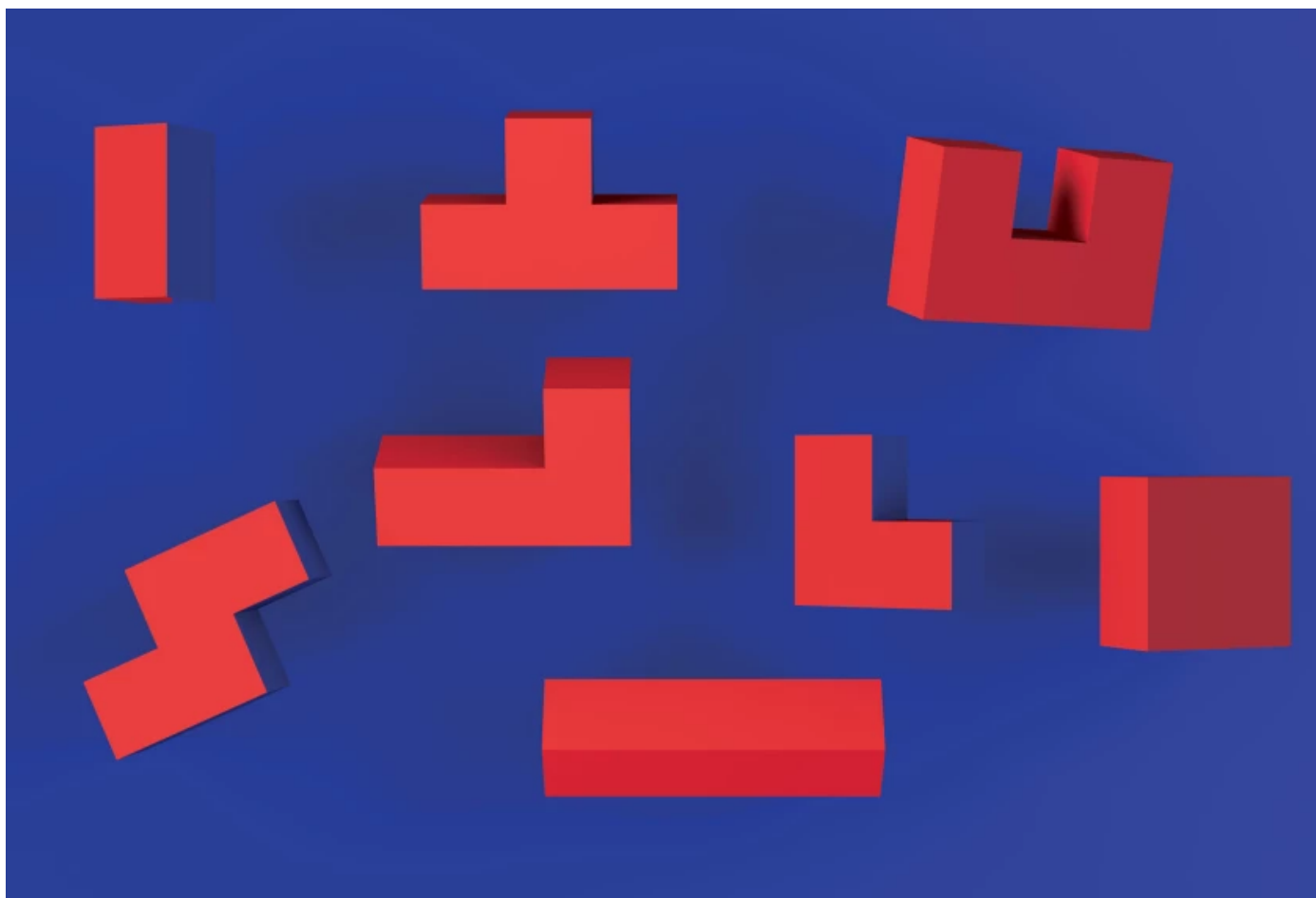


# Ditch Those Math Worksheets. The Case for Teaching Real-World Problem Solving in K-5



By Alyson Klein — May 03, 2022

8 min read



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The designers for Monte Vista Elementary School's proposed outdoor classroom had some key questions to answer: What materials could they use while staying under the district's \$10,000 budget? How much square footage would work? How would they produce the scalable models the client wanted?

