

# Dynamic Classroom Assessment: Linking Mathematical Understanding to Instruction

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Materials published by ETA/Cuisenaire  
800-445-5985 [www.etacuisenaire.com/DCA](http://www.etacuisenaire.com/DCA)

## Program Overview

*Dynamic Classroom Assessment (DCA)* is a professional development program that is designed to help mathematics teachers learn how to gather information about students' mathematical thinking, make inferences about what students know and can do, and then make instructional decisions that are better aligned with students' mathematical understanding. *Classroom assessment* is the label for this process.

In order to be implemented effectively, classroom assessment needs to be incorporated into instruction, specifically by—

- integrating classroom assessment into planning for instruction
- gathering evidence about what students know and can do
- making inferences from that evidence about what students understand
- adjusting instruction to account for the inferred levels of students' understanding

Carrying out this process is not easy. Teachers need opportunities to learn about classroom assessment and then plan for implementing the ideas. *Dynamic Classroom Assessment* is designed to enrich teachers' knowledge so that they can implement better instruction using knowledge of what students know and can do.

**There is strong evidence that if teachers use classroom assessment effectively, one result will be greater student learning.**

*DCA* will be deemed a success if teachers use classroom assessment to help students learn more. Teachers who understand what students know and can do are able to plan instruction so that it is better aligned with the needs of students.

## Key Program Elements

In *DCA*, teachers first explore the ways in which different assessment methods can be aligned with specific learning targets. Different methods have the potential to reveal different information about students' thinking, just as different approaches to solving mathematics problems may indicate different levels of mathematical thinking. These explorations help teachers become more cognizant of the importance of examining students' thinking.

**Second**, in order to understand students' thinking, teachers learn to distinguish between what students know (i.e., the substance of an idea) and the way that students show what they know (i.e., the presentation of an idea). Said another way, the substance of an idea is the meaning that students have internalized, while the presentation of an idea is the way that this meaning is communicated. Errors that students make may be miscommunication of real understanding, or they may be more-or-less accurate communication of misunderstanding.

**Third**, in order to gather information about students' thinking, teachers develop questioning skills. There are several kinds of questions that teachers might ask, but the most important ones for revealing students' thinking are clarifying and probing questions. These questions help students clarify their own thinking and clarify that thinking for the teacher and other students. Developing the skills to create specific questions takes practice and reflection.

**Fourth**, once information is gathered and interpreted, teachers use their inferences as part of instructional decision-making. Better planning happens when there are opportunities for reflection, discussion with colleagues, analysis of associated mathematical ideas, and exploration of different strategies for teaching. *DCA* helps teachers improve their instructional decision-making.

## Organization and Delivery of Materials

*Dynamic Classroom Assessment* is a professional development program consisting of 14 contact hours designed for elementary teachers and 60 hours geared to secondary math teachers.

Each DCA course offers two kinds of sessions, each of which is organized around a series of activities (e.g., solving mathematics problems or studying students' solutions to mathematics tasks). In most sessions, new information is introduced to participants, sometimes with specific suggestions for homework tasks that help teachers apply what they have learned. Every third session is a "classroom implementation" session during which participants reflect on the information from the two previous sessions and share the ways that they have used that information in their teaching.

The elementary materials provide 14 hours of professional development in seven, two-hour sessions. The core module is designed to introduce elementary teachers to the positive effects of careful implementation of classroom assessment on students' learning.

The elementary core module lays out the major components and issues related to classroom assessment addressed in three main ideas:

- assessment methods and grading (sessions 1-3)
- mathematical language, symbols, and models (sessions 4-5)
- questioning to reveal students' thinking and to promote discussion. (sessions 6-7)

At the beginning and end of the Core Module, participants reflect on their understanding of classroom assessment. Comparison of these reflections is a way to document participants' learning

The secondary materials offer a core module and three extension modules for a total of 60 hours of professional development. The sessions should be scheduled over a period of months, perhaps as long as two years, to give participants time to internalize the information and become comfortable using it in their own teaching.

The secondary core module addresses three main ideas:

- model for classroom assessment and study of different assessment methods (sessions 1–3)
- scheme for distinguishing between the substance and the presentation of a mathematical idea and study of how clarity of language can influence students' learning (sessions 4–6)
- categorization of questions according to their purposes and opportunities to develop questioning skills (sessions 7–9)

Session 10 of the secondary core materials provides a chance for participants to reflect on and synthesize what they have learned and to think about how the skill of classroom assessment might continue to develop.

The secondary extension modules provide opportunities to revisit and focus in greater depth on ideas from the core module. Specifically, they extend teachers' knowledge of (a) how to make sense of the thinking of a group of students, (b) ways to encourage and support student self-assessment, and (c) substance and presentation as it relates to the content of data and geometry.

*DCA* materials include Facilitator's Guides and Participant's Guides, a PowerPoint slide presentation for each session, and videos for some sessions. Facilitator's Guides include management suggestions and background information for the professional developer. The Participant's Guides include all handouts, readings, and copies of the PowerPoint slides with space for note-taking. There are "benchmark tasks" at the beginning and end of the core module that help document what teachers learn from participation in *DCA*. When the sessions have been completed, the Participants' Guides become references on classroom assessment that have been personalized with specific comments and reflections.

## **Research Background**

*Dynamic Classroom Assessment* was created in large part as an outgrowth of the belief that when teachers understand what students know and can do, and then use that knowledge to make more effective instructional decisions, the net result is greater learning for students and a greater sense of satisfaction for teachers. Fortunately, this belief is supported by a large and expanding body of research and theory about effective instruction—

- Black and Wiliam (1998) conclude from an examination of 250 research studies on classroom assessment that "formative assessment does improve learning"—and that the achievement gains are "among the largest ever reported for educational interventions." The effect size of 0.7, on average, illustrates just how large these gains are.... In other words, if mathematics teachers were to focus their efforts on classroom assessment that is primarily formative in nature, students' learning gains would be impressive. These efforts would include gathering data through classroom questioning and discourse, using a variety of assessment tasks, and attending primarily to what students know and understand. (Wilson & Kenney, 2003, 55)
- Classroom-based formative assessment, when appropriately used, can positively affect learning. According to the results of this review, students learn more when they receive feedback about particular qualities of their work, along with advice on what they can do to improve. They also benefit from training in self-assessment, which helps them understand the main goals of the instruction and determine what they need to do to achieve. But these practices are rare, and classroom assessment is often weak. The development of good classroom assessments places significant demands on the teacher. Teachers must have tools and other supports if they are to implement high-quality assessments efficiently and use the resulting information effectively. (Pellegrino, Chudowsky, & Glaser, 2001, p. 38)

## References

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