Enclosures for Packet #2

 *indicates that this document should be photocopied by the Site Leader and distributed to all participants. This icon will also appear in the upper right hand corner of all pages that should be copied.*

Workshop Materials

Worksheets for Workshops #1 and #2

Workshop #1
February 24, 1998 • Content Guide–Michael Hibbard

Will This Be on the Test?

Knowing vs. Understanding

Worksheets for Workshop #1 can be found on pages W1-W41.

Pre-Workshop Assignment for Workshop #1

* Please notes that this assignment is *slightly different* from the previous instructions given in Packet #1 (p. 1- 32). The differences are indicated in bold.

1. **During the course of this eight-week series, you will have an opportunity to try new assessment strategies with a set of lessons that you plan to teach later in the spring. Come to the workshop with a specific unit in mind that you want to work on.**

2. **From the unit you have selected,** choose a project or open-ended task that requires students to use math or science content they learn in your class. This project or task can be anything from a one-day assignment to a three-week project. The idea is to bring a lesson from your own curriculum that will have meaning to you.

3. Please answer the following question:

   What is the science or math content that you want your students to understand as a result of the project or open-ended task you have chosen?

4. Please bring a set of math or science standards with you to the first workshop. These may be standards that you currently use, or they may have been used to help shape your curriculum. They may have been developed by your school, your district, or your state, or they may be from one of the national standards groups.

   Groups in the United States who have developed standards include:

   - The National Council of Teachers of Mathematics (NCTM)
   - The National Assessment of Educational Progress (NAEP)
   - The National Science Teachers Association (NSTA)
   - The American Association for the Advancement of Science (AAAS)
   - The New Standards Project

   You will be using your standards throughout Workshop #1, as well as for some of the subsequent workshops, so we recommend that you bring them with you to every workshop.

About the Workshop

What is important for students to understand about science and math? How do we judge the depth of their understanding? Starting from content standards in science and math, we will examine strategies for creating classroom performance tasks that serve two purposes: helping your students learn, and helping you assess their level of understanding. These performance tasks require the student to demonstate content information, thinking skills, communication skills, and work habits.

Suggested Strategies For Assessing Understanding

1. With reference to the worksheet about what we mean by understanding called *Dimensions of Understanding* (p. W-1), find projects or performance tasks that you use that relate to some of the 10 aspects of understanding on the list.

2. Refer to the project or open-ended task that you chose in item 2 of the pre-workshop assignment, and the science or math concept that you identified in item 3. Select one aspect of understanding of the science or math concept. How does the project or task get at this understanding?

3. Using the worksheet entitled *Action Verbs Define Thinking Skills* (p. W-5), identify the verbs that you use most often in your projects or performance tasks. Select two other verbs from the list to use in your upcoming project or performance task.

4. Decide on the format or formats for the final product of your project or performance task. Categorize those formats according to writing, constructions, oral presentation, graphics, multimedia, or other.

Post-Workshop Discussion Questions

1. On the *Dimensions of Understanding*, (p. W-1) list, which types of understanding should be given more attention. How would you do that?

2. Do the projects or performance tasks you do with your students seem to be worth the time they take? Are those projects or tasks well-connected to the important content of your course? Are the length and complexity of the project or task usually worth the information you gain about how well students understand the math or science content? How could you improve the quality of your projects or tasks?

3. If you had the feeling that a student really had deep understanding of the math or science

content, but was not able to express that understanding through your projects or tasks, what would you do?

4. It has been said that writing is the most important way to show what you know. What are some arguments for and against that position?

Related Resources

Archbald, D. & Newmann, F. (1988). *Beyond Standardized Testing: Assessing Authentic Achievement in the Secondary School.* Reston, VA: National Association of Secondary School Principals (NASSP).

Bredekamp, S. & Rosegrant, T. (Eds.) (1992). *Reaching Potentials: Appropriate Curriculum and Assessment for Young Children.* Washington, DC: National Association for the Education of Young Children (NAEYC).

Brandt, R. (Ed.) (1992). *Readings from Educational Leadership: Performance Assessment.* Alexandria, VA: Association for Supervision and Curriculum (ASCD).

