

**Supporting Implementation of
Math Recovery® Professional Development**

**A Michigan Mathematics and Science Partnership (MSP) Grant
Muskegon Area ISD Regional Mathematics and Science Center**

**ANNUAL EVALUATION
REPORT**

April 2015 – June 2016

October 2016

Prepared by SAMPI – Western Michigan University

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Annual Evaluation Report

from Evaluation Activities

April 2015 – June 2016

Prepared by the External Evaluation Team
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Supporting Implementation of Math Recovery® Professional Development was a project funded by the Michigan Mathematics and Science Partnership competitive grants program of the Michigan Department of Education. The purpose of the project was to implement a 40-hour training called Add+VantageMR® (AVMR®) designed for K-5 teachers. The training consisted of two AVMR® courses designed to provide a detailed understanding of how children develop understanding of early numeracy (Course 1) and number domains of place value and multiplication and division (Course 2). K-5 teachers also were trained to administer AVMR® assessment tools that help them recognize students' current mathematics understanding and build on their current ways of reasoning. The training of the first cohort of teachers began in spring/summer 2015 and was implemented by the Muskegon Area ISD Regional Mathematics and Science Center (Muskegon) and the following partners:

- Calhoun Intermediate School District (Calhoun)
- Eastern Upper Peninsula Mathematics and Science Center (EUP)
- Mason-Lake Oceana Mathematics and Science Center (Mason)

Supporting Implementation of Math Recovery® had six major objectives: 1) deepen teacher mathematics content knowledge and understanding of the continuum of mathematical thinking, assessment tasks, and instruction to move students forward along the continuum; 2) strengthen district level expertise in providing on-demand support to teachers to promote strong teaching skills and in turn improve student mathematics achievement; 3) provide administrative support for Math Recovery® implementation to create a system that will allow teachers to close the achievement gap of students in mathematics; 4) improve student achievement in mathematics by developing mathematical understandings which move

students along the continuum of mathematics thinking; 5) build capacity in Michigan in understanding the development of early numeracy and to support teachers in closing the mathematics achievement gap in Michigan; and 6) provide a coherent continuum of supports for all students (multi-tiered system of supports) to close the achievement gap and decrease the number of students needing tier 2 and 3 supports.

Science and Mathematics Program Improvement (SAMPI) at Western Michigan University served as external evaluators for the project. The evaluation team included Dr. Kristin Everett, Researcher; Dr. Robert Ruhf, Researcher; Dr. Mary Anne Sydlik, Director of SAMPI, and other SAMPI staff. This document is an annual report based on data collected between April 2015 and June 2016. This report has been prepared by the evaluation team for use by the project team, the Michigan Department of Education, and other key stakeholders.

Contents of the Evaluation Report

This report is based on an analysis of evaluation data collected over the past year. It includes: 1) a description of the evaluation design, including a detailed list of the evaluation tasks completed over the program's five years; 2) a description of the project, including its various components and number of participants; 3) a description of the project management team; 4) evaluation findings organized around the five key questions that framed the evaluation; 5) progress made toward each of the six project objectives; and 6) appendices containing compilations of selected data.

Questions about the evaluation should be addressed to Dr. Robert Ruhf at Science and Mathematics Program Improvement (SAMPI) at Western Michigan University (269-387-5390) or email to: robert.ruhf@wmich.edu.

Evaluation Design and Activities

SAMPI's evaluation of *Supporting Implementation of Math Recovery® Professional Development* was framed by the following questions: 1) What has been the impact of the program on teachers (mathematics content knowledge, classroom practice), students, and administrators and schools? 2) What has been the impact of the program on higher education professors and their future classes? 3) Have the project goals and objectives been accomplished as planned? 4) What are the strengths and limitations of the project? This report is based on data collected and analyzed as of June 2016.

SAMPI completed the following evaluation tasks between April 2015 and June 2016:

- Developed and administered various teacher surveys, including pre-program and end-of-program surveys for AVMR® and MRIS® trainings.
- Administered a teacher pre/post mathematics content test.
- Developed and administered a teacher video pre/post test. Teachers viewed two short video clips of teacher-student math activities and responded to the following question at the beginning (pre) and end (post) of AVMR® training: “What would you say and do to help the student [in each video] develop understanding of the mathematics in this situation?”
- Observed select professional development sessions, including day 1 of AVMR® Course 1 at all four sites, the Cohort 1 administrator training session at Muskegon, and day 5 of the MRIS® Course at Calhoun.

In addition, SAMPI conducted interviews with teachers, administrators, and members of the leadership during the spring of 2016; conducted classroom observations of a sample of teachers; analyzed the

nationally normed Measures of Academic Progress (MAP) scores from the classes of participating teachers in three Priority Partner schools; and administered a pre/post math content test to students of participating teachers for grades K, 1, 2, 3, 4, and 5. The student tests were developed by SAMPI and were reviewed and validated by mathematics education professionals.

SAMPI also conducted a pre-program interview with the university faculty involved in the project. A post-program interview was conducted in spring 2016.

Supporting Implementation of Math Recovery® Professional Development

The Math Recovery® program was dedicated to using Math Recovery® resources as a tool for deepening teacher content knowledge, promoting strong teaching skills, and closing achievement gaps in partner schools. The Muskegon Area ISD Regional Mathematics and Science Center and its three partners understood that for such training to be effective, teachers must have the support of school and district administrators, trained teacher leaders, and higher education faculty. Project leaders developed the following programmatic components assumed to build local and regional capacity and expertise in Math Recovery® instructional and assessment practices:

Teacher Training. The goal of the Math Recovery® Add+VantageMR® (AVMR®) two-course training was to provide K-5 teachers with efficient assessment tools to help them recognize their students’ current understandings of number concepts in the domains of “Operations and Algebraic Thinking” and “Numbers and Operations in Base Ten” in the Common Core State Standards (CCSS). It offered a framework to increase students’ level of sophistication in solving problems similar to progressing students in their reading level. AVMR® described constructs that provide a focus for building on students’ knowledge to move them to higher levels of understanding and sophistication in solving math problems. Course 1 provided a detailed understanding of how children develop understanding of early numeracy, and Course 2 focused on number domains of place value and multiplication and division.

Each partner provided the AVMR® training to two cohorts of K-5 teachers. Cohort 1 began April 2015 and ended in August 2015 (Table 1):

Table 1. Cohort 1 Teacher AVMR Training Dates by Site

| Course | Muskegon | Calhoun | EUP | Mason |
|---------------|-----------------------------|-----------------------|------------------------------|----------------------------|
| AVMR 1 | April 21-22, 27-28, 2015 | June 22-25, 2015 | June 22-25, 2015 | July 13-14, 15-16, 2015 |
| AVMR 2 | July 7-8, 9-10, 2015 | August 10-13, 2015 | August 12-13, 19-20, 2015 | July 20-23 2015 |

Cohort 2 began in October 2015 and ended in March 2016 (Table 2):

Table 2. Cohort 2 Teacher AVMR Training Dates by Site

| Course | Muskegon | Calhoun | EUP | Mason |
|---------------|--------------------------------|------------------------------|--------------------------------------|--------------------------------------|
| AVMR 1 | October 5-6, 19-20, 2015 | October 12-15, 2015 | October 12-13, 19- 20, 2015 | November 5-6, 16, 21, 2015 |
| AVMR 2 | December 10-11, 19-20, 2015 | December 7-8, 14-15, 2015 | February 22-23, 29; March 1, 2016 | February 22-23; March 8, 12, 2016 |

K-5 teachers were recruited from 37 school districts to complete the training. (Table 3):

Table 3. Number of Teacher Participants and School Districts Represented

| Site | No. of Teachers | | School Districts Represented |
|--------------|-----------------|------------|------------------------------|
| | Cohort 1 | Cohort 2 | |
| Calhoun | 26 | 34 | 8 |
| EUP | 19 | 27 | 11 |
| Mason | 29 | 29 | 8 |
| Muskegon | 24 | 40 | 10 |
| Total | 98 | 130 | 37 |

A third cohort of 101 teachers were provided with AVMR® training during the summer of 2016. Data analyzed in this report are from Cohorts 1 and 2.

