

Findings from Observations of Mathematics Lessons in M³RP Teacher Leader Classrooms During the 2000-01 School Year

Prepared by SAMPI--Western Michigan University

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□ **Background.** The Michigan Middle Schools Mathematics Reform Project (M³RP) is a four-year collaborative effort designed to assist Michigan school districts in aligning their middle school mathematics curriculum and instruction with the Michigan Curriculum Framework in Mathematics and other professional recommendations. There were 90 school districts (or consortia of districts) involved in the project in June 2001. This includes 147 schools. Each participating school has a District Leadership Team made up of teachers, administrators, and community members that is responsible for facilitating the mathematics improvement effort in their school/district. Each team has 2 or more Teacher Leaders. In June 2001 there were 197 Teacher Leaders. These teachers receive extensive training in mathematics content and pedagogy through M³RP in summer institutes and school-year sessions. They also facilitate mathematics professional development for their colleagues in their home schools.

The evaluation of M³RP includes gathering a variety of information from Teacher Leaders over the course of the project. Between October 2000 and May 2001, members of the M³RP Evaluation Team made visits to participating schools, including observing mathematics lessons in Teacher Leader classrooms. This report is a compilation of findings from those lessons observations and represents a "snapshot" of middle school mathematics lessons in Teacher Leader Classrooms across schools participating in M³RP. A separate report based on interviews conducted during the site visits is also available. **Thanks to all those Teacher Leaders who let us observe a lesson in their classrooms.**

□ **Study Methods.** Evaluators asked participating school contacts to help arrange site visits to schools. During the site visits, principals, district contacts (if other than the principal), and Teacher Leaders at each school were interviewed to learn about their mathematics program, school-based professional development activities, issues and problems in the mathematics improvement effort, and value of their participation in M³RP. Evaluators also observed a mathematics lesson in Teacher Leader classrooms in each school visited.

Observers were trained on the use of the SAMPI Lesson Observation System, a protocol based on state and national teaching and learning standards. The observation system is a two-step process. The first involves having trained observers watch a complete lesson, take notes, and conduct brief pre- and post-observation interviews. The second step is for observers, using their notes, to complete a debriefing protocol. This five-part instrument provides observers with a systematic way to assess the key elements of a lesson by scoring a set of criteria on a 7-point scale. The first section of the instrument includes basic information about the lesson--date, length, purpose, description, materials used, etc. The remainder of the instrument is divided into four sections, one each for the four major components of a lesson: planning and organization, implementation, content, and classroom culture in which the lesson was conducted. Each of these sections include 5-9 criteria based on state and national teaching and learning standards.

Tests of internal consistency and observer agreement have been conducted on the debriefing instrument. Coefficient Alpha scores were computed to determine internal consistency and represent one type of reliability of the instrument. Alpha scores ranged from .75 to .93, with 1.0 perfect consistency. The actual criteria are based on established state and national teaching and learning standards in science and mathematics. Training on the use of the system is designed to establish reliability/consistency among observers. The consistency tests were based on data gathered during training sessions. A detailed description of the development and testing of the instrument is available from SAMPI, as well as information about the instrument and training on its use. Only those receiving the two-day training are authorized to use the instrument.

When debriefing instruments were complete, data was entered into an electronic database and compiled. This report is based on the analysis of the observations conducted during the 2000-2001 school year.

Sample. Lessons were observed in 124 classrooms, representing approximately 70% of Teacher Leaders across all participating schools. This involved visits to 85% of all participating districts (including two consortia), in which from 1 to 4 lessons were observed.

Profile of Lessons Observed.

