

Growing with math

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SCHOOLS: Ridgefield's new approach to math teaches not just 'how,' but 'why'

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[http://www.acorn-online.com/news/publish/article\\_14189.shtml](http://www.acorn-online.com/news/publish/article_14189.shtml)

Math was being taught even though it was "Western Day" at Veterans Park School. Students in Aileen Howards' class looked over a "hundreds chart" that they can use as one of some seven approaches to doing addition problems. From left are Lauren Ahern, John Odeen (in front), Dante Langdon, Juliana Waite, Ms. Howards, Math Coordinator Jeff Swiatowicz, and Andrew Mercorella. ?Macklin Reid photo

Brilliant generals don't just follow orders.

Problem solvers - whether in West Point, grade school, or the minefields of life - need to know more than procedures, rules, and formulas. They must learn to venture guesses, imagine consequences, try out ideas, backtrack and try again. They need to learn to think.

Elementary school students used to learn addition boot-camp style: Line up the ones over ones, tens over tens: Computation, hut! And if the ones total more than ten, "carry" a one to the top of the next column.

Second graders learning addition in the Ridgefield schools today are more like West Point cadets who learn to obey orders but also study tactics, military history, foreign cultures: What's the heart of the problem, and the best way to tackle it? What would happen if we did this?

$14+32=46$

There's more than one way to add.

"Now, with this new program, there are at least seven or eight strategies that students can choose from," said Jeffrey Swiatowicz, who's helping elementary teachers learn the schools' new Growing with

Math program.

To add 14 and 32, there's the traditional approach. Line them up carefully, starting at the right: the 4 of 14 goes over the 2 of 32 on the right; and the 1 of 14 over the 3 of 32 in the next column to the left. Add the numbers in the right column: Four plus two is six. And the left: One plus three is four.

Six, on the right, beside four on the left: 46. The answer is forty-six.

Today, though, students could also add by "decomposing the numbers." It's not hard. People do it to add things in their head, without paper.

The numbers are looked at in parts, tens and ones: 14 is also  $10 + 4$ . And 32 is  $30 + 2$ .

So the problem of  $14 + 32$  is taken in three steps:

$$10 + 30 = 40.$$

$$4 + 2 = 6.$$

$$40 + 6 = 46.$$

Another approach that works well for some students is "the hundreds chart."

Students start to learn this method by drawing out great square charts in which the top line goes from 1 to 10, the second line goes from 11 to 20, the third line goes from 21 to 30, down to a bottom line going from 91 to 100. They learn the patterns of the chart.

The horizontal lines count from left to right: On top there's 1, 2, 3, 4, 5, 6... to 10. Just below it: 11, 12, 13, 14... to 20. And below that 21, 22, 23... to 30.

The vertical columns also have patterns that are interesting, and memorable. At left, from top to bottom: 1, 11, 21, 31, 41, 51... down to 91. Next column: 2, 12, 22, 32, 42... down to 92. At far right, 10, 20, 30, 40... all the way to 100.

Kids learn that another way to add 14 and 32 is to count on the chart. First they find one number - the 14, say. They want to add 32, so they count down three more, vertically, from the 14 spot: 14, 24, 34,

44. From there, 44, they add two, counting two more over from 44 horizontally on the chart: 44, 45, 46. The answer to  $14 + 32$  is 46.

Eventually, some kids learn an easy way to add the numbers is to visualize what they'd do on the chart, without drawing the whole thing out. They start at 14, and arrive at the right answer by mentally going down three lines and over two columns:

14

24

34

44, 45, 46.

Concepts, not just process

"It's really a conceptually-based program," said Barlow Mountain Principal Pat Michael, who served on the committee that chose McGraw-Hill's Growing with Math series for the Ridgefield schools.

"In addition to promoting the core skills, say for example numeric thinking - addition, multiplication, subtraction, division - you're also looking at those core skills as being conceptual," she said. "And so the teacher teaches children the whole idea that addition is combinations and recombinations, and the whole idea of subtraction is wholes and parts removed from wholes.

"Numeric thinking is emphasized in all these new programs," Ms. Michael said, "but in this one in particular."

The committee, which included teachers, administrators and parents chose Growing with Math after spending most of the 2005-06 year looking at different programs, visiting schools where they're used, and trying them out here.

Assistant Superintendent Michael Hibbard, who oversees curriculum and instruction throughout the school system, said that after visiting other schools, "we got sample materials from each of the programs, and tried them out with our kids."

The committee would pick out a particular lesson - say "estimation" as taught to third graders - and get the version of it each different program offered, and have teachers try them out in Ridgefield classes.

Eventually, Growing With Math was chosen, which includes "a great huge set of student consumables, and student books, and teacher books, and manipulatives - a very, very extensive classroom set," Dr. Hibbard said.

Growing with Math started being used in kindergarten, first and second grade this fall, and will be introduced in third, four and fifth grade next year.

#### Test scores

The decision to look for a new approach in math grew from several years of scoring behind other top suburban schools on the Connecticut Mastery Tests CMTs, which also highlighted some particular areas of weakness - such as estimation skills.

For instance, among eight similar Fairfield County suburban school districts in the state's top "demographic reference group" - called "DRG-A" - on the most recent CMTs, Ridgefield students scored eighth of the eight schools in third grade, with 75.1% of students at state goal (New Canaan was first with 85.4% at goal).