Administrator Training. The goal of the administrator training was to engage school and district administrators in learning and conversation around providing constructive feedback to teachers using a teacher evaluation rubric (*The Math Recovery® Implementation Coaching Tool*). The training began with a one-day professional development session that outlined how to observe teacher-student interactions and provide constructive feedback to teachers based on the following questions from the rubric: (1) What is the evidence of students developing conceptual understanding of mathematical ideas before fluency/procedures are addressed? (2) What is the evidence of the teacher using formative assessment to inform instruction? (3) What is the evidence of differentiated instruction? (4) What is the evidence of teachers connecting student thinking to mathematical notation? (5) What is the evidence of students exhibiting problem solving characteristics? (6) What other components of quality math instruction are seen? Administrators later engaged in a practice observation of a teacher that included a debrief with the teacher and with leadership. They then completed two observations with a partner during the 2015-16 school and met for a one-hour “reflection and next steps” meeting at the end of the school year.

Each partner provided the one-day professional learning session for school and district administrators in August or October 2015. All sites offered the training to one or two cohorts of administrators (Table 4):

Table 4. Administrator Training Dates by Site

| Course | Muskegon | Calhoun | EUP | Mason |
|----------|--------------------------------|------------------|-----------------|------------------|
| Cohort 1 | October 2, 2015 (morning) | August 20, 2015 | October 1, 2015 | October 14, 2015 |
| Cohort 2 | October 2, 2015 (afternoon) | October 19, 2015 | -- | October 20, 2015 |

Administrators included a total of 52 principals, assistant principals, curriculum directors, and superintendents over two cohorts; and were recruited from 27 school districts (Table 5):

Table 5. Number of Administrators and School Districts Represented

| Site | No. of Administrators | | School Districts Represented |
|--------------|-----------------------|-----------|------------------------------|
| | Cohort 1 | Cohort 2 | |
| Calhoun | 6 | 10 | 8 |
| EUP | 9 | -- | 6 |
| Mason | 4 | 4 | 5 |
| Muskegon | 11 | 8 | 8 |
| Total | 30 | 22 | 27 |

Teacher Leader Training. A selected group of teacher leaders attended the Math Recovery® Intervention Specialist (MRIS®) course, the goal of which was to develop in-depth understanding of learning

trajectories in addition & subtraction, place value, and multiplication & division concepts, as well as a systematic approach to planning and monitoring K-5 intervention for students identified as needing additional support. Teacher leaders participated in 10 face-to-face sessions, two one-on-one coaching sessions, and two course projects that demonstrate understanding of Math Recovery® assessment and instruction.

Two partners (Muskegon and Calhoun) hosted the 10 face-to-face MRIS® sessions for teacher leaders (Table 6):

Table 6. Teacher Leader MRIS Training Dates by Site

| Sessions | Muskegon | Calhoun |
|-----------|-----------------------|---------------------------|
| Days 1-4 | August 10-13, 2015 | August 17-18, 20-21, 2015 |
| Days 5-7 | September 28-30, 2015 | September 28-30, 2015 |
| Days 8-10 | January 5-7, 2016 | January 5-7, 2016 |

Thirty-two (32) K-5 teachers from 13 school districts were recruited to be teacher leaders (Table 7):

Table 7. Number of Teacher Participants and School Districts Represented

| Site | No. of Teacher Leaders | School Districts Represented |
|--------------|------------------------|------------------------------|
| Muskegon | 9 | 7 |
| Calhoun | 10 | 6 |
| Total | 19 | 13 |

Institute of Higher Education Partnership. The goal of the higher education partner was to create a mutually beneficial relationship between students, teacher-candidates and teacher educators. To accomplish this, Dr. David Coffey from Grand Valley State University (GVSU) attended the Cohort 1 AVMR® training. After attending this training, Dr. Coffey, in cooperation with the development team, created a GVSU course for elementary education math majors that integrates AVMR® training into the coursework. The course was offered in summer 2016 and was attended by 16 pre-service teachers.

Project Management Team

Supporting Implementation of Math Recovery® Professional Development was led by Kristin Frang, Program Director of the Muskegon Area ISD Regional Mathematics and Science Center. She was supported by a Project Coordinator, Rachael Zorn. Three partners worked with the Muskegon Areas ISD to implement the 2015-16 program:

- Calhoun Intermediate School District (Calhoun)
- Eastern Upper Peninsula Mathematics and Science Center (EUP)
- Mason-Lake Oceana Mathematics and Science Center (Mason)

The 2015-16 leadership team included Michelle Tatrow (Educational Consultant, Calhoun), Kim Fox (Educational Consultant, Calhoun), Julie Bazinau (Math Recovery® Specialist, EUP), and Meg Brown (Educational Services Consultant, Mason).

FINDINGS RELATED TO EVALUATION QUESTIONS

The following comments are organized around the five key evaluation questions. All findings are based on data collected in 2015-16.

1) What has been the impact of the program on teachers (mathematics content knowledge, classroom practices), students, and administrators and schools? The program had a tremendous impact on everyone involved. Evaluation data shows that teachers' math skills and classroom practices were enhanced, students' math skills also were positively impacted, and administrators were better enabled to support teachers in implementing Math Recovery® in their schools.

➤ Teachers

- A pre/post content test was administered to all teacher participants. The test was developed cooperatively between the evaluation team and the project leaders and was reviewed by mathematics education professionals before being administered. It contained 12 items representing math concepts and strategies teachers were exposed to during Math Recovery® training. Some items had several parts, bringing to the total possible score to 25 points. ***Most teachers made significant improvement in their mathematics content knowledge.*** The mean score (for all teachers from all sites combined) increased from 70.8% on the pre-test to 81.7% on the post-test (p-value < 0.001, n = 198). Teacher pre/post scores also improved significantly for each of the project sites, except the Cohort 2 group at Muskegon (see Appendix 1 for details).
- ***All teachers who were interviewed in winter/spring 2016 stated that their ability to teach mathematics content changed or was enhanced by the program.*** One remarked, "I am able to take what I learned in Math Recovery® and apply it to my curriculum, and I can integrate my assessments and determine where my kids are, and what further instruction is needed from there." Another stated, "I have a much better understanding of how to teach math to younger students, as well as more knowledge of a variety of strategies to use with early numeracy."
- Administrators who were interviewed felt teachers' classroom practices were improving. ***Nine (82%) attributed the improvements to Math Recovery®.*** They felt teachers focused more on problem-solving, became better teachers of math, identified holes in their curriculum, and used the AVMR® assessments to inform instruction. They also said students learned to think before doing a problem, had fun, and improved their subtraction and addition skills. This included two administrators who said teachers were now using a common language and one who commented that teachers were "having powerful math conversations with students."
- ***SAMPI pre/post classroom observations of Cohort 1 teachers (n = 20) showed some evidence of increased Math Recovery® intervention.*** For example, seven (35%) of Cohort 1 teachers were observed to use differentiated assignments during the pre-observation in fall 2015. When observed again in spring 2016, the number of teachers using differentiated assignments increased to 9 (45%). Other increases included:
 - The number of teachers who made use of progress monitoring as formative assessment to inform instruction increased from 11 (fall 2015) to 14 (spring 2016).
 - The number of classrooms where students showed assuredness about the correctness of their solutions increased from 12 (fall 2015) to 15 (spring 2016).

- The number of classrooms where students remained engaged in the problem-solving process increased from 11 (fall 2015) to 14 (spring 2016).