- Of the 124 lessons observed, 45% came directly from Connected Math, Math Scape, or Math Thematics; 31% were from other commercial text/curriculum materials; and 24% were teacher assembled materials (gathered from a variety of sources).
- The number of lessons observed by grade level were: 4th = 1 (.5%), 5th = 3 (2%), 6th = 28 (22%), 7th = 50 (40%), 8th = 41 (33%), 9th = 1 (.5%).
- 54% of the lessons came from pre-packaged mathematics or science programs, such as Everyday Math, Connected Math, Addison-Wesley, Core Plus, FOSS, DASH, GEMS, etc.
- 96% of lessons had appropriate and adequate supplies and equipment to conduct the lesson.
- Primary intended purpose(s) of the lesson were categorized. Purposes are shown in the chart below (numbers add to more than 100% because there can be more than one primary purpose for single lesson).

Purposes	% of Lessons
Identify prior student knowledge	17%
Introduce new concepts	35%
Develop conceptual understanding	52%
Review concepts	24%
Demonstrate how a concept applies in a real world context	20%

Purposes	% of Lessons
Develop awareness of contributions of mathematicians/scientists from diverse backgrounds	2.5%
Learn mathematics/science processes/skills	22.5%
Learn vocabulary/specific facts	11%
Develop appreciation for core mathematics/science ideas	8%
Assess student understanding of concepts	17%

- Over the course of a lesson, teachers use a variety of configurations of student activities, including whole group, small group, pairs, and individual work as primary ways of engaging students. Lessons conducted with teaching and learning standards in mind will likely have a combination of configurations but emphasize small group work and pairs of students working together. Across all lessons observed, students were engaged in the following ways (number is % of particular configurations; adds to more than 100% because there can be more than one configuration in a lesson).

Configuration	% of Lessons
Whole group and small group (or pairs)	38%
Small group or pairs only	29%
Whole group only	20%

Configuration	% of Lessons
Individual work only	9%
Whole group and individual work only	8%

- For 100% of lessons, the classroom was arranged to maximize student-student interactions.

□ **Assessment of Lesson Components.** After observing a lesson, observers rated a series of indicators (or criteria) in four categories: 1) planning and organization of the lesson, 2) implementation of the lesson, 3) content of the lesson, and 4) classroom culture in which the lesson was conducted. There are 5 to 9 indicators in each category. These indicators represent the major valued attributes and characteristics for each category based on state and national teaching standards. Indicators describe evidence that can be used to determine if progress is being made toward goals and objectives, in this case, lessons with strong investigative elements and based on standards. Observers rated each indicator on a scale of 1 to 7, with 1 = low rating and 7 = high rating for that item. **In the findings below for each category, the percentages presented represent the lessons that received a 6 or 7 rating.** For Planning and Organization indicators, observers rated each as "yes" or "no."

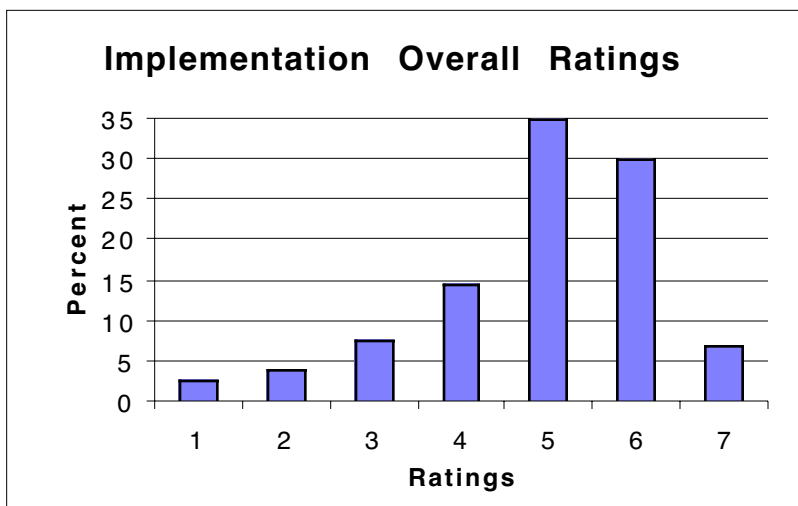
□ **Planning and Organization of the Lesson.** This component of the lesson is concerned with the planning for, organization of, and structure of a lesson. It is not about the effectiveness of implementation, the quality of content, or the effectiveness of the classroom climate, but whether the lesson was organized in a way to maximize learning.

