

Assessment Dimensions

Assessment in *Connected Mathematics* is an extension of the learning process, as well as an opportunity to check what students can do. For this reason, the assessment is multidimensional, giving students many ways to demonstrate how they are making sense of the mathematics.

The *Curriculum and Evaluation Standards for School Mathematics* (NCTM, 1989), the *Assessment Standards for School Mathematics* (NCTM, 1995), and the *Principles and Standards for School Mathematics* (NCTM 2000) provide guidelines that describe mathematics education in schools, not only in terms of mathematical objectives, but in terms of the methods of instruction, the processes used by students in learning and doing mathematics, and the students' disposition towards mathematics. Assessment in *Connected Mathematics* is designed to collect data concerning these three dimensions of student learning:

Content knowledge

Assessing content knowledge involves determining what students know and what they are able to do.

Mathematical disposition

A student's mathematical disposition is healthy when he or she responds well to mathematical challenges and sees himself or herself as a learner and inventor of mathematics. Disposition also includes confidence, expectations, and metacognition (reflecting on and monitoring one's own learning).

Work habits

A student's work habits are good when he or she is willing to persevere, contribute to group tasks, and follow tasks to completion. These valuable skills are used in nearly every career. To assess work habits, it is important to ask questions, such as "*Are the students able to organize and summarize their work?*" and "*Are the students progressing in becoming independent learners?*"

The NCTM *Principles and Standards 2000* reinforces the CMP philosophy on assessment. Its Assessment Principle states:

Assessment should support the learning of important mathematics and furnish useful information to both teachers and students.

Assessment Tools

Connected Mathematics provides a variety of tools for student assessment. These assessments fall into three broad categories:

Checkpoints

Some of the assessment tools—such as ACE assignments, notebooks, Mathematical Reflections, and the Unit Review—give teachers and students an opportunity to check student understanding at key points in the unit. Checkpoints help students solidify their understanding, determine the areas that need further attention, and help teachers make decisions about whether students are ready to move on. The “Check for Understanding” feature of some summaries gives students and teachers an additional checkpoint on students progress.

Surveys of Knowledge

Check-ups, quizzes, unit tests, and projects provide teachers with a broad view of student knowledge both during a unit and at the end of a unit.

Observations

The curriculum provides teachers with numerous opportunities to assess student understanding by observing students during group work and class discussions. This form of assessment is important, since some students are better able to show understanding in verbal situations than in formal, written assignments. Teachers may also receive feedback from parents—who may comment on their child's enthusiasm or involvement with a particular problem—and from students who may observe that another student's method is more efficient or useful, or who may offer an important observation, conjecture or extension. More information about each assessment tool is given below.

Checkpoints

ACE By assigning ACE exercises as homework, teachers can assess each student’s developing knowledge of concepts and skills.

Notebooks and Notebook Checklist Many teachers require their students to keep organized notebooks, which include homework, notes from class, vocabulary, and assessments. Each unit includes a checklist to help students organize their notebooks before they turn them in for teacher feedback. Teachers can also assess student understanding during their study of the unit by examining their work or summaries for particular problems.

Mathematical Reflections A set of summarizing questions, called Mathematical Reflections, occurs at the end of each investigation. These questions can help teachers assess students’ developing conceptual knowledge and skills in the investigation. (See page 70.)

Looking Back and Looking Ahead This Unit Review feature includes two to four problems that ask students to explain their reasoning. Collectively, the pieces have students summarize and connect what they have learned within and across units. This component can be used as a review, helping students to stand back and look at the “big” ideas and connections in the unit. (See page 71.)

Surveys of Knowledge

Check-ups Check-ups are short, individual assessment instruments. Check-up questions tend to be less complex and more skill-oriented than questions on quizzes and unit tests. These questions provide insight into student understanding of the baseline mathematical concepts and skills of the unit. Student responses to Check-ups can help teachers plan further instruction for the unit.

Partner Quizzes Each unit has at least one partner quiz. Quiz questions are richer and more challenging than checkup questions. Many quiz questions are extensions of ideas students explored in class. These questions provide insight into how students apply the ideas from the unit to new situations. The quizzes were created with the following assumptions:

- Students work in pairs.

- Students are permitted to use their notebooks and any other appropriate materials, such as calculators.
- Pairs have an opportunity to submit a draft of the quiz for teacher input. They may then revise their work and turn in the finished product for assessment.

Unit Tests Each unit includes a test that is intended to be an individual assessment. The test informs teachers about a student’s ability to apply, refine, modify, and possibly extend the mathematical knowledge and skills acquired in the unit. Some of the questions draw on ideas from the entire unit, while others are smaller, focusing on a particular idea or concept. Some of the questions are skill oriented, while others require students to demonstrate problem-solving abilities and more in-depth knowledge of the unit concepts. Teachers can use holistic scoring techniques and rubrics that take into account the many dimensions addressed by the test.

Self-Assessment After every unit, students complete a self-assessment, summarizing the mathematics they learned in the unit and the ideas with which they are still struggling. The self-assessment also asks students to provide examples of what they did in class to add to the learning of the mathematics. The goal of this activity is to have students reflect on their learning. For many students, self-assessment is a new experience, and they may struggle with this at first. However, by receiving feedback from teachers and using other students’ work as models, students can learn to reflect on their own progress in making sense of mathematics.

