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This Issue’s Focus
Formative Assessment
Changing Our Approach to Assessment

There are many problems with education’s current practice in testing and assessment. The tests that have provided valuable national data for forty years, National Assessment of Educational Progress (NAEP), may be scaled back and some subject areas cancelled because of reduced federal funding. The results of statewide tests that have been designed in response to No Child Left Behind often cannot be compared to one another. And none of these tests helps teachers and students to make improvements in an ongoing fashion to benefit students immediately.

A variety of formative assessment strategies can provide regular feedback to both teachers and students, supporting high quality learning and encouraging teachers to modify instruction to support each student. In this issue you’ll find articles from classroom teachers, teacher-trainers, and researchers who provide sound evidence of how our teaching and learning can improve through formative assessment. Practice is changing, educator by educator, and school by school. Explore these ideas with colleagues and take part in it!
The expression, “Curriculum as an animated conversation” is attributed to the cognitive psychologist, Jerome Bruner. I have found it useful when thinking about what could happen between teacher and student in the teaching, learning, and assessment process. When engaged in a meaningful conversation, both you and the persons you are conversing with are able to share your thoughts and ideas. There’s giving and taking, listening and being listened to, reflecting on new angles being presented, offering and receiving feedback, and expanding and modifying of original thoughts. Sometimes there’s animation, sometimes debate, and all is toward the end of understanding or resolution.

The context for formative assessment in science: student inquiry

Formative assessment is a perfect match for teaching and learning science concepts, skills, and dispositions through an inquiry-based approach. When integrated with instruction, it is useful no matter what the discipline.

Formative assessment is the part of the “conversation” in which the teacher seeks to clarify what it is that children bring to the learning from the start, or what they understand throughout the unit, by asking good questions, listening closely, and providing feedback.

Just as scientists do, when students investigate questions about the natural world, they engage with materials and ideas, collect information, and analyze and interpret the data in ways to help find answers. At each step along the way students propose explanations, and connect what they already know about the phenomena with new knowledge gained from their investigations, from their teachers, and from other scientific resources. At every stage of this cycle of learning, teachers can check in with students to determine progress in relation to the desired learning goals and adjust their instruction accordingly.

What is formative assessment and how is it used?

When data about students are collected at certain planned intervals, and are used to show what students have achieved to date, they provide a summary of progress over time and are summative assessments. These assessments are used to evaluate a student’s acquisition of knowledge and skills.

On the other hand, ongoing assessment is formative in nature and happens when evidence is gathered during learning activities and interpreted in terms of progress toward the lesson goals. (Harlen, 2007) Teachers use the evidence to inform as well as to form practice.
When they use the evidence to determine where students are in relation to the desired results, teachers are better able to make decisions about the appropriate next steps for a student or group of students. When the evidence is provided as feedback to the students, they become more aware of where they are in relation to the goals and what they need to do to revise or improve their understanding or practices. Additionally, as teachers adjust their instruction so that all children can participate in the learning, they inform and improve their own practice.

Both formative and summative assessments are important and useful for the purposes they serve. The greatest benefit to students is the alignment of what is valued across the continuum of formative to summative assessment.

Integrating formative assessment and inquiry learning

Here are examples of some of the things teachers can do to integrate inquiry-based science instruction and learning with formative assessment practices.

- **Provide clear expectations**

We know that expressing oneself clearly while in a conversation provides a good basis for dialogue and encourages participation of others. Likewise, clarifying the desired learning results for both you and your students is the best first step. Both broad and specific expectations are helpful. For example, you may be doing a unit on matter, and you know the enduring understanding you have as a goal for your students is: *All living and non-living things are composed of matter having characteristic properties that distinguish one substance from another.* An example of a more specific expectation you have for your students is that they are able to make good observations and include them in their scientists’ notebooks. How will students know what a “good” observation is and if they have met that expectation? You can create a list of indicators of “good” observations with your students and post them so that both you and the students can assess progress towards this goal. (Figure 1)

<table>
<thead>
<tr>
<th>A GOOD OBSERVATION . . .</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Uses more than one of the five senses whenever possible</td>
</tr>
<tr>
<td>• Describes the object and includes details</td>
</tr>
<tr>
<td>• Makes connections to things you already know</td>
</tr>
<tr>
<td>• Notices things that are alike and different</td>
</tr>
<tr>
<td>• Looks for patterns</td>
</tr>
<tr>
<td>• Looks for things that have changed</td>
</tr>
</tbody>
</table>

Peggy Sprague, Hardwick Elementary School Grade K. VSI Action Research Project 05/06/05

- **Listen closely**

As in any good conversation, you feel valued if others are listening to what you have to say. In formative assessment, teachers listen to and observe closely what students are saying and are doing while they investigate questions, share their findings, or participate in discussions during a scientists’ meeting. A third-grade teacher participating in a Vermont-based, NSF funded project was amazed at what she found out about her students when she carefully listened to the exchanges between students as they worked. She reported:

When I first tried listening quietly and taking notes about what I heard students
saying as they worked, my insight into their learning was phenomenal! I actually stopped talking and just listened. The data I collected showed some incorrect conceptions as well as understandings. It often opened windows into how a student had learned. The rich data I gathered helped me determine which steps I needed to take to further learning.

- **Ask productive questions and use “wait time”**

As in any good conversation, the type of questions asked can either promote or stifle dialogue. Jos Elstgeest (in Harlen 2001) refers to productive questions, the type of questions that promote dialogue to elicit students’ ideas and understandings of concepts. He illustrates how unproductive questions focus a child’s thoughts on finding someone else’s “right” answer and how using productive questions help students focus on their own ideas and make sense of them. Productive questions serve a dual purpose in that they engage students in inquiry investigations as well as provide formative assessment information. (Figure 2)

One teacher in the Vermont Science Initiative implemented a “no grading” approach to the students’ everyday classroom work. She instituted using the code letters: M for meets the goal/standard; P for partially meets the goal/standard; N for not yet meets the goal/standard and has a chance to revise or add to their work.

It took some time for her students to adjust to not always knowing their “grades,” but as they worked within the new system they began to realize more of a sense of their own responsibility in meeting the learning goals.

- **Provide feedback to students**

Just as providing reflection and feedback in a conversation shows another person that you are listening and that you value their input and perspective, the same applies to our interactions with our students. Providing timely feedback throughout investigations catalyzes deeper thinking and understanding. It also encourages students to expand their thinking, modify their investigations, and revise ideas. Feedback is only useful if students are given the opportunity to reflect on their investigative processes and experiences, and when they are encouraged to explore, experiment, and revise their work.

Black et al (2003) offer the following ideas about feedback:

- Give comments only, no grades;
- Comments should highlight what has been done well and what needs further work;
- Avoid “ruining” student’s work with red pen marks (some teachers use “sticky” notes);
- Write legibly so that comments can be read;
- Write statements that can be understood;
- Provide the expectation and a timeline for work to be completed.

An example of providing feedback to students is to write to your students about the observations, questions, data samples, analysis, claims, and evidence they have included in their scientists’ notebooks and ask more deeply probing questions. Ask them to write back to you.