➤ Students

- Pre/post content tests for students in grades K, 1, 2, 3, 4, and 5 were developed by SAMPI. Test content was based on the Common Core Standards that were relevant to Math Recovery® for each of the grade levels. Tests were reviewed and validated by mathematics education professionals before being administered. One-hundred fifty-eight (158) teachers administered the pre and post tests to 2,869 students. ***Results of the pre/post analysis of student test scores suggest that Math Recovery® training impacted students' understanding of relevant mathematics concepts.*** Mean test scores improved from pre-to-post for all grade levels (see Appendix 2 for details).
- Comments made in interviews with administrators indicated that ***positive changes were being observed in student outcomes as a result of the program.*** These changes were primarily seen on internal assessments. Comments included:
 - “We are seeing gains on assessments we give students; for years we have been stagnant.”
 - “We have collected data in two of our buildings and it has positively impacted our students (these are internal assessments).”
 - “MAP data indicates our students are performing above the norm for expected growth; we typically have the lowest amount of growth in the district.”
 - “We have small chunks of data that show positive results.”
- The nationally normed Measures of Academic Progress (MAP) fall 2015 and spring 2016 scores were obtained from the classes of participating teachers in three Priority Partner schools. Findings from an analysis of the data included:
 - ***How the fall 2015 and spring 2016 scores compared to the 2015 national norms.*** In the fall, average scores were below the norm for all grades. In the following spring, the average scores again were below the norm for all grades, but to varying degrees, each grade's spring score averages were closer to the norm than the fall scores.
 - ***Proportion of students at or above the national norm.*** In the fall, the proportion of students who were at or above the norm (50th percentile) ranged from 19% (4th Grade) to 39% (1st Grade). In the spring, for two grades, 1st and 5th, the proportion increased significantly with both grades at or near 50%. Statistically speaking, no change was detected for the other grades.
 - ***Math Recovery® students' growth from fall 2015 to spring 2016 compared to nationally normed growth.*** For every grade, more than half of the students' growth scores met or exceeded the projected growth, ranging from 65% of the students (kindergarten) to 92% of the students (4th Grade). Growth is clearly well above the norm.

➤ Administrators

- Comments made in interviews with 11 of the administrators indicated the training impacted the way they carry out their roles as administrators; most, however, felt they needed more support. When asked what kinds of support, six (55%) stated that they needed more training. One remarked, “*I know enough to know that I don't know enough.*” Another commented, “*I need more time to learn the language of Math Recovery®.*” A third remarked, “*I need more training about what to look for in the classroom.*” Others wanted more training for the coaches in their

schools, more practice using *The Math Recovery® Implementation Coaching Tool*, and more interactions with the project leadership.

- Comments made in interviews with the leadership team indicated the program had notable impacts on administrators including *shifting their thinking regarding mathematics teaching, informing them of ways to better support teachers, and providing a sense of where administrators fit into Math Recovery®*. However, it was also noted that administrators still needed to learn more about how to support teachers and relevant math content. Comments from project leadership included:
 - “Every administrator who’s participated said it’s changed their entire perspective; it’s been a huge mind-shift on how they’re going to support mathematics.”
 - “Administrators have been active participants on how they can help teachers implement this in the classroom.”
 - “Administrators have a better understanding of how they fit into this program, how they can help, and how it aligns with the Common Core guidelines.”
 - “We are having conversations with our administrators. However, I don’t think our administrators are yet at a point where they know how to support teachers in it. They’re struggling to know what it should look like in the classroom as well.”

2) What has been the impact of the program on higher education professors and their future classes? Dr. David Coffey from Grand Valley State University (GVSU) attended the Cohort 1 AVMR® training. He created a GVSU course for elementary education math majors that integrated AVMR® training into the coursework. The course was offered during the summer of 2016 to 16 pre-service teachers, 15 of which were math majors and one a history major.

➤ The GVSU Course

- ***Dr. Coffey reported in an interview that formal and informal course evaluations were all positive.*** Pre-service teachers were very excited to have something that set them apart from other pre-service teachers. He added, “They are certified in Math Recovery®; they get a certificate. And this is something that is on the radar of school districts in Michigan because of this grant.”
- Dr. Coffey identified several benefits Math Recovery® brought to the pre-service teachers who enrolled in his course:
 - ***Concrete support***
 - ***Existing assessments that were well thought out and represent a way of identifying where students are***
 - ***Instructional and interventionist resources that pre-service teachers are looking for and can use immediately***
 - ***Math Recovery® is much stronger and more research-based than what has been offered to pre-service teachers in the past***

➤ Future Courses

- ***Dr. Coffey was hopeful about the integration Math Recovery® into future pre-service methods courses.*** He stated during an interview, “From the standpoint of existing courses, there is plenty of room to use the research and resources [from Math Recovery®] in some of the courses.” He added, however, that he was concerned about trademark and copyright issues. He explained, “I

would want to check with the Math Recovery® people before using the assessments. But they would fit well.”

3) Have the project goals and objectives been accomplished as planned? Progress was made toward accomplishing all project objectives. SAMPI’s evaluation data analysis indicated impacts among the teacher and administrator participants, as well as among teachers’ students.

- The Math Recovery® project built and strengthened the capacity of the Muskegon Area ISD Regional Mathematics and Science Center, in cooperation with three partners, to deepen teacher content knowledge, promote strong teaching skills, and close achievement gaps in partner schools across the state of Michigan. The Math Recovery® AVMR® Course was offered to 228 teachers of K-5. In addition, administrator training was offered to 52 principals, assistant principals, curriculum, and superintendents, and the Math Recovery® MRIS® course was offered to 32 teacher leaders.
- Details of progress toward specific project goals is found in the “Project toward Project Objectives” section of this report (pp. 12-17).

4) What are the strengths and limitations of the project? Several strengths and limitations of the project were identified by the evaluation team.

➤ **Strengths**

- Common strengths identified from teacher surveys and interviews with the various participants included:
 - *Knowledgeable workshop facilitators*
 - *The hands-on, engaging and/or interactive nature of the program*
 - *Assessments to help teachers discover a student’s current level/construct of understanding*
 - *Collaboration among teachers from different districts*
 - *The safe or non-threatening environment*
- Several additional strengths were identified from interviews with the leadership team:
 - *Teachers were provided with ideas for differentiating instruction to meet students’ needs*
 - *Improved teacher content knowledge*
 - *Increased teacher enthusiasm for teaching math*
 - *The project generated interest and encouraged collaboration between partners across the state of Michigan*
- Comments from the leadership team included:
 - “Math Recovery® goes through the process of how to differentiate activities. It was difficult to differentiate activities for our kids because we were lacking the diagnostic assessments.”
 - “I think the greatest strength that we’ve had as a grant is just building capacity in the state so that we have facilitators who can then work with each other instead of in solo.”
 - “From the post-test results we’ve received, we’ve been able to identify that teachers are improving their mathematical content knowledge.”

➤ Limitations

- Teachers identified program limitations. Several felt there was *too much information to sort through and understand*. One remarked on the post-survey, “It was a lot of information in too little time, so it was overwhelming at times.” Others felt that *the Math Recovery® assessments were too difficult to work with*. One commented on the post-survey, “Some of those diagnostics are really hard for those kids. Once they don’t pass the first question, they’re basically done.” Another stated, “The only hard part is the assessment. I don’t know if there’s an easier way to do that or if there’s an easier assessment.”
- Administrators said some of the challenges they encountered included *scheduling and time out of the classroom, some teachers won’t participate or think they do not need Math Recovery®, and getting all the teachers in their district trained*. Others felt it was challenging to get the entire staff to “*buy into*” Math Recovery®.
- Other limitations identified by the leadership team included:
 - *The lack of ability to provide on-going support for all teachers who have been trained*
 - *Teachers did not always have enough class time to complete the AVMR® assessments*
 - *The initial training is overwhelming in terms of the amount of information for teachers*
 - *A lot of time was needed during Math Recovery® training to collect evaluation data*

PROGRESS TOWARD PROJECT OBJECTIVES

Objective 1: Deepen teachers' mathematics content knowledge and understanding of the continuum of mathematical thinking, assessment tasks and instruction to move students forward along the continuum.