- ▶ 73% of lessons were organized so that there could be substantive student-student interaction, such as small group work, think-pair-share, and/or whole group work that engaged all students in substantive discussion.
- ▶ 83% of lessons were organized so there could be substantive teacher-student interaction during whole group discussions facilitated by the teacher and/or during small group work or think-pair-share groupings with the teacher interacting with students.
- ▶ In 78% of lessons, investigative tasks were essential elements of the lesson plan, involving manipulation of information to help make sense of the lesson content, problem-solving, applications of content to the real world.
- ▶ 76% of lessons were organized so they could address students' developmental levels, preparedness, and/or learning styles. A lesson design should incorporate a variety of specific learning strategies that accommodate student learning styles. The lesson should build on previous student experiences.
- ▶ 63% of lessons were organized so they addressed issues of access, equity, and diversity, including engaging all students, providing activities appropriate for the diversity of the class, and giving all students an equal chance to be engaged in the learning.
- ▶ 58% of lessons were organized to provide adequate time for students and/or the teacher to reflect on the lesson and its content.
- ▶ 38% of lessons were organized to provide adequate time for wrap-up and closure of the content of the lesson. This refers to designing the lesson so there is time to bring an appropriate level of closure to the lesson or there is clarity about how next lessons will bring closure to the ideas of this lesson if closure is not appropriate for this lesson.

□ **Implementation of the Lesson.** Implementation is about how the lesson is actually carried out based on the lesson design, and teacher and student roles in it.

- ▶ In 64% of the lessons teachers appeared confident in their ability to teach the lesson. In these lessons teachers seemed to know the topical materials and were comfortable with the instructional strategies being used.
- ▶ During 32% of the lessons observed, teacher-student interaction was highly substantive and probing in nature. Questioning and dialog emphasized higher-order thinking and deep understanding and exposed students' prior knowledge.

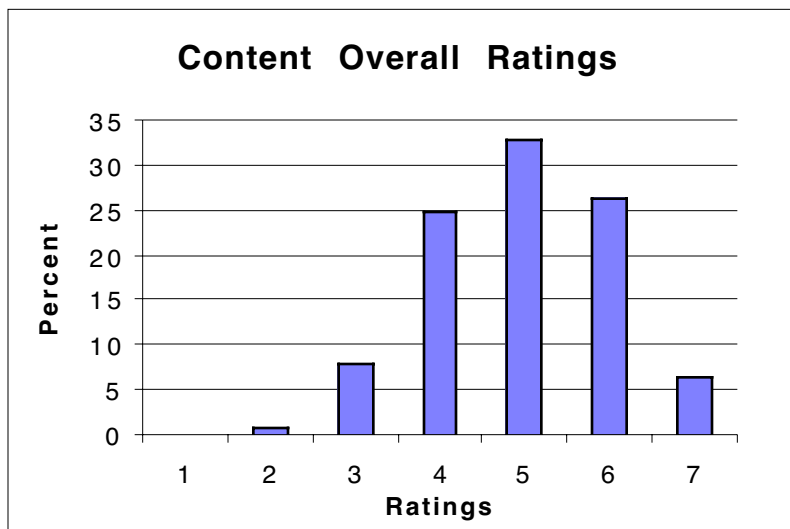
- In 50% of the lessons, activities and other components were managed in ways that effectively engaged students in their own learning.
- The pace of the lesson was most appropriate in 43% of the lessons observed.
- During 35% of the lessons observed, student-student interaction was highly productive and enhanced individual understanding of the lesson's content in small group, pairing, and/or whole group discussion.
- Observers rated the overall effectiveness of the implementation of the lesson on a 7-point scale, with a 7 meaning the implementation of the lesson was very consistent with best practice in investigative mathematics/science investigative teaching and learning. The chart below shows the percent of lessons receiving each rating.