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**Feedback is only useful if students are given the opportunity to reflect on their investigative processes and experiences…**

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*Attention-Focusing Questions*

- Comparison Questions
- Measuring and Counting Questions
- Action Questions
- Problem-Posing Questions
- Reasoning Questions

Learning how to ask the right question at the right time is a skill that takes practice on your part, as does another skill, using wait time. Based on the research of Mary Budd Rowe (1974), when teachers increase their wait time from an average of 0.9 seconds to 3 seconds, the quality of the dialogue they have with their students changes. Students’ answers are longer and more confident, more students enter the dialogue, more alternative explanations are offered, the number of questions asked by children increases, and students challenge and add to the answers of other students.
Use peer and self-assessment

How do teachers help their students to practice peer and self-assessment? Paul Black and his colleagues (2003) make the following suggestions:

Because it takes effort to have your students think of their work in terms of a set of goals, you are more successful in introducing peer and self-assessment when you provide clear expectations for your students and model giving feedback with your own comments. By being clear about expectations and by modeling feedback, you provide a classroom culture that recognizes and values the use of feedback to promote student understanding. Peer assessment turns out to be an important complement to self-assessment. You’ll find that children work more carefully when they know they will be assessed by their peers, and see that peer assessments are another form of “instruction” and reinforcement of the desired learning results. Students often accept and take seriously the criticisms they hear from their peers.

Adjust instruction

When you learn more about what your students do and don’t understand, you are better able to determine their next steps toward supporting student growth immediately and over the long term. Sometimes that intervention is immediate, such as when you provide rulers to a group that is trying to classify objects as “small,” “medium,” and “large.” Other times the information you gather helps you decide what to do the next day, such as having students test out a misconception you notice they have about size versus density of an object and its ability to float. Finally, you will find yourself thinking about what you will do in the next week’s class or during the next month’s unit; for instance, how you might use the scientists’ notebooks differently next time.

Good dialogue promotes action

Just as in a successful conversation, when the parties come away with more clarity and understanding, they often take action on what they’ve discussed. The same is true with formative assessment. Based on the findings of the formative assessment, both the teacher and the student come away with clearer idea of what to do next to take understanding and practice to a deeper level.

Maura O’Brien of Vermont is a senior program associate with Learning Innovations at West Ed and co-author of the book Weaving Science Inquiry and Continuous Assessment; Using Formative Assessment to Improve Learning.

Resources

Promoting Hope in All Students
An Interview with Rick Stiggins

Rick Stiggins has been deeply involved in educational assessment issues for over twenty-five years. He has led performance and classroom assessment programs, directed large-scale test development, and trained educators in thousands of schools to use assessment more effectively. Rick’s ability to focus on practical issues has helped him become a leading national proponent for quality classroom assessment as a key to school effectiveness and student achievement. He is co-author of Assessment FOR Learning: An Action Guide for School Leaders (2004) and Classroom Assessment for Student Learning: Doing It Right—Using It Well (2004). Connect recently talked with Rick about the increasing popularity of formative assessment, NCLB requirements, and what lies ahead in education. The ideas here express not only Rick’s inimitable optimism about ways of helping individual learners achieve their goals, but also for helping educators, administrators, and policy makers achieve their professional goals to better the world of education.

—Editor

CONNECT: How would you define formative assessment?

RS: Formative assessment is any assessment we use with students for the purpose of helping them learn more. We draw a distinction between summative assessment, which asks if our students have learned enough, and formative assessment, in which we ask how we can help students learn more. We use the assessment process to diagnose their needs, or to help them watch themselves grow, so they can feel more confident as they move forward. We use it to provide descriptive feedback to them so we can help them understand how to do better the next time.

CONNECT: It seems as if formative assessment ideally would be happening all the time. Why is it so difficult to implement?

RS: The problem has been that so few teachers have been given the opportunity to learn how. We know what it means to assess productively. And we know what will happen when teachers do the right thing. We know what will happen with student learning and we even know how to deliver good quality formative assessment tools and capacities into teachers’ hands.

It is still the case that teacher preparation programs often are very thin in their assessment preparation. Lest we believe that teachers can turn to their principals for help in this regard, the shocking truth is that pre-service leadership training programs across the country are almost devoid of any relevant helpful assessment training.

CONNECT: Yet we seem to be testing so much. How does that relate?

RS: We’re so obsessed with producing district-wide test scores, state-wide test scores, national test scores, and international test scores. It’s not that those things are inappropriate, but we’ve been so obsessed with them over the last sixty years that it has cost us billions of dollars and we haven’t paid any attention whatsoever to the other 99.9 percent of the assessments that happen in a kid’s life. Those are the ones that can be used formatively, day-to-day in the classroom.

Our national obsession with standardized testing has meant that there’s an imbalance between summative and formative assessment.
A personal evolution

CONNECT: In “Assessment Through the Student’s Eyes” (Educational Leadership, Vol. 64, No. 8), you write with great empathy about the differences between students who experience success and the students who experience failure. What were your experiences as a student?

RS: In the winner or loser distinction, I was one of the losers. From early on, I had great difficulty learning to read. I had and continue to have, as an adult, great difficulty with oral reading fluency. It turns out to be a wiring problem. My eyes and my mouth and my brain don’t connect in the right way to allow me to see and to say quickly what I see.

What happened to me in that context is what happens to a lot of kids early on. They see themselves not performing and getting Fs on their report cards—for me it was in reading—and it doesn’t stop there. They begin to draw inferences beyond merely reading to other academic capabilities. That’s the tumble of inevitable failure that kids can get themselves into. Once they’re in there, it can be very difficult to get out.

Confidence is like trust: Once lost, it’s really hard to get it back. It can be done if we manage the classroom assessment process in a way that rekindles in students, or maintains in them if they have it, the confidence that success is within reach. It wasn’t until I was well out of high school, actually in the Air Force, that I began to realize that all the inferences I had drawn about myself were wrong, and I began to gain perspective and confidence. But early on, it was hard.

CONNECT: What sparked your interest in formative assessment?

RS: Early in my professional career I was involved in large-scale standardized testing. I was director of test development at ACT in Iowa City developing college admission tests. What sparked my interest in the classroom was that I began to read between the lines, and to think, “Testing is okay and I’m working in one of the largest testing programs in the world; it influences critical decisions in students’ lives, but what about the rest?”

I began investigating assessment methods other than multiple-choice testing. That included performance assessment, and that led me into the classroom, to assessments based on observation and professional judgment. Once I was in the classroom, working with teachers, trying to understand classroom assessment, I was hooked.

A colleague and I conducted a ten-year program of research to understand the complexities of the classroom from an assessment point of view. We published the results and one of things that spun out of that was an interest in formative applications, and then assessment for learning.

Partnering with students

CONNECT: How is Assessment FOR Learning distinct from formative assessment?

RS: The most unique feature of formative assessment and assessment for learning is deep student involvement in the assessment process. We had not thought of formative assessment in that way before.

Traditionally, formative has been conceived of as, “we assess more frequently.” Assessment for learning must be continuous. Traditionally, formative assessment has been used to inform teachers, to improve teacher instructional decision-making. Assessment for learning wants to inform both student and teacher decision-making. We operate on the belief that students can hit any target that they can see and that will hold still for them. In an assessment for learning classroom we show them the target right up front and say, “Here’s where you’re headed. Now let’s get you there.” That empowers students to be full partners in the process.

