence for high school math and selecting common learning materials in 2011-2012.

Additional Recommendation #6 Initiatives:

- All purchases approved under the November 2, 2009 approval of the administrative response have been ordered, received, and distributed to the schools. These purchases included finishing the full implementation of the updated Connected Mathematics Project 2 (CMP 2) at the middle level, and purchases of the Balanced Mathematics Resources (Investigations and Singapore materials) at the elementary level. For 2011-2012, schools are being provided with all recommended core resources per the revised Curricular Review and Renewal Process (formerly ELM).
- To meet the needs of students who need additional challenge in mathematics, specialized resources were purchased for each elementary school to support students' acceleration in number and algebra.
- The Elementary Balanced Math Advisory Group met four times during the 2010-2011 school year. The group of 12 classroom teachers and 12 instructional resource teachers worked to develop a scope and sequence for geometry, measurement, and data which is aligned to the Common Core State Standards.
- Through the continued efforts of the Middle School Leadership Academy, middle schools continue to work toward consistent implementation of the Connected Mathematics Project 2 materials.

Recommendation #7:
In making improvements and investing resources, the district should consider how best to reduce the large achievement gaps among subgroups of students.

- At the elementary level, professional development is largely focused on differentiating instruction to meet the needs of all learners. During 2010-2011, the cohort of math IRTs has been focused on elaborating learning progressions and instructional guides which facilitate interventions with struggling learners.
- During 2010-2011, the IRTs have also been developing a progress monitoring system for elementary mathematics that can help with early identification of struggling learners. This progress monitoring system uses district-developed assessments of fact fluency and problem solving. Moving forward, it will be important to coordinate this with the district's Balanced Assessment Plan.
- During the summer of 2010, over 75 teachers participated in a summer institute entitled "Understanding Number Development and Using Effective Interventions with Struggling Learners." The summer institute will be offered again in August, 2011 along with a follow-up institute entitled, "Understanding Operation Development and Planning for Effective Guided Groups." The courses are intended for all elementary teachers, as well as secondary teachers who work with students in need of intervention.
- Middle school teachers are being encouraged to attend the two summer institutes referred to above.
- During the 2009-2010 school year, the Mathematics Division shared the Equity vision from the National Council of Supervisors for Mathematics (NCSM) with the building-based leadership from the District secondary schools. The intent was to develop an understanding of the impact of equitable teaching and assessment practices on student outcomes. This was also intended to begin discussions on how to ensure all students have access to meaningful mathematics.
- Middle School Math Leadership Academy used NCSM's Prime Leadership Framework for a book study. This book was highlighted in the original Math Task Force Response document in the section on Recommendation #7 (see Appendix D). Using this book, the Academy not only explored the achievement gap and equity but also ideas surrounding the topics of teaching and learning, curriculum, and assessment leadership. The goals of this book are for mathematics leaders to accomplish 1) success for every student, teacher, and leader; 2) research-informed teacher actions; and 3) teacher collaboration and professional learning.
- Mathematics Division staff are working collaboratively with staff from the Educational Services Department to support the learning of all students.
- Some middle schools piloted programs to identify struggling students and provide pointed accelerated learning opportunities to those students in addition to grade-level math.
- A representative group of math teachers from the four comprehensive high schools and alternative programs met seven times in 2010-2011 as part of the High School Math Academy. The academy focused on building a shared understanding of the Standards for Mathematical Practice of the Common Core State Standards, the role of cognitive demand in student learning, and how formative assessment can be used to improve student achievement.

Recommendation #8:
A value-added type of analysis of Wisconsin Knowledge and Concepts Examination (WKCE) scores by district, school, and grade level should be made a standard part of district reporting.

The MMSD Value Added Report, which included value-added numbers by school and subgroup for both mathematics and reading was shared with Principals and Instructional Resource Teachers at a meeting on December 17, 2010 at Olson Elementary School. The

Wisconsin Center for Educational Research made a presentation which illustrated how Principals and the Superintendent could use this data to evaluate their impact on student learning growth in mathematics and reading. WCER also had office hours allowing Principals and staff to receive individual training and ask any questions they had about the results. WCER also offered online training on how to use value-added reports to improve instruction. The report was submitted to the Board of Education on January 3, 2011.

Recommendation #9:
More time should be provided for teacher collaboration for teachers to learn from each other, analyze achievement data, meet needs of diverse learners, plan for instruction, and ensure both horizontal and vertical alignment of the curriculum.

- The Balanced Math Advisory Group, consisting of twelve classroom teachers and twelve IRTs, has met throughout the year to develop a scope and sequence for geometry, measurement, and data in order to facilitate both horizontal and vertical alignment of the curriculum. Additionally, a cohort of math IRTs has worked collaboratively throughout the year to elaborate learning progressions and instructional guides in number and operations in order to facilitate consistent instruction for students at all levels of proficiency.
- The Middle School Math Leadership Academy is continuing in 2010-2011. It provides professional development to, and builds leadership capacity of, a representative from each school.
- The Middle School Math Specialist program highlights connections to the elementary and high school curricula for the middle school teacher-participants. This type of vertical awareness of the curriculum can help reduce duplication of topics being taught and provides connection to student prior knowledge upon which middle grade teachers can capitalize.
- A representative group of math teachers from the four comprehensive high schools and alternative programs met seven times in 2010-2011 as part of the High School Math Academy. This provided an opportunity for teachers from across the district to collaborate in a way that was not being addressed in other district initiatives.
- Individual schools also worked on building specific goals.
  - Two high schools, along with their feeder middle schools, were part of a DPI funded grant to increase student participation in AP courses.
  - The math departments at two high schools collaborated on the development of common summative assessments.

Recommendation #10:
Parents should be provided opportunities to learn about district mathematics instruction to be able to assist and reinforce student learning at home.

- A number of elementary schools have held Family Math nights in which school staff introduced Balanced Math to families and supported families in doing math together.
- Middle schools were provided with family math support materials, which included how to help students at home. A district math IRT gave presentations at the district and state level focused on providing parents and teachers with strategies and tools to assist mathematics learning at home. Additionally, schools provided Back to School nights and Parent Math nights to provide opportunities for families to engage in district mathematics instruction.
- Math division staff, elementary, middle, and high school, explored Ruth Parker's model for parent interaction and involvement in mathematics education in the 21st century. Ruth Parker, co-founder and CEO of the Mathematics Education Collaborative, is a leading expert in working with parents and the public in support of quality mathematics education in schools. The staff plans to implement many of her strategies with parents/families in the 2011-2012 school year.

- Two high schools, along with their feeder middle schools, have been participating in the DPI funded Advanced Placement Incentive grant. The goals of the grant are to increase the numbers of low income students taking and being successful in AP courses. As part of this grant both high schools developed, and have begun to implement, parent outreach plans to better inform parents of student options in mathematics and the value of AP courses.

Recommendation #11:
Instruction at all grade levels should focus on the integration of conceptual and procedural knowledge; in particular, laying conceptual foundations for procedural and symbolic manipulation skills.

- The intent of Balanced Math is to integrate conceptual understanding and procedural fluency. The four blocks of instruction in Balanced Math include problem solving, number work, inspecting equations, and fluency and maintenance. The first three blocks focus primarily on developing conceptual understanding. The fluency and maintenance block is intended to develop procedural fluency. The curricular resources used at the elementary level also reflect a balance between conceptual understanding and procedural fluency. The Investigations curricular materials are aimed at developing conceptual understanding, while the Singapore materials are intended to develop procedural fluency.

- The Middle School Mathematics Specialist courses cover both the conceptual and procedural knowledge of the participants. The participants are expected to not only do the computations but also explain the conceptual reasoning for why the computations make sense. In addition the courses often focus on multiple conceptual formats that might be seen in the middle school classroom by students. The expectation is that the teacher participants will be better prepared to instruct in their classroom integrating both the procedural and conceptual knowledge.
- The Middle School Mathematics Leadership Academy consistently explores ways to balance expectations placed on teachers and the math curriculum, including the ideas of conceptual understanding and procedural fluency. Some schools incorporated the school-based continuation of these conversations during their PCT time, while other schools are still searching for effective structures with which to disseminate this information.
- A representative group of math teachers from the four comprehensive high schools and alternative programs met seven times in 2010-2011 as part of the High School Math Academy. One focus of this group was the examination of how tasks with high cognitive demand are essential in developing student's conceptual understanding of mathematics.