- *Data suggests that the two Math Recovery® AVMR® courses provided teachers with the content knowledge, pedagogical insight, and tools (such as assessment tasks) they needed to help move their students forward in their understanding of mathematics.*

The teacher participants themselves made statistically significant improvement in their mathematics content knowledge. Analysis of pre/post math content assessments provide evidence that the AVMR® training impacted the content knowledge of teacher participants at all sites (details are in Appendix 1). The greatest growth was observed among Cohort 2 teachers, perhaps because of an improved presentation of the AVMR® material. Facilitators likely learned from their Cohort 1 experiences and were better able to address the needs of Cohort 2 teachers, resulting in a greater impact on teachers' content knowledge.

School administrators who were interviewed identified significant impacts of Math Recovery® on the teachers and students in their schools. Overall, administrators felt teachers focused more on problem-solving, became better teachers of math, identified holes in their curriculum, and used the AVMR® assessments to inform instruction. They also said students learned to think before doing a problem, had fun, and improved their subtraction and addition skills. Comments from administrators included:

- “My second grade teacher identified holes in the curriculum so she could make students stronger in math.”

- “I see teachers using Math Recovery® resources to supplement their instruction; they used the Math Recovery® assessments to inform instruction at the beginning of the year.”
- “Students are actually thinking before doing a problem, having fun, and are better at subtraction and addition.”
- “Teachers have more instructional strategies to increase students’ understanding of math.”
- “Teachers focus more on problem-solving and have a greater understanding of the learning progressions.”

Nine (82%) of the school administrators who were interviewed attributed changes they observed in teachers’ classroom practice to Math Recovery®. This included two who said teachers were now using a common language and one who commented that teachers were “having powerful math conversations with students.” One observed more individualized instruction as opposed to whole group instruction. Others observed that teachers had a better understanding of where students are in their understanding, were using more hands-on strategies, were focused on bringing Math Recovery® into their curriculum, and were making more use of small groups.

Teacher leaders felt the most significant changes in instructional practice from Math Recovery® were related to the use of tools and providing students with multiple problem solving strategies. A total of 32 teacher leaders participated in MRIS® teacher leader training. Leaders included coaches, interventionists, and teachers. SAMPI interviewed a sample of six teacher leaders about their experiences with Math Recovery®. They noted that teachers in their building were now using more tools such as number racks, bead strings, and ten frames. In addition, there is now much more of an emphasis on teaching students that there are multiple strategies for solving problems.

Project leaders stated through interview that teacher content knowledge had improved as a result of Math Recovery®. They noted improvements in understanding of early numeracy, student problem solving strategies, and the need to teach math for meaning. They also said teachers’ confidence in teaching math, usage of manipulatives, and the language they use with students have improved. Comments from the project leadership team included:

- “The teachers’ ability to respond to students appropriately has changed.”
- “First grade teachers who didn’t want kids using their fingers now realize that it’s more about how kids use their fingers, and advancing them to more sophisticated strategies.”
- “Teachers and administrators understand the need to shift to comprehension just like we would want students to comprehend reading.”
- “Sixty or seventy percent of them tell me that they understand the math so much better after the course, and they feel more comfortable teaching it.”
- “The program developed teacher content knowledge, confidence in teaching math, and excitement for teaching math. Teachers who never liked teaching math before.”
- “Teachers said it really changed the way that they question the kids. They’re asking more probing questions about their thinking and less just telling the kids what they need to know.”
- “I see teachers starting to use manipulatives more strategically.”

Objective 2: Strengthen district level expertise in providing on-demand support to teachers to promote strong teaching skills and in turn improve student mathematics achievement.

- *Overall, district level support for teachers is just getting started.*

Project leaders indicated through interviews that they are developing a network of teacher leaders who can serve as a “first line of support.” They are hoping that these networks will continue to develop. In some cases, progress in providing district-level support is being slowed by a lack of administrator support. Administrators are not currently at a level of content understanding to provide adequate support to teachers. Comments from project leaders are below:

- “I don’t think our administrators are at a point where they know how to support teachers in it. They don’t know the content themselves and so they’re struggling to know what it should look like in the classroom as well. I think we’re having more success in the regions and in the districts where we have the teacher that were trained because those are the teachers who are leading conversations. Because they’ve gone a lot deeper with the content, they’re able to support teachers in their building.”
- “We trained consultants to provide support for teachers. We’ve tried to get a consultant in each building that has trained teachers so they’re able to provide on-demand support. So it’s a really fast resource for teachers to be able to get their questions answered and get help with different things.”
- “Last year I trained a group of teachers; most were coaches or teacher leaders. So I think that this project has allowed districts to have in-district support for their teachers.”

Teacher leaders who received MRIS® training felt that their school and/or district will be positively impacted by their training. Several reported that have already been involved in supporting multiple buildings within their districts. Additionally, one teacher leader said that their district curriculum director is now providing support for Math Recovery® as a result of the project. Comments from teacher leaders are included below:

- “This is life-changing in terms of how I teach math. I wish I would have known about this many years ago.”
- “Math Recovery® has the missing piece for kids learning about math concepts. I’m really happy that I stumbled upon it.”
- “This will help us find a way to really help teachers develop well-rounded math students, not just students who can do one thing and not the other.”
- “I really like the Math Recovery® outlook. I like having the materials presented to the kids, I really enjoy that. I don’t have enough of a long perspective to really say this is the best thing; I just think the kids are getting a lot of the understanding that goes with it and I appreciate that.”

Objective 3: Provide administrative support for Math Recovery implementation to create a system that will allow teachers to close the achievement gap of students in mathematics.

- *Administrators who participated in the program were supportive of teachers in implementing Math Recovery® in their classrooms.*

Teachers stated in interviews that their building administrators or principals supported them in implementing changes in classroom practice. Teachers said that administrators sent them to the training and plan to send others from their building to future trainings; they received assistance from

their ISD, facilitator, or interventionist; and they were encouraged to use what they’ve learned from Math Recovery® and implement it in the classroom.

Cohort 1 teachers reported receiving more assistance from their ISD, facilitator or interventionist while Cohort 2 teachers reported having more support to attend Math Recovery® trainings. One Cohort 1 teacher said, “[My administrator] has professional development with a Math Recovery® coach for the whole building because she really wants everybody to be aware of what it is.” One Cohort 2 teacher commented, “[My administrator has] been part of the AVMR® training and also plans to send one team member from each grade this year.”

All six of the teacher leaders who were interviewed felt that their school administrators were supportive of Math Recovery® being implemented in their building. Half ($n = 3$) felt that while administrators were supportive of their teachers attending Math Recovery trainings, they were not doing enough to ensure that teachers were making changes to their classroom practice. Another also noted that they were not given enough planning time by their administrator to implement Math Recovery®. Comments from teacher leaders are included below:

- “Overall this is what they would like us to do and are very supportive of the implementation.”
 - “Absolutely. Our principals and curriculum director have been key in getting some of our teachers trained.”
 - “The administrators here are 'gung-ho' about Math Recovery®. They want teachers to be using MR ideas and tools in the classroom. They definitely have given us the opportunity to do the training, and we get a lot of the tools when we do that”
 - “Our principal is highly supportive of MR. She is a math teacher herself.”
- ***Administrators received training that impacted their ability to coach teachers on how to improve their math instruction.***

Eight (73%) of the 11 administrators who were interviewed believed that Math Recovery® training impacted the way they carry out their roles. Some felt they were better able to observe teachers or offer feedback to help teachers reflect on their practice. One remarked, “I’m looking for more student engagement, differentiation, and less focus on algorithms when I’m doing an observation.” Another commented, “I have a better perspective on how to help teachers.” Others said they were committed to having all their teachers trained or to ensuring the training is happening equitably across all schools within the district.

Seven (64%) administrators stated that *The Math Recovery® Implementation Coaching Tool* helped them improve their evaluation practices and feedback to students. Examples of how the tool improved administrators’ evaluation practices and feedback to teachers included: “It has allowed me to have conversations about teachers,” “It was very specific about what to look for in the classroom,” and “I can look for specific things such as, ‘Can students explain their own strategies?’”

Objective 4: Improve student achievement in mathematics by developing mathematical understandings which move students along the continuum of mathematical thinking.