The idea in assessment for learning is that students can become partners in learning in several ways: by monitoring the quality of their own work, by keeping track of changes in those capabilities;
and by communicating with their teachers and their parents about their progress over time.

So we teach lessons in our program at ETS Assessment Training Institute about student-involved assessment, record-keeping, and communication.

It is that kind of student-involved assessment and record-keeping that has demonstrated its capacity in research conducted over the last twenty years, literally around the world, to have a profound impact on student achievement. And what’s most interesting is that the largest achievement score gains are for the perennial low achievers. Everybody wins, but those who have the most to win, win the most. It’s really quite compelling.

The changed mission of schooling

CONNECT: Why have formative assessment and assessment for learning become such hot topics these days?

RS: I think we’re coming to realize that in the last decade, schools have undergone a major change in mission. The schools that you and I graduated from were actually designed to leave lots of students behind. Then by the end of high school we were to be ranked from the highest achiever to the lowest achiever, so there were winners and losers. Some students prospered while others gave up in hopelessness. This was consistent with the assigned mission.

For very good social reasons, that mission has changed. What we have come to realize is that schools that merely sort don’t meet our needs. The bottom one-half to one-third of students failed to develop the essential reading, writing, math, problem solving, and digital living capacities that they need to survive in an increasingly complex society. It’s a new mission, a whole new assignment. So an assessment and instructional system that was designed to sort now has to produce competence too. That requires a major retooling.

Assessment for learning must play a major role in this new schooling process.

CONNECT: In the October 17th Education Week commentary, “Five Assessment Myths and Their Consequences” (vol. 27, no. 8), you write about the almost complete lack of assessment literacy through the fabric of American education. What is the best way for educators to acquire and integrate the skills necessary to see the potential of this and to understand how to use assessment productively?

RS: Step one is to get teachers the tools they need to do this job. We can’t give them a new mission of leaving no child behind without giving them new tools. Teachers need to have the opportunity to participate in the kind of professional development that provides assessment for learning tools and practice in using them.

The same is true for school leaders. Administration preparation programs must be revised to include strong assessment components. The new people we bring in to the profession must bring with them the tools they need to assess productively.

Everybody wins, but those who have the most to win, win the most. It’s really quite compelling.

Teachers in a summer session on formative assessment. These educators are learning to implement the Educational Testing Service (ETS) program, Keeping Learning on Track, based on the work of Paul Black and Dylan Wiliam.
Step two is that we need policy makers—federal legislators, state legislators, their legislative aides, school board members, non-educator policy makers—to more deeply understand the complexities of sound assessment practice. They collectively are being incredibly naive—dangerously naive—in their understanding of sound assessment practice. They must come to understand that we don’t help students who have completely lost confidence in themselves to regain that confidence by hitting them between the eyes with a bigger baseball bat. The emotional dynamics of that experience are exactly wrong. And yet that’s what we’re doing on lots of fronts. What we need to promote is a much deeper understanding of the subtleties of effective assessment practice.

We live in a nation of policy makers who at all levels are obsessed with the idea that standardized test scores are the answer. They are doing the best they can given their level of understanding. They’ve not been given the opportunity to understand the alternatives. We need to provide that opportunity.

ETS/Assessment Training Institute, http://www.assessmentinst.com/ (800-480-3060), was founded in 1992 in Portland, Oregon, by Rick Stiggins and purchased by Educational Testing Service in 2006. Their work is guided by the belief that involving students in the classroom assessment process puts them in touch with the skills they need to take responsibility for their own progress and success. ETS is focused on building students’ confidence in themselves as learners, as well as supporting teachers as they face the challenges of developing quality day-to-day classroom assessment.

ETS/Assessment Training Institute offers training and professional development, books, videos, and other resources including newsletters and grant information. Rick Stiggins, the author of this article, has co-authored two titles available from ETS/ATI, Classroom Assessment for Student Learning: Doing It Right—Using It Well and Assessment FOR Learning: An Action Guide for School Leaders.

Step three is to balance our assessments. The information provided by our assessments has to meet the needs of various people. Students and teachers need the classroom level of assessment to support learning. School leaders need the program level of assessment to improve instruction. Both of those can be formative. Then there is the summative institutional assessment used for accountability purposes. All three of these are important and we must balance them.

Assessments that happen once a year are not likely to be very useful for people who are making decisions every three to four minutes, like students and teachers. No single assessment can serve all purposes. We need to use all three kinds—classroom, program, and accountability—to provide accurate results and we need to use them well.

CONNECT: What final advice would you give us?

RS: A typical teacher is going to spend between a third and a quarter of his or her available professional time involved in

While standardized testing plays an important role, its impact on the quality of schools pales in comparison to the classroom level of assessment.
assessment-related activities. If they do it well, kids prosper; if they do it badly, kids suffer. Right now they do it almost completely without the professional learning opportunities that they need to do it well. Society ought to be up in arms about that, and we ought to be getting people the professional learning experiences they need.

We have a lot of work to do. And that work centers on making sure that society understands that, while standardized testing plays an important role, its impact on the quality of schools pales in comparison to the classroom level of assessment. I’m very optimistic that we can accomplish this shift in emphasis.

Finally, I say to teachers all the time that it’s important what you think your students are capable of, but what’s really critical is what they think they’re capable of. We need to frame our achievement expectations, instruction, and assessment in a way that keeps students believing that success is within reach. If they stop believing that, they take their teachers right out of action. Our adult data-based decision-making doesn’t have any impact on a hopeless student. So we need to promote hope in all learners. That’s what assessment for learning is all about.

Notes

Although the term formative assessment seems to have exploded into our education vocabulary during the past decade, its roots go back to Ralph Tyler’s curriculum rationale (1949), B. F. Skinner’s behaviorism and programmed instruction (1953, 1960), and Benjamin Bloom’s concept of Mastery Learning (Bloom, 1968). While there are many formative assessment definitions, we believe that the key difference between formative assessment and other types of assessments, usually summative, is the use of the results. Formative assessment is used to inform instruction and learning, summative assessment is used to measure and report student learning.

Various types of assessments are currently being marketed as being formative, among them district- or school-wide benchmark assessments given periodically (often quarterly) to all students in a particular grade and subject; for example, quarterly district-wide benchmark assessments in language arts or mathematics. However, we think that real formative assessment is curriculum-embedded—part of teachers’ classroom assessment. Such assessments are formative only when results are used to guide immediate teaching and learning. If classroom assessments are used only or primarily for grading purposes, they too are summative.

Should teachers use classroom formative assessments to adjust their instruction? The answer is “yes.” Research has been quite strong that high quality classroom formative assessment increases student learning. Paul Black and Dylan Wiliam’s landmark analysis of 250 studies found effect sizes ranging between .4 and .7 (Black & Wiliam, 1998). An effect size of .2 is generally considered to have a small effect, .5 a moderate effect, and .8 a large effect (Becker, 2007). Black and Wiliam also report that classroom formative assessment seems to be particularly effective for improving the learning of low-ability students.

A model of quality formative assessment

But what is quality formative assessment that leads to substantial learning gains? We believe that quality formative assessment requires continuous attention to quality in three critical components: teaching and learning goals, assessment of those goals, and use of the assessment results to better achieve goals for student learning. (Figure 1) The components are tied together by a loop of continuous feedback and improvement.