Burke, K. (1993). *How to Assess Thoughtful Outcomes.* IRI/Skylight Publishing: Palatine, IL.

Congress of the United States (1992). *Testing in American Schools: Asking the Right Questions.* Washington, DC: Office of Technology Assessment.

Curriculum and Evaluations Standards for School Mathematics (1989). Reston, VA: National Council of Teachers of Mathematics (NCTM).

Diez, M., Castenell, L., Wegener-Soled, S., Galluzzo, G., Hinkle, D., Murray, F., Trentham, L., & Kunkel, R. (1993). *Essays on Emerging Assessment Issues.* Washington, DC: American Association of Colleges for Teacher Education (AACTE).

ERIC Review (Winter 1994). *Performance-Based Assessment.* Washington, DC: Educational Resources Information Center (ERIC).

Hammond, L.D., Ancess, J., and Falk, B. (1995). *Authentic Assessment in Action: Studies of Schools and Students at Work.* New York, NY: Teachers College Press.

Hart, D. (1994). A*uthentic Assessment: A Handbook for Educators.* Menlo Park, CA: Addison-Wesley Publishers.

Herman, J., Aschbacher, P., and Winters, I. (1992). *A Practical Guide to Alternative Assessment.* Alexandria, VA: Association for Supervision and Curriculum Development.

Marzano, R., Pickering, D., and McTighe, J. (1993). *Assessing Student Outcomes: Performance Assessment Using the Dimensions of Learning Model.* Alexandria, VA: Association for Supervision and Curriculum Development.

McDonald, J., Barton, E., Smith, S., Turner, D., and Finney, M. (1993). *Graduation by Exhibition: Assessing Genuine Achievement.* Alexandria, VA: Association for Supervision and Curriculum Development.

McTighe, J., and Ferrara, S. (1994). *Assessing Learning in the Classroom.* Washington, DC: National Education Association.

Mitchell, Ruth. (1992). *Testing for Learning: How New Approaches to Evaluation Can Improve America's Schools.* New York: The Free Press.

Neill, M., Bursh, P., Thall, C., Yohe, M., and Zappardino, P. (1995). *Implementing Performance Assessments: A Guide to Classroom, School, and School Reform.* Cambridge, MA: FAIRTEST: The National Center for Fair and Open Testing.

Perrone, V. (Ed.) (1991). *Expanding Student Assessment.* Alexandria, VA: Association for Supervision and Curriculum Development.

Rotham, R. (1995). *Measuring Up: Standards, Assessment, and School Reform.* San Francisco, CA: Jossey-Bass Publishers.

Stiggins, R.J. (1994). *Student-centered Classroom Assessment.* New York, NY: MacMillan Publishing Company.

Stiggins, R.J., Quellmalz, E., and Rubel, E. (1988). *Measuring Thinking Skills in the Classroom.* West Haven, CT: National Education Association.

Wiggins, G. (1993). *Assessing Student Performance: Exploring the Purposes and Limits of Testing.* San Francisco, CA: Jossey-Bass Publishers.

Workshop #2
March 3, 1998 • Content Guide–Michael Hibbard

What'd I Get?
Scoring Tools

Worksheets for Workshop #2 can be found on pages W2-W69.

Pre-Workshop Assignment for Workshop #2

1. Using the approach presented in Workshop #1, revise the performance task that you designed in preparation for that workshop, or design a new one.

2. Please bring with you to Workshop #2 a sample of student work on a project or open-ended performance task that you assigned this year.

About the Workshop

Students give us information about what they understand and what they can do through their writing, oral presentations, constructions, actions, and graphics. One of our important jobs is to learn how to look for evidence of understanding in student work. We can use assessment tools of various sorts, including rubrics and analytical lists, to analyze student work. We will learn how to make and use these assessment tools. We will also explore how to coach students to use these tools to assess their own work and take more responsibility for their learning.

Suggested Classroom Strategies

1. Work with your students to construct an assessment tool for one important type of product such as a graph, a written explanation of the solution to a math problem, or a drawing with written explanation of a science concept.

2. Work with other teachers to collect several examples of excellent work your students have done such as a graph, a written explanation of the solution to a math problem, or a drawing with written explanation of a science concept. Use these examples of excellent work along with an assessment tool the next time you assign a performance task that involves this type of product.