- ***It is too soon to determine the degree to which student achievement in math, including the extent to which they have moved along the continuum of mathematical thinking, because Math Recovery® efforts have only just gotten underway. However, there is evidence, including from MAP data, to***

suggest that students’ math abilities have improved as a result of their teachers’ participation in Math Recovery®.

Over two-thirds of teachers who were interviewed felt that their students’ ability to do mathematics improved as a result of their involvement in Math Recovery®. Teachers who expressed this belief also said they have increased their teaching skills and strategies. As a result, their students have increased their understanding of math concepts such as number sense or structuring numbers. A Cohort 2 teacher said, “The numbers have more of a value to my students. They understand quantity, they can visualize it, they can say it; it’s just more meaningful.”

But nearly a third of teacher participants were not sure or felt it was too soon to tell if their students’ ability to do mathematics improved. Some said this was because it was their first year using Math Recovery®, or that they expect to see more benefits to students in the future. One Cohort 1 teacher commented, “I can’t say for sure because this is my first year teaching math knowing Math Recovery®.”

Four of the 11 administrators who were interviewed noted that student assessment data has improved as a result of Math Recovery®:

Analysis of Measures of Academic Progress (MAP) scores from the classes of participating teachers in three Priority Partner schools showed that, for every grade, more than half of the students’ growth scores met or exceeded the projected growth, ranging from 65% of the students (kindergarten) to 92% of the students (4th Grade). Growth is clearly well above the norm.

Objective 5: Build capacity in Michigan in understanding the development of early numeracy and to support teachers in closing the achievement gap in Michigan.

- ***Again, it is too soon to say the extent to which Math Recovery® is building capacity in the state to support the development of early numeracy or to close the achievement gap in Michigan. However, there is evidence that the impacts of the program have extended beyond the participants to a state-wide level.***

Nearly all of the teachers who were interviewed felt their knowledge of early numeracy was enhanced by the program. Many teachers learned new ways and tools to teach these concepts, better understand how children learn these concepts, and how to help them move forward in their learning. One teacher remarked, “There are so many ah-ha moments; I wish I had been taught this way.” Another commented, “I screened all my kids in the fall with the Math Recovery® assessments and I just screened them again in January, and I could really tell there was a difference. There were only a few special education kids who did not improve but the rest of them bumped up.”

These impacts extended beyond the teacher participants. Members of the project leadership team noted in interviews that consultants were trained across the state who can help teachers with Math Recovery® at many different sites. One remarked, “In terms of scale, we’ve increased the number of regions who are able to support teachers using Math Recovery® instruction and assessment.” Interest in Math Recovery® has been spreading by word of mouth across the state. It has also been spread through presentations at conferences. The Michigan Department of Education (MDE) has also shown a strong interest in the program. Comments from the leadership team are included below:

- “I know the MDE is very interested in it and interested in supporting this in an ongoing way. This is building capacity to create more trainers to be able to deliver this at other sites around Michigan.”
- “It’s been spreading really fast. We have people trained all across the state. It’s definitely spreading at a much higher rate than what I think we even anticipated.”
- “News is getting around of how teachers liked the training.”
- “We’ve getting the word out through presenting it at conferences. You know, just telling people what Math Recovery® is.”

Objective 6: Building Level Instructional System - to provide a coherent continuum of support for all students (Multi-Tiered Systems of Supports) to close the achievement gap and decrease the number of students needing Tier 2 and Tier 3 supports.

- *Schools and districts who have sent teachers to Math Recovery® training are more skilled with providing multi-tiered supports for their students, although it is still a work in progress.*

The project leadership team stated in interviews that progress in providing multi-tiered support for students has been dependent on how many teachers have been trained and the amount of support available in a given district. Districts with more trained teachers and support are doing better with providing multi-tiered support for students. The leadership did note that they are seeing improved multi-tiered support overall. Comments from the leadership team are included below:

- “I think in every district, it’s different. When there’s a lot of staff that are trained and they have a good understanding, I think it does well.”
- “We have a very small district with only one or two teachers trained, so it is only happening in that room and it’s only happening at basically a tier one, sometimes a tier two level. So it just depends on how big of a cohort you have in your building to support that and your knowledge of it. So it varies.”
- “We saw an increased focus on tier two and tier three support through the Math Recovery® intervention specialist training and then tier one supports just in the classroom differentiated instruction through the AVMR training.”

Over two-thirds (68%) of the teachers who were interviewed said their role in the multi-tiered system of supports has changed as a result of their involvement in Math Recovery®. Teachers reported having a better understanding of where children are and how to further support their understanding. They also stated they are more skilled at grouping students to better support them, and that they have more tools, strategies or resources to identify what students need. One Cohort 2 teacher said, “I feel like I’m able to do a better job with tier 3 students for math because of Math Recovery®.”

One teacher leader mentioned in an interview that multi-tiered support is slowly improving at her school, particularly at the tier 2 level. Another felt that she was able to lead the way in her school in terms of implementing tier 3 support.

Appendix 1: Supporting Implementation of Math Recovery® Professional Development

**A Michigan Mathematics and Science Partnership (MSP) Grant
The Muskegon Area ISD Regional Mathematics and Science Center**

Pre/Post Teacher Content Assessment

**Prepared by the External Evaluation Team
Science and Mathematics Program Improvement (SAMPI)
Western Michigan University**

Robert Ruhf, PhD
Mary Anne Sydlik, PhD

May 2016

Supporting Implementation of Math Recovery® Professional Development is a project funded by the Michigan Mathematics and Science Partnership competitive grants program of the Michigan Department of Education. The purpose of the project is to implement a 40-hour training called Add+VantageMR® (AVMR) designed for K-5 teachers. The training consists of two AVMR courses designed to provide a detailed understanding of how children develop understanding of early numeracy (Course 1) and number domains of place value and multiplication and division (Course 2). K-5 teachers also are trained to administer AVMR assessment tools that help them recognize students' current mathematics understanding and build on their current ways of reasoning. The training of the first cohort of teachers began in spring/summer 2015 and was implemented by the Muskegon Area ISD Regional Mathematics and Science Center (Muskegon) and the following partners:

- Calhoun Intermediate School District (Calhoun)
- Eastern Upper Peninsula Mathematics and Science Center (EUP)
- Mason-Lake Oceana Mathematics and Science Center (Mason)

The training of the second cohort of teachers began in fall 2015 and was implemented by the same four partners. A pre/post content test was administered to all teacher participants. The following document reports the outcome of this testing.

The test was developed cooperatively between the evaluation team and the project leaders and was reviewed by mathematics education professionals before being administered. The test contained 12 items representing math concepts and strategies teachers were exposed to during Math Recovery® training. Some items had several parts, bringing to the total possible score to 25 points. Data were subject to paired sample t-tests for each of the four sites and for each of the two cohorts.

Pre-assessments were administered to 214 teacher participants; 206 participants completed the post-assessment. Of these, 198 data pairs were identified for further analysis (Cohort 1 = 92; Cohort 2 = 106). The data pairs were further subdivided by site for each of the two cohorts (Table A1.1)

Table A1.1. Number of Matched Pre/Post Tests

| Site | Cohort 1 | Cohort 2 |
|--------------|-----------|------------|
| Calhoun | 24 | 30 |
| EUP | 17 | 24 |
| Mason | 29 | 23 |
| Muskegon | 22 | 29 |
| Total | 92 | 106 |

The following comments are intended as feedback for the *Supporting Implementation of Math Recovery® Professional Development* project team as they reflect on accomplishments and plan for future efforts.

Tables A1.2 and A1.3 show that teachers in both cohorts...

- **...began their AVMR training with a comparable level of content knowledge.** Overall mean pre-test scores were similar for both cohorts (Cohort 1: $\bar{x} = 70.0\%$, $n = 92$; Cohort 2: $\bar{x} = 71.2\%$, $n = 106$). An independent samples t-test indicated that the difference was not statistically significant ($p = 0.596$).
- **...made improvements in their content knowledge.** A statistically significant pre-to-post change ($p \leq 0.05$) was observed for all Cohort 2 sites and all Cohort 1 sites except Muskegon, which was on the cusp of significance ($p\text{-value} = 0.056$).