Quality goals are the starting, ending, and recycling points in the selection, development, and implementation of high quality classroom assessments. Quality goals reflect the immediate and longer...
term targets for teaching and learning, ideally a continuum that takes students from where they are to the achievement of curriculum objectives and specific state standards.

Quality assessments are those that can well serve their intended purpose, in this case, formative purposes. Are the assessments aligned with learning goals? Do they provide accurate, reliable information about student learning? Do they provide diagnostic information that can be used to guide instruction? Do the assessments measure what they intend to measure? Are they fair in enabling all students to show what they know? Will results provide a natural step to reasonable instructional changes in the classroom?

Quality use highlights the process of assessment use in classrooms: whether and how assessment is used to monitor student progress and probe student understanding; whether and how teachers provide feedback on assessment results; and whether and how results are used to inform subsequent teaching and learning.

We recently used this general framework as part of a research study conducted with colleagues at the Center for the Assessment and Evaluation of Student Learning (CAESL) to answer the following questions:

1) How do teachers implement formative assessment as part of a middle school science curriculum?
2) What is the quality of feedback that teachers provide students?
3) To what degree do teachers use assessment results to modify subsequent instruction?

The science program

To help answer our research questions, the team selected the Foundational Approaches in Science Teaching (FAST) program for middle school science, developed by the University of Hawaii Curriculum Research and Development Group (Pottenger & Young, 1992). Aligned with National Science Standards (Rogg & Kahle, 1997), the FAST program uses carefully sequenced, student-conducted investigations to develop students’ learning. FAST has been designated as an exemplary program by the U. S. Department of Education’s Expert Panel on Mathematics and Science Education (2001) and the National Staff Development Council (1999). This unit was chosen for study because of the formative assessments specially developed and embedded in it, called “Reflective Lessons” (Shavelson, SEAL & CRDG, 2005, p. 6).

The reflective lessons

Termed “reflective lessons” to avoid expectations for grading and to encourage teacher and student reflective thinking, the FAST/CAESL formative assessments evaluated progress at key transition points in the curriculum. These were points at which students needed solid understanding of particular concepts as a foundation for subsequent progress and where both teachers and students might benefit from feedback about whether students were ready to move forward. Each assessment involved a Predict-Observe-Explain sequence of activities involving why things sink and float. For these assessments, students worked with paper and pencil on individual activities. Teachers engaged in small group and whole class discussion to further draw out, challenge, and deepen student understandings.

Study sample and methods

The full report detailing our methods and study sample, Report 703, may be found at http://CRESST.org. In brief, thirteen middle school science teachers from a diverse range of schools participated in this study. The schools ranged from a private school serving a relatively affluent community to urban sites serving economically disadvantaged students. Attrition or incomplete data resulted in a final sample size of eight teachers from eight different schools. While the study size was small,
it was sufficiently large enough to help answer our research questions.

Consistent with the self-reports from the teacher surveys, observations suggested that all teachers understood the core concepts of the FAST unit, including mass, volume, density, relative density, and their relationship to buoyancy.

The results

1. Teachers’ formative assessment implementation

The quality of implementation varied considerably among teachers. In classrooms where the assessment sequence appeared successful, teachers seemed to have special strategies for maintaining engagement and assuring accountability. In one classroom, the teacher asked students to stand to show their predictions; the teacher then could follow up easily with students who had opposing predictions.

In other cases, however, student engagement in the intended assessment sequence was less successful. Teacher probing was ineffectual in revealing students’ underlying rationales or did not help students understand their misconceptions. Whole class discussions ended when the lesson period ran out, with no resolution of students’ conflicting ideas and no attempt at synthesis.

The quality and level of student engagement during small group activity was likewise variable. Some students found it difficult to engage in sustained activity or in substantive discussion with their peers, unaided by the teacher, and their attention wandered. Even when small groups were engaged, there was a tendency to rely on one or two students within the group to carry the workload.

The contrast between the most and least interactive teachers was striking. Two of the observed teachers frequently used probing questions to elicit their students’ ideas; asking for students to generate explanations, hypotheses and predictions; and probing for meaning and evidence. However, by far the predominant style of questioning was, “teacher questions; student responds,” with limited instances of students raising questions of the teacher or of peers, or students responding to student-raised questions.

2. Use of feedback

Use of classroom feedback also varied considerably, but surprisingly in most cases was relatively rare. One teacher provided no feedback at all to students during whole class interactions. In contrast, about a quarter of another teacher’s interactions involved feedback, but nearly half of these simply noted whether students were right or wrong and failed to provide the descriptive feedback or substantive follow-up that has been associated with increased learning.

Written teacher feedback on student reflective lessons was similarly limited. Teacher responses were infrequently, if ever, returned to students on a timely basis or with any written feedback. For many, interpretation or scoring of student work did not occur until after the unit was completed, and analysis of patterns and implications was done informally, at best.

3. Formative use of assessment results

One teacher quickly sorted students’ responses into piles reflecting different learning issues and then planned subsequent instruction and grouping around
those results. For the most part, however, teachers did not go back and re-teach or involve students in additional activities to directly address their misunderstandings, even though the FAST reflective lesson materials included specific activity suggestions for remedying particular misconceptions or understanding gaps.

Three teachers, after reviewing student work, did use the results to re-teach or review particular concepts or ideas. But most teachers felt pressure to move ahead in the unit and did so, with little use of the results to change instruction.

**Daunting, even for the experienced**

We stated earlier that research supports formative assessment as an effective way to increase student learning. The Quality Classroom Assessment Framework supports that assertion. However, we believe that our study points to the implementation issues that Adam Urbanski put into succinct words: “Real change is real hard” (1994). Like so many school reforms, implementing formative assessments is a daunting task requiring time, energy, and a great deal of trial and error, even for accomplished, experienced, talented, and knowledgeable teachers. More importantly, we believe that our results suggest that the Quality Classroom Assessment Framework is a useful model for implementing a high quality formative assessment program. Assessment in support of learning goals requires quality assessments, quality use of assessment results, plus continuous feedback and improvement.

**Resources**


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**Dr. Joan Herman** is Director of the National Center for Research on Evaluation, Standards, and Student Testing (CRESST) at UCLA. Author of *Tracking Your School’s Success: A Guide to Sensible School-Based Evaluation and A Practical Guide to Alternative Assessment*. Dr. Herman also has published extensively in research journals and is a frequent speaker to policy audiences on evaluation and assessment topics.

**Dr. Ron Dietel** is the CRESST assistant director for research use and communications. He has written and directed a number of video programs on educational testing and is the author of *Get Smart! Nine Sure Ways to Help Your Child Succeed in School* (Wiley/Jossey Bass, 2006).

Joan Herman is the lead author of the report upon which this article is based. Ron Dietel was not involved in the study but was responsible for adapting the report for this article together with Joan Herman. The authors wish to express their appreciation to the full research team including Ellen Osmundsen, Carlos Ayala, Stephen Schnieder, and Mike Timms.
Gathering Appropriate Evidence During Instruction

by Catheryne Draper

Many teachers are already doing formative assessment, but maybe they don’t know it. The Cliff Notes version of formative assessment involves strategies that allow for correction in the course of students’ learning. The longer definition involves a description that refers to a systematic “Collection of appropriate evidence during [instruction, student learning, and curriculum construction] for the purpose of improving any of these three processes” (Handbook of Formative and Summative Evaluation, p. 117).

