

Observing Mathematics and Science Lessons in Michigan Classrooms: An Assessment of Classroom Practice

**A Report of Findings from Observations of Mathematics and Science Lessons
in a Sample of Michigan Classrooms--2000-01 School Year
as Part of a Review and Assessment of the
Michigan Eisenhower Professional Development Program**

June 2001

□ **Background.** A review and assessment of the Michigan Eisenhower Professional Development Program began in Fall 1999. The purpose of the evaluation was to determine effects of the Michigan Eisenhower program, as well as take a "snapshot" of the status of mathematics and science teaching and learning in Michigan. In addition to requiring participation of 1999-2000 higher education grantees, local grantees and mathematics and science centers were also invited to participate.

The Michigan Department of Education identified a set of performance objectives for which evaluative information would be gathered to assess progress in mathematics and science teaching and learning in Michigan. An evaluation plan incorporating those performance objectives was developed and implemented by Science and Mathematics Program Improvement (SAMPI) at Western Michigan University. The work was conducted between November 1999 and June 2001. A variety of data collection procedures were identified, including a statewide survey of teachers who had participated in Michigan Eisenhower-funded programs provided by higher education and local grantees (including Michigan Mathematics and Science Centers), observations of mathematics and science lessons in a sample of Michigan classrooms, observation of professional development sessions conducted by higher education grantees, interviews with program directors and staff, gathering of data on the nature and extent of professional development programming provided, and information on who is served by higher education grants.

To gather information about lessons and classroom practice, it was decided to conduct observations of lessons in a statewide selection of K-12 classrooms. To accomplish this major task, representatives from higher education grantees, local and intermediate school districts, and mathematics and science centers, and other educational leaders in Michigan received two days of training on the use of a lesson observation protocol developed by SAMPI (see description below). Higher education grantees submitted lists of teachers being served by their projects. A random sample was selected and grantees were asked to conduct lessons in the classrooms of those teachers. For local grantee and mathematics and science centers, SAMPI helped design studies and determine observation samples. SAMPI also conducted lesson observations in classrooms in local school districts.

Observers completed debriefing protocols and submitted them to SAMPI for compilation and analysis. Reports based on the observations conducted by individual higher education grantees, local grantees, and mathematics and science centers were developed and returned to the projects. This report is a compilation of all observations conducted across Michigan.

□ **Organization of the Report.** This report provides background and context for the study, study methods, and what the sample of observations represents. A profile of the lessons observed is presented, followed by findings about the various lesson components. This report includes results from all observations conducted across mathematics, science, and social studies. Separate reports for mathematics and science will be available, along with other analyses.

□ **Study Methods.** A cadre of project directors, administrators, university faculty, curriculum specialists, mathematics and science center directors and staff, and teachers participated in two-day training sessions the goals of which were to: 1) learn to identify characteristics of and describe investigative science and mathematics teaching and learning, 2) develop effective skills for observing science and mathematics lessons, and 3) learn to use the SAMPI Lesson Observation Protocol for assessing science and mathematics lessons.

The SAMPI lesson 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. The purpose of the two-day training programs was 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, observers returned them to SAMPI for compilation and analysis. This report is based on the analysis of all observations conducted during the 2000-2001 school year.

□ **Sample.** A total of 323 lessons were observed between January 2000 and May 2001. All 1999-2000 Eisenhower higher education grantees working with inservice teachers were expected to conduct observations based on a random sample prepared by SAMPI from a list of all teachers being served by their project. In addition, local grantees and mathematics and science centers were invited on a voluntary basis to participate in the training sessions and then conduct observations in their schools/districts. Not all local grantees who were trained chose to conduct observations. In addition, SAMPI staff conducted observations in classrooms in a variety of local school districts across the state. The degree to which the final sample represents the whole population is hard to determine. The proportion of middle school lessons observed is higher than other grade levels. There were also more mathematics lessons observed than science. It is also important to remember that a large proportion of the lessons were conducted by teachers who have received professional development in mathematics and/or science through Eisenhower-funded programs and mathematics and science centers. Readers should see this report as a "snapshot" of lessons from a large sample of classrooms from across Michigan.