Recommendation #12:
Although the increase in the number of students taking and passing algebra is encouraging, the large number of failing grades is a serious concern. The district should investigate causes of the problem and identify and implement research-based remedies.

- At the elementary level, the focus of Balanced Math is on providing differentiated instruction that accelerates the learning of students at all levels of proficiency. In August, 2011, two summer institutes are being offered to help teachers develop strategies for working with struggling learners so that they will develop the mathematical foundations necessary to be successful in algebra. Additionally, algebra is explicitly addressed in Balanced Math through one of the four instructional blocks, inspecting equations
- The Middle School Math Specialist program is increasing the content knowledge of middle school teachers to increase the effectiveness of pre-algebra and algebra

instruction. Participants also learn about connections between the middle grades concepts that they are teaching and the concepts of the elementary and high school grade levels. The participants have explored the building of topics across the grade levels, which often takes algebraic forms. They have also been trying to address the inconsistent implementation of the CMP2 materials in MMSD.

- Math Division staff worked with Response to Intervention (RTI) staff to identify and provide accelerated learning for at-risk students through pilots in some middle schools.
- Math Division staff presented at a conference for Bilingual Resource Teachers and Bilingual Resource Specialists providing targeted strategies to increase the understanding of pre-algebraic math concepts.
- The High School Math Academy focused on the role of cognitive demand in developing student understanding and improving student achievement. Teachers also learned about how formative assessment and descriptive feedback can improve student learning. Incorporating these strategies in instruction has been demonstrated to improve student outcomes and can therefore lead to better passing rates.

Recommendation #13:
The district should pursue a challenging, coherent, and focused K-12 mathematics curriculum that includes core concepts of algebra and geometry early enough and with progressively increasing depth so that the content covered in Integrated Math I and II or in traditional Algebra I and Geometry courses is mastered by the end of grade 9.

- As a district, we are beginning the process of transitioning to the Common Core State Standards, which provide a framework for ensuring that students are on track to graduate from high school prepared for college and career.
- At the elementary level, as mentioned above, inspecting equations is an important part of the K-5 curriculum. Additionally, this year, the Balanced Math Advisory Group has been developing a scope and sequence for geometry that will ensure students are on track to complete Geometry early in high school.
- Math Division staff began integrating the Common Core State Standards into the MMSD curriculum, specifically identifying concepts new to each grade level. Teachers will need to supplement the existing curriculum to meet the CCSS standards.
- Middle school teachers are using the research-based Connected Mathematics curriculum which includes a solid pre-algebra foundation in 6th and 7th grade. In 8th grade, algebra concepts including formal symbol manipulation are investigated and practiced.
- The middle school curriculum includes investigations in geometry, and the relationship between geometry, measurement, algebra, and coordinate grid geometry in 6th, 7th, and 8th grades.
- A representative group of math teachers from the four comprehensive high schools and alternative programs met seven times in 2010-2011 as part of the High School Math Academy. One goal of this academy was to develop shared understanding of effective mathematics teaching practices to lay the groundwork for creating a scope and sequence for high school mathematics. This scope and sequence will then be incorporated as part of the aligned K-12 mathematics curriculum. This alignment should lead to more students completing Algebra and Geometry on time.
- Two institutes are planned for the summer of 2011 to allow high school math teachers to collaborate in the development of a deep understanding of the Common Core State Standards for Mathematics and the ACT College Readiness Standards for Mathematics. This work is also intended to prepare teachers to work on the development of a scope and sequence during the 2011-2012 school year.

III. Implications

A. Budget $99,731

The Mathematics Task Force budget is targeted to support the Middle School Math Specialist program in 2011-2012. This funding will continue the support of the first cohort and enable a second cohort to begin the program. If the second cohort is fully enrolled with MMSD teachers the total expense for both cohorts in 2011-2012 is estimated at $105,000.

B. Strategic Plan

Support of the Strategic Plan Objectives include:

• Student	Achievement for All Students
• Curriculum	Accelerated Learning Assessment Cultural Relevance Flexible Instruction
• Staff	Professional Development

C. Equity Plan

Recommendation #7 sets the focus on reducing the achievement gap. Throughout the work the District has engaged in thus far, the Mathematics Division is bringing quality materials and programs to the district that support this focus.

D. Implications for other aspects of the organization

The emphasis of the Math Task Force on alignment and consistent resources is an aspect of the district's work toward K-12 consistency and alignment in core content areas. The Middle School Math Specialist project is a strong professional development program aimed at providing rich content knowledge for teaching, which is needed to improve instruction and close the achievement gap.

IV. Supporting documentation

- Appendix A - Mathematics Task Force Administrative Status Update
- Appendix B - Math Task Force Budget Summary 2008-2011
- Appendix C - Math Task Force Executive Summary
- Appendix D - The National Council of Supervisors of Mathematics (NCSM) Vision of Equity Leadership
- Appendix E - Middle School Math Specialist Website for Staff

Math Task Force
Administrative Recommendations
Status Update - June 6, 2011

Recommendation	Time Frame	Resources Needed	Status
1. Establish the goal of moving to the full use of mathematics specialists in grades 5 through 8 within six years.	• Goal established on October 25, 2010 by Board of Education • Targeted completion of goal by end of 2015		• The Board's expectation that "all MMSD middle school math teachers must be credentialed by the year 2015" was communicated to all middle school teachers and principals in Spring of 2011.
2. Focus hiring of grade 5-8 mathematics teachers on candidates who are mathematics specialists or who commit to meeting the district's criteria for a mathematics specialist within three years.	• Ongoing starting in the Spring of 2011 • Spring 2012		• In Spring of 2011, wording was added to job postings for internal transfer and external hire which involve the teaching of mathematics in grades 6-8, stating that the applicant is required to become a Middle School Math Specialist as recognized by MMSD within 3 years, if they have not previously achieved that status. • A definition of what it means to be a Middle School Math Specialist within MMSD is being formulated in collaboration with the UW. It includes the course expectations being created in partnership with the UW, as well as alternatives to the courses that also demonstrate specialization in middle school mathematics. A process will be developed for determining whether teachers have met the criteria for being considered Middle School Math Specialists.
3. Make a much larger commitment to mathematics professional development than has been possible in recent years.	• Ongoing	• Continuation or expansion of Math Task Force funding to pay for professional development • A system to better align building-based professional development and district-based efforts with the goals of the Math Task Force Recommendations	**Elementary School Level** • The primary focus for professional development at the elementary level in 2010-2011 has been literacy. • Professional development has continued for math-specific IRTs. • A number of building-based IRTs continued professional development around mathematics in their buildings. • Summer institutes in number and operations will again be offered in Summer 2011. **Middle School Level** • The Middle School Math Specialist courses developed in collaboration with the UW have increased opportunities to learn mathematical knowledge for teaching.

