



For the Success of Each Learner

ClassroomLeadership

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What Should We Teach?

Critical Thinking at the Primary Level



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Discrete mathematics, combinatorics, games of logic: these terribly complex-sounding concepts actually can—and should—be taught to children as early as age five. So asserts Judith Gugel, a veteran primary teacher whose innovative instructional approaches have earned her a host of awards, including the 1998 Presidential Award for Excellence in Mathematics and Science Teaching. Still, Gugel told teachers at ASCD's 2001 Classroom Leadership Conference, despite her creativity in the classroom, she always felt there was something missing from her primary program.

That something, it turns out, was mathematics instruction that required younger students to think critically. Primary teachers "are taught very well how to teach arithmetic," but children need to be trained to think about mathematics "in a way that's logical" and that takes them beyond computation, Gugel says. If children become used to making predictions, looking for patterns, and applying mathematics to real-world situations, then "they won't be surprised" when they're asked to perform such tasks in upper-level mathematics classes.

Discovering the Missing Piece

Gugel came to this realization after attending a workshop on discrete mathematics. Discrete mathematics, she explains, is based in real-world situations. "It's the math used by decision makers in our society," Gugel states. It's the math, for example, that a city planner would use to determine the best route for snow plows to follow when clearing streets in the winter.

At the primary level, it's the kind of math that helps children figure out the following problem:

Bobbie Bear and her grown-up are going on vacation for four days. Her grown-up tells her to pack her clothes for four days. Bobbie Bear has a red shirt and a blue shirt, a pair of red shorts and a pair of blue shorts. Can Bobbie Bear dress differently each day?

To begin, students are given a worksheet with six bears and asked to indicate how many bears they'll have to dress (the answer is four). Students are then asked to predict the answer—whether or not Bobbie Bear can dress differently each day—before they begin dressing the bear in different outfits and comparing the outcomes. Students are asked to record the outcome of the predict-and-compare activity. Did they predict correctly?

This kind of problem supports national early childhood education and mathematics standards, Gugel points out. Students use communication and problem-solving skills—skills emphasized in the standards.

Leveling the Playing Field

Meeting standards and preparing students for upper-level mathematics are key reasons for introducing discrete mathematics to younger students, Gugel says. What's equally important, she notes, is that more children succeed in mathematics through this approach. "Students with special needs may not have strong computation skills," but this type of applied mathematics "gives them an opportunity to be leaders," she states.

Indeed, Gugel believes that teaching discrete mathematics has dramatically improved her instruction—her students think more deeply than she ever thought possible. This approach to mathematics instruction, she maintains, "opened my eyes about the ability of students that age."

Judith Gugel teaches kindergarten at Agnes E. Little School in Pawtucket, R.I. She became involved with the Discrete Mathematics Leadership Program at Rutgers University in 1996. Two years later, she received the 1998 Presidential Award for Excellence in Mathematics and Science Teaching for elementary mathematics. Gugel can be reached by e-mail at ride0870@ride.ri.net.

Note: a longer version of this article appears in the Web-Only section of this issue.

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