Table A1.2. Cohort 1 Teacher Pre/Post Test Analysis by Site ¹

| Total possible score = 25 | n | Pre-Test | | Post-Test | | p-value |
|---------------------------|-----------|-------------|--------------|-------------|--------------|---------------|
| | | Score | % | Score | % | |
| All Teachers | 92 | 17.5 | 70.0% | 19.8 | 79.0% | 0.001* |
| Calhoun | 24 | 17.8 | 71.3% | 19.0 | 76.2% | 0.021* |
| EUP | 17 | 17.1 | 68.5% | 19.5 | 78.1% | 0.023* |
| Mason | 29 | 17.1 | 68.4% | 20.9 | 83.6% | < 0.001* |
| Muskegon | 22 | 17.7 | 70.9% | 19.1 | 76.5% | 0.056 |

* Statistically significant difference, $p \leq 0.05$

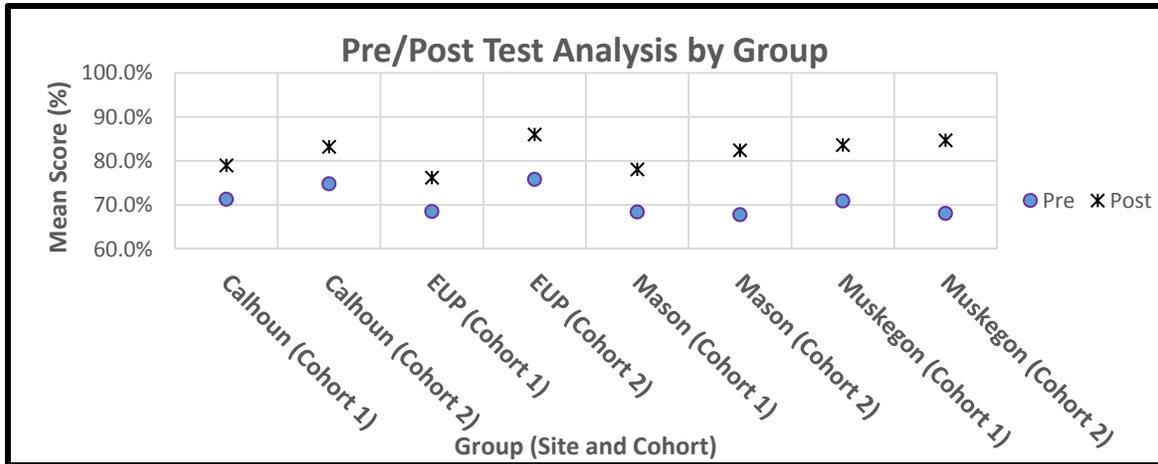
Table A1.3. Cohort 2 Teacher Pre/Post Test Analysis by Site

| Total possible score = 25 | n | Pre-Test | | Post-Test | | p-value |
|---------------------------|------------|-------------|--------------|-------------|--------------|--------------------|
| | | Score | % | Score | % | |
| All Teachers | 106 | 17.9 | 71.2% | 21.0 | 84.0% | < 0.001* |
| Calhoun | 30 | 18.7 | 74.8% | 20.8 | 83.2% | 0.001* |
| EUP | 24 | 19.0 | 75.8% | 21.5 | 86.0% | < 0.001* |
| Mason | 23 | 17.0 | 67.8% | 20.6 | 82.4% | < 0.001* |
| Muskegon | 29 | 17.0 | 68.1% | 21.2 | 84.7% | < 0.001* |

* Statistically significant difference, $p \leq 0.05$

The mean pre and post scores are shown graphically in the figure at the top of the next page.

¹ Data reported in Table 1 are different from a preliminary analysis performed in October 2015. Five (5) Cohort 1 teachers were added to the analysis. Data for these teachers were received late and were not included in the October 2015 analysis.



Cohort 2 teachers demonstrated the strongest growth in content knowledge. Overall mean post-test scores were highest among Cohort 2 participants (Cohort 1 \bar{x} = 79.0%, n = 92; Cohort 2: \bar{x} = 84.0%, n = 106). An independent samples t-test found the difference to be statistically significant (p = 0.019).

Table A1.4 shows statistics for each site when Cohorts 1 and 2 data are combined.

Table A1.4. Teacher Pre/Post Test Analysis (All Teachers)

| Total possible score = 25 | N | Pre-Test | | Post-Test | | p-value |
|---------------------------|------------|-------------|--------------|-------------|--------------|--------------------|
| | | Score | % | Score | % | |
| All Teachers | 198 | 17.7 | 70.8% | 20.4 | 81.7% | < 0.001* |
| All Calhoun | 54 | 18.3 | 73.3% | 20.0 | 80.1% | < 0.001* |
| All EUP | 41 | 18.2 | 72.8% | 20.7 | 82.7% | < 0.001* |
| All Mason | 52 | 17.0 | 68.1% | 20.8 | 83.1% | < 0.001* |
| All Muskegon | 51 | 17.3 | 69.3% | 20.3 | 81.8% | < 0.001* |

* Statistically significant difference, $p \leq 0.05$

Analysis of pre/post assessments provide evidence that the AVMR training impacted the content knowledge of teacher participants at all sites. The greatest growth was observed among Cohort 2 teachers, perhaps because of an improved presentation of the AVMR material. Facilitators likely learned from their Cohort 1 experiences and were better able to address the needs of Cohort 2 teachers, resulting in a greater impact on teachers' content knowledge. Project staff should be encouraged by these finding and are encouraged to continue in their efforts.

Appendix 2:
Supporting Implementation of
Math Recovery® Professional Development
A Michigan Mathematics and Science Partnership (MSP) Grant
Report on Student Pre/Post Tests

Prepared by:
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Mary Anne Sydlik, Ph.D.

October 2016

Supporting Implementation of Math Recovery® Professional Development is a project funded by the Michigan Mathematics and Science Partnership competitive grants program of the Michigan Department of Education. The purpose of the project is to implement a 40-hour training called Add+VantageMR® (AVMR) designed for K-5 teachers. The training consists of two AVMR courses designed to provide a detailed understanding of how children develop understanding of early numeracy (Course 1) and number domains of place value and multiplication and division (Course 2). K-5 teachers also are trained to administer AVMR assessment tools that help them recognize students' current mathematics understanding and build on their current ways of reasoning.

The training was implemented to two cohorts of teachers (Cohort 1: spring/summer 2015; Cohort 2: fall/winter 2015-16) by the Muskegon Area ISD Regional Mathematics and Science Center (Muskegon) and the following partners:

- Calhoun Intermediate School District (Calhoun)
- Eastern Upper Peninsula Mathematics and Science Center (EUP)
- Mason-Lake Oceana Mathematics and Science Center (Mason)

This report highlights findings from an analysis of student test data to help determine impact of the project. Pre/post content tests for students in grades K, 1, 2, 3, 4, and 5 were developed by SAMPI. Test content was based on the Common Core Standards that were relevant to Math Recovery® for each of the grade levels. Tests were reviewed and validated by mathematics education professionals before being administered. Results are presented in this report. *More detailed statistics are available on request.*

Results

Sample. One-hundred sixty-one (161) teachers from four training sites (Calhoun: 50, EUP: 27, Mason: 37, and Muskegon: 47) administered the pre and post tests to 2,869 students (Calhoun: 961, EUP: 460, Mason: 579, and Muskegon: 869) during the 2015-16 school year (see Tables A2.1-2 and Figures 1-2). Teachers received packets of tests and instructions for administering and returning them.

TABLE A2.1. NUMBER OF TEACHERS

| Grade Level | Calhoun | EUP | Mason | Muskegon | Total |
|--------------|-----------|-----------|-----------|-----------|------------|
| K | 7 | 4 | 10 | 4 | 25 |
| 1 | 5 | 6 | 7 | 13 | 31 |
| 2 | 8 | 4 | 5 | 13 | 30 |
| 3 | 14 | 7 | 8 | 15 | 44 |
| 4 | 9 | 3 | 5 | -- | 17 |
| 5 | 7 | 3 | 2 | 2* | 14 |
| Total | 50 | 27 | 37 | 47 | 161 |

*All Muskegon fifth grade participants were from the first cohort.

