

Winnipeg School Division

Understanding Classroom Assessment

TIPS

Planning Classroom Assessment.

When teachers plan any classroom assessment, they must consider many different questions. How will they be certain that students clearly understand the learning targets? What are the criteria [Briars; Sowder; Thompson] for good work? What strategies might students use in completing assessments? How might students communicate what they are learning? What are strategies to involve students in goal setting and self-assessment? What assessment strategies will give the most information about students' achievement of the learning targets? How can mathematics be embedded in a variety of contexts during assessments?

Teachers do have a variety of classroom assessment strategies to use: portfolios, interviews, questioning, journaling, projects, etc. These strategies are also becoming increasingly familiar to teachers. But it seems likely that many teachers do not know enough about the differences in the quality of information that these different strategies generate [Sowder]. One of the key questions for teachers is deciding what to assess [Richardson; Spresser]. Teachers have to decide what they think is the most important mathematics for students to learn. One approach is identifying the "big ideas" in mathematics. For example, fluency with numbers seems to be one of the big ideas across much of mathematics instruction. But teachers also have to decide what it means for students to "understand" mathematics.

It is also important to consider whether the types of effective classroom assessment strategies change as teachers gain experience. Certainly the range of strategies will increase during a teacher's career, but there may be some "elementary" strategies (e.g., asking the questions of "Why?" and "How?") that yield information that is useful to beginning teachers and "advanced" strategies (e.g., using different questions to probe a student's ability to communicate versus probing a student's ability to understand a mathematical process) that yield information that is useful to more experienced teachers. Even experienced teachers who are changing their classroom assessment strategies may find that early in the change process one type of strategy is effective, whereas later in the change process a different type of strategy is effective. Much more needs to be known about the process of development as an effective classroom assessor.

Communicating expectations and outcomes of assessment. Part of every implementation of classroom assessment is the communication of expectations (i.e., feed forward) and progress toward goals (i.e., feedback). Communication with students [Sowder] can proceed in any of the following ways:

- Show students standard-setting performances and have them discuss why they are high quality.
- Show and discuss the criteria used to judge performance.
- Have students judge each other's work using criteria (e.g., in the form of a rubric) and provide feedback to each other.
- Allow students to be part of the judging/standard-setting process as early as possible in their education within and across grades.
- Give students tools and opportunities to become self-assessors.
- Allow students to gain ownership of expectations through goal setting.
- Allow students to monitor their own progress by posting their problem solving, writing, etc., so that performance is shared among all students.
- Talk to the students and have students talk to each other about their understanding. Indeed, one job of teachers after they listen to students is to help students listen to each other.
- Give feedback, frequently and in a timely manner, on what students can do to improve their performance.

Student Self-Assessment

Teachers almost always assess what students know and what they can do. In the workplace, an employee's performance review (also called an evaluation or an assessment) usually begins with a self-assessment. The employee is expected to reflect on her or his performance and present evidence of how that performance meets or exceeds their goals and enhances the mission of the organization. Allowing students to assess their own performance provides them with a valuable experience that they will encounter at some point in the workplace.

In addition to providing a connection to future work, student self-assessment provides an opportunity for exercising metacognitive skills-thinking about their own thinking and learning, reflecting on what and how they learn. Here are several suggestions for employing student self-assessment with your classes.

Project Self-Assessment

A group of students has been assigned a project. To encourage self-assessment, pose the following summative task to the group:

Your group has completed its project and received \$1,000 for doing so. Now you must decide how much each member of the group is to be paid from that \$1,000 and explain why each should receive that amount. If each is to receive an equal amount, describe the work done by each member and how each is equal. Explain clearly the amount each member is to receive and why. First do this individually, then negotiate as a group and submit a recommendation with which all group members agree.

Task Self-Assessment

After they have completed a learning task (such as one of the activities in this Y2K unit), ask each student to think about what he or she did and learned. Have each student fill out a rubric you design.

Unit Self-Assessment

To assess student conceptual understanding of a unit and to trace progress of student thinking, hand out a self-assessment rubric at the beginning of a unit, then periodically allow students to add or change the connections. At the end of the unit, have students think back on what they've learned and create a final diagram.

Related Resources:

Clarke, David. "Assessment Alternatives in Mathematics." Mathematics Curriculum and Teaching Project, Canberra, Australia. NCTM, 1998.

North West Regional Education Lab. "Caity's Conference." Education Magazine. Fall 1996.
http://www.nwrel.org/nwedu/fall_96/article4.html

Student Self-Assessment Project
[Http://www.projectzero.harvard.edu/Research/StuSA.htm](http://www.projectzero.harvard.edu/Research/StuSA.htm)

Developing Meaningful Self-Assessment

Assessment of students, in contrast to grading, should be designed to provide the teacher and the student with information that they can use to guide or improve teaching and, subsequently, learning. Assessment of teachers and teaching should also be done for the purpose of providing a guide and framework for further professional development. The following are a few tips to help you develop a meaningful self-assessment program:

- **Find a partner with whom to undertake this process.**

This person might be an administrator or a fellow teacher. Be sure that everyone understands that the goal of the assessment is to improve as a teacher. Develop a relationship in which you help each other improve your teaching.

