

TEACHERS'
INNOVATIONS IN
K-8 SCIENCE,
MATH, AND
TECHNOLOGY

Connect™

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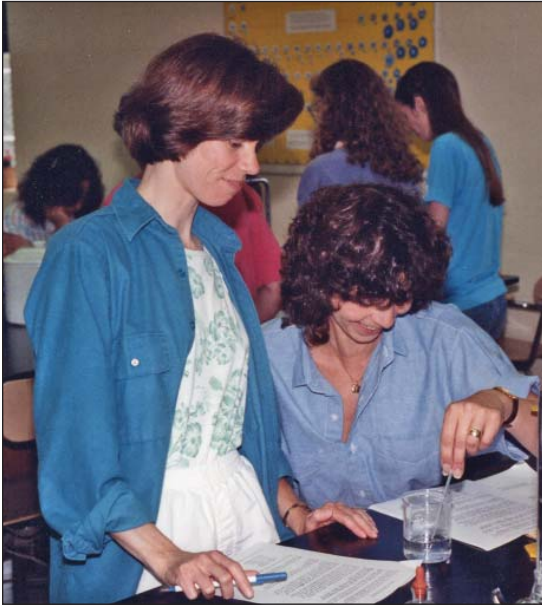
THIS ISSUE'S FOCUS

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!

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Important Lessons

TEACHERS ADJUST THEIR INSTRUCTION METHODS

by Joan Herman and Ron Dietel

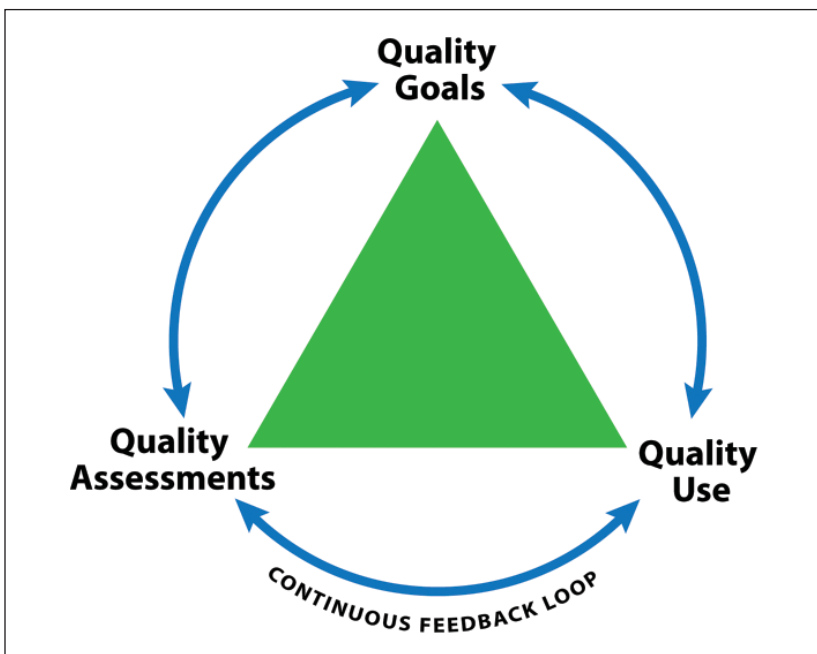
Although the term *formative assessment* seems to have exploded into our education vocabulary during the past decade, its roots go back to Ralph Tyler's curriculum rationale (1949), B. F. Skinner's behaviorism and programmed instruction (1953, 1960), and Benjamin Bloom's concept of Mastery Learning (Bloom, 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.

Figure 1. *Quality Classroom Assessment Framework* (adapted from the CAESL *Quality Assessment Framework*, CRESST Report 703)



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 stu-

dents' 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



Teachers engage in initial planning for a community mapping project. When carried out, the project used various ongoing assessment strategies, in order to provide a picture of students' achievements in mapping and measurement skills, as well as a record of their ways of representing information on their maps.

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. ✍

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.

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