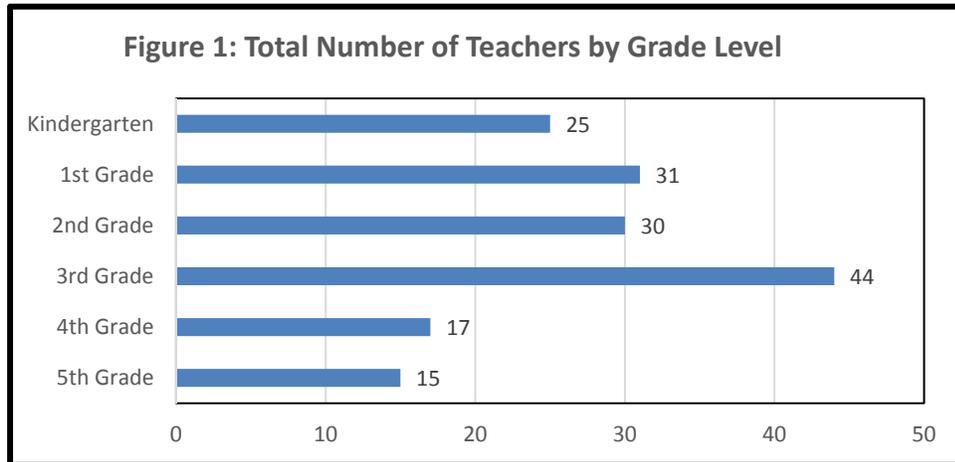
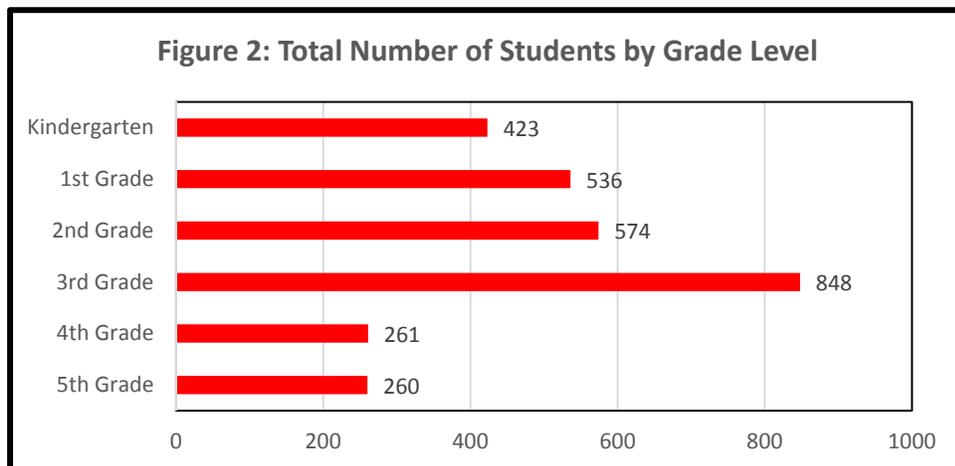


TABLE A2.2. NUMBER OF STUDENTS

| Grade Level | Calhoun | EUP | Mason | Muskegon | Total |
|--------------|------------|------------|------------|------------|--------------|
| K | 123 | 62 | 173 | 65 | 423 |
| 1 | 93 | 107 | 107 | 229 | 536 |
| 2 | 168 | 73 | 77 | 256 | 574 |
| 3 | 289 | 111 | 129 | 319 | 848 |
| 4 | 151 | 35 | 75 | -- | 261 |
| 5 | 137 | 72 | 18 | 33* | 260 |
| Total | 961 | 460 | 579 | 902 | 2,902 |

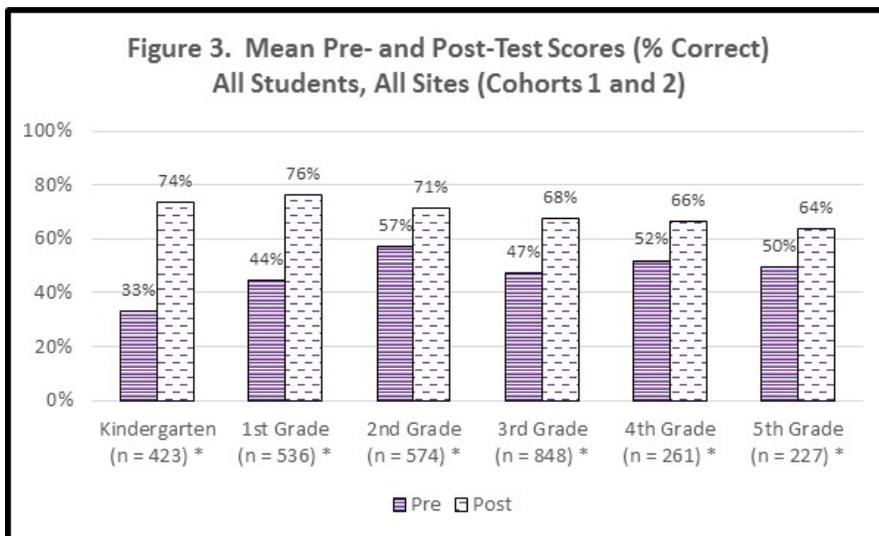
*All Muskegon fifth grade participants were from the first cohort.



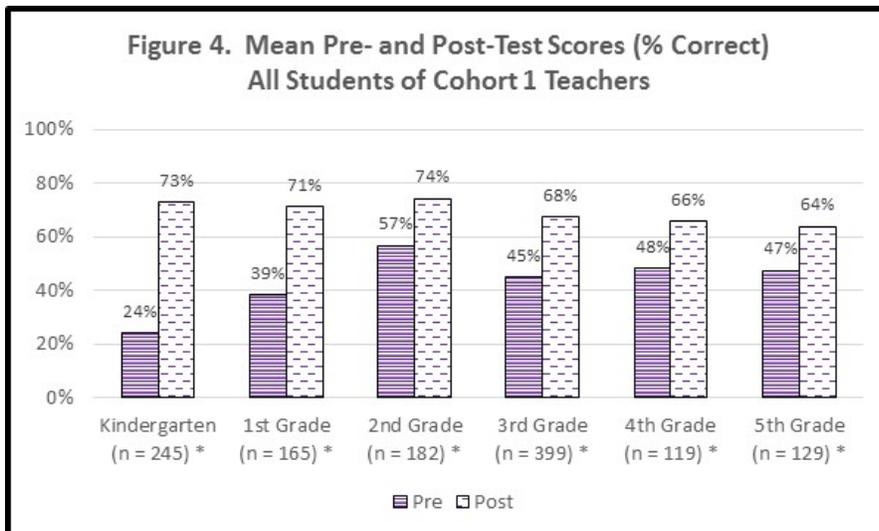
Pre/post student math test scores. Pre- and post-test score data represent the mean percentage of correct answers. Standard pre-post quantitative analysis tests were used to determine statistical significance. *Math Recovery® training appears to have impacted students’ understanding of relevant mathematics concepts:*

- Mean pre/post scores improved in all grade levels for all students combined (Figure 1), all Cohort 1 students combined (Figure 2), and all Cohort 2 students combined (Figure 3). *Improvements were statistically significant.*
- Mean pre/post scores also improved in all grade levels at each of the four sites (all Calhoun students combined, all EUP students combined, all Mason students combined, and all Muskegon students combined; Figure 4-7). *Improvements were statistically significant, except 5th grade Mason students (Figure 6) and 5th grade Muskegon students (Figure 7).*

