

## Mathematically Connected Communities (MC<sup>2</sup>) Rationale for Program Recommendations

**Rationale:** MC<sup>2</sup> supports programs that are field tested and shown to address higher level thinking skills (beyond skills and procedures) in students' learning of mathematics. The programs supported by the MC<sup>2</sup> project emphasize the following components:

### Mathematics Content

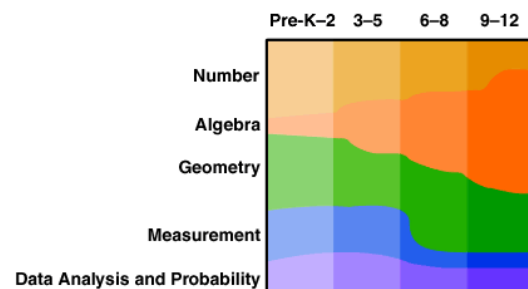
**The program's content reflects the problem solving nature of mathematics and the thinking that mathematicians use.** The mathematics is developed from problem situations. Situations are sufficiently simple to be manageable but sufficiently complex to provide for diversity in approach. They are amenable to individual, small group, or large group instruction; involve a variety of mathematical domains; and are open and flexible as to the methods to be used.

**The program makes connections within mathematics and between disciplines.** The program approaches mathematics as a whole. Concepts, procedures, and intellectual processes are interrelated through specific instructional activities designed to connect ideas and procedures among the different mathematical topics, with other content areas and to life situations.

**Mathematics as communication and representation are built into the program.** Students have many opportunities to use language to communicate their mathematical ideas. The program asks students to explain, conjecture, and defend their ideas orally and in writing. As students mature and develop, the program expects students' mathematical communication to become more formal and symbolic. The student is asked to form multiple representations of ideas, express relationships within and among representations systems, and formulate generalizations. The program asks students to create and use representations to organize, record, and communicate mathematic ideas.

**Mathematics as reasoning and proof are built into the program.** Throughout the program, students are asked to explain and justify their thinking and to question the statements of other students and the teacher. As students mature, the program asks students to do both inductive and deductive reasoning. In Grades 9-12, the program expects mathematically mature students to use informal and formal arguments to support conclusions.

**The program is comprehensive and includes the mathematics content emphasized in the New Mexico Standards & Benchmarks at each level.** The program redistributes the emphases from a major focus on number and operations in all pre high-school grades to the inclusion of roots of algebra, geometry, measurement and data analysis and probability. The program aligns with local, state, and national standards: including an appropriate balance of all five content strands: number & operations, algebra, geometry, measurement, data analysis & probability:



**Figure 1:** Content Standards Emphases across grade bands (from NCTM: Principles & Standards for School Mathematics, 2000)

### Instructional Design and Student Experiences

**The program's learning goals are clear and explicitly stated and the students are engaged in worthwhile mathematical tasks that build deep understanding and provide in-depth exploration of concepts.** The tasks do not separate mathematical thinking from mathematical concepts or skills; they capture students' curiosity and invite them to speculate and to pursue their hunches. Many tasks require that the students reason about different strategies and outcomes, weigh the pros and cons of alternatives, and pursue particular paths.

**The program is designed so that students are active learners and expected to construct their own understanding of mathematics.** Students are expected to read, write, and discuss mathematics. The program asks students to conjecture, test, and build arguments about a conjecture's validity. Students are asked to reason about different strategies and outcomes. The program recognizes that students approach a new task with prior knowledge and encourages students to use natural language and informal processes.

**The program is designed for students to use manipulatives and/or technology to explore mathematical ideas, model mathematical situations, analyze data, calculate numerical results and solve problems.** Students learn appropriate use of tools and when to use them.

### Teacher Role

**The instructional materials provide suggestions to teachers so that in tasks and lessons teachers can help students to:**

- work together to make sense of mathematics;
- rely more on themselves to determine whether something is mathematically correct;
- reason mathematically;
- learn to conjecture, invent, and solve problems;
- connect mathematics, its ideas, and its applications to other topics within mathematics and to other disciplines; and
- explain their thinking and reasoning.

**The instructional materials provide suggestions to teachers for establishing a classroom learning environment focused on sense making and for facilitating learning by all students.** Teachers are provided suggestions on how to:

- structure the time so students can grapple with significant mathematical ideas and problems;
- use physical space and materials in ways that facilitates student learning;
- assist students to work together collaboratively, as well as independently.

### Assessment

**Student assessment is integrated into the instructional program.** Conceptual understanding and procedural knowledge are frequently assessed through tasks that ask students to apply information about a given concept in novel assessment activities that are similar to learning activities. Assessment activities examine the extent to which students have integrated and made sense of mathematics concepts.

- Multiple means of assessment are used, informal as well as formal.
- Suggestions are provided for assessing students, individually or in small groups, through observations, oral and written work, student demonstrations or presentations, and student self-assessment.