Recommendation	Time Frame	Resources Needed	Status
		• Math division budget to fund substitute teachers for Balanced Math Advisory Group, Middle School Math Leaderships Academy, High School Math Academy and summer institutes	• The Middle School Math Leadership Academy is continuing. **High School Level** • The High School Math Academy provided math-specific professional development for a representative group of teachers from the four comprehensive high schools as well as alternative programs. • Two summer institutes are being offered in Summer 2011.
4. Extend the partnership with the University of Wisconsin and also other colleges and universities, especially with faculty in mathematics and mathematics education, to provide coherent programs that lead to a mathematics specialist certification.	• First cohort in process, ends in Spring 2012 • Second cohort: Fall 2011-Spring 2013 • Reflection of progress and expectations: ongoing	• Continuation of a dedicated IRT assigned to the Middle School Math Specialist Program	• A partnership involving MMSD, the UW Mathematics Department , UW Math Education faculty, and UW Educational Outreach and Partnerships, has created a total of five courses which include the topics of number, generalization, proportional reasoning, ratio, geometry, algebra, and general reasoning. The first cohort started the courses in Fall of 2010 and are expected to complete the courses in Spring of 2012. The second cohort is expected to start in the Fall of 2011. Advertising for that cohort is currently in progress.
5. Advocate to both the University of Wisconsin and the DPI for a new middle school level mathematics certification.	• Ongoing	• Significant positive results from our ongoing data collection of the MSMS courses (in action step 4) to convince DPI of the need to change certification requirements	• MMSD and UW-Educational Outreach and Partnerships are working to encourage the Wisconsin Department of Public Instruction to change its certification in the middle grades to either a dual-certification process (where the teacher is a specialist in two content areas) or to a specialty STEM (Science, Technology, Engineering and Mathematics) certification in the middle grades.
6. Give serious consideration to selecting a single textbook for each grade level or course and to requiring a common core sequence across all high schools.	• Implementation of elementary and middle school core resources: Ongoing • Selection of consistent district-wide resources at the high school level: 2011-2012	• Math division budget to fund substitute teachers for Balanced Math Advisory Group, Middle School Math Leadership Academy and High School Math Academy and summer institutes	**Elementary School Level** • Consistent core resources have been purchased for all elementary teachers over the past two years. Implementation of the core resources is ongoing. This year, the Balanced Math Advisory Group has been meeting to develop a consistent scope and sequence for geometry, measurement, and data.

Recommendation	Time Frame	Resources Needed	Status
	• Implementation of consistent district-wide resources at the high school level: 2012-2013		**Middle School Level** • Middle schools are continuing to work toward consistent implementation of the Connected Mathematics Project 2 (CMP 2) materials. **High School Level** • A representative group of high school math teachers met as part of the High School Math Academy to collaborate around a shared understanding of research-based practices to improve instructional outcomes for all students. There are two institutes planned for the summer of 2011 to provide teachers an opportunity to deepen their knowledge of the Common Core State Standards and ACT College Readiness Standards for mathematics. All of this work is intended to lay the groundwork for the development of a common scope and sequence in 2011-2012.
7. In making improvements and investing resources, the district should consider how best to reduce the large achievement gaps among subgroups of students.	• Ongoing	• Math division budget to fund substitute teachers for Balanced Math Advisory Group, Middle School Math Leadership Academy, High School Math Academy and to fund summer institutes	**Elementary School Level** • Two summer institutes during the summer of 2011 will focus on intervening for struggling students. • The cohort of math IRTs has been focused on elaborating learning progressions and instructional guides which facilitate interventions with struggling learners. • IRTs have been developing a progress monitoring system for elementary mathematics that can help with early identification of struggling learners. **Middle School Level** • Middle school teachers are being encouraged to attend the two summer institutes referred to above. • Mathematics Division staff are working collaboratively with staff from the Educational Services Department to support the learning of all students. • Some middle schools piloted programs to identify struggling students and provide pointed accelerated learning opportunities in addition to grade-level math. **High School Level** • Through the High School Math Academy teachers were able to deepen their understanding of research based instructional practices that can improve learning outcomes

Recommendation	Time Frame	Resources Needed	Status
			for all students and have been shown to be particularly effective with students who have traditionally struggled in math class.
8. A value-added type of analysis of Wisconsin Knowledge and Concepts Examination (WKCE) scores by district, school, and grade level should be made a standard part of district reporting. Value-added analysis gives a more accurate picture of district performance and trends in student achievement, especially in a district like the MMSD with a diverse student population and changing demographics.	• Ongoing	• Research & Evaluation local budget	• The MMSD Value Added Report, which included value-added numbers by school and subgroup for mathematics was shared with Principals and Instructional Resource Teachers at a meeting on December 17, 2010 at Olson Elementary School. • The Wisconsin Center for Educational Research made a presentation which illustrated how Principals and the Superintendent could use this data to evaluate their impact on student learning growth in mathematics. • The Value Added Report was submitted to the Board of Education on January 3, 2011.
9. More time should be provided for teacher collaboration for teachers to learn from each other, analyze achievement data, meet needs of diverse learners, plan for instruction, and ensure both horizontal and vertical alignment of the curriculum.	• Ongoing	• Math division budget to fund substitute teachers for Balanced Math Advisory Group, Middle School Math Leadership Academy, and High School Math Academy	**Elementary School Level** • The Balanced Math Advisory Group, consisting of twelve classroom teachers and twelve IRTs, has met throughout the year to develop a scope and sequence for geometry, measurement, and data in order to facilitate both horizontal and vertical alignment of the curriculum. • Math IRTs have collaborated to develop learning progressions and instructional guides in number and operations in order to facilitate consistent instruction for students at all levels of proficiency. **Middle School Level** • The Math Leadership Academy provided opportunities for collaboration across the middle schools. • The Leadership Academy participated in collaborative professional development around the construction of valid and reliable constructed-response and project-based

Recommendation	Time Frame	Resources Needed	Status
			common assessments. Leaders explored analysis and interpretation of a variety of common assessment results to plan for differentiated instruction. • Math IRTs collaborated with RTI and BRT/BRS around core practice and differentiation. **High School Level** • Teachers from across the district met as part of the HS Math Academy. There were also building-specific opportunities for teachers to collaborate around topics such as common assessments and increasing student participation in AP courses.
10. Parents should be provided opportunities to learn about district mathematics instruction to be able to assist and reinforce student learning at home.	• Ongoing		**Elementary School Level** • A number of elementary schools have held Family Math nights in which school staff introduced Balanced Math to families and supported families in doing math together. **Middle School Level** • The Mathematics Division provided schools with family math support materials, including how to help students at home. • A district math IRT gave presentations at the district and state level focused on providing parents and teachers with strategies and tools to assist mathematics learning at home. • Schools provided Back to School night and many had a Parent Math night to provide opportunities for families to engage with district mathematics instruction. **High School Level** • As part of their grant work, the two schools involved in the DPI Advanced Placement Incentive Grant developed and have begun to implement parent outreach plans to better inform parents of student options in mathematics and the value of AP courses.
11. Instruction at all grade levels should focus on the integration of conceptual and procedural knowledge;	• Ongoing	• Math division budget to fund substitute teachers for Balanced Math Advisory Group, Middle School Math	**Elementary School Level** • The intent of Balanced Math is to integrate conceptual understanding and procedural fluency.

Recommendation	Time Frame	Resources Needed	Status
in particular, laying conceptual foundations for procedural and symbolic manipulation skills.		Leaderships Academy, High School Math Academy and to fund summer institutes • Math Task Force funding to pay for Middle School Math Specialist professional development	• The curricular resources used at the elementary level reflect a balance between conceptual understanding and procedural fluency. The Investigations curricular materials are aimed at developing conceptual understanding, while the *Singapore* materials are intended to develop procedural fluency. **Middle School Level** • The Middle School Mathematics Specialist courses address both the conceptual and procedural knowledge of the participants. The expectation is that the teacher participants will then be better prepared to instruct in their classroom integrating both the procedural and conceptual knowledge. **High School Level** • Much of the work of the High School Math Academy was about instructional practices that help develop students' conceptual knowledge of mathematics.
12. Although the increase in the number of students taking and passing Algebra is encouraging, the large number of failing grades is a serious concern. The district should investigate causes of the problem and identify and implement research-based remedies.	• Ongoing	• Math division budget to fund substitute teachers for Balanced Math Advisory Group, Middle School Math Leaderships Academy, High School Math Academy and to fund summer institutes	**Elementary School Level** • Differentiated instruction at the elementary level aims to accelerate the learning of students at all levels of proficiency so that all students are ready to succeed in high school mathematics courses. • Summer institutes focused on improving instruction for struggling learners are being offered in August, 2011. • One of the components of Balanced Math is inspecting equations, the intent of which is to develop algebra readiness in all students. **Middle School Level** • Math Division staff worked with RTI staff to identify and provide accelerated learning for at-risk students through pilots in some middle schools. • Math Division staff presented at a BRT/BRS conference providing targeted strategies to increase the understanding of pre-algebraic math concepts. • Middle school staff have identified inconsistency in the fidelity of implementation of core practices and the common curriculum as issues contributing to students' lack of

