

Mathematics Assessment

struggle in making the transition from traditional instruction toward teaching mathematics for understanding. When teachers use a reform curriculum, with its potential to promote student understanding, initially they are often unaware of the need to reconsider their current assessment practices in light of the rich evidence generated through complex, real-world mathematics problems. However, as portrayed in Chapters 2, 3, and 4, and particularly in Chapters 11 and 12 by teachers Ann Frederickson and Teresa Her, considerable instructional conflict is generated when teachers use a limited range of assessment practices to assess more substantive learning goals. Getting teachers to shift their assessment practices toward assessing student understanding has the potential of invoking real instructional change, which is key to reaching the overall reform goals for school mathematics.

Although research supports the contention that formative assessment benefits student learning and can be used to facilitate learning with understanding, many mathematics teachers (as described in several chapters here) show limited understanding of the ways in which formative assessment can be incorporated into their classroom prac-

but in order to do this effectively, teachers require support in developing their ability to monitor student progress. In the studies reported in this volume, we found that teachers needed technical assistance with assessment design and that they sought tools and methods to further develop their capacity to assess student learning. The studies also showed that teachers could learn to use such practices in their classrooms, that they needed the support of appropriate professional development to do so, and that, as a result, their students' achievement improved (Fennema & Nelson, 1997; Webb et al., 2001).

The assessment methods used by teachers at the sites initially were /Tmproved nt methods uoteaessds at the suchleary21 Tj1thers could leurt ctet

activities to further develop those conceptions. The mapping of instructional activities and assessment tasks onto a learning sequence for specific mathematical domains is based on the concept of *hypothetical assessment trajectories* (de Lange, 1999), which are loosely sequenced sets of performance benchmarks for student learning in a content domain. The notion of learning lines within content domains is used as an organisational framework for teachers to select, adapt, and design assessments. There are practical issues teachers must consider, however:

they can reasonably assess individual and collective learning within a classroom setting. (For additional examples of using learning trajectories as an organizational tool for instruction, see van den Heuvel-Panhuizen [2001], Fosnot and Dolk [2002], and Romberg, Carpenter,

Outcomes

- Teacher dissatisfaction with current methods
 - Teacher classroom experimentation
 - Teacher use of other formative assessment methods
 - Teachers developing a sense of the pros and cons of using other methods in *their*
- Teacher categorization of tasks
 - Teachers designing Level 2 and Level 3 tasks
 - Teachers designing and using classroom instruments to assess a wider range of student thinking
 - Teacher development of nonconventional assessment instruments
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- Teachers learning to interpret student reasoning and use different student work as starting point for instruction (i.e., teaching student understanding)
 - Increased use of student argumentation

Initiate

Professional development activities in this category are oriented

assessment practices. Teachers critique "expert" assessments, such as commonly used standardized tests and conventional classroom assessments. Teachers also engage in other assessment methods, as students, and respond to tasks that require Level 2 and Level 3 reasoning and

of shared knowledge is promoted through ongoing institutes, design and

a more comprehensive view use a wider range of assess administrators and teachers sional development program room assessment. Those inv as an opportunity to promo student understanding of m interrelated principles of ass work, and instructional deci

In the CATCH program grounded in the theory and ers developed a broader view for teaching for student unde tasks, instructional activities struction. Teacher inquiry o ploration of classroom as supported by ongoing collab ers the beginnings of a the assessment practices more teachers and administrators practical ways to monitor th lum standards and develop ing student performance on standardized tests. We note

last several years—until the practices become *self-sustaining*—and that the goals for students are long term. By *collaborative*, we mean that there is a mutual relationship between the professional development staff and the teachers and that information and resources provided by the professional development staff respond to the needs and gradual development of the teachers as they change their formative assessment practices.