- **Develop a set of teaching goals for yourself.**

These goals will serve as guides for the assessment. They should focus the attention on the acts of teaching and learning, not on the person.

- **Work to collect data over time in a range of setting and situations.**

Teaching happens in diverse settings. Your partner may need to make time to observe you or capture your teaching on videotape to review it later.

As you reflect on the observations or videotape of your lesson, here are a few questions that might help you in the assessment process:

- a. What were my goals for this lesson?
- b. What activities did I do to achieve these goals?
- c. To what extent did the activities work to achieve my goals?
- d. Are there other activities that may have had a better chance of achieving the goals?
- e. Was there anything unusual about the lesson or how the students reacted that I should note?
- f. Are there any questions that I wish I had asked, but did not?
- g. Knowing what I know now, if I had the chance to go back in time to teach the lesson again to these students, what would I do differently?

As you plan for subsequent lessons, think about your answers in the previous section. Use these ideas to improve your responsiveness to the teaching environment and to your students so that you can improve as a teacher.

- **Do not hurry**

Good teaching takes time to develop, and meaningful reflection is difficult. Substantive change takes time. If you stay with it, you will see improvements in the quality of your teaching and your students' learning.

Adapted from:

Koss, R., & Marks, R. (1994). "The Teacher and Evaluation." Mathematics Teacher. Reston, VA: National Council of Teachers of Mathematics.

The Do's and Don'ts of Questioning

What do you say when a student is stuck? How do you frame your questions to help students understand what to do? More importantly, how do you ask questions so that students learn the mathematics rather than follow a routine? There are real differences among concentrating on following instructions, trying to figure out what someone else did, and approaching a problem all on your own. Students come away with a very different understanding in each situation.

Do ask:

What do you think?
What can you observe just from reading the problem?
What do you know? Does what you know seem useful?
Is there another way to think about the problem?
What are your thoughts, or, What are you thinking?
What do you think will happen next?
What do you understand about fractions?
What do you need to know to find an area?
Have you tried drawing a picture?
Have you ever seen a problem like this before?

Don't ask:

What is the formula?
What is the radius?
Do you see where to put the numbers?
What is the order of operations?
What do you do first?
Can you remember how to add fractions?

Don't say:

Here is what you need to do.

Students will have a hard time at first when you deflect their questions with one of your own. But remember, your goal is to have students who can solve problems when you are not there to answer their questions!

What Is a Good Question?

A major aspect of effective teaching is the creation of assessment opportunities. Classroom questioning, both written and oral, offers the mathematics teacher a wealth of assessment information.

Classroom questioning is one of the most fundamental teaching skills. Some questions are simply better than others in revealing the level of student understanding. Through the questioning process, teachers and students establish a dialogue from which the teacher can draw very specific conclusions regarding the relative competence of individuals in the classroom.

A "good question" possesses three features:

1. It requires more than recall of a fact or reproduction of a skill.
2. It has an educative component; that is, the pupil will learn from attempting it, and the teacher will learn about the pupil from the attempt.
3. It is, to some extent, open; that is, there may be several acceptable answers.

- **Some examples:**

What is the area of a rectangle with a perimeter of 20 cm?

A set of 3 test scores has a mean of 11.2. If one of the numbers is 7.6, what are the other two?

What number when rounded becomes 5.8? Is this the only possible answer? What is the highest possible answer? The lowest? How many possible answers are there?

- **A good question also has these features:**

1. It is clear.
2. Everyone can make a start.
3. It makes it clear to both pupil and teacher when the pupil's learning is incomplete, or when the level of expectation is achieved.

Pupils with a clear understanding will be able to solve the task.

Testing Higher-Level Thinking Skills

Students and teachers need regular and constant feedback to better assess student progress in mathematics. Consider giving short quizzes on individual topics to assess the level of mastery the students have achieved.

To best assess student progress, these quizzes should cover low, medium and high level thinking skills. Educational psychologist Benjamin Bloom identified six levels of cognitive thinking, also known as Bloom's Taxonomy. These six levels and the verbs that describe the intellectual activity associated with each level are as follows:

- Knowledge: memorize, name, recognize, repeat, recall, define
- Comprehension: describe, discuss, explain, restate, translate
- Application: apply, demonstrate, illustrate, interpret
- Analysis: analyze, categorize, compare, contrast, distinguish
- Synthesis: arrange, create, develop, design, formulate
- Evaluation: assess, defend estimate, judge, predict, rate, support

Developing a short quiz of 3 or 4 questions that incorporates a range of these levels will help teachers assess each student's mastery of the topics covered. Students can use this information to pinpoint their areas of weakness. Quizzing students on higher level thinking skills allows teachers to distinguish whether a student's difficulties lie in the understanding a mathematical concept, or whether it lies in the real world application of the mathematical concepts. Based on the quiz results, teachers can decide on the necessity of spending additional class time discussing a certain topic.