Recommendation	Time Frame	Resources Needed	Status
			success in middle school and high school mathematics courses. The Math Leadership Academy has brainstormed possible strategies for increasing school- and district-wide fidelity of implementation. Several schools have utilized PCT time and math cadres to advance this work. **High School Level** • Teachers from all four comprehensive high schools participated in the HS Math Academy and deepened their understanding of research-based instructional practices to improve student outcomes.
13. The district should pursue a challenging, coherent, and focused K-12 mathematics curriculum that includes core concepts of Algebra and Geometry early enough, and with progressively increasing depth, so that the content covered in Integrated Math I and II or in traditional Algebra I and Geometry courses is mastered by the end of grade 9.	• Ongoing	• Math division budget to fund substitute teachers for Balanced Math Advisory Group, Middle School Math Leaderships Academy, High School Math Academy and to fund summer institutes	**K-12** • MMSD is beginning the process of transitioning to the Common Core State Standards, which provide a framework for ensuring that students are on track to graduate from high school prepared for college and career. **Elementary School Level** • As mentioned above, inspecting equations is an important part of the K-5 curriculum in Balanced Math classrooms. Additionally, this year, the Balanced Math Advisory Group has been developing a scope and sequence for geometry that will ensure students are on track to complete geometry early in high school. **Middle School Level** • Math Division staff began integrating the Common Core State Standards into the MMSD curriculum, specifically identifying concepts new to each grade level. Teachers will need to supplement the existing curriculum to meet the CCSS standards. • The common curriculum used in mathematics in MMSD middle schools emphasizes pre-algebra in 7th grade. Algebra concepts including formal symbol manipulation are investigated and practiced in 8th grade. **High School Level** • A representative group of high school math teachers met as part of the High School Math Academy to collaborate around a shared understanding of research-based practices to improve instructional outcomes for all students. There

Recommendation	Time Frame	Resources Needed	Status
			are two institutes planned for the summer of 2011 to provide teachers an opportunity to deepen their knowledge of the Common Core State Standards and ACT College Readiness Standards for mathematics. All of this work is intended to lay the groundwork for the development of a common scope and sequence in 2011-2012.

Hyperlink to Middle School Math Specialist for Staff:: http://mathweb.madison.k12.wi.us/node/352

MADISON METROPOLITAN SCHOOL DISTRICT

MATH TASK FORCE BUDGET OVERVIEW

APPENDIX B

	2009-2010			2010-2011			Projected 2011-2012			TASK FORCE TO DATE		
	FTE	BUDGET	ACTUAL	FTE	BUDGET	ACTUAL	FTE	BUDGET	ACTUAL	FTE	BUDGET	ACTUAL
Revenues												
Fund 10 Operational Budget - Fine Arts Task Force		150,384	150,384		99,720	99,720		99,731			349,835	250,104
Total Revenues		**150,384**	**150,384**		**99,720**	**99,720**		**99,731**	-		**349,835**	**250,104**
Expenditures												
CURRICULAR RESOURCES												
Student Materials											-	-
Purchased Services/Support		89,589									89,589	-
Supplies & Materials (Instructional/Audio Visual Media, Software, etc.)			93,657								-	93,657
Equipment											-	-
Professional Resources											-	-
Purchased Services/Support											-	-
Supplies & Materials (Instructional/Audio Visual Media, Software, etc.)			35,316								-	35,316
Equipment											-	-
TOTAL	-	89,589	128,973	-	-	-	-	-	-	-	89,589	128,973
PROFESSIONAL DEVELOPMENT												
Middle School Math Specialist											-	-
Salary & Benefits:											-	-
Instructional Resource Teacher	1.00	60,795									60,795	-
Extended Teacher Employment, PAC, Substitutes					5,958	3,017					5,958	3,017
Purchased Services/Support											-	-
Tuition (MS Math Specialist Courses)					51,202	18,589		99,731			150,933	18,589
Supplies & Materials (Instructional/Audio Visual Media, Software, etc.)					4,340	4,394					4,340	4,394
Equipment											-	-
Other Professional Development												
Salary & Benefits:											-	-
Extended Teacher Employment, PAC, Substitutes					38,220	5,260					38,220	5,260
Purchased Services/Support											-	-
Employee Travel						3,238					-	3,238
Supplies & Materials (Instructional/Audio Visual Media, Software, etc.)											-	-
Equipment											-	-
PROFESSIONAL DEVELOPMENT TOTAL	1.00	60,795	-	-	99,720	34,498	-	99,731	-	-	260,246	34,498
Total Expenditures	**1.00**	**150,384**	**128,973**	-	**99,720**	**34,498**	-	**99,731**	-	-	**349,835**	**163,471**
Surplus (Deficit)		-	**21,411**	-	-	**65,222**	-	-	-	-		**86,633**

Introduction

Charge of Board of Education to Task Force.

At a meeting of the MMSD Board of Education on November 16, 2006, the Board approved a motion to initiate and complete a comprehensive, independent, and neutral review and assessment of the district's K-12 mathematics curriculum and related issues. With Board approval, the Superintendent was to appoint a task force to undertake the review and assessment.

Composition of the Task Force and introductory remarks.

Superintendent Rainwater appointed a 10-person Task Force and arranged for district and SCALE[1] personnel to provide staff support for the Task Force. While most Task Force members (a parent, a teacher, and six UW-Madison faculty and researchers with a range of expertise) were drawn from the Madison community, co-chairs were selected from outside the Madison community in an effort to ensure that the review was independent and neutral. Jim Lewis, Professor and former chair of the Mathematics Department at the University of Nebraska-Lincoln, and Merle Price, former Los Angeles Unified School District Deputy Superintendent of Instruction, and now a faculty member in the Department of Educational Leadership at California State University, Northridge, and Graduate School of Education and Information Studies Liaison at UCLA, were appointed as Task Force co-chairs. They were introduced to the Board of Education and the Board approved their appointments at a meeting on April 16, 2007.[2]

The Task Force functioned as a learning community that met and communicated over a 12-month period. This is an important point, since the mathematical, cognitive, educational, cultural, political, financial, and psychological issues raised by the Board of Education charge to the Task Force constitute a complex landscape. Research and experience can shed some light on this landscape, but there is still much that is not understood. With that caveat, the Task Force offers this report to fulfill its charge from the Board of Education.[3]

The remainder of this document consists of the following: a section that highlights the Task Force's major findings and recommendations; a section that maps the original charge of the Board of Education to the research and conclusions in this report; and five additional sections – Learning from Curricula; Instruction and Teacher Preparation; Analysis of Student Achievement; Surveys of Teachers, Parents, and Students; and the MMSD Mathematics Task Force Meeting Minutes.

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[1] See Acknowledgements
[2] See Appendix A
[3] See Appendix B for more background on the Task Force and the BOE charge

Findings

The first two findings represent a synthesis from across all of the research sections and the experience and professional opinions of the Task Force members. The remaining findings highlight selected results from the research sections. Additional findings can be found in the individual research sections. This section provides greater elaboration for the first two findings, because these findings are overarching syntheses of the research findings and the Task Force's deliberations and are not specific to a particular research section.

Finding 1: The single most important step that the MMSD Board of Education can take in support of improved student achievement in mathematics is to align district goals, policies, and resources in ways that result in a mathematics teacher workforce well prepared in the content of mathematics and in the techniques of teaching mathematics. This issue is especially critical in grades 5 to 8.