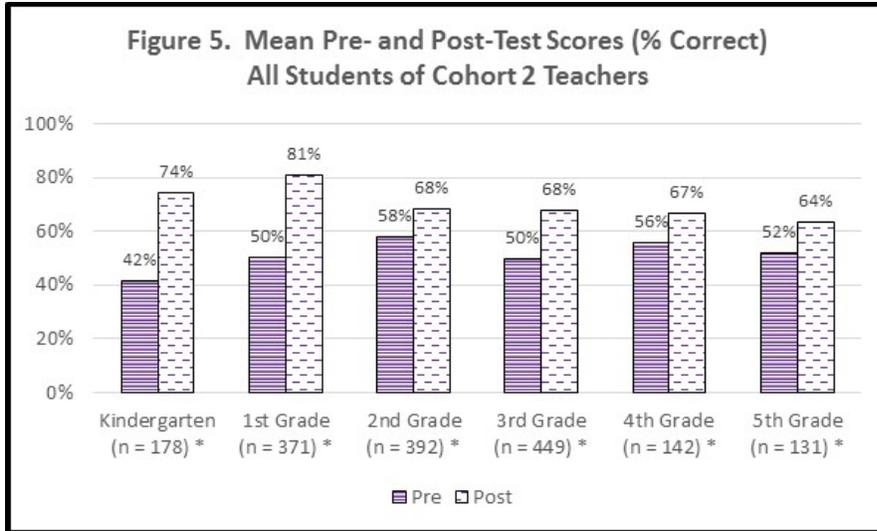
FIGURES 3-5. ALL STUDENTS OF COHORT 1 AND 2 TEACHERS COMBINED, ALL SITES



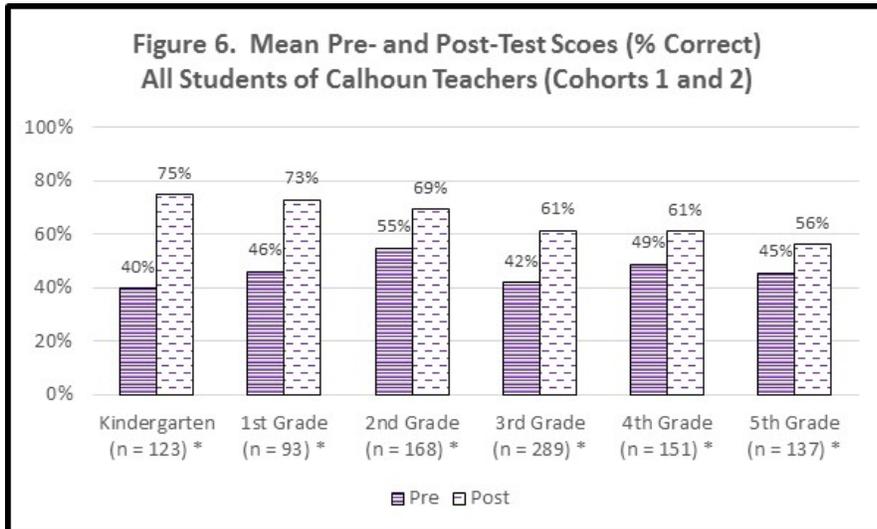
*Statistically significant change from pre to post (alpha ≤ 0.05)

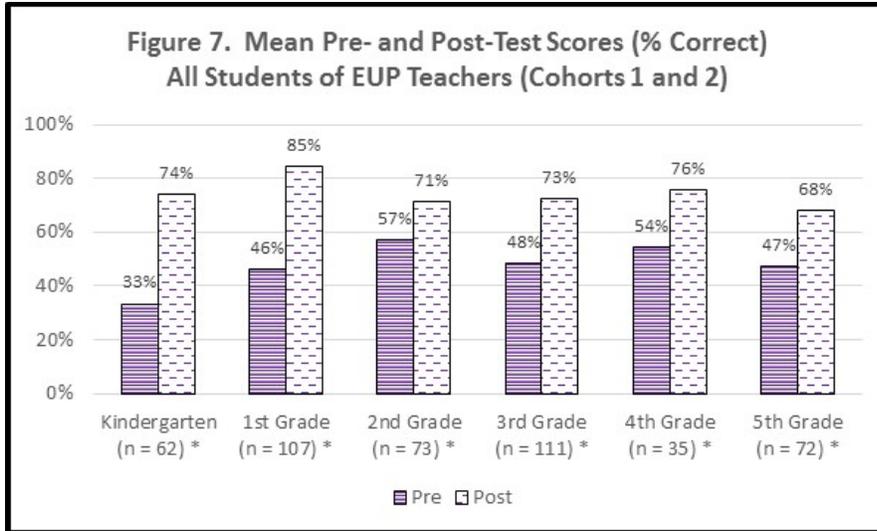


*Statistically significant change from pre to post (alpha ≤ 0.05)

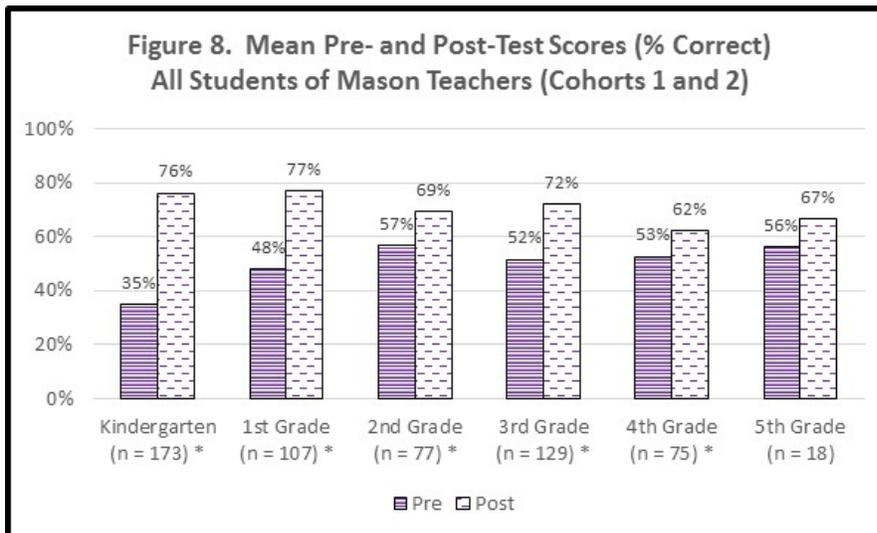


FIGURES 6-9. SITE GRAPHS

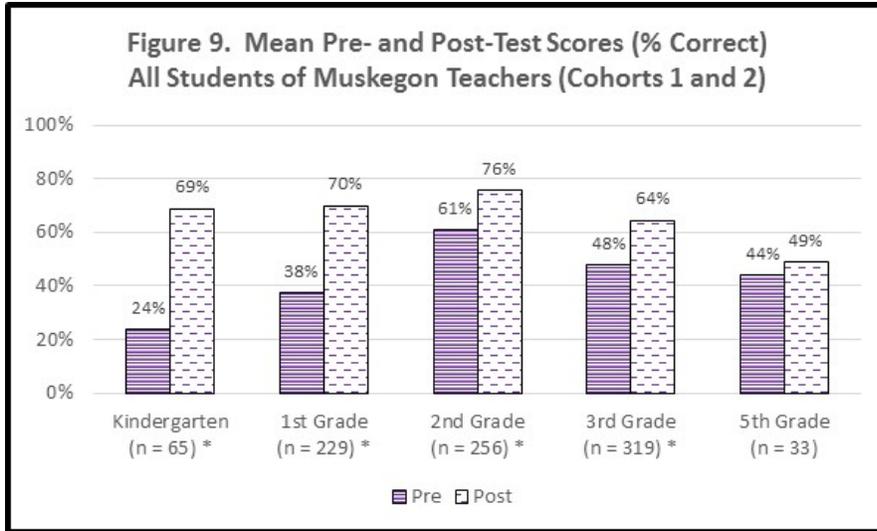




*Statistically significant change from pre to post (alpha \leq 0.05)



*Statistically significant change from pre to post (alpha \leq 0.05)



*Statistically significant change from pre to post ($\alpha \leq 0.05$)