Over the years, the emphasis on formative assessment has resurfaced several times and it appears again to be at the cutting edge of our instructional focus. Now, as was true then, formative assessments can provide us with valuable information about how and what is happening in our students’ view of their mathematics learning. Some key words in this effort are systematic, appropriate evidence, and during. The larger question on all of our minds is “How can we collect in this manner and still have time to teach?”

Interweaving good practice

We are in a state of transition in classrooms, adjusting to the demands of NCLB and other assessment requirements. We must be vigilant in order to preserve our students’ (and our) learning and instructional values. Thus the conundrum is, how do we do this appropriately without trading off valuable instruction time? One obvious answer is: do not replace instructional time with additional add-on tasks, rather, take notes during your observations of kids working. This may be obvious, but it is not simple.

We must incorporate the formative assessments that we are already doing into a more formal status, share with our fellow teachers and administrators what we do that works, and include what others are successfully doing within our own classrooms. To that end, I would like to share with you some successful formative assessment strategies that I have used and others have used.

Formative implies a work in progress. To keep a record of progress, including notes about difficulties and outstanding achievements, I have used Observation Cards at all grade levels. These Observation Cards are 5.5" x 8.5" color-coded cards with spaces delineated for several notations: date, observations, actions to be taken, student name, and frequency check boxes. They served as a tool to allow both my students and me to keep a real-time record of progress. I taped the cards on a clipboard and carried them with me when I was observing students working in the classroom.

I saw the developers of these cards demonstrate how to use them during one of their workshops for elementary school teachers. At the time I was working with older students but I immediately recog-
nized their value. The joy in using them relied on the caveat provided by the authors: make sure you write both the positive and the negative observations so that students get a sense of the balanced assessment. One of the developers said that soon students would be asking me to write down what they had just accomplished because they were so proud of themselves. She was right; they did. Students didn’t seem to take issue when I wrote negative comments, as long as they knew I was writing down the “good stuff,” too.

Any instrument that can generate student participation in sharing their understandings, their current reasoning, and their questions is appropriately designated as a formative assessment tool. Just such a tool is found in a concept generator known as a Splash. As a math tool, it allows students to express current understandings and also share questions about new topics in any given lesson.

A ready-made Splash allows students to see topics that may or may not be presented in the current lesson. That discrepancy does not pose a problem because (1) students are generally not concerned that there are extra items on a Splash and (2) students get a “heads up” on later topics. If students develop their own Splash then they can provide a connected visual of terms, pictures, symbols, and other snippets of related information that clearly help them remember a whole concept.

The Splash shown in the illustration was developed by middle school teachers in Leominster Public Schools (Massachusetts) for studying linear equations as part of an Algebra I class. Leominster teachers can write and share their Splashes with other teachers by downloading from the system’s Web site.

The Splash can be used to start a conversation with students or as a culminating discussion in which they can share the information they have learned. Teachers have used Splashes with groups of students as well as individuals.

The important piece of information about Splashes is that students share their understandings, their questions, and their thinking.

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**Look to students’ writing**

Student writings give us valuable information about how they are thinking. Some examples that I have found valuable are located in the NCTM Assessment books. The particular sheets that I have used are described on pages 43 and 44 of *Mathematical Assessment, A Practical Handbook for Grades 6–8*. These sheets can be adapted very easily for any lesson; the student writing inventory and the self-assessment questionnaire illustrated in the book were companion assessments for a problem solving activity. The sheets allow students to write a comment in response to their teacher’s guiding questions. I recommend using these tools judiciously because it is time-consuming.

By using them, shy students have a chance to express themselves without
peer judgment and talkative students do not have the opportunity to capture and imprison class attention. It is worth the time if only to keep the teacher from making assumptions about how and what the students are doing and thinking. In the beginning I used it just a few times during the grading term. Later as I got better, I used it more frequently.

Algebra cards

One of the formative assessment strategies built into The Algebra Game program, *Topic for Linear Graphs*, involves the use of pocket charts that hold an arrangement of matching cards in decks. Students match cards after practicing with matching pairs and tracing patterns. Both activities require yet another formative assessment strategy that includes talking and writing responses to given discussion questions.

After students arrange the cards so that all of the matches are obvious, one representative of their group may walk around the classroom and ask other groups to describe the thinking that the original group had in arranging the cards in the pocket chart. To make it a bit more difficult, the student or the teacher can remove some of the cards and ask specific students to replace the cards in the appropriate pocket. In the process of replacing the cards, students are self-correcting misconceptions or confirming correct concepts.

I prefer that a formative assessment tool should not create a number scale in the same manner as summative tests tend to do. Children get the wrong message and confuse the summative measure with the formative course-correction purpose. For any assessment to be meaningful it must represent what the student thinks, understands, and uses within contexts. We need to have evidence of these representations within our formative assessment protocols. We should systematically include examples, such as student writing about their learning, plus student record keeping in verbal, symbolic, pictorial, or graphic representations.

*Catheryne Draper started The Math Studio in Massachusetts twenty-five years ago to focus on the tactile and visual pedagogy for teaching mathematics to all grade levels, K–college.*

**Resources**


Splashes developed by Leominster Schools, Leominster, MA.

Literature Links

Usually our Literature Link choices relate to the theme of the issue, but not many children’s books have formative assessment as their subject! Instead, we offer books that are highly recommended by Bank Street School, Newberry Awards, or others.

*The Story of Salt*, by Mark Kurlansky (G. P. Putnam’s Sons, 2006), is an adaptation of the adult bestseller, *Salt: A World History*. This picture book, with illustrations by S. D. Schindler, highlights historical facts and lore about one of the most valued substances on Earth. Informative paragraphs roughly follow a timeline through the pages. Many cultures are shown using salt. A brief explanation is given at the beginning about properties of salt and how it can be manufactured or harvested. This is a provocative text that is helpful for fourth- through eighth-grade students researching foods, minerals, history, or cultures.

*Mosquito Bite*, by Alexandra Siy and Dennis Kunkel (Charlesbridge, 2005), is a fascinating non-fiction title for children ages seven through twelve that explains the life cycle (and feeding habits) of one of the “deadliest animals on earth.” The text is from the perspective of a mosquito who is looking for a meal. Photomicrographs, taken with a scanning electron microscope, illustrate the storyline with amazing detail and exciting colors. The approach of the book seems to be one of accuracy, explaining, for instance, that mosquitoes don’t think about whom to bite, they merely respond to the information their senses gather. Some information about mosquitoes around the world, and how the micrographs were created, is included. This would be a wonderfully interesting book to have available as a reference, or to read aloud to small groups learning about insects.

*All in One Cookie*, by Susan E. Goodman (Greenwillow Books, 2006), is a fun combination of storybook and encyclopedia that follows Grandma as she bakes cookies using ingredients from all over the world. Her curious cat and pet dog romp around the pages, providing information about ingredients, their nutritive qualities, and origins. Lots of opportunities here to talk about measuring, chemical reactions, etc. Timothy Bush’s watercolor illustrations add expression and humor. This could be used to read aloud to young children, but the pictures and multiple perspectives of Grandma and pets lends itself better to students reading or looking at the book on their own.