Content of the Lesson. Content is concerned with the basic ideas and concepts associated with a lesson, as well as the necessary skills to accomplish the lesson tasks.

- Among 65% of the lessons observed, the content was considered very important and worthwhile. Concepts were significant and directly relevant to curriculum and what students were expected to know and do.
- During 39% of lessons observed, there was high intellectual engagement of students with the important ideas of the lesson. Students sought answers to important questions or problems, gathered appropriate information to address them, and discussed what they found with other students and the teacher.
- In 31% of the lessons science/mathematics was strongly portrayed as a dynamic body of knowledge enriched by conjecture, investigation, analysis, and justification. Tasks and activities did not lead to "canned" answers. Alternative solutions were appropriate. Students were expected to be able to defend their ideas.
- In 64% of the lessons, teachers showed a good understanding of the concepts and content of the lesson and the topical area being addressed in the lesson.
- In 43% of the lessons observed, good connections were made between concepts and content of the lesson to previous and/or future lessons in the overall curriculum unit. In 23% of the lessons, connections were made between the lesson and other areas of science/mathematics or other subjects.
- In 29% of lessons, appropriate applications of the concepts/content were made to real-world situations.

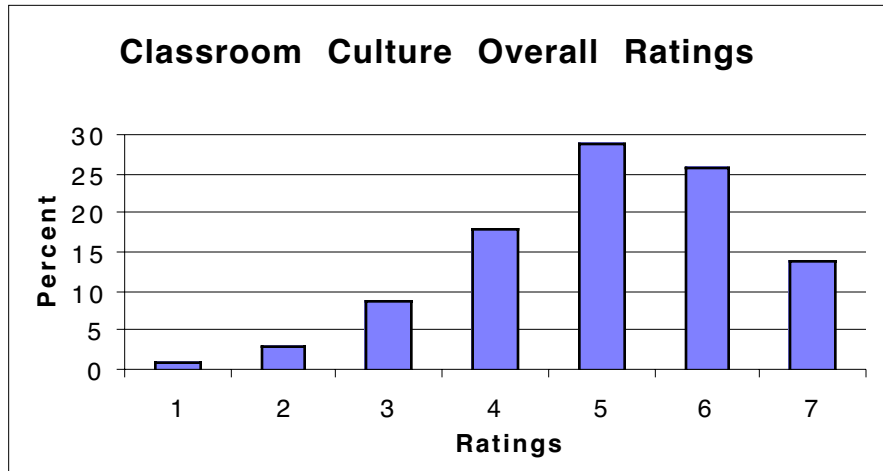
- Science/mathematical theories, algorithms, and/or scientific models were incorporated in the lesson as appropriate in 29% of the lessons. Lesson concepts were put in larger contexts; solutions to problems and answers to questions required students or the teacher to use an existing model or create one to represent their ideas.
- Observers rated overall appropriateness and quality of the content of the lesson on a 7-point scale, with a 1 meaning the content addressed in the lesson was trivial or lacking in significance (little relationship to curriculum standards and benchmarks) and a 7 meaning significant content consistent with curriculum standards and benchmarks. The chart below shows the percent of lessons receiving each rating.



□ Culture in Which the Lesson Was Conducted. This component of the lesson is related to the classroom climate, the level of engagement of students in activities and tasks, and the nature of the working relationships among students and between students and the teacher.

