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Return to Basics
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Drills Without Calculators****Taking Cues From Singapore****By JOHN HECHINGER**
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The nation's math teachers, on the front lines of a 17-year curriculum war, are getting some new marching orders: Make sure students learn the basics.

In a report to be released today, the National Council of Teachers of Mathematics, which represents 100,000 educators from prekindergarten through college, will give ammunition to traditionalists who believe schools should focus heavily and early on teaching such fundamentals as multiplication tables and long division.

The council's advice is striking because in 1989 it touched off the so-called math wars by promoting open-ended problem solving over drilling. Back then, it recommended that students as young as those in kindergarten use calculators in class.

Those recommendations horrified many educators, especially college math professors alarmed by a rising tide of freshmen needing remediation. The council's 1989 report influenced textbooks and led to what are commonly called "reform math" programs, which are used in school systems across the country.


The new approach puzzled many parents. For example, to solve a basic division problem, 120 divided by 40, students might cross off groups of circles to "discover" that the answer was three.

Infuriated parents dubbed it "fuzzy math" and launched a countermovement. The council says its earlier views had been widely misunderstood and were never intended to excuse students from learning multiplication tables and other fundamentals.

Nevertheless, the council's new guidelines constitute "a remarkable reversal, and it's about time," says Ralph Raimi, a University of Rochester math professor.

Francis Fennell, the council's president, says the latest guidelines move closer to the curriculum of Asian countries such as Singapore, whose students tend to perform better on international tests. There, children focus intensely on a relative handful of topics, such as multiplication, division and algebra, then practice

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by solving increasingly difficult word and other problems. That contrasts sharply with the U.S. approach, which the report noted has long been described as "a mile wide and an inch deep."

If states adopt the new standards and teachers adjust their methods, "we'll be more competitive," says Prof. Fennell, who teaches at McDaniel College in Westminster, Md.

Nearly 80 teachers and other experts spent 18 months writing and reviewing grade-by-grade guidelines, which cover preschool through eighth grade. The panel aims to give a roadmap to instructors, schools systems and states about exactly what children should be learning -- and to start a debate that could put the math wars to rest.

According to their report, "Curriculum Focal Points," which is subtitled "A Quest for Coherence," students, by second grade, should "develop quick recall of basic addition facts and related subtraction facts." By fourth grade, the report says, students should be fluent with "multiplication and division facts" and should start working with decimals and fractions. By fifth, they should know the "standard algorithm" for division -- in other words, long division -- and should start adding and subtracting decimals and fractions. By sixth grade, students should be moving on to multiplication and division of fractions and decimals. By seventh and eighth grades, they should use algebra to solve linear equations.

Unlike many countries, the U.S. has no nationally mandated curriculum, so the math council's guidance has significant influence. In recent years, states have developed their own standards, in part because of the federal No Child Left Behind law, which requires that schools make progress in raising students' scores on state achievement tests. Another math group, the National Mathematics Advisory Panel, created by President Bush, is preparing its own guidance for how best to teach the subject. It meets in Cambridge, Mass., this week.

A recent study by the Thomas B. Fordham Foundation, a Washington nonprofit group, found that only two dozen states specified that students needed to know the multiplication tables. Many allowed calculators in early grades.

Chester E. Finn Jr., the foundation's president and a former top official at the U.S. Department of Education, blamed the earlier math-council guidelines for state standards that neglect the basics. He described the new advice as a "sea change," saying that "it's a little bit like Lutherans deciding to become Catholics after the Reformation."

Supporters of the council's previous views worry that the new report may lead to a return to the kind of rote learning they say left many children without any understanding of concepts. They say few adults spend much time doing long division, and students are better served getting a grounding in real-life problem solving.

"The risk is that we end up with students who have no idea what math is all about or how to use it," says Joseph Rosenstein, a math professor at Rutgers University in New Jersey who reviewed the new guidelines.

Understanding math, rather than parroting answers to poorly understood equations, was the goal of the council's controversial 1989 standards. Those guidelines called on teachers to promote estimation, rather than precise answers. For example, an elementary-school student tackling the problem 4,783 divided by 13 should instead divide 4,800 by 12 to arrive at "about 400," the 1989 report said. The council said this approach would enable children using calculators to "decide whether the correct keys were pressed and whether the calculator result is reasonable."

"The calculator renders obsolete much of the complex pencil-and-paper proficiency traditionally

emphasized in mathematics courses," the council said then. In 2000, in another report, the council backed away somewhat from that position.

Still, in response to the earlier recommendations, many school systems required children to describe in writing the reasoning behind their answers. Some parents complained that students ended up writing about math, rather than doing it.