*Hey There, Stink Bug!* by Leslie Bulion (Charlesbridge, 2006), is an anthology of poems devoted to entomology. Short, often humorous poems are accompanied by more factual information on each page. Leslie Evans’s beautiful, colored woodcuts lend an air of stateliness to the sometimes ridiculous poetry emphasizing the more extreme and gross insect behaviors that are sure to engage children. A glossary and list of Web resources follow the poems. These could be read aloud to younger students or left for third to sixth graders to peruse on their own.

*My Father’s Dragon*, by Ruth Stiles Gannett (Yearling, 2005), was originally published in 1948. This young person’s chapter book is an imaginary tale of the adventures of Elmer Elevator, who travels to Wild Island and Tangerina to rescue an imprisoned baby dragon. One of a trilogy, this story has opportunities for exploring problem solving, addition and subtraction, mapping, and writing word problems. Elmer leaves his home with items in his backpack like tangerines, bubble gum, ribbons, and encounters creatures such as monkeys and lions, who keep the dragon chained. Numerous lithographs by Ruth Crissman Gannett add to the charm of this Newberry honor book.
Resource Reviews

**Seamless Assessment in Science**, by Sandra K. Abell and Mark J. Volkmann, is a guide for elementary and middle school teachers that looks at the 5E model (Engage, Explore, Explain, Elaborate, and Evaluate) of inquiry-based science instruction. It ties formative assessment to that model. The authors’ hope is to assist educators in regarding teaching, learning, and assessing as one seamless act. Vignettes written by several contributing teacher/authors punctuate ideas for three areas of science: life science, physical science, and earth and space science. The anecdotal nature of the vignettes makes the information very accessible. Examples are given in each chapter for three levels of elementary school: grades K–3, 4–5, and 6–8. Many samples of student work illustrate the text. Extensive lists of online and other resources are provided in the appendix.


**Uncovering Student Ideas in Science, Volumes 1 and 2**, by Page Keeley, Francis Eberle, and Joyce Tugel, are large volumes of twenty-five science probes, K–12, for student assessment. The first volume focuses on an overview of formative assessment and formative assessment probes. The second volume looks at using formative assessment to teach for conceptual change. An anticipated third volume will outline ways of using the probes to further professional development and also advise readers on initiating learning communities that engage teachers in looking at student work and student thinking. The activities in each of these books have been extensively tested by teachers in classrooms throughout New England. These are great books with much specific, helpful content to offer teachers who are looking to better their practice.


**Yardsticks: Children in the Classroom Ages 4–14**, by Chip Wood, is now in its third edition. This guide progresses year by year to outline typical cognitive, social, and physical issues, qualities, challenges, and strengths of each age. General information is accompanied by suggestions for curricular implications (across subjects) based on the developmental traits of each age. This new edition includes discussion of bilingual issues for Latino/Hispanic children, updated recommendations for children’s books and updated teacher resources. This is a valuable resource to have on hand when considering the needs and abilities of the whole child, both for teachers and parents.


“The Inside the Black Box: Raising Standards Through Classroom Assessment,” by Paul Black and Dylan Wiliam, is the seminal work on formative assessment, published in 1998 in *Phi Delta Kappan*. This writing, based on research conducted in Great Britain, examines what conditions are necessary to create the best possibilities for teaching and learning. In addition to addressing teaching practice, the article looks at what support is needed from policy makers.

Checking for Understanding: Formative Assessment Techniques for Your Classroom, by Douglas Fisher and Nancy Frey, uses examples from actual classroom assessments, along with vignettes and model assessments to provide a variety of strategies for productive assessment. The authors have created an informative book with substantial background information, yet structured in a readable way. Their concern throughout is to check for understanding with the intent of advancing student learning. They explore the use of oral techniques, how (and how not) to use written work for assessment, and ways to approach projects, performances, and other nontraditional work from the point of view of assessment. Both authors have experience as classroom teachers, as well as with special education and intervention. Both now teach at San Diego State University.


Exploring Classroom Assessment in Mathematics, by Deborah Bryant and Mark Driscoll, is a handy step-by-step guide for any staff developer wanting to support teachers in a more meaningful assessment program. Written in 1998, this book continues to offer sound, reliable advice for planning assessment activities, putting them into action, and evaluating how helpful they are. Six teacher investigations are provided as well as an annotated resource list. This book contains a large amount of practical information in a brief number of pages.


Enhancing Inquiry through Formative Assessment, by Wynn Harlen, is a monograph inspired by a forum conducted by the Institute for Inquiry, part of the Exploratorium. The booklet presents research and theory to support ideas of formative assessment increasing student achievement. It examines what is necessary to implement these assessment practices and discusses the particular appropriateness of these practices with inquiry learning.

Keeping It All Together

by Bob Coulter

One of the biggest challenges I have faced over the years in trying to manage formative assessment is the seemingly simple task of keeping all of my information together. All too often I have found that my insightful observation about a student was a distant memory before I started to pull thoughts together for a more formal evaluation. Twenty years ago when I was doing my teaching internship, I worked one semester with a teacher who maintained a large three-ring binder with pages of notes about each student. Later in the year, another teacher I worked with seemed to have an amazing capacity to remember and integrate observations about each child’s abilities and disposition. Alas, neither the repository nor the memory bank approach worked for me. The endless managing of a binder meant lugging it home every night and back to school the next morning, or staying after school to record notes. Quite often for project work, I ended up writing the same thing in each student’s section. On the other end of the spectrum, my memory just isn’t good enough to remember all of the kids all of the time. In particular, the quieter kids were the ones for whom I regularly found myself drawing a blank when it came time to synthesize what I knew about each student.

Help on the Web

My twenty-year grail quest—first as a full-time teacher and now in my role as mentor to a couple dozen teachers—seems to have ended with the development of new (and free!) Web-based tools for managing all the intermittent pieces of information we need to hold on to if formative assessment is going to be useful.

The most significant addition to my professional tool belt in this regard is Highrise, a Web-based contact management tool from 37signals (http://www.37signals.com). While there are a plethora of address books, databases, and other software tools out there, Highrise has proven to be of particular value to me. Pragmatically, being Web-based means that I can access the information on each person from wherever I happen to be. Home, office, or even on the road (via my iPhone), I can check my notes or add to them almost instantly, whenever I need to. Even better, e-mails can be forwarded to a special e-mail address where the Highrise servers will add that information in that person’s page. Imagine how much easier that can make your life, as you instantly file parent suggestions and observations along with all of your other information about that student. You can improve two-way communication as you list each student’s parent contact and e-mail addresses on the sidebar for the student’s page.

Powerful organizational tools

Aside from this simplicity, you can assign tags to your students, using a virtually unlimited number of categories that you create. These tags then let you quickly call up the students with that tag for a quick note. Imagine you’ve identified the kids in the Bluebird group as needing a quick refresher on adding with decimals. Within Highrise, click on the Bluebird tag to “grab” all of the group members. All of the kids’ records with that tag will appear, lined up on the right side of the screen waiting for you to click on them. From here, simply type your observations once, copy them, and paste them into each student’s record. While you’re at it, create a to-do item reminding yourself to actually provide that refresher. Your to-do list is also in the sidebar on your screen.