□ Profile of Lessons Observed.

➤ A total of 323 lessons were observed. Mathematics, science, and social studies lessons were observed: 221 mathematics, 90 science, and 12 social studies.

➤ Lessons were observed in classrooms from Kindergarten through 12th grade. The percentage of lessons by grade level is shown in the chart below.

Grade Level	% of Lessons
Kind	2.5%
1st	3.5%

Grade Level	% of Lessons
4th	5%
5th	9%

Grade Level	% of Lessons
9th	9%
10th	3%

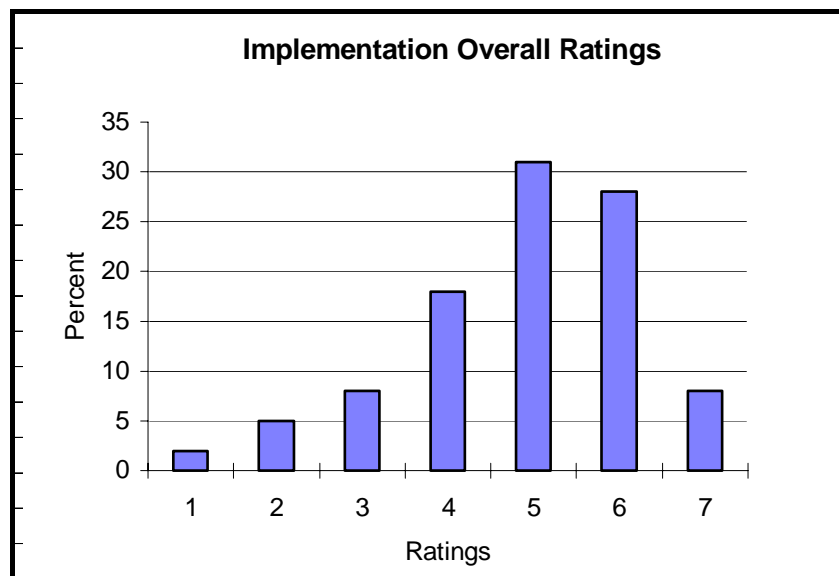
□ Assessment of Lesson Components. After observing a lesson, observers rated a series of indicators (or criteria) in four categories: 1) planning and organization of the lesson, 2) implementation of the lesson, 3) content of the lesson, and 4) classroom culture in which the lesson was conducted. There are 5 to 8 indicators in each category. These indicators represent the major valued attributes and characteristics for each based on state and national teaching standards. Indicators can be used to 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.

□ 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.

- 68% 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.
- 81% 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 72% 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.
- 73% 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.
- 55% 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 change 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.
- 46% 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.

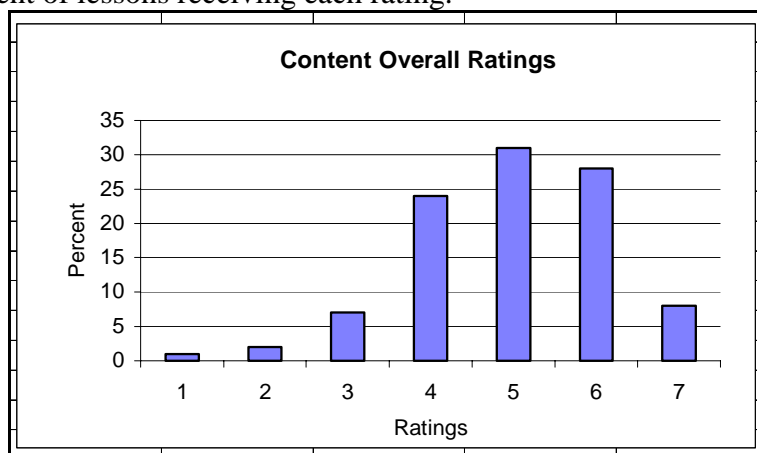
□ Implementation of the Lesson. Implementation is about how the lesson is actually carried out based on the lesson design, and teacher and student roles in it.