In the sample quiz below, note the range of levels of cognitive learning are covered. Each problem is labeled with its corresponding level of thinking to help students identify areas of weakness.

Level 1: Knowledge: Solve: 4×8 .

Level 3: Application: Matt bought three boxes of pencils. There are 12 pencils in each box of pencils. How many pencils did Matt buy?

Level 5: Synthesis: Write a word problem to illustrate when you would multiply. Solve your word problem.

Level 6: Evaluation: Rachael was studying for a math test. She discovered that when she solved the following problems, 4×5 and 5×4 , she got the same answer. Use an illustration to show why she got the same answer.

Resources:

Learning Skills Program - Bloom's Taxonomy

<http://www.coun.uvic.ca/learn/program/hndouts/bloom.html>

Open-Ended Questions

An open-ended question allows students to respond in a variety of ways.

There is a distinction between open-response question and open-ended questions:

- **Open-response questions:** the test writer sets forth a problem or a set of steps leading to a particular answer.
- **Open-ended questions:** the student has the opportunity to give a variety of successful responses, and the teacher's evaluation applies to the different paths to the solution rather than the answers themselves.

The important quality in the open-ended question is the ability to see the student's thinking rather than the test-writer's thinking.

Creating Open-ended Questions

- When using an arithmetic operation, ask students to explain, in writing or with a diagram, what that operation means and how it works.
- Add the statement "Explain how you arrived at your answer." to word problems from the textbook.
- Include questions that prompt additional thinking rather than asking for the answer to the existing problem.
- Change the directions and answers given to students so that whenever possible the students are explaining their work.
- Look for opportunities that invite students to formulate hypotheses, write directions, make generalizations, and so forth.

Sample Open-ended Questions

What is the problem about? What can you tell me about the problem?

How would you interpret that?

Please explain that in your own words?

Is there something missing or something that can be eliminated?

Where could you find the needed information?

Would it help to draw a diagram or make a sketch?

What is the relationship of this to that?

Is there a pattern?

Can you write another problem related to this one?

Have you tried making an estimate?

What else have you tried?

Give me another problem. Is there an easier problem?

Please reword that in simpler terms.

Which words were most important? Why?

What do you predict will happen?

How do you feel about your answer?

What do you need to do next?

What have you accomplished?

What were the mathematical ideas in this problem?

What was one thing you learned (or two, or more)?

How did you know you were finished?

Is that the only possible answer?

How could you help another student without telling them the answer?

Did you work together? In what way?

Other than retracing your steps, how can you determine if your answers are appropriate?

Open ended questions are one technique to get "inside the student's head" to see what they are thinking, rather than concentrating on just one answer.

Multiple Choice Tests

Teachers use multiple choice questions to quickly and inexpensively determine whether students have mastered certain knowledge and skills. Multiple choice tests have fallen from favor recently because they usually measure procedural knowledge and factual recall. Well-designed multiple choice questions can measure mathematical understanding beyond procedural knowledge. You can also design multiple choice questions that overcome some of the limitations of the guessing factor. However, multiple choice questions do limit your ability to judge the depth and sophistication of a student's grasp of many crucial mathematics ideas.

The criteria of well-designed multiple choice tests:

- can assess conceptual understanding, procedural knowledge, or problem solving
- can test recognition of examples of concepts and require that students identify numbers, objects, or data having certain properties
- should not be workable by simply substituting values, estimating measurements, or comparing sizes in graphics supplied
- should contain distracters that shed light on what students know or do not know about mathematics
- should not contain distracters that offer alluring possibilities designed to trick students
- can be used when an item might require a drawing, graph, or construction of a figure too complicated and/or time consuming to do by hand
- should require students to read, reflect, or compute and then select the choice that best expresses what they believe to be the answer

Examples:

1. Non routine question for a routine percentage problem.

Which of the following is true about 87 percent of 10?

- A. It is greater than 10.
- B. It is between 9 and 10.
- C. It is less than 9.
- D. Can't tell from the information given.

This item does not allow the student to plug in values to determine the solution but forces them to have to think about what each alternative means in relation to the problem.

2. Testing the understanding of a mathematical relationship.

A straight line on a graph passes through the points (3,2) and (4,4). Which of these points also lies on the line?

- A. (1,1)
- B. (2,4)
- C. (5,6)
- D. (6,3)
- E. (6,5)

In this question, the students must bring together their conceptual understanding of linearity and its properties combined with their procedural knowledge involving lines or slope.

3. The following is an example of a poorly designed question.

Solve: $3x - 5 = 19$ for x .

- A. $x = 2$
- B. $x = 5$
- C. $x = 8$
- D. $x = 4$

This question is poorly designed because students can find the solution by substituting each choice into $3x - 5$ and evaluating. It shows whether a student understands what it means to "solve," but it does not allow you to determine whether students can actually solve an equation.

Reference: Item and Test Specifications for the Voluntary National Test in 8th-Grade Mathematics, The Mathematics Committee Recommendations to the National Test Panel, October 1997, Copy right 1997 by MPR Associates, Inc. p. 61–63.