

Acknowledgements

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Mary Jean Winter, A.B., Vassar College, and Ph.D. in mathematics, Carnegie Institute of Technology, has been Professor of Mathematics at Michigan State University since 1965. She has been involved in mathematics education at both school and college (Teacher training) level since 1975. She has been especially interested in developing middle school and secondary activities using computers and other manipulatives.

Similarity and Equivalent Fractions

The Middle Grades Mathematics Project (MGMP) is a curriculum program developed at Michigan state University funded by the National Science Foundation to develop units of high quality mathematics instruction for grades 5 through 8. Each unit

- is based on a related collection of important mathematical ideas
- provides a carefully sequenced set of activities that leads to an understanding of the mathematical challenges
- helps the teacher foster a problem-solving atmosphere in the classroom
- uses concrete manipulatives where appropriate to help provide the transition from concrete to abstract thinking
- utilizes an instructional model that consists of three phases: launch, explore, and summarize
- provides a carefully developed instructional guide for the teacher
- requires two to three weeks of instructional time

The goal of the MGMP materials is to help students develop a deep, lasting understanding of the mathematical concepts and strategies studied. Rather than attempting to break the curriculum into small bits to be learned in isolation from each other, MGMP materials concentrate on a cluster of important ideas and the relationships that exist among these ideas. Where possible the ideas are embodied in concrete models to assist students in moving from the concrete stage to more abstract reasoning.

THE INSTRUCTIONAL MODEL: LAUNCH, EXPLORE, AND SUMMARIZE

Many of the activities in the MGMP are built around a specific mathematical challenge. The instructional model used in all five units focuses on helping students solve the mathematical challenge. The instruction is divided into three phases.

During the first phase the teacher *launches the* challenge. The launching consists of introducing new concepts, clarifying definitions, reviewing old concepts, and issuing the challenge.

The second phase of instruction is the class *exploration*. *During exploration*, students work individually or in small groups. Students may be gathering data, sharing ideas, looking for patterns, making conjectures, or developing other types of problem-solving strategies. It is inevitable that students will exhibit variation in progress. The teacher's role during exploration is to move about the classroom, observing individual performances and encouraging on-task behavior. The teacher urges students to persevere in seeking a solution to the challenge. The teacher does this by asking appropriate questions and by providing confirmation and redirection where needed. For more able students, the teacher provides extra challenges related to the ideas being studied. The extent to which students require attention will vary as will the nature of attention they need, but the teacher's continued presence and interest in what they are doing is critical.

When most of the students have gathered sufficient data, they return to a whole class mode (often beginning the next day) for the final phase of instruction, *summarizing*. Here the teacher has an opportunity to demonstrate ways to organize data so that patterns and related rules become more obvious. Discussing the strategies used by students helps the teacher to guide them in refining these strategies into efficient, effective problem-solving techniques.

The teacher plays a central role in this instructional model. The teacher provides and motivates the challenge and then joins the students in exploring the problem. The teacher asks appropriate questions, encouraging and redirecting where needed. Finally, through the summary, the teacher helps students to deepen their understanding of both the mathematical ideas involved in the challenge and the strategies used to solve it.