In 1998, the Learning First Alliance, a consortium of 15 education organizations that include the Council of Chief State School Officers, the Education Commission of the States, the National Association of State School Boards of Education, the National School Boards Association, the American Association of School Administrators, and the National Education Association, published its report, *Every Child Mathematically Proficient*[4]. In it, the Learning First Alliance set forth two important recommendations that are relevant to the MMSD Board's request for "a discussion of how to improve MMSD student achievement":

- Virtually all students starting school this fall [1998] will complete a challenging, coherent, and focused K-12 mathematics curriculum that includes core concepts of algebra and geometry early enough and with progressively increasing depth so that the content covered in current algebra I and geometry courses is mastered by the end of grade 9.

- All students of mathematics should be taught by teachers who have been well prepared in the content of mathematics and techniques of teaching mathematics. In particular, all mathematics teachers grades 5 through 9 will be mathematics specialists, educated to meet the mathematical needs of students studying a challenging curriculum that includes algebra and geometry.

As discussed in the sections on instruction, the students who started school in the fall of 1998 have just completed the ninth grade. In 2008, MMSD Board of Education policy is to have all students complete Algebra I by the end of grade nine; full implementation of this policy is still in the future. Moreover, the district's middle-level mathematics teacher workforce is overwhelmingly elementary certified with mathematics preparation far below that of a mathematics specialist[5].

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[4] Learning First Alliance (2007), Washington, D.C.
[5] See below for a discussion of *mathematics specialist*

It is perhaps obvious that the district is faced with two types of challenges: those it cannot affect and those that it can affect. The changing demographics of the student population is an example of a challenge in the first category. A challenge in the second category is the cumulative effect of state policy and teacher preparation programs on the mathematics preparation of teachers who provide middle school mathematics instruction. These policies and programs include Wisconsin Department of Public Instruction (DPI) regulations; the state's teacher preparation programs, especially that of the University of Wisconsin, which understandably aligns teacher preparation requirements with state requirements; and the district's own goals and priorities as established by previous Boards. The section on Instruction and Teacher Preparation discusses the need for additional mathematics content-based pre-service instruction and in-service professional development for MMSD mathematics teachers.

The adequacy of teacher preparation is a significant problem that cannot be solved without a substantial investment in mathematics content-based professional development and a change in hiring priorities at the district level. In addition, other district and school-level practices must be brought into alignment to take advantage of professional development that is provided. For example, re-assigning a middle school mathematics teacher who has had extensive content-based professional development in mathematics to social studies instruction is not an optimal use of district resources, even if it solves a school-level staffing challenge. The Task Force also recognizes that significant change will be difficult without a corresponding change in state regulations and teacher preparation programs at University of Wisconsin member campuses and other Wisconsin colleges and universities. Still, the Task Force notes that the current situation would be quite different if in 1998 the MMSD Board of Education had made it official policy to implement the two Learning First Alliance recommendations within a decade and had secured and provided resources necessary to provide mathematics professional development on a level sufficient to achieve that policy.

The Task Force also emphasizes that the issue is not as simple as suggesting that teachers should know more mathematics. *The Mathematical Education of Teachers*[6], published in 2001 by the Conference Board of the Mathematical Sciences (CBMS), stresses (a) the intellectual substance in school mathematics and (b) the special nature of the mathematical knowledge needed for teaching. The publication goes on to offer recommendations for the preparation of mathematics teachers and joins with the Learning First Alliance in recommending that mathematics in middle grades (grades 5-8) should be taught by mathematics specialists. This "special nature of the mathematical knowledge needed for teaching" has been the focus of the work of many education scholars and is discussed further in the Instruction and Teacher Preparation section. For a measure of the mathematical knowledge needed by a mathematics specialist, the Task Force suggests that a reasonable expectation could be the CBMS recommendation for grade 5-8 teachers: "at least 21 semester-hours of mathematics, that includes at least 12 semester-hours on fundamental ideas of school mathematics appropriate for middle grades teachers."

[6] Edited by Cathy Kessel, Judith Epstein & Michael Keynes (2001). CBMS Issues in Mathematics Education, Vol. 11. American Mathematical Society and Mathematical Association of America.

Finding 2: The MMSD Board of Education must resolve the conflict between the value offered by site-based management and the value offered by a more coherent K-12 mathematics curriculum.

The Task Force recognizes the appeal of making curricula decisions at the school level. At the same time, the net effect is to have multiple district mathematics curricula that, taken as a whole, lack coherence – a fact that was recognized by many MMSD mathematics teachers who responded to the Task Force survey, especially in the elementary schools and high schools. Many education professionals, including the members of our Task Force, are concerned that this results in a special challenge to highly mobile students, who are disproportionately from low-income households. Thus, the policy of permitting different schools to have different mathematics programs and use different textbooks has its greatest negative impact on a population that is already hardest for the district to reach. At the high school level, we are also concerned that the instruction available may be dependent on the high school attended. In particular, concern was expressed among the Task Force members that two of the high schools require two credits of math between Geometry and Calculus AB, whereas the other two have a one year option for students. This disparity has caused stress on students, teachers and parents as early as elementary school in select schools across the district.
In addition, the Integrated Math course option is only offered at two of the district's high schools, which can create problems for students who transfer schools after taking Integrated Mathematics I.

The Task Force is aware, as is the Board, that some parents strongly disapprove of one or more textbooks used by the district. However, when considered as a whole, the published, peer-reviewed research literature reviewed by the Task Force does not offer evidence that a particular choice was a mistake. Moreover, our surveys did not receive significant student, parent, or teacher feedback indicating concern with any specific textbook that is currently used within the district. At the same time, teachers did not in significant numbers praise the textbooks they use (with the exception of the *Connected Mathematics Project* series)[7].

The district policy supporting the middle school curriculum of the *Connected Mathematics Project* (CMP) is laudable because (a) the curriculum has been adopted district wide; (b) the national research available, though woefully incomplete, suggests that CMP is as good or better than other choices for students overall; (c) CMP has strong support from teachers, as reflected in the teacher survey data; and (d) the district-wide Web site has provided an outlet for teachers using CMP to organize and share accommodations for struggling and advanced students, common assessments, and grading practices.

[7] Lappan, F., Fitzgerald, S., Friel, P. (2004). *Connected Mathematics*. Upper Saddle River, NJ: Prentice Hall.

Finding 3: Research on the effectiveness of mathematics curricula is limited, but the available research indicates that many curricula choices are at least acceptable, and that when one controls for other factors that influence student achievement, the effect of choosing one textbook over another is small.

Three reviews (meta-analyses) of the published research on the effectiveness of mathematics curricula on student learning were reviewed. Each employed different criteria for inclusion of studies. (Although few studies of any curriculum materials, including those used in the MMSD, were considered of sufficient quality to meet the highest methodological standards, this lack probably reflects deficits in the applied research realm rather than criticisms of the curricula themselves.) Overall, the available research literature suggests that the effects of curricula on learning are small, once the effects of student factors (e.g., socio-economic status, educational level of parents), teacher factors (level of teacher preparation, quality of implementation), and school factors (available scholastic resources) are controlled for. (See Section 1: Learning from Curricula for more information on reform curricula, research, and this finding.)

Finding 4: Taken together, the available research literature supports the thesis that the district has made reasonable curricular choices that support MMSD teachers' efforts to offer courses and curricula that address MMSD and DPI mathematics standards. A few published peer-reviewed studies would suggest that reform curricula, like those used in the district, show promise in serving low-performing students, and there is some evidence that both reform and traditional curricula are less successful at improving achievement of high-performing students.

The available published research literature suggests that NSF-sponsored reform-based curricula that emphasize a constructivist philosophy, with a strong emphasis on individual and collaborative problem solving, use of manipulatives, and concept development, are as good or better than traditional curricula overall, and have particular promise for historically underserved and minority populations and low-achieving students. Districts should, however, pay special attention to the performance of high-achieving students, providing supplemental materials as needed to ensure their success in mathematics. (See Section 1: Learning from Curricula for more information on this finding.)

Finding 5: The district's curriculum should simultaneously develop conceptual understanding, computational fluency, and problem-solving skills. Debates regarding the relative importance of these aspects of mathematical knowledge are generally misguided.