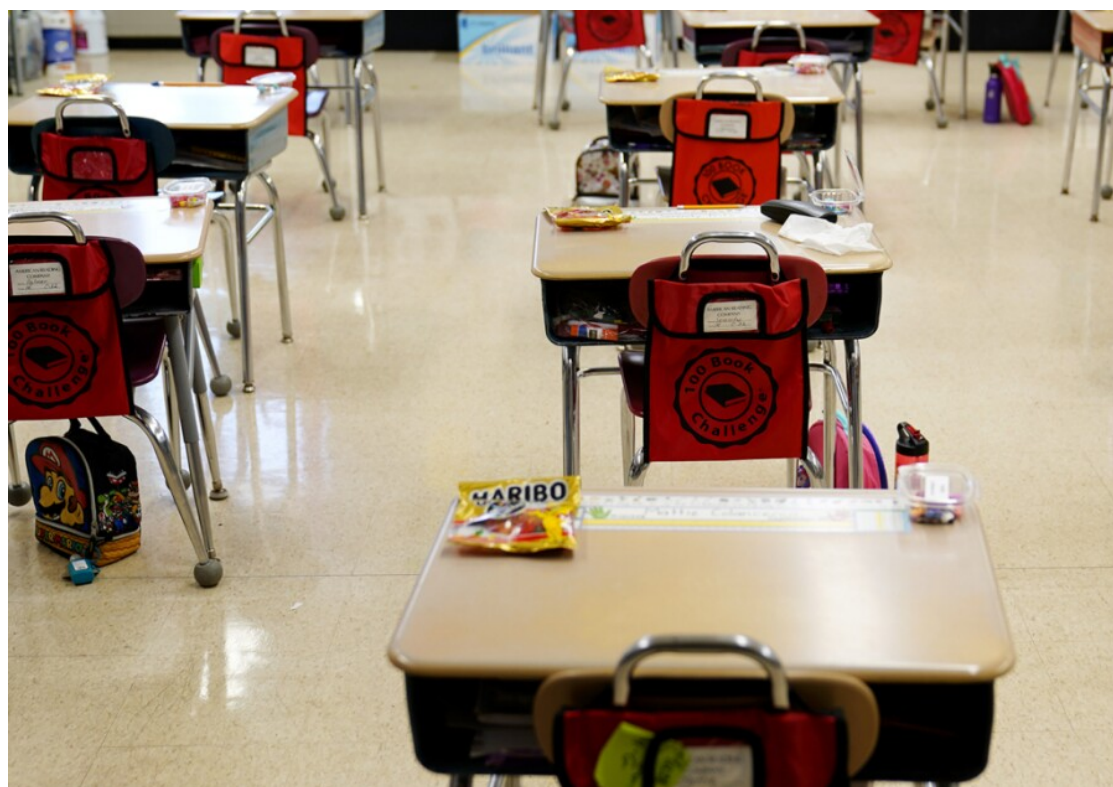
Those critical questions—which could have been considered at a local architecture firm—were part of just another math assignment in Robbi Berry’s 5th grade class at the Las Cruces, N.M., school. The prototypes the students created in class ultimately helped inform the work of the professional architects hired for the job.

And the project helped Berry’s students master some important 5th grade math concepts—such as adding and subtracting multidigit numbers with decimals. And the students did it without having to plod through boring math worksheets.

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This problem-solving approach to teaching math to elementary school kids makes the subject much more intriguing and relevant, Berry and other educators say. It allows students to experience math the way it is used in real life, rather than as a pile of equations with no meaningful context.

It’s never too early to begin having kids learn math this way, experts say.