I’ve found that the tags are a particularly powerful tool. Aside from organizational tags you might want to use (such
as which period of the day you see that student), you can also create tags based on projects or personal interests. For example, you can easily create an “eagles” tag for the group tracking eagles through Journey North, and use that to quickly log observations about their work. Again, through copying and pasting, you can save yourself considerable time in recording information that is relevant to more than one student, even if you have to manually tweak exactly what you record about each student. This redundancy was one of the reasons I was never able to maintain my enthusiasm for manual record keeping such as the “big binder” approach.

Add multiple users

All of this data management capacity is available to you as a free product that imposes no time limit. If you want to go further, paid subscription options are available that add useful features. Two of the most powerful are the ability to add users and add files. If you team-teach, having accounts for each teacher feeding into a common set of observations can create a much more useful record of students’ abilities, interests, and dispositions. Given that teachers almost never have time to talk about individual kids, this is a way you can literally compare notes on students for whom you share responsibility. Adding files simply provides a convenient way to store work samples or other relevant documents that are part of your ongoing assessment efforts.

While none of these tasks are impossible to do with paper-based tools, or with a software application installed directly on your computer, the flexibility of easy Web access and the grouping by tags has greatly improved my ability to manage information, to know what issues people are facing, and to plan the best next steps—all essential parts of making formative assessment a useful part of your professional practice. It’s free and there is no commitment required. Give it a try!

OTHER WEB 2.0 FAVORITES

GooToDo (http://www.gootodo.com): While I was skeptical about yet another “to-do list” at first and just gave it a quick try, it has now become a staple of my daily life. Unlike most lists that become overwhelming, GooToDo makes you focus on today’s projects, though of course you can flip ahead or backwards as needed. What I find most useful, though, is the ability to forward e-mails to the list. Imagine you get an e-mail from the principal about a staff meeting next Tuesday, with an agenda attached. Forward the e-mail to Tuesday@gootodo.com and it will know it’s from you (based on your e-mail address) and place it in your to-do list for Tuesday, complete with the attachment. When Tuesday comes around, it’s there waiting for you.

Backpack (http://www.backpackit.com): This Web-based service from the developers of Highrise is just what you wish your students’ backpacks were: A neat and organized way to store information, accessible to you from any browser. Need that information when you get home? Just open your Web browser, log in, and it’s there. Individual pages can also be made public without sharing your entire backpack, which can be great for parent communication. Directions for your next major project can easily be posted there for review, saving you the trouble of sending home another
The Silver Lining of NCLB

by Becky Reid

As I finalize my schedule for report card conferences I can’t help but reflect on how different my meeting with parents this year will be from those I held four years ago. As part of the effort to meet the mandates of NCLB, our district’s five point grading scale (Outstanding, Good, Satisfactory, Needs Improvement and Unsatisfactory), has been replaced with a Standards-Based Report Card. When compared to grade level standards students are rated as Advanced, Proficient, Basic, or Below Basic. We are in our fourth year of implementation. I have modified the way I plan instructional units, learned to use the results of student assessments to improve my teaching practice, and completely abandoned the traditional grade book.

The same year we moved to standards-based reporting, I was invited to join CAESL (Center for Assessment and Evaluation of Student Learning), a five-year grant funded by the National Science Foundation. CAESL is a collaboration of WestEd, UCLA, UC Berkeley, Stanford University, and the Lawrence Hall of Science. As a teacher participating in the CAESL Science Assessment Leadership Academy, I collaborated with teachers from my district and other districts around California to examine student work and the assignments that generated the work. We struggled together to align our assessments with standards, learning goals, and instructional tasks. The five steps listed below reflect my newest classroom practices.

1. Build a concept map

When planning, most of the time I used to refer to the teachers guide to determine general concepts, and searched for materials to supplement and add variety to the basic text. I was focused on content and learning objectives as defined by the publisher of the text I was currently using. Now, creating a concept map or conceptual flow for the unit allows me to plan, structure, and sequence the content in a way that leads to conceptual understanding of the big ideas in science. I currently use the textbook to reinforce and validate the ideas that students uncover on their own.

2. Select standards and identify benchmarks

I have developed a true intimacy with the standards, not just at my own grade level, but as a K–12 continuum. This has allowed me to streamline my teaching units and put more emphasis on the standards appropriate for my grade level. For example, matter and energy are addressed at both first and third grade. I previously assumed my students had no prior knowledge about matter and spent from two to four days providing experiences with solids, liquids, and gases. I learned that students are expected to know these properties by the end of first grade.

Now I ask students to do a quick pre-write to tell me what they know about matter and its properties. I use the pre-write to determine what students already know. I discovered that they retained most of what they had learned in first grade, allowing me to build on their previous learning.

Standards concepts build from grade level to grade level. If you learn what your students already know, you don’t need to start from the beginning every year. The other side of that is true as well. If students do not have the conceptual base they need to understand the new information, learning is not likely to happen unless you revisit some of the concepts from previous years first.

3. Review existing assessments. Determine whether to modify, or create new assessments.

As I struggled to align student assessment with the standards it became necessary to look critically at my assessment practices, asking myself, “How does this show that students are building skills and knowledge?” The publisher-made tests are mostly multiple choice, matching, and short answer. While they are good at letting you know if a student can select the one correct answer from a list of answers, they don’t tell you anything.
about the students’ level of understanding of the concept.

Before working with CAESL, I would give a pretest, teach the unit, give a post-test and compare the results to see if my teaching had been effective. If more than a few students missed particular items I would re-teach part of the unit and retest. I still give a pretest, but I look at what the test tells me about what each student understands and use that information to determine where to focus my instruction. I select several places throughout the unit to systematically monitor student levels of understanding using formative assessments. I learned that standards are endpoints, or the place I want all my students to get to by the end of the year, but that if I really want to improve student learning I need to monitor and adjust my teaching throughout the unit.

Of course, I already had inquiry built in to the lesson sequence, was using science notebooks, and was circulating among cooperative groups to monitor understandings, but I had no formalized system for consistently keeping track of student understandings during the unit. Through CAESL I learned to identify benchmarks along the way and to use formative assessment to see if those benchmarks were being met. (Figure 1)

**Examples:**

Grade 4 Standard: The properties of rocks and minerals reflect the processes that formed them. As a basis for understanding this concept:

Students know how to differentiate among igneous, sedimentary, and metamorphic rocks by referring to their properties and methods of formation (the rock cycle).