3. Play the game "Find the Flaw" with your students. Show your students a purposely flawed example of some work you are going to ask them to do, such as a graph, a written explanation of the solution to a math problem, or a drawing with written explanation of a science concept. Have your students work in cooperative groups to find the flaw and fix it.

Post-Workshop Discussion Questions

1. What are the advantages and disadvantages of the following types of assessment tools?

    - holistic rubric
    - analytic rubric
    - analytic list

2. What strategies will be successful in coaching students to be accurate self-assessors?

3. How can self-assessment lead to increased responsibility on the part of students?

4. How should the following be addressed with assessment tools?

    - the content of the task
    - the thinking skills used
    - the communication skills used
    - the quality of the craft skills used
    - work habits

5. How can assessment tools be modified to meet the needs of students with various needs?

6. Should there be one standard of quality for all students in your class, grade level, or course, or should standards be set according to each individual student's performance?

Related Resources

Please refer to the list of resources on pages 4-5 in Workshop #1.

Workshop #3
March 10,1998 • Content Guide–Monica Neagoy

Is This Going to Count?

Embedded Assessment

Pre-Workshop Assignment for Workshop #3

1. "Embedded assessment" and "integrated assessment" are phrases you have probably read about in assessment literature or heard about in teacher circles. What do you understand embedded assessment to mean?

2. Please bring with you to Workshop #3 some examples of embedded assessment that you practice in your classroom. Also bring some examples that are *not* embedded assessment (these can be in written and/or oral form). Share your examples and non-examples with others at your site, and find out how your concept of embedded assessment is similar to, or different from those of your colleagues.

3. Please read the enclosed articles from the *Mathematics Teacher* and *Arithmetic Teacher* journals (included at the end of this Workshop's print materials after page 11) and be sure to bring the article with you to Workshop #3.

About the Workshop

The goal that "student assessment be integral to instruction" (NCTM 1989, p. 190) is consistent with the *Evaluation* (NCTM, 1989) and *Assessment* (NCTM, 1995) Standards. Almost every instructional activity, say the Standards, can be an assessment opportunity for the teacher as well as a learning opportunity for the student. Even the *Professional Standards* advocate embedded assessment: "Well-chosen tasks afford teachers opportunities to learn about their students' understandings even as the tasks also press the students forward," (NCTM 1991, p. 27).

This workshop will address the imperative in current educational reform that **assessment be viewed — and designed — as an integral part of instruction**. We will draw briefly upon recent research to describe some selected current assessment practices and needed changes in the United States and abroad. Then, after defining high-frequency, key phrases such as "embedded assessment" and "performance-based assessment," we will examine some concrete examples in which assessment provides not only a window to students' thinking, but also a compass for instruction. These examples will take on various forms: it may be a video clip of a teacher's classroom in which she or he is modeling one or more aspects of embedded assessment; it may be a studio/site discussion in which teachers share successful embedded-assessment practices; it

may be a hands-on activity in which we take the time to brainstorm the most important criteria for performance tasks, and then develop one for a particular topic.

We will discuss a variety of teaching strategies, in greater or lesser detail, that may help you begin the challenging process of converting isolated, individual, passive, paper-and-pencil, and post-instruction assessment of facts and skills to embedded, collaborative, active, and multi-formed assessment of what students think, understand, know, and can do in mathematics or science. These strategies will include methods of observing student progress, organizing and implementing group-work, writing as a means of knowing, analyzing student discourse, and encouraging student self-assessment.

The workshop will end with reflections on the implications and advantages of embedding assessment into curricula in general, and instruction in particular: What are the challenges? What is in it for teachers? What is in it for students? How will it affect teaching and learning in the long run? How might it change — down the road — people's appreciation of the nature of mathematics and science?

Hopefully, it will become obvious by the end of this workshop that the best time for assessing what children know and can do is *during* instruction while the students are actively involved in the learning process, constructing their own knowledge and finding their own solutions, and not *after* instruction, when students passively fill in bubbles or blanks on a test sheet, showing that they understand the test designer's solutions. Also, you will hopefully see beyond the introductory statement, "Almost every instructional activity can be an assessment opportunity for the teacher as well as a learning opportunity for the student," and expand it to "Almost every instructional activity can be an assessment opportunity for the teacher as well as a learning opportunity for the student, *and* almost every instructional activity can be a learning opportunity for the teacher as well as an assessment opportunity for the student."