Today's elementary school students need to learn how to analyze, reason, and make complex decisions to improve their chances of success later in life, said Jo Boaler, a professor of education at Stanford University.

In the world of work, “it is not very useful to be somebody who has memorized methods to [answer] textbook questions, because the work that is in our world is very different from that,” she said. “In whatever job you go into, you need to problem solve, think critically, make connections between different areas. And we’re just not helping our students develop those kinds of capabilities” in most schools.

The benefits of a real-world problem-solving approach can stick with students for years,

Boaler said. For a study published in 2017 in the *Journal for Research in Mathematics Education*, she followed a group of high school students who were learning math through real-world problem solving and another group—with similar socioeconomic characteristics—who were taught math in a more traditional way. (Boaler has not conducted similar research with elementary students.)

Eight years later, the students who had been exposed to the problem-solving methods were in higher-skill jobs and more likely to be looking at upward mobility in their careers than those

who were taught more traditionally. The ones who had learned the traditional way said they saw math all around them in their professional lives but felt that their K-12 education had left them unprepared to use it for professional success.

What's more, the problem-solving approach gives teachers the opportunity to introduce students to all kinds of possible careers.

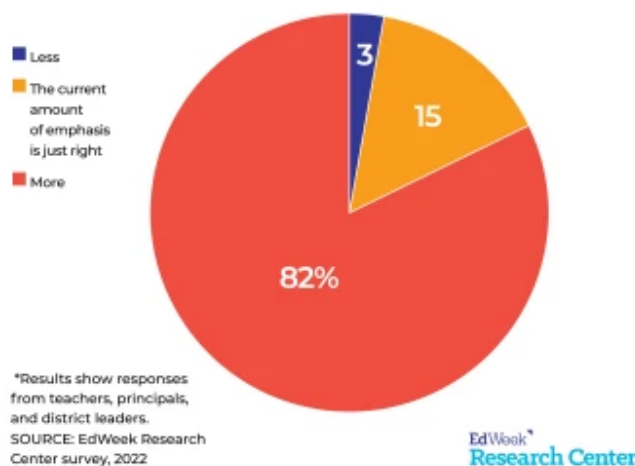
Berry's students, for instance, wear all sorts of professional hats to tackle math problems that she makes up based on real problems people face in the working world.

They've been event planners tasked with coordinating transportation to a wedding with 76 guests and four cars that can hold differing numbers of passengers. They've designed a house for a very picky client—played by Berry, doing her best posh lady voice. The house had to be built to certain specifications: a particular range of square footage, number of rooms, and sizes for those rooms.

The strategy gives students insight into how professional mathematicians think, Berry said. "Real mathematicians [see] a problem in the world, and they use math to solve it."

#### EXCLUSIVE DATA

How much emphasis should your district or school's early elementary math curriculum place on solving real-world problems?



## More than one right answer, more than one right method

While those tasks make sense for 5th graders, kindergartners—and even preschoolers—can learn math through problem solving, Boaler said. She pointed to a lesson she created, called

“foot parade,” in which children see pictures of the feet of different types of animals and are told to select as many creatures as they need to reach a particular number of feet. A cat and a bird, for instance, would be a total of six feet.

In the Howard County public schools in Maryland, elementary school math classes typically kick off with a problem-solving exercise, such as a discussion of a level-appropriate “target” number. For instance, students have a few minutes to brainstorm as many equations as possible to reach the number 147. Correct answers could be 100 plus 47, 823 minus 676, or other combinations of numbers. Students then share their answers in groups.

They must collaborate and recognize there are usually multiple ways to solve a problem, skills people in the working world exercise every day.

The goal is to expose “kids to different ways of thinking, without telling kids, ‘here’s the different ways you have to think,’ ” said John SanGiovanni, the district’s elementary math coordinator.

These math problems often have multiple correct answers, and multiple pathways for getting to a solution. That’s exciting for kids, Boaler said. “One of the things that has [turned] off so many kids [to math] is that [they] think it’s a subject with one answer and one method,” she said.

