Education

Good Guess
Why we shouldn't underestimate the value of estimating

By Annie Murphy Paul

QUICK, TAKE A GUESS: HOW TALL IS AN eight-story building? How many people can be transported per hour on a set of train tracks in France? How many barrels of oil does the U.S. import each year?

Maybe you gave these questions your best shot—or maybe you skimmed right over them, certain that such back-of-the-napkin conjecture wasn't worth your time. If you fall into the second, just-Google-it group, you may want to reconsider, especially if you're a parent. According to researchers who study the science of learning, estimation is the essential foundation for more advanced math skills. It's also crucial for the kind of abstract thinking that children need to do to get good grades in school and, when they're older, jobs in a knowledge-based economy.

Parents can foster their kids' guessing acumen by getting them to make everyday predictions, like how much all the items in the grocery cart will cost. Schools, too, should be giving more attention to the ability to estimate. Too many math textbooks "teach how to solve exactly stated problems exactly, whereas life often hands us partly defined problems needing only moderately accurate solutions," says Sanjoy Mahajan, an associate professor of applied science and engineering at Olin College.

Research has shown that everyone, even a baby, possesses a basic ability to estimate. But studies also indicate that some people are much better guessers than others and that the differences are linked to a more general facility with arithmetic. For example, in a 2004 article in *Child Development*, psychologists at Carnegie Mellon University asked elementary-school students where to place various numbers on a horizontal line with a zero at one end and 100 at the other. Among the study's findings: the kids who were more accurate in their estimates had also scored higher on a math achievement exam.

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What gave the skilled guessers the edge? They pictured a line on which all the numbers were evenly spaced rather than one with the bigger numbers scrunched closer together. Most schoolchildren start out doing the latter and shift their understanding as they grow more experienced with numbers.

One of the more surprising ways to get kids thinking about numbers is to play board games with them. Flicking the spinner or rolling the dice and then counting out the spaces to move ahead on the board helps children adjust the number line that they carry around in their heads. As evidence, a board-game-based intervention program led by Clark University education professor Sharon Griffin produced large and lasting improvements in students' math performance.

Another estimation strategy Mahajan emphasizes in his book *Numbersight*, due out next summer, is to compare an unfamiliar quantity to what he calls "human-sized numbers"—thinking of a football field, for example, as being 60 dads long. Parents can help kids acquire more of these mental benchmarks by remarking on the dimensions they encounter in daily routines, like how many miles it is to Grandma's house. Children also benefit from hearing a range of others' estimates, so every family member should chime in.

Sharpen kids' logic enough and maybe some day they'll dazzle people at cocktail parties (or TED talks) the way Mahajan does with his ballpark calculations. His answers to the questions at the top of this story: 80 ft., 30,000 passengers and 4 billion barrels. To come up with these, he guessed at a lot of things. For instance, for the number of barrels of oil the U.S. imports, he made assumptions about the number of cars in the U.S., the number of miles driven per car per year and average gas mileage to arrive at the number of gallons used per year. Then he estimated how many gallons are in a barrel. He also assumed that imported oil is used for transportation and domestic for everything else. The official tally for U.S. imports in 2010 was 4,304,533,000 barrels. Mahajan's 4 billion isn't perfect, but it's close enough to be useful—and most of the time, that's what counts. ■

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