Suggested Classroom Strategies

The following strategies help transform assessment tasks into learning activities. In particular, they help: (1) students learn about their own progress, (2) teachers learn about the progress of individual students, (3) teachers learn about their own teaching and curriculum, and (4) both teachers and students develop a greater appreciation of what it means to "do" and "know" mathematics or science.

- **Teacher observation during instruction** (elementary math or science lesson)
  In the case of whole-class instruction, for instance, this could include assessment of group concept formation (teacher uses students' different ways of thinking about "X", as expressed in their verbal answers to a question, and classifies them in an organized way to form a concept map of "X".) Clearly, teachers also gain insight into individual concept formation.

- **Journal Reading to Inform Instruction** (middle school math or science lesson)
  We read a lot about journal *writing*, but *reading* aloud and sharing journal entries regarding specific content areas can be enlightening for both teachers and students. Suppose a teacher asks the students to spend the last 5-10 minutes of class writing about what they have just learned: What did you learn today? Explain the main points of today's lesson. On what points are you still confused? If the teacher begins the following class with "journal reading," the insight gained from students' verbal explanations will allow him or her either to review certain points, or to proceed with the lesson as planned. In addition to informing instruction, journal reading gives students the opportunity to "communicate" their own ideas and understandings, and learn from those of others.

- **Teacher Observation During Group Work** (middle or high school math or science)
  The teacher assigns a task, problem, or investigation to his or her class, which is divided up into cooperative-learning groups. Each member of a group is assigned a particular role. The investigations encourage exploration, organization, communication, creativity, and active involvement. The evaluation criteria incorporate those same processes. The teacher's role as "roving observer" affords an opportunity to observe students in the process of thinking, doing, and communicating. The teacher's role as "guide on the side" provides assistance that might come in the form of questions to prod students to extend their thinking, or review to help students recall pertinent information. Whether through questions, or answers, or mere silent observation, teachers are finding out in a meaningful way who understands what. Additional assessment is provided by the final presentation of the group's solution or product.

Post-Workshop Discussion Questions and Activities

1. When is it necessary to get feedback during a lesson, rather than at some later date? (Give three or four cases.)

2. Research shows that there are topics that teachers notoriously leave for "the end of the year," and, most often, these topics are superficially or never covered (e.g., probability and statistics). Applying what you learned about performance tasks and embedded assessment, articulate ways in which we could ameliorate this situation. Apply your suggestions to a topic that you haven't yet taught in great depth because you leave it for "the end of the year."

3. Carry out a classroom observation experiment, during whole-class or group instruction, and then write what you learned from it: about students, about yourself, about teaching, about learning, about the topic in question, etc. Then share your experiment with your colleagues. Encourage them to transform their informal observations into formal assessment.

4. During the workshop, we spoke of student self-assessment. Develop a self-assessment task for your students on a topic that you consider important. What are the three most important things you want to find out about what students think about themselves in relation to this topic? Use a different format from those discussed in the workshop. Reflect on what you learned about your students' learning by either writing in your journal or discussing it with your colleagues.

Related Resources

Brandt, Ronald S. *Readings from Educational Leadership: Performance Assessment.* Alexandria, VA: Association for Supervision and Curriculum Development, 1992.

Connecticut State Department of Education. "Performance Task Sampler." Document produced as part of the Connecticut Common Core of Learning Assessment Project. Hartford, CT: Connecticut State Department of Education, 1991.

Hart, Diane. *Authentic Assessment: A Handbook for Educators.* Menlo Park, CA: Addison-Wesley, 1994.

Kuhs, Therese M, ed. *A Viewer's Guide: Mathematics Assessment, Alternative Approaches.* Reston, VA: The National Council of Teachers of Mathematics, 1992.

Lesh, Richard, and Susan J. Lamon. "Assessing Authentic Mathematical Performance." In *Assessment of Authentic Performance in School Mathematics*, edited by Richard A. Lesh and Susan J. Lamon. Washington, DC: American Association for the Advancement of Science. 1992.