Here is a test question from Harcourt, 2001, Chapter Test 2:

Which of the following is NOT a characteristic scientists use to classify minerals?
- a. hardness
- b. volume
- c. luster
- d. streak

---

**Figure 1**

<table>
<thead>
<tr>
<th>Focus Question</th>
<th>Formative or Gradebook/ Juncture</th>
<th>How to Assess</th>
<th>Publisher Material— Lesson</th>
<th>CA Content Standard Addressed</th>
<th>Expected Student Response</th>
<th>Scoring Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>What causes changes in the earth’s physical features?</td>
<td>Pre</td>
<td>Pre-write</td>
<td>Harcourt B 4–TE</td>
<td>5.a 5.b 5.c</td>
<td>Rocks break down and cause sediment, the sediment is carried down the river and deposited at the river’s mouth. As the sediment increases the land area grows and the river changes.</td>
<td></td>
</tr>
<tr>
<td>What changes occur in a delta over time?</td>
<td>Formative</td>
<td>Written response/ drawings</td>
<td>Harcourt B 7, TE</td>
<td>5.a</td>
<td>Wind picks up sand and dry soil and carries it from one place to another. As a glacier moves, the great size and weight of the ice mass scrapes the land beneath it and carries pieces of rock and soil along with it. Wind forms sand dunes and unusual rock formations; glaciers form U-shaped valleys.</td>
<td></td>
</tr>
<tr>
<td>How do wind and glaciers change landforms?</td>
<td>Formative</td>
<td>Written response</td>
<td>Harcourt B 8, TE</td>
<td>5.a</td>
<td></td>
<td></td>
</tr>
<tr>
<td>What forces cause erosion and deposition?</td>
<td>Gradebook/ Juncture</td>
<td>Written response</td>
<td>Harcourt B 11, TE</td>
<td>5.a 5.b</td>
<td>The action of water, wind, ice, and gravity break down Earth’s crust and change landforms. Students know that moving water erodes landforms, reshaping the land by taking it away from some places and depositing it as pebbles, sand, silt, and mud in other places (weathering, transport, and deposition). Tree roots weather rocks by growing into them and breaking them into pieces.</td>
<td></td>
</tr>
<tr>
<td>What part do tree roots play in the weathering of rocks?</td>
<td>Formative</td>
<td>Written response</td>
<td>Harcourt B 50, TE</td>
<td>5.b</td>
<td></td>
<td></td>
</tr>
<tr>
<td>What are some conditions that are likely to produce a mudslide?</td>
<td>Formative</td>
<td>Written response</td>
<td>Harcourt B 9, TE</td>
<td>5.c</td>
<td>Mudslides can be caused by any combination of heavy rains, steep hills, or wet soil. Gravity becomes stronger than the friction that holds soil in place on the hill.</td>
<td></td>
</tr>
<tr>
<td>What processes cause changes in the surface of the earth? How do these changes occur?</td>
<td>POST</td>
<td>Written response</td>
<td>Harcourt Lesson 1 B-11</td>
<td>5.a</td>
<td>Slow processes that shape and reshape the earth’s surface are waves, wind, water, ice, and gravity.</td>
<td></td>
</tr>
</tbody>
</table>
When the student answers this item correctly you don’t know whether it is because they made a lucky guess or whether they really know that hardness, luster, and streak are properties that can be used to identify rocks and minerals.

Instead, I’ve replaced the item with an open-ended writing prompt, adapted from the End-Of-Module Assessment for the FOSS Earth Materials Unit:

This prompt gives me a lot more information about what my students already know and what they need to learn to move to the next level. This information informs my instruction and guarantees that every student will have an opportunity to move forward from where they began.

4. Plan instructional opportunities
I began to notice that when I planned my assessments first, it changed the way I thought about planning learning experiences for my students. I moved from just planning a sequence of activities designed to eventually lead to concept understanding, to asking myself: “How am I going to formulate questions for students about this, and what are the students going to learn?”

5. Use data from assessment to improve student learning
As part of our CAESL portfolio we were required to analyze patterns of understandings for our target students and for the class as a whole. The researchers did not tell us how to go about looking at our assessments. This was uncomfortable, but it forced me to think about what concepts were important and how to identify assessment points throughout the instructional sequence that could provide meaningful information about what students really understand. CAESL prompted me to keep asking myself how my assessment practices could uncover learning for all kids.

Yes, NCLB has created many difficulties as districts struggle to implement its many mandates, but I am grateful that I am now working in a standards-based school. I see the difference it makes in how I plan for student learning and how students learn to accept responsibility for what they learn. The changes are at times uncomfortable and always challenging, but the payback is worth the effort.

Sasha found a stone in the park near her home. She wasn’t sure if it was a rock or a mineral, so she took it home to try some tests. Below are the observations she wrote in her field notebook.

**DATE:** 4/12/2006
**PLACE FOUND:** Sunset Park
**OBSERVATIONS:**
- About the size of my fist.
- Colors: mostly light gray with brown, tan, black, and white smooth round pieces sticking out.
- I can scratch the black pieces with a paper clip.
- I can scratch the brown and white pieces with a penny
- When I put the stone in a glass of vinegar, it fizzes.

The stone Sasha found was a _______________.
(circle the correct answer below)
rock
mineral

Write an explanation that justifies your answer; include supporting evidence from Sasha’s observations. Explain the relationship between rocks and minerals.

Becky Reid is currently working as a third/fourth grade teacher at Sunset View Elementary School in San Diego, California. She has also taught grades one, five, six and Learning Handicapped students, both in the Special Day Class and as a Resource Specialist. She is a part time science staff developer through the NEXT STEP grant with San Diego City Schools and the K–12 Alliance.
<table>
<thead>
<tr>
<th>Level</th>
<th>What the Student Already Knows</th>
<th>Expected Student Response</th>
<th>What the Student Needs To Learn</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>Advanced</td>
<td>Student identifies the stone as a rock and notes the difference between a rock and a mineral by stating that rocks are made up of minerals and identifies at least three of the following properties.</td>
<td>The student needs a better understanding of the range of properties that can be used to determine whether the object is a rock or a mineral.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• There were several colors in the same rock.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• It looked like pieces stuck together and minerals have only one ingredient.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• The different pieces showed different scratch results.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Fizzing indicated that calcite is an ingredient.</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Proficient</td>
<td>Student identifies the stone as a rock and notes the difference between a rock and a mineral by stating that rocks are made up of minerals and justifies it with two of the properties listed above.</td>
<td>Needs to state that minerals are the basic elements of rocks.</td>
</tr>
<tr>
<td>2</td>
<td>Basic</td>
<td>Student identifies the stone as either a rock or a mineral and supports the choice with at least one property from the list. The student may say that rocks and minerals are different, but does not state that rocks are made up of minerals.</td>
<td>The student needs to state that rocks and minerals are not the same thing.</td>
</tr>
<tr>
<td>1</td>
<td>Below Basic</td>
<td>Student identifies the stone as either a rock or a mineral, but supporting information shows misconceptions (a rock cannot be flat, minerals have colors and rocks are gray, rocks are bigger, etc.).</td>
<td>Student needs to know that minerals have properties that can be described.</td>
</tr>
<tr>
<td>0</td>
<td>Off Target</td>
<td>Does not complete task or gives information that has nothing to do with what was asked.</td>
<td></td>
</tr>
</tbody>
</table>
Mid-Stream Performance Assessment

Amid the focus on formative assessment in this issue, there is also an opportunity to explore performance assessment in which students carry out a specific task or investigation, actively using materials to accomplish the task. Their work is observed and their performance is assessed using appropriate rubrics.

In these assessments, students demonstrate skills in real time. Science, math, and technology are ideal fields for this type of assessment. It is particularly valuable “midstream” in a unit or period of time, providing excellent formative assessment. Students need experience with performance assessment in order to be comfortable doing it, but this is a skill they will use on many occasions in the future.

You can find examples of teacher-designed performance assessment related to math and science at every level, K through 5th grade on the Synergy Learning Web site: http://www.synergylearning.org. Select Connect archives, choose search articles, then enter Mid-stream performance assessment.

Performance assessment has to be designed to be a fair test for students and manageable by teachers. It needs simple materials and equipment with which students have some familiarity. Teachers have to arrange a way to observe individuals or small groups. Is it too much trouble? Not when you see the results of what you and students learn by going through the process.