This finding duplicates a finding of the National Mathematics Panel. It is important to note that this point of view is consistent with district philosophy regarding mathematics instruction, particularly in the elementary and middle school grades. Research shows that conceptual knowledge and procedural knowledge in mathematics develop in an integrated, iterative fashion. Because a few studies have found that students using reform curricula perform less well on computation and algebraic manipulation than do control

groups, the district should monitor performance in these areas to ensure that adequate attention is given to the development of basic skills without sacrificing the development of conceptual understanding. (See Section 1: Learning from Curricula for a careful discussion of this and other issues.)

Finding 6: The surveys indicate that most teachers, parents, and students offer a positive assessment of the mathematics instruction provided by the district.

In general, teachers approve of the district curricula options, especially at the middle school level. Overall, students approve of and feel challenged by their mathematics instruction. Likewise, parents generally approve of the mathematics instruction and think it is appropriately challenging for their children. (See Section 4: Survey of Teachers, Parents, and Students for more in-depth analysis.)

Finding 7: The surveys uncovered concern with the coherence of the curriculum, the opportunities afforded teachers to collaborate, and communication between teachers and parents.

Especially at the elementary and high school levels, parents and teachers expressed concern about the lack of coherence both within and across schools. A significant percentage of teachers feel that they do not have enough time to collaborate with other teachers concerning mathematics instruction. A significant number of parents were concerned about their ability to communicate with their children's teachers concerning mathematics instruction and expectations. (See Section 4: Survey of Teachers, Parents, and Students for a more in-depth analysis.)

Finding 8: Overall, the student achievement data confirm known district strengths, such as ACT performance, and known problems, such as the gap in achievement by demographic and ethnic categories.

Madison has experienced significant demographic changes. Academic performance is different within different demographic groups; this phenomenon is often referred to as the "achievement gap." If student performance is analyzed by group using some of the traditional demographic categories (ethnicity, socioeconomic status), mathematics scale scores within each group have varied from year to year from the 1999-2000 to the 2006-07 school years. The scale scores varied the most for Hispanic students (range in variation from 26 to 30 scale points for grades 4, 8, and 10) and least for White students (ranged from 7 to 17 scale points for grades 4, 8, and 10). Mathematics scale scores of students at each of grades 4, 8, and 10 have generally declined from the 1999-2000 to the 2006-07 school years. The one exception is for grade 8 African American students. This group had their highest WKCE mean scale score (677) in 2006-2007.

The average ACT math score remained about 24.6 over this period with an increase to 25.0 in 2006-07, the highest average score in five years. The MMSD average score of 25.0 with 58% of students taking the test is high compared to other states and Wisconsin districts. The average score for the state of Wisconsin is 22.2, which is the second highest

of any state in which more than 20% of students take the test. Of the 11 districts in Wisconsin that have 10,000 or more students, the second best average score is 22.9 (for Green Bay, with 48.8% of students taking the test). Within Dane County, two smaller, less demographically diverse districts, McFarland and Middleton-Cross Plains, each have an ACT average score of 24.7 (still below 25) and a percent of students taking the test of just above 70%.

An increasing number of MMSD students have received credit for Algebra I by grade 10 and geometry by grade 11 over the past five years, from 2003-04 through 2007-08—an increase from 65% to 77% for Algebra I and an increase from 60% to 67% for geometry. (See Section 3: Analysis of Student Achievement for a careful discussion of these and other issues.)

Recommendations

This section contains the recommendations relevant to the two overarching findings and a listing of some of the recommendations that occur in the four research sections of the report.

To significantly improve the mathematical knowledge for teaching of the MMSD mathematics teacher workforce, the district should:

1. Establish the goal of moving to the full use of mathematics specialists in grades 5 through 8 within six years;

2. Focus hiring of grade 5-8 mathematics teachers on candidates who are mathematics specialists or who commit to meeting the district's criteria for a mathematics specialist within three years;

As discussed in our Findings section, the challenge of implementing Recommendations 1 and 2 is made all the more difficult because of current DPI certification requirements and available teacher education programs in Wisconsin which are aligned with those requirements. As a consequence, it may be necessary for the District to seek to implement Recommendations 1 and 2 in stages, first focusing on middle school mathematics teachers (grades 6-8), while advocating for changes in DPI policies and collegiate teacher education programs. At the same time, the Task Force hopes that MMSD will experiment with ways to strengthen the mathematical knowledge of 5th grade teachers, in order to learn more about the benefits to student achievement if the District is eventually able to extend mathematics specialists to grade 5.

3. Make a much larger commitment to mathematics professional development than has been possible in recent years;

4. Extend the partnership with the University of Wisconsin and also other colleges and universities, especially with faculty in mathematics and mathematics education, to provide coherent programs that lead to a mathematics specialist certification; and

5. Advocate to both the University of Wisconsin and the DPI for a new middle school-level mathematics certification.

To significantly improve the district coherence of the mathematics curricula, the district should:

6. Give serious consideration to selecting a single textbook for each grade level or course and to requiring a common core sequence across all high schools.

Additional recommendations are the following:

7. In making improvements and investing resources, the district should consider how best to reduce the large achievement gaps among subgroups of students.

8. A value-added type of analysis of Wisconsin Knowledge and Concepts Examination (WKCE) scores by district, school, and grade level should be made a standard part of district reporting. Value-added analysis gives a more accurate picture of district performance and trends in student achievement, especially in a district like the MMSD with a diverse student population and changing demographics. (See Section 3: Analysis of Student Achievement.)

9. More time should be provided for teacher collaboration for teachers to learn from each other, analyze achievement data, meet needs of diverse learners, plan for instruction, and ensure both horizontal and vertical alignment of the curriculum. (See Section 4: Survey of Teachers, Parents, and Students.)

10. Parents should be provided opportunities to learn about district mathematics instruction to be able to assist and reinforce student learning at home. (See Section 4: Survey of Teachers, Parents, and Students.)

11. Instruction at all grade levels should focus on the integration of conceptual and procedural knowledge; in particular, laying conceptual foundations for procedural and symbolic manipulation skills. (See Section 1: Learning from Curricula.)

12. Although the increase in the number of students taking and passing algebra is encouraging, the large number of failing grades is a serious concern. The district should investigate causes of the problem and identify and implement research-based remedies.

13. The district should pursue a challenging, coherent, and focused K-12 mathematics curriculum that includes core concepts of algebra and geometry early enough and with progressively increasing depth so that the content covered in Integrated Math I and II or in traditional Algebra I and geometry courses is mastered by the end of grade 9.

This last recommendation enables the Board to focus on a key student outcome that the Task Force believes is consistent with the Madison community's goals for MMSD and the students that it educates. To implement this recommendation, the MMSD Board of Education will need to make a major commitment to the professional development needs of its middle level mathematics teachers (see Recommendation 3).

Summary Response to Board Charge

The Task Force was charged with preparing and presenting to the Board a preliminary outline of the review and assessment to be undertaken. The Board directed that the outline include: (a) an analysis of mathematics achievement data for MMSD K-12 students, including an analysis of all mathematics sub-tests scores disaggregated by student characteristics and schools; (b) an analysis of performance expectations for MMSD K-12 students; (c) an overview of mathematics curricula, including the MMSD's mathematics curriculum; (d) a discussion of how to improve student achievement; and (e) recommendations on measures to evaluate the effectiveness of the MMSD's mathematics curriculum. The Task Force's outline was provided to the Board on March 24, 2008.

In this report, the Task Force has addressed its charge in the following ways:

(1) An analysis of math achievement data for MMSD K-12 students, including an analysis of all mathematics sub-tests scores disaggregated by student characteristics and schools

The Analysis of Student Achievement section includes analyses of WKCE and ACT scores disaggregated by student characteristics with trends over the last several years. The results are reported by grade level. Because of time and resource constraints, the section does not include an analysis disaggregated by school.