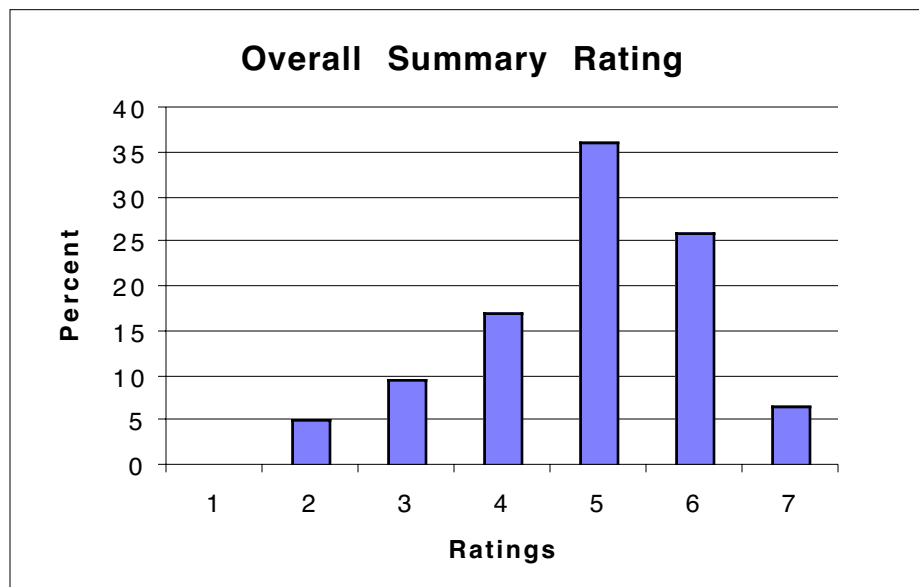
- During 52% of the lessons observed, active participation of all was encouraged and valued. All students were actively engaged in activities and tasks, with the teacher making specific efforts to engage all students.
- During 50% of lessons, teachers were very respectful of and valued students' ideas, questions, and contributions to the lesson. Ideas are accepted without making judgments; no ideas are dismissed out of hand, but students are expected to "make a case" for their ideas.
- During 40% of lessons observed, students were very respectful of and valued each others' ideas, questions, and contributions to the lesson. Ideas were not "put down." The sharing of ideas was valued.
- In 42% of the lessons observed, the classroom climate encouraged all students to generate ideas, questions, conjectures, and propositions. There was a very trusting and risk-taking atmosphere in the classroom.
- In 39% of lessons observed, student-student interactions reflected strong collaborative working relationships. Students readily worked in pairs and small groups or as teams to complete assignments and tasks.
- In 50% of lessons observed, teacher-student interactions reflected strong collaborative working relationships. The teacher and students work together to solve problems and seek answers to questions.

► Observers rated the nature and effectiveness of classroom culture in which the lesson was conducted on a 7-point scale, with a 7 meaning the culture/climate of the classroom was very supportive for student learning. The graph below shows the percent of lessons receiving each rating.



▣ Overall Summary Assessment of Lessons

► Observers gave each lesson an overall summary rating on a 7-point scale, with 7 meaning that the lesson, overall, was an excellent example of a high quality investigative lesson. The graph below shows the percent of lessons receiving each rating.



COMPARISON OF LESSONS FROM REFORM MATHEMATICS PROGRAMS AND TRADITIONAL MATHEMATICS PROGRAMS/TEACHER ASSEMBLED MATERIALS

Comparison of Lesson Ratings from Reform Mathematics Programs and Traditional Text-Based Programs/Teacher Assembled Materials. Based on the observation data above, lessons were placed in two categories: 1) Lessons from reform mathematics programs (Math Scape, Math Thematics, Math in Context, and Connected Math) and 2) Lessons from more traditional text-based programs or lessons based on teacher assembled materials (from a variety of sources, but not including reform mathematics programs). There were 53 lessons based on reform mathematics programs and 66 other lessons. Scores for the various observation criteria were compiled. Comparison of category summary ratings are shown in the graphs below.

First Column = Lessons Based on Investigative Mathematics Programs
Second Column = Lessons Based on Traditional Mathematics Programs

1 = Scores of 1 or 2 2 = Scores of 3, 4, or 5 3 = Scores of 6 or 7