Marzano, Robert J., Debra Pickering and Jay McTighe. *Assessing Student Outcomes: Performance Assessment Using the Dimensions of Learning Model.* Alexandria, VA: Association for Supervision and Curriculum Development, 1993.

Mathematical Sciences Education Board, National Research Council. *Measuring Up: Prototypes for Mathematics Assessment.* Washington, DC: National Academy Press, 1993.

Mathematical Sciences Education Board, National Research Council. *Measuring What Counts: A Conceptual Guide for Mathematics Assessment.* Washington, DC: National Academy Press, 1993.

National Council of Teachers of Mathematics. *Curriculum and Evaluation Standards for School Mathematics.* Reston, VA: The Council, 1989.

National Council of Teachers of Mathematics. *Professional Standards for Teaching Mathematics.* Reston, VA: The Council, 1991.

National Council of Teachers of Mathematics. *Assessment Standards for School Mathematics.* Reston, VA: The Council, 1991.

Stenmark, Jean K, ed. *Mathematics Assessment: Myths, Models, Good Questions, and Practical Suggestions.* Reston, VA: National Council of Teachers of Mathematics, 1991.

Webb, Norman L., and Arthur Coxford, eds. *Assessment in the Mathematics Classroom: 1993 Yearbook.* Reston, VA: The National Council of Teachers of Mathematics, 1993.

Workshop #4

March 17,1998 • Content Guide–Monica Neagoy

I Didn't Know This Was an English Class

Connections Across Disciplines

Pre-Workshop Assignment for Workshop #4

1. New strategies for curriculum and assessment design must include ways to link mathematics and science problems to issues students care about. These can include projects in school, in the community, or in society; they can also include educational, environmental, social, cultural, or artistic dilemmas students might have to face, in which mathematical and scientific reasoning play an important part.

   After questioning your class for a topic of high priority and concern to them, take the topic to one or two other teachers (if in secondary school, to teachers who teach other subjects.) Spend some time brainstorming a performance task that would take the students to the heart of the matter of concern. The following questions should guide your discussion:

   - What is (are) the big idea(s) we wish to address?
   - What "school subjects" are these ideas connected to?
   - What "real-life subjects" are these ideas connected to?
   - How can we make these connections explicit?
   - Is this task thought-provoking?
   - Will this task answer some questions and raise others?
   - Will this task expand students' knowledge and awareness?
   - Is this task feasible?
   - Is this task open-ended?
   - Are mathematics and science necessary to answer some questions?
   - Will this task enhance student perceptions of mathematics and science?

   After designing this special performance task, assign it to your class, organized in groups.

   Bring your comments about the process to Workshop #4 and share your learning with your colleagues.

2. Please read the article from *Mathematics Teaching in the Middle School* (included at the end of this Workshop's print materials after page 16).

About the Workshop

When teachers are asked, "What do you hope that your students will retain from all you have taught them, ten years down the road?", they usually come up with answers similar to these:

- a critical mind
- an inquisitive mind
- a logical mind
- inductive and deductive reasoning
- critical thinking
- creative problem solving
- the application of skills
- the scientific method

These are attributes, processes, and strategies that are independent of a particular topic of study. If educational reform is calling on teachers to make connections in the curriculum they teach, it is only logical that these connections be reflected in the assessment tasks they administer. The above criteria should be present in assessment tasks across the disciplines.

Workshop #4 will explore a variety of connections, including the ones mentioned above. After exploring the importance of connections, and connections as a problem-solving tool in mathematics and science, we will look at a series of connections, in curriculum and consequently in assessment:

- connections within mathematics
- connections between mathematics/science and other school disciplines
- connections between mathematics/science and the real world.
- connections across the curriculum at a certain level (e.g., elementary school curriculum)

We will brainstorm together and model the design of performance tasks in mathematics and science that borrow from other disciplines. We will visit teachers' classrooms (via video clips) where an interdisciplinary approach is being used to teach and/or to assess.