Madison has experienced significant demographic changes. Academic performance is different within different demographic groups; this phenomenon is often referred to as the "achievement gap." If student performance is analyzed by group using some of the traditional demographic categories (ethnicity, socioeconomic status), mathematics scale scores within each group have varied from year to year from the 1999-2000 to the 2006-07 school years. The scale scores varied the most for Hispanic students (range in variation from 26 to 30 scale points for grades 4, 8, and 10) and least for White students (ranged from 7 to 17 scale points for grades 4, 8, and 10). Mathematics scale scores of students at each of grades 4, 8, and 10 have generally declined from the 1999-2000 to the 2006-07 school years. The one exception is for grade 8 African American students. This group had their highest WKCE mean scale score (677) in 2006-2007.

The average ACT math score remained about 24.6 over this period with an increase to 25.0 in 2006-07, the highest average score in five years. This performance is remarkable in light of the averages seen state-wide and in other states. An increasing number of MMSD students have received credit for Algebra I by grade 10 and geometry by grade 11 over the past five years, from 2003-04 through 2007-08—an increase from 65% to 77% for Algebra I and an increase from 60% to 67% for geometry. (See Section 3: Analysis of Student Achievement.)

(2) An analysis of performance expectations for MMSD K-12 students

The findings and recommendations address current expectations that students will complete algebra by grade 9 and geometry by grade 10. While these expectations for all students provide some focus, the district should reconsider these goals so that they are in alignment with recommendations from the Learning First Alliance, for example, by including more focus on providing a "challenging, coherent, and focused K-12 math curriculum that includes core concepts of algebra and geometry early enough and with progressively increasing depth so that the content covered in current algebra I and geometry courses is mastered by the end of grade nine."

It should be noted that in the surveys of teachers, parents, and students, 71% of teacher respondents strongly agreed or somewhat agreed that the mathematics program results in students receiving a high-quality mathematics education, and 75% of the parent respondents strongly agreed or somewhat agreed that their child's mathematics teacher meets their child's learning needs. While these results suggest that there is a significant level of confidence in the district's performance expectations, the Task Force believes that these expectations can be more ambitious.

(3) An overview of mathematics curricula, including MMSD's mathematics curriculum

The Learning from Curricula section includes an overview of MMSD's mathematics curriculum at each level.

The recommendations include giving serious consideration to selecting a single textbook for each grade level or course and requiring a common curriculum across each district high school. (See recommendation 6.)

(4) A discussion of how to improve student achievement

The Task Force believes that the issues identified in the Findings and Recommendations parts of the report that are most pertinent to improved student achievement are those pertaining to teacher preparation for grade 5-8 teachers and to a focused K-12 mathematics curriculum that includes core concepts of algebra and geometry early enough, and with progressively increasing depth, so that the content covered in current algebra and geometry courses is mastered by the end of grade 9. The recommendation for a common textbook at each grade level is also directed at improving student achievement. Other areas for consideration in the report that bear directly on student achievement are commitments to professional development and teacher collaboration time, parent opportunities for learning how to help their students with mathematics at home, and expanded opportunities for students to complete algebra in grade 8. In addition, the Task Force recommends that instruction at all grade levels should focus on the integration of conceptual and procedural knowledge; in particular, laying conceptual foundations for procedural and symbolic manipulation skills. (See Section 1: Learning from Curricula.)

(5) Recommendations on measures to evaluate the effectiveness of the MMSD's math curriculum

The Task Force feels that interpretations about the impact of a particular curriculum, teacher pedagogy, and effects of school level decisions would be better evaluated if value-added analyses of the WKCE were available. Value-added analysis gives a more accurate picture of district performance and trends in student achievement, especially in a district like the MMSD with a diverse student population and changing demographics. (See recommendation 7.)

Appendix A: MMSD Mathematics Task Force Membership

Jim Lewis, Co-chair, Professor (and former Chair), Department of Mathematics, University of Nebraska-Lincoln
Merle Price, Co-chair, former Los Angeles Unified School District Deputy Superintendent for Instruction, Lecturer, Educational Leadership and Policy Studies, California State University, Northridge and Graduate School of Education and Information Studies Liaison at UCLA
Martha Alibali, Professor, Departments of Psychology and Educational Psychology, UW-Madison
Charles Chapin, Science Teacher, La Follette High School
David Griffeath, Professor (and former Chair), Department of Mathematics, UW-Madison
Jill Jokela, MMSD Parent
Eric Knuth, Associate Professor, Department of Curriculum and Instruction, UW-Madison
Mitchell Nathan, Professor, Departments of Educational Psychology and Curriculum and Instruction, UW-Madison
Norman Webb, Senior Scientist, Wisconsin Center for Education Research, UW-Madison
Kenneth Zeichner, Associate Dean and Professor, School of Education, UW-Madison

Staff to MMSD Mathematics Task Force:

William H. Clune, Voss-Bascom Professor of Law, UW-Madison Law School and Researcher, Wisconsin Center for Education Research, UW-Madison
Mathew Felton, Graduate Research Assistant, Mathematics Education, UW-Madison
Angela Hoistion, Project Manager, Wisconsin Center for Education Research, UW-Madison
Steve Kosciuk, Researcher, School of Education, UW-Madison
Sarah Mason, Researcher, Wisconsin Center for Education Research, UW-Madison
Terry Millar, Professor of Mathematics, Graduate School Associate Dean for the Physical Sciences, and Director, System-wide Change for All Learners and Educators, Wisconsin Center for Education Research, UW-Madison
Paula A. White, Researcher, Wisconsin Center for Education Research, UW-Madison

Appendix B: MMSD Mathematics Task Force History

The Board of Education set the 2006-07 goals for the Superintendent at the Board meeting of November 13, 2006. The first goal was:

> Initiate and complete a comprehensive, independent and neutral review and assessment of the District's K-12 mathematics curriculum.
>
> - The review and assessment shall be undertaken by a Task Force whose members are appointed by the Superintendent and approved by the BOE. Members of the Task Force shall have mathematics and mathematics education expertise and represent a variety of perspectives regarding mathematics education.
>
> - The Task Force shall prepare and present to the Board of Education a preliminary outline of the review and assessment to be undertaken by the task force. The outline shall, at a minimum, include: (a) analysis of mathematics achievement data for MMSD K-12 students, including analysis of all mathematics sub-tests scores disaggregated by student characteristics and schools; (b) analysis of performance expectations for MMSD K-12 students; (c) an overview of mathematics curricula, including the MMSD's mathematics curriculum; (d) a discussion of how to improve MMSD student achievement; and (e) recommendations on measures to evaluate the effectiveness of the MMSD's mathematics curriculum. The Task Force is to present the preliminary outline and a timeline to the BOE for comment and approval.
>
> - The Task Force is to prepare a written draft of the review and assessment, consistent with the approved preliminary outline. The draft is to be presented to the Board of Education for review and comment.
>
> - The Task Force is to prepare the final report on the review and assessment.

At the special Board of Education meeting on April 16, 2007, where the Co-chairs of the Task Force were introduced, the Board was able to articulate a number of concerns and questions related to the choice of curricula, the success of sub-groups, as well as high school issues such as the impact and results of mandating algebra, the success of students after high school, the use of instructional time and other miscellaneous issues. Board minutes include a list of the more than 30 questions and issues discussed by Board members with the Co-chairs at the meeting. The Co-chairs used these questions to help further frame the objectives of the Task Force.

The first Task Force meetings on June 12-13, 2007 served to acquaint the members of the Task Force with the MMSD, the Board's charge, and the expertise and backgrounds of members. At meetings on June 12-13, 2007, the MMSD Math instructional staff gave presentations on the instructional system in mathematics and some of the curricular and

instructional issues. The agenda for these meetings included open discussions of how to proceed, possible timelines, and additional background materials. Further meetings on July 31 and August 1, 2007 were convened to organize teams to engage in research tasks in the areas of (a) data analysis and student achievement; (b) surveys and focus groups of teachers, parents, and students; (c) research synthesis on teacher preparation; (d) research synthesis on the effectiveness of curricula; and (e) interviews and policy analysis of how districts similar to Madison have approached ensuring performance of all students.