As the debate heated up, concern grew about U.S. students' math competence. In 2003, Trends in International Mathematics and Science Study, a test that compares student achievement in many countries, ranked U.S. students just 15th in eighth-grade math skills, behind both Australia and the Slovak Republic. Singapore ranked No. 1, followed by South Korea and Hong Kong. Fueling concern about the quality of elementary and high-school instruction: one in five U.S. college freshmen now need a remedial math course, according to the National Science Board.

If school systems adopt the math council's new approach, their classes might resemble those at Garfield Elementary School in Revere, Mass., just north of Boston. Three-quarters of Garfield's students receive free and reduced lunches, and many are the children of recent immigrants from such countries as Brazil, Cambodia and El Salvador.

Three years ago, Garfield started using Singapore Math, a curriculum modeled on that country's official program and now used in about 300 school systems in the U.S. Many school systems and parents regard Singapore Math as an antidote for "reform math" programs that arose from the math council's earlier recommendations.

According to preliminary results, the percentage of Garfield students failing the math portion of the fourth-grade state achievement test last year fell to 7% from 23% in 2005. Those rated advanced or proficient rose to 43% from 40%.

Last week, a fourth-grade class at Garfield opened its lesson with Singapore's "mental math," a 10-minute warm-up requiring students to recall facts and solve computation questions without pencil and paper.

"In your heads, take the denominator of the fraction three-quarters, take the next odd number that follows that number. Add to that number, the number of ounces in a cup. What is nine less than that number?" asked teacher Janis Halloran. A sea of hands shot up. (The answer: four.)

Ms. Halloran then moved on to simple pencil-and-paper algebra problems. "The sum of two numbers is 63," one problem reads. "The smaller number is half the bigger number. What is the smaller number? What is the bigger number?" (The answers: 21 and 42.)

In this class, the students didn't use the lettered variables that are so prevalent in standard algebraic equations. Instead, they arrived at answers using Cuisenaire rods, sticks of varying colors and lengths that they manipulate into patterns on the tops of their desks. The children use the rods to learn about the relationship between multiplication and geometry. The goal: a visceral and deep understanding of math concepts.

"It just makes everything easier for you," says fifth-grader Jailene Paz, 10 years old.

The Singapore Math curriculum differs sharply from reform math programs, which often ask students to "discover" on their own the way to perform multiplication and division and other operations, and have come to be known as "constructivist" math.

One reform math program, "Investigations in Number, Data and Space," is used in 800 school systems

and has become a lightning rod for critics. TERC, a Cambridge, Mass., nonprofit organization, developed that program, and Pearson Scott Foresman, a unit of **Pearson PLC**, London, distributes it to schools.

Ken Mayer, a spokesman for TERC, says many parents have a "misconception" that Investigations doesn't value computation. He says many school systems, such as Boston's, have seen gains in test scores using the program. "Fluency with number facts is critical," he says.

Polle Zellweger and her husband, Jock Mackinlay, both computer scientists, moved to Bellevue, Wash., from Palo Alto, Calif., two years ago so their two children could attend its highly regarded public schools. She and her husband grew suspicious of the school's Investigations program. This summer, they had both children take a California grade-level achievement test, and both answered only about 70% of the questions correctly. Ms. Zellweger and her husband started tutoring their children an hour a day to catch up.



Molly Mackinlay

"It was a really weird feeling," says their daughter, Molly Mackinlay, 15. "I do really well in school. I am getting A-pluses in math classes. Then, I take a math test from a different state, and I'm not able to finish half the questions."

Eric McDowell, who oversees Bellevue's math curriculum, says parents misunderstand Investigations. Mr. McDowell says schools supplement the program with more traditional drilling in the basics, and students end up flourishing in the system's rigorous high-school courses. "It's not an either/or situation," he says.

In the Alpine School District in Utah, parent Oak Norton, an accountant, has gathered petitions from 1,000 families to protest the use of Investigations. His complaints began more than two years ago, when he discovered at a parent conference that his oldest child, then in third grade, wasn't being taught the multiplication tables.

Barry Graff, a top Alpine school administrator, says the system has added more traditional computation exercises. Over the next year, Alpine plans to give each school a choice between Investigations or a more conventional approach. Mr. Graff, who says Alpine test scores tend to be at or above state averages, expects critics to keep up the attacks and welcomes the national math council's efforts to provide grade-by-grade guidance on what children should learn.

"Other than the war in Iraq, I don't think there's anything more controversial to bring up than math," he says. "The debate will drive us eventually to be in the right place."

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