When mathematics and science assessment is no longer viewed as a series of short, stereotyped, predictable questions set in artificial contexts, but rather experiences in which math or science is used as a powerful language, method, and tool to solve non-routine, interesting, real-world problems, students' awareness and appreciation of the nature of these sciences will change for the better, and their attitudes toward the subjects will improve.

Suggested Classroom Strategies

The following alternative assessment strategies can be applied across the disciplines, and will be discussed and/or modeled in greater detail in Workshop #4:

- Conduct one-on-one interviews
- Have students keep journals
- Develop student portfolios
- Assign group, investigational tasks
- Get students involved in the assessment process
- Use video to capture students communicating and presenting
- Use student-error analysis with the whole class (keeping the authors anonymous)

The following performance tasks create dialogue and excitement, require creativity and decision making, and make a host of connections.

Make Order out of Disorder (middle and high school)

Whether it is audio or video tapes at home, books in a school library, or food in a grocery store (or whatever large set of items that students can identify with), the project assignment (performance task) consists of designing an organizational structure for the entire set of items. Students must include a written explanation to justify their organizational strategies and final plan. The project culminates in an oral "show and tell" presentation to the entire class, in which students should be encouraged to use a variety of media. (This task not only connects several disciplines, but it connects several disciplines to the *real world*!)

Brainstorm Webs (elementary and middle school)

Students and teachers are becoming more and more acquainted with the World Wide Web. Why is it called a web? What is a web page? After discussing the link between "connections" and "web", ask the students to brainstorm a web (also called concept mapping) for a number, a shape, an idea, a word, a name, or a symbol (or any item of your choice.) Placing the initial item at the center of the page, have students create a brainstorm web of items, connected to the initial item in some orderly, logical way. The web can make use of a variety of media. Students must be able to explain the logic of their connections.

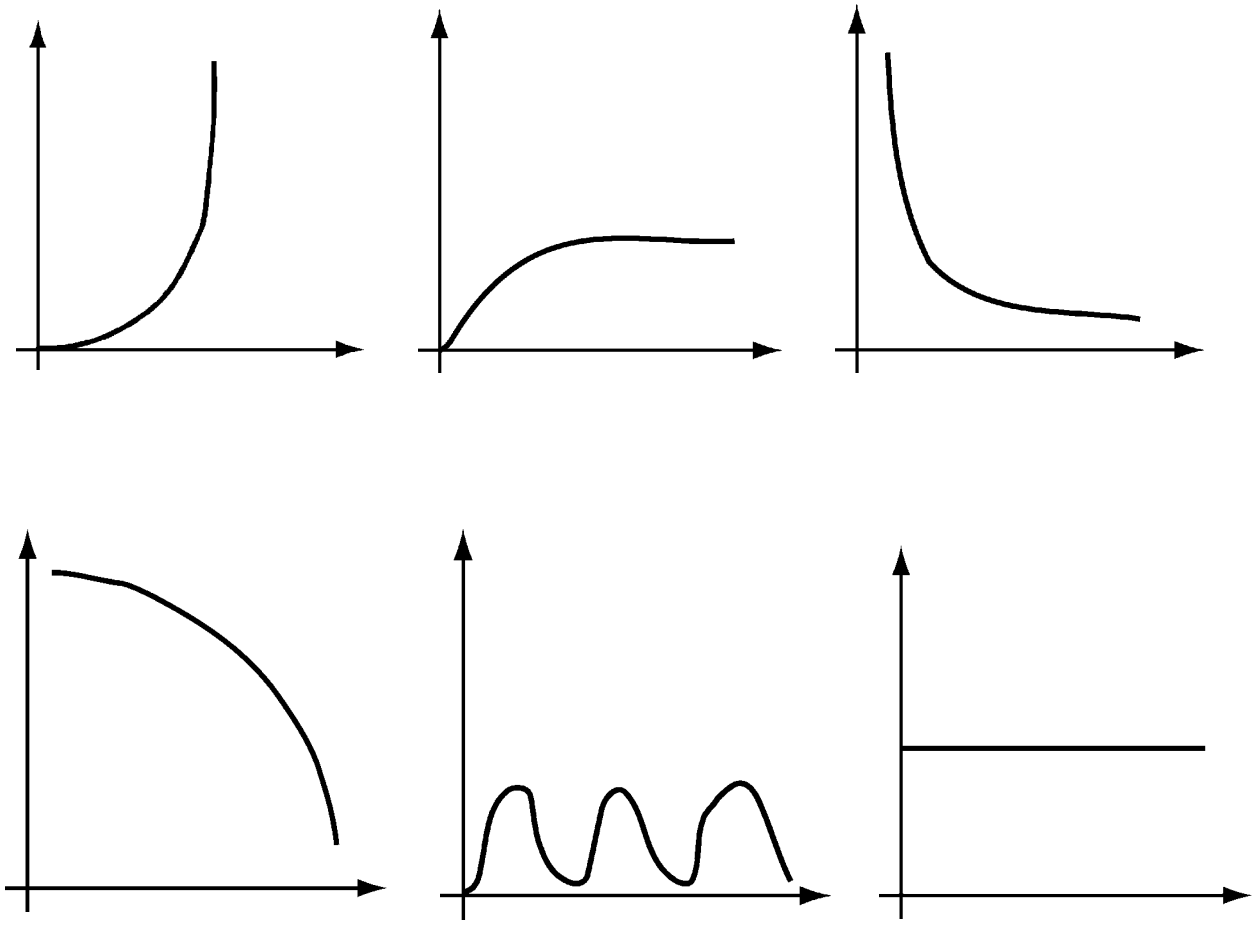
Creating webs encourages student-student dialogue as well as student-teacher dialogue; it fosters creative and critical thinking; it doesn't have one right answer, it has an infinite number; it has no real "end" to the process; it helps students use what they know to figure out what they don't know; it demonstrates connections among multiple topics.