Project At least four units in each grade include projects that can be used to replace or supplement the unit test. Projects give teachers an opportunity to assign tasks that are more product/performance-based than those on traditional tests. Project tasks are typically open-ended and allow students to engage in independent work and to demonstrate broad understanding of ideas in the unit. Through students’ work on the projects, teachers can gather information about their disposition toward mathematics. Project guidelines, student examples, and scoring rubrics appear in the Assessment Resources section for the unit. The table on the next page gives locations and descriptions of projects by grade level.

Question Bank A bank of questions is provided for each unit. Teachers may use these questions as homework problems, as class investigation problems, or as replacements for quiz and check-up questions.

Some of these questions give students an additional opportunity to work on problems similar to those in the unit, while others extend the ideas of the unit.

Unit Projects by Grade

| Grade 6 | Grade 7 | Grade 8 |
|---|---|---|
| <p>Prime Time PROJECT: My Special Number Students choose a “special number” and use all they have learned in the unit to describe mathematical properties and real-world applications or occurrences of their numbers.</p> <p>Shapes and Designs PROJECT: What I Know About Shapes and Designs Students create representations of what they have learned about various polygons, the relationships of their sides and angles, and where these shapes can be found in their world.</p> <p>Covering and Surrounding PROJECT: Plan a Park Students create scale drawings for a park that meet given constraints and submit a written proposal highlighting the features of their parks.</p> <p>Bits and Pieces III PROJECT: Ordering From a Catalog Students select items from a catalog and fill out an order form, calculating shipping, tax and discounts.</p> <p>Data About Us PROJECT: Is Anyone Typical? Students apply what they have learned in the unit to gather, organize, analyze, interpret, and display information about the “typical” middle school student.</p> | <p>Stretching and Shrinking PROJECT: Shrinking or Enlarging Pictures Students shrink or enlarge a drawing or photograph by hand. They then analyze the relationships among the lengths, areas, and angle measurements of the original and those of the new drawing.</p> <p>PROJECT: All-Similar Shapes Students analyze a variety of shapes to determine which shapes are always mathematically similar to other shapes of the same kind.</p> <p>Comparing and Scaling PROJECT: Paper Pool Students look at several simplified pool tables to determine the number of hits a ball will make before it goes into a pocket and the pocket in which it lands. They use their results to make predictions for other tables.</p> <p>Filling and Wrapping PROJECT: Package Design Contest Students design packages for table-tennis balls, calculate the costs of their packages, and justify the designs of their packages.</p> <p>What Do You Expect? PROJECT: The Carnival Game Students design carnival games and analyze the probabilities of winning and the expected values. They then write a report explaining why their games should be included in the school carnival.</p> <p>Accentuate the Negative PROJECT: Dealing Down Students apply what they have learned to a game. They then write a report explaining their strategies and their use of mathematics.</p> <p>Moving Straight Ahead PROJECT: Conducting an Experiment Students collect data about dripping water or rebounding balls and make predictions based on their data.</p> | <p>Growing, Growing, Growing PROJECT: Half-Life Students use cubes to simulate the radioactive decay of a substance and estimate its half-life. They then create a new situation involving radioactive decay and design and carry out their own simulation.</p> <p>Kaleidoscopes, Hubcaps and Mirrors PROJECT: Making Tessellations Students analyze the symmetries of various tessellations and create their own tessellations.</p> <p>PROJECT: Making a Wreath and a Pinwheel Students make an origami wreath and transform it into a pinwheel. They investigate and describe the symmetries of their creation at various stages.</p> <p>Say It With Symbols PROJECT: Finding the Surface Area of Red Stacks Students find the volume and surface area of stacks and rods. They look for patterns and then apply what they have learned about writing algebraic expressions to describe patterns that they observe and verify the equivalence of those expressions.</p> <p>Samples and Populations PROJECT: Estimating a Deer Population Students simulate a capture-recapture method for estimating deer populations, conduct some research, and write a report.</p> |

Observations

Group Work Many problems provide the opportunity to observe students as they “do mathematics,” applying their knowledge, exhibiting their mathematical disposition, and displaying their work habits as they contribute to group tasks.

Class Discussions The summary portion of each problem and the Mathematical Reflections at the end of each Investigation provide ongoing opportunities to assess students’ understanding through class discussions.

Students and Parents Through Self Assessments, Partner Quizzes, group work, and class discussions, students have the opportunity to observe and

assess their own content knowledge, mathematical disposition, and work habits. Parents may also observe their child’s progress, disposition, and work habits and share them with the teacher.

Summary of Assessment Dimensions and Tools

Finally, this chart summarizes the assessment tools in *Connected Mathematics* and the dimensions addressed by each assessment item.

| Assessment Tool | Assessment Dimension | | |
|--------------------------------|----------------------|--------------------------|-------------|
| | Content Knowledge | Mathematical Disposition | Work Habits |
| Checkpoints | | | |
| ACE | ✓ | ✓ | ✓ |
| Notebooks | ✓ | ✓ | ✓ |
| Mathematical Reflections | ✓ | ✓ | ✓ |
| Looking Back and Looking Ahead | ✓ | ✓ | ✓ |
| Surveys of Knowledge | | | |
| Check-ups | ✓ | | |
| Partner Quizzes | ✓ | ✓ | ✓ |
| Unit Tests | ✓ | | |
| Self-Assessment | ✓ | ✓ | ✓ |
| Project | ✓ | ✓ | ✓ |
| Question Bank | ✓ | | |
| Observations | | | |
| Group Work | ✓ | ✓ | ✓ |
| Class Discussions | ✓ | ✓ | ✓ |
| Students and Parents | ✓ | ✓ | ✓ |