Whether the math problems are as intricate as Berry’s outdoor classroom challenge—or simpler, like Howard County’s “target number” exercise—the underlying goal is to “create interest and wonder,” and help students unlock the concepts behind operations like addition, subtraction, multiplication, and division, SanGiovanni said.

When students veer off in the wrong direction, it’s a chance to learn, Berry said.

“Mistakes grow our brain, we celebrate them,” she said. Going over a misstep is “when we have the best conversations.”

If a kid gets tripped up, Berry will ask the student privately if they are OK sharing their process with the class as a “favorite mistake.” If they aren’t, Berry will still share their work, but pretend the blunder was her own.

## **Should teachers throw out their worksheets?**

Teachers using the real-world problem-solving approach can present the problem without initially giving instruction in the operations they might use to solve it, such as multiplication, Boaler said. That's the reverse of how it's done in a typical classroom where teachers say, "here are your methods, now do some questions that practice them."

Flipping that traditional process on its head means giving students a rich problem first. Then, once they've given it some thought, a teacher can introduce methods that might help students find a solution.

"At that point, kids are interested. They're like, 'Oh, yeah, I need that method.' Whereas, when you show them the methods first kids are like, 'Why? Why am I doing this?'" Boaler said.

SanGiovanni agrees with that perspective, to a point. But in his mind, the occasional worksheet still has its place. "Ten [math] problems on a paper from time to time, it's probably good for maintenance of a skill," he said.

Plus, he emphasized that most kids won't be able to learn all they need to know just by solving a big problem, he said. "There has to be some explicit instruction about some of the math," he said. "You can't just discover it all."

## **The problem-solving approach can be problematic for some**

Teaching math this way can be a lot to ask of teachers, students, and even parents.

Many teachers learned the subject through more traditional methods back in their student days, such as practicing math problems on worksheets before applying that knowledge to real world situations. They're skeptical that young kids can learn this way, SanGiovanni said.

"Some of our teachers [believe] that you can't solve this huge problem or this really cool problem, because you don't know how to add three plus four yet, or better yet, you don't know how to do it quickly," he said. They say they "don't feel like I can take the time" for the real world problem-solving approaches.

It's also tough for some teachers to give up control, said Latrenda Knighten, a mathematics instructional coach in Baton Rouge, La.

“It is scary because you don’t know what answers you’re going to get,” she said. Children may get frustrated with the open-ended process, or a class discussion may veer off topic if every kid is encouraged to talk about the problem in their own way.

Another big hurdle: “There isn’t always access to good materials that frame lessons in [real world] problems,” SanGiovanni said.

While Boaler and others have created excellent resources, he said, “you teach kids for an hour and a half of math every day,” he said. “That means you need 180 lessons, or 180 [real world] problems. And I know that some of those problems could be two or three days. But just the sheer volume isn’t there.”

Teacher preparation programs often don’t help prospective educators teach math through rich problem solving, particularly at the elementary level, he added.

District and school administrators may also push back against the approach. They worry students taught this way aren’t going to perform well on standardized tests, though those assessments increasingly measure students’ problem-solving abilities, Knighten said. “If we allow children to really internalize the concept, so that it sticks, you’re going to see [good test scores] because they’re going to make sense of it.”

Teachers get grief from parents, too, SanGiovanni said. “A lot of parents say they want their kids to be able to think and reason. They just don’t want it to look different from the way they learned,” he said.

Berry is quick to point out the real-world problem solving approach was not the way the subject was taught when she was a student. That, she said, is largely why she grew up hating math and now makes it her mission for students to love it by the time they leave her classroom.

“Sitting in a seat, just doing problems out of a textbook, or me walking the kids through step by step on how to do a procedural. That, to me, is not authentic learning,” she said. “I don’t want them just to be test takers. I want them to be productive citizens when they leave me.”

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