Making Connections with Graphs (middle and high school)

For a long time, the primordial form of assessment has been the written word ("paper and pencil"). In mathematics, the traditional form of assessment has been, more specifically, the written symbol or number. Graphs, on the other hand, are powerful, visual pictures that tell a lot, with very few or no words. (Graphs are considered so important that ETS incorporated a section

on “Charts and Graphs” in the SAT exams.) Graphs are usually associated with mathematics, and sometimes with science. This performance task connects graphs to other disciplines and words to mathematics.

Select a set of two-dimensional graphs (an x-axis and a y-axis.) These graphs can be simple or complex, depending on the grade level (e.g., rising graphs, falling graphs, constant graphs, alternating graphs, or any combination therein. See figure below.)



(1) Have students find and describe a situation that can be modeled by each one of the graphs.

(2) [More advanced: you may choose a subset of the following.]
Have students find a situation in (a) mathematics, (b) physics, (c) chemistry, (d) language arts, (e) social science, (f) computer science, (g) history, and (h) health science that corresponds, more or less, to each of the graphs.

(3) Have each student make a graph that models a certain situation in his or her mind, and then quiz the class on the concrete or abstract situation it models.

Post-Workshop Activities Discussion Questions

1. How can you use the Internet in a performance and/or assessment task to enrich students' connections between the sciences and the arts? After you have thought about it (and perhaps discussed it with a colleague), design such a task and use it in your classroom.

2. Teachers are often reluctant to assign group work because (1) they think the high-ability student(s) in the group will end up doing all the work, and (2) it is difficult to assess the individual contribution of each member of the group, to the final product. How can the interdisciplinary nature of a performance task help resolve these issues?

3. One of the logical extensions of the *Connections Standard* (NCTM, 1989) is to encourage finding examples of mathematics in other countries and cultures. Children should be exposed to examples of mathematics from many cultures to appreciate their contributions and come to respect their different ways of thinking. Incorporate research projects into your math class. For example, divide students into groups, assign a different country to each group, and have them research one great contribution from that country, to the field of mathematics. Have the groups make classroom presentations that use a variety of media. (This is an exercise in *ethnomathematics.)*

Related Resources

House, Peggy A. and Arthur F. Coxford, eds. *Connecting Mathematics A cross the Curriculum: 1995 Yearbook.* Reston, VA: The National Council of Teachers of Mathematics, 1995.

Web Sites

Annenberg Institute for School Reform
http://www.aisr.brown.edu

The Coalition of Essential Schools
http://www.ces.brown.edu

(For additional resources, please refer to the list on page 11 in Workshop #3.)