- In 71% 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 34% 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 49% of the lesson observed.
- During 32% 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 72% 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 32% 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 69% 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 40% 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 24% of the lessons, connections were made between the lesson and other areas of science/mathematics or other subjects.
- In 34% 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 27% 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 57% 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 57% 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.

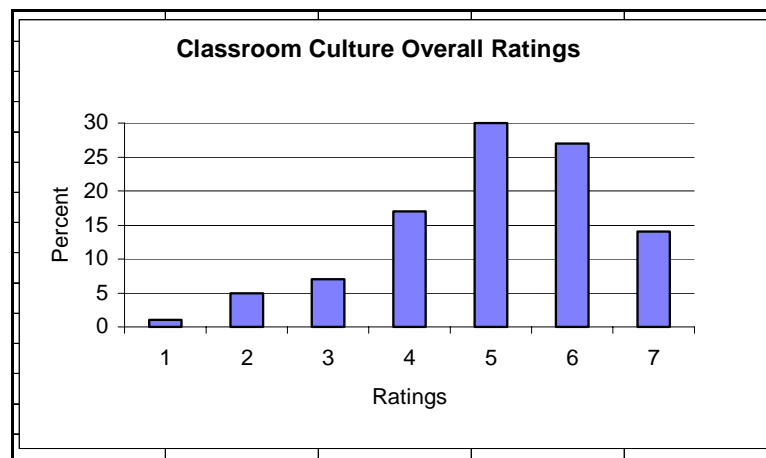
➤ During 38% of lessons observed, students were very respectful of and valued each others' ideas, questions, and contributions to the lesson. Ideas were not "put down." The sharing of ideas was valued.

➤ In 44% 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 38% 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.

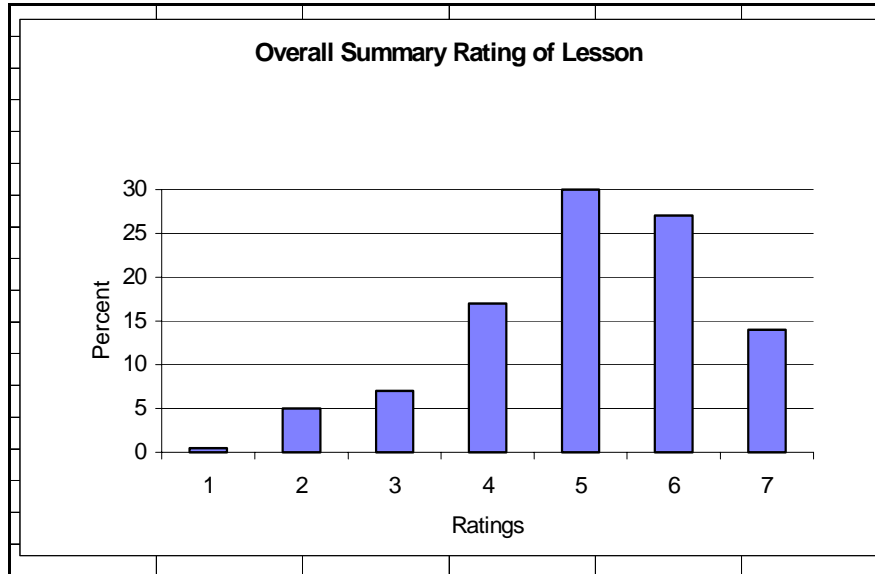
➤ In 48% of lessons observed, teacher-student interactions reflected strong collaborative working relationships. The teacher and students work together to solve problems and seek answers to questions.

➤ 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.



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