"We needed to have a foundation that was much stronger than what we were getting," Dr. Hibbard said. "...Basis skills are necessary but not sufficient to develop math common sense, math problem solving. If you don't have the tools you can't do anything, but just because you've memorized facts doesn't mean you know how to thoughtfully use them, and have common sense.

"If you don't learn to use the tools in a way that's rigorous and thoughtful, that's not going to help you."

#### Problem solving

A major goal of the new program - and one of the overarching goals of the entire school system, and not just in mathematics - is to help kids become better "problem solvers."

A benefit of teaching seven different ways to learn addition is that students absorb the notion that in math it isn't just that you know how to do something or you don't. You are confronted with a problem and there is a right answer but there may be several ways to get to there. You have to find one that seems likely to work, do the problem - do all the steps correctly - and then think about your answer to see if makes sense.

"Continue to teach the basics," Dr. Hibbard said. "But you do it in a way that creates students who are better problem solvers, have more math common sense, and have stamina - you have a problem that's tough, you stick with it and stick with it and try solving it this way."

Eventually, he said, such students will find "the most productive way to solve it."

The emphasis on "math common sense," which includes skills such as estimating, is part of preparing students to be able to use math as problem-solvers in the real world.

An engineer or architect uses complex mathematics, and has to know the abstract formulas. But before something is built, these designers also need to check their math against a real-world common sense - their knowledge of the physics of things.

"It's not simple, like there's a right answer," Dr. Hibbard said. "There are design constraints, and here's the amount of force you need - it's very complex. Besides being good at the basics, you have to know how to apply all this.

"And," he added, "when you come up with a wrong answer, you have to know that it's not reasonable."

When engineers lose sight of that, things happen like the roof of the Hartford Civic Center caving in under the weight of snow in 1978, or the dramatic architecture of an Orly Airport terminal in Paris collapsing in 2004.

"If you're never conscious of the whoops situation, you're never going to go back and find your mistakes," Dr. Hibbard said.

### The budget

The math program's biggest budgetary bump came this year, the program's first, and the total in the budget approved last spring runs to about \$258,000. Big items are \$113,000 for books, \$74,000 in salary and benefits for a math "professional developer."

In the proposal to continue the math program next year, the new costs to be added on in the budget are projected at another \$91,000. The biggest line is \$78,000 in salary and benefits for two and half math paras paraprofessionals who will work in the elementary schools. Those new math paras will bring the system's compliment up to six - one for each elementary school, as was the case before the budget

squeeze of 2003-04.

By the third year, 2008-09, the additional cost of program is projected at only \$6,000. Once the elementary school program is up and running, some of the start-up costs disappear - though a percentage of them will migrate to middle school, when the new math program is introduced there.

Eventually it will reach the high school.

"From the beginning to end of this process is approximately 10 years," Dr. Hibbard said. "You can't do it all at once. You couldn't afford to do it all at once, and you don't know enough about what to do.

"You don't want to make changes in the high school program until you know what's happening in the elementary and middle school programs. You don't know enough about what's happening earlier to know what you're building on," he said.

In the trenches

Mr. Swiatowicz, who taught math at East Ridge Middle School and at Branchville Elementary School, is working this year as coordinator of the new math program, helping elementary school teachers with what is a big change to one of the largest and most important things they do.

"One of the biggest things, that the teachers love, is called the 'math chat' - five to seven minutes where they talk about math, no paper and pencil," he said.

Mr. Swiatowicz holds up a clear bag filled with small plastic cubes. "How many are in here?"

Then he hides the bag.

This would lead into a "math chat" in which the elementary school teacher is "talking about the strategies of estimation," he said.

Then the bag is shown again. How many?

"The next important question is: Did you change your estimate? If so, why?" Mr. Swiatowicz said.

"Math for so long has been: 'Two plus four is what?' And you get the answer, and you stop. Now, we're asking students to explain their thinking, using their math vocabulary, starting young," he said.

Yes, math vocabulary: One of the more obvious differences between the school system's new math program and the old one is the introduction of real mathematics terms - math language - right from the beginning.

"They're introduced in kindergarten and first grade to things I introduced in sixth grade," Mr. Swiatowicz said. "You don't call it a 'box'. You call it a "rectangular prism."

"We're arming our students with a vocabulary that going to allow them to be successful at a higher level," Mr. Swiatowicz said. "They're comfortable with it. They're comfortable talking about math."

The "why?" of it

The "conceptual" approach tries to help kids learn how to do math by better understanding it.

"Children who may not be very good at memorizing math facts can approach numeric skills and problem-solving in a conceptual way, so they can show what they know," said Principal Michael. "If you're just teaching math as a series of procedures and kids can't memorize that procedure, they're going to be lost."

"But if you approach the child with a problem and say 'How would go about solving this problem? Let's think it through. Why are you saying that?' And you guide them through the thought process, and then say, 'Oh, by the way, there's a procedure that matches your thinking,' they're much more likely to remember the procedure because they already understand the thinking behind it.

"It's not an 'either-or,' she added. "We still want the kids to memorize their basic facts. We still want them to know the procedures. We want them to be able to solve problems. Those algorithms that we all learned are still valid algorithms - they're valid because they work. We just want them to understand why they work."