Resources and revised focus. Resources for the work of the MMSD Mathematics Task Force were addressed by an application to the NSF from the UW's Wisconsin Center for Educational Research (WCER) for a District Mathematics Instructional System Evaluation and Case Study. In August 2007, the WCER was informed that the NSF did not fund the proposal. Nevertheless, Superintendent Rainwater and UW leadership pursued other means of funding a scaled-back version of the anticipated research studies and reports. In September, UW Mathematics Professor Terry Millar and Superintendent Rainwater were able to identify some resources that allowed for a more limited set of studies. An award of $40,000 from the UW Baldwin endowment, $16,000 from MMSD and some SCALE[8] research funding were identified as resources for a more modest study. The Task Force was on a forced hiatus until new resources could be identified, and therefore the meeting schedule was pushed back until October 2007.

After Task Force reactivation in October 2007, the meeting of October 19, 2007 refocused on the key tasks, tentative working groups of Task Force members and WCER staff who would propose plans for addressing the Board of Education charge within available resources. Four working groups were established: Analysis of Student Achievement, Curriculum Review and Research Findings, Instruction and Teacher Preparation, and Survey of Teachers, Parents, and Students. A chair was appointed for each working group who was asked to convene meetings of working group members and WCER staff to identify work plans within each domain that would help address the Board of Education charge and related questions.

Meetings in November and December 2007 were used primarily to review the proposed scope of work and research that could be accomplished within each working group area of responsibility. Finally, at the March 7, 2008 meeting, a plan was approved by the Task Force for each of the working groups.

Open Meetings Law and reports by individuals. To meet the requirements of Wisconsin's Open Meetings Law, Task Force working group meetings were posted and open to members of the general public. The inability of the work groups to schedule smaller subgroup meetings and the limited ability of members to communicate other than at meetings was a constraint in pursuing work plans. To proceed more expeditiously, work groups were eliminated once they had provided guidelines to complete the research in the areas assigned to them. The agreed upon tasks and reports were assigned by the Co-chairs to individuals on the Task Force or in the WCER so that they could proceed more efficiently to engage others in analysis and preparation of draft reports.

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[8] See Acknowledgements

The individuals assigned the task of completing the four sections were as follows:

1. Learning from Curricula (Dr. Mitchell Nathan)
2. Instruction and Teacher Preparation (Dr. Eric Knuth)
3. Analysis of Student Achievement (Dr. Norman Webb)
4. Surveys of Teachers, Parents, and Students (Dr. Paula White)

These sections were submitted to and reviewed by the full Task Force at their scheduled meetings of June 6, 19 and 20, 2007. Minutes for all Task Force meetings are included in Section 5, at the end of the report.

APPENDIX D

The NCSM Vision of Equity Leadership

> *A growing body of research makes it clear poverty and ethnicity are not the primary causal variables related to student achievement... leadership, teaching and adult actions matter. Adult variables, including the professional practices of teachers and the decisions leaders make can be more important than demographic variables.*
>
> —Reeves, 2006, p. xxiii

A vision for equity begins with understanding our leadership responsibility to seek out and erase biases and inequities that exist in student learning and assessment experiences. Time and again, too many students—especially those who are English language learners, are poor, disabled, members of minorities, or female—are victims of low expectations by mathematics teachers and by programs with barriers of access to the best school curriculum. Students who do not have access to a *rigorous* and *coherent* curriculum that holds high expectations for each student will have limited opportunities available to them later in school and in life. Leaders in mathematics education have an obligation to provide students with a mathematics curriculum and learning experience that prepare them for their future, whatever that may be. As Kati Haycock (2001) indicates, "to increase the achievement levels of minority and low-income students, we need [leaders] to focus on what really matters: high standards, a challenging curriculum, and good teachers."

Leaders in mathematics education have an obligation to provide students with a mathematics curriculum and learning experience that prepare them for their future, whatever that may be.

It is the responsibility of mathematics education leaders to ensure underperforming student populations are identified and to provide teachers with the resources, structures, and accountability to address the identified gaps in student achievement and identified gaps in access to the curriculum. More specifically, it is imperative leaders help all teachers to collaboratively monitor the progress of traditionally underrepresented populations and create strategic plans to raise the achievement of all students, especially those who are underperforming. Mathematics education leaders are responsible for leading teachers out of private practice into a collaborative working culture focused on making thoughtful and consistent decisions about curriculum, instruction, and assessment that will meet the unique needs of all students while at the same time helping students develop deep and connected mathematical understandings.

Leaders need to eliminate practices that begin tracking students in the primary grades or lock students into particular levels of mathematical study, thereby essentially precluding opportunities to learn the mathematics necessary to open future opportunities for success. Effective leaders diminish barriers that limit student access to rigorous mathematics and at the same time ensure that every student is taught by highly qualified and well-informed mathematics teachers.

Action Indicators for Equity Leadership

The indicators for NCSM's leadership standard for equity focus on the following key issues:

- Ensuring high expectations for each student
- Providing strong intervention and support for each student
- Orchestrating continuous improvement of achievement for each student

For every student to succeed, mathematics teachers must work together by grade or course level to build a foundation of challenging mathematics that present students with rich, engaging mathematical tasks and require higher-order thinking. Mathematical experiences must be meaningful and relevant; that is, the mathematics we teach should connect to student knowledge and personal experiences. Thus, leaders need to define effective teaching beyond content knowledge and classroom environment to one of developing and nurturing student, family, and community relationships by infusing culturally relevant, engaging, rigorous, yet accessible mathematics tasks into instruction (Haberman, 1997; Strutchens, 2000). It is up to the mathematics education leader to help classroom teachers create learning environments that place a high value and focus on student discourse. In these environments, teachers ask all students high-level, probing questions, while also providing differentiated instruction to support every child's learning.

PRIME leaders also understand that if *every* student is to achieve high levels of mathematical skills and understanding, teachers must collectively and critically examine meaningful data—data that will identify where students are underperforming and provide direction for action and intervention. When used wisely, data on achievement, participation, and access to the curriculum help to address inequity in a straightforward and constructive way (Chu Clewell, 1999). Using research-informed best practices, the leader determines how best to address the needs of students and works with individual teachers as well as teacher teams to make instructional and curricular changes that will hold all students to high standards and expectations.

APPENDIX E

Middle School Math Specialist

The Middle School Math Specialist (MSMS) Program is a partnership with the University of Wisconsin – Madison. This partnership grew out of the recommendations from the MMSD Math Task Force:

> *Recommendation #2: Focus hiring of grade 5-8 mathematics teachers on candidates who are mathematics specialists or who commit to meeting the district's criteria for a mathematics specialist within three years.*

This program is a cohort-based model that consists of five courses that has connections from elementary through high school mathematical topics with a concentration at the middle school level. These courses include:

- C&I 636: Number and Generalization
- C&I 637: Rational Number and Proportional Reasoning
- C&I 638: Geometry, Measurement, and Trigonometry
- C&I 639: Algebra and Functions
- C&I 640: Experimentation, Conjecture, and Reasoning

These courses are each three credit courses that can be connected to a master's degree in Curriculum and Instruction (C&I). At this time, MMSD teachers who participate in these courses will have their credits paid for from Math Task Force funds.

In keeping with the recommendations of the Math Task Force, the follow statement was made:

> *As of October 25, 2010, it is the expectation of the MMSD Board of Education that all MMSD middle school teachers of math successfully complete a full sequence of these courses by the end of 2015.*

Thus all new hires and transfers into math positions in the district will be required to successfully complete the MSMS Program within three years as a condition of hire. Those interested in continuing to teach middle school mathematics are encouraged to participate in this program because it is the District's goal that as of 2015 all middle school math teachers will have successfully completed this program. Those that do not may be reassigned to teach other subject areas. Teachers may request exemptions from the expectation through a process which is currently being developed. Possible, though not guaranteed, reasons for exemptions include:

- National Board Certification in Middle School Mathematics
- Secondary Mathematics Certification
- Middle School Math Certification from another state that is accepted by DPI
- Unique Exemptions

Questions concerning the Middle School Mathematics Specialist Program can be directed to Grant Goettl.