Memorizers are the lowest achievers and other Common Core math surprises

by **JO BOALER**
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It's time to debunk the myths about who is good in math, and Common Core state standards move us toward this worthy goal. Mathematics and technology leaders support the standards because they are rooted in the new brain and learning sciences.

All children are different in their thinking, strength and interests. Mathematics classes of the past decade have valued one type of math learner, one who can memorize well and calculate fast.

Yet data from the 13 million students who took PISA tests showed that the lowest achieving students worldwide were those who used a memorization strategy – those who thought of math as a set of methods to remember and who approached math by trying to memorize steps. The highest achieving students were those who thought of math as a set of connected, big ideas.

The U.S. has more memorizers than most other countries in the world. Perhaps not surprisingly as math teachers, driven by narrow state standards and tests, have valued those students over all others, communicating to many other students along the way – often girls – that they do not belong in math class.

The fact that we have valued one type of learner and given others the idea they cannot do math is part of the reason for the widespread math failure and dislike in the U.S.

Common Core math experts say teachers need to stop using shortcuts and math tricks
Brain science tells us that the students who are better memorizers do not have more math "ability" or potential but we continue to value the faster memorizers over those who think slowly, deeply and creatively – the students we need for our scientific and technological future. The past decade has produced a generation of students who are procedurally competent but cannot think their way out of a box. This is a problem.

Mathematics is a broad and multidimensional subject. Real mathematics is about inquiry, communication, connections, and visual ideas. **We don't need students to calculate quickly in math. We need students who can ask good questions, map out pathways, reason about complex solutions, set up models and communicate in different forms.** All of these ways of working are encouraged by the Common Core.

Technology leaders are publically arguing that calculation is not math, and that math is a much broader subject. Conrad Wolfram, one of the leaders of one of the world's most important mathematics companies, Wolfram-Alpha, urges schools to stop emphasizing calculating and focus instead on problem solving, modeling, thinking, and reasoning as these are the mathematical abilities that students need in the workplace and their high tech lives. This broad, multidimensional mathematics is the math that engages many more learners and puts them on a pathway to lifelong success.

Part of the problem in the U.S. is the desperation of many parents to advance their children in math, pushing them to higher levels of math faster and sooner, somehow believing that a resume packed with advanced math courses will guarantee their future. Bill Jacob, a mathematics professor at the University of California, Santa Barbara, speaks openly about the dangers of students being pushed to higher levels of mathematics too soon. "I know it is hard to persuade parents that their students shouldn't race to get calculus, but I really wish they wouldn't. Too much content and depth is left out when they do." said Jacob, who is not alone in saying that he would rather have students in his university mathematics courses that have breadth in their mathematical experiences than any additional Advanced Placement courses. Experts in England are giving the same advice to parents of high achieving

students. Geoff Smith, chairman of the British and International Math Olympiads warns that accelerating children through the system is a “disaster” and a “mistake”. He, like me, recommends that high achieving students explore the mathematics they are learning in depth, instead of rushing forward.

Mathematics is not a subject that requires fast thinking. Award winning mathematicians talk about their slow, deep thinking in math. Fields Medal winning mathematician Laurent Schwartz wrote in his autobiography that he felt stupid in school because he was one of the slowest thinkers in math. Eventually he realized that speed was not important – “What is important is to deeply understand things and their relations to each other. This is where intelligence lies. The fact of being quick or slow isn’t really relevant.”

Some school districts, such as San Francisco Unified, are trying to slow down the math experience, requiring that advanced students go deeper rather than faster. Students still reach calculus but the pathway to calculus consists of deep understanding rather than procedures and memorization. This is an important move. There is no harm in students being introduced to higher-level mathematics earlier, as long as the mathematics is enjoyable and ideas can be explored deeply. Third graders can be fascinated by the notion of infinity, or the fourth dimension, but they do not need a race through procedural presentations of mathematics.

New brain science tells us that no one is born with a math gift or a math brain and that all students can achieve in math with the right teaching and messages. The classrooms that produce high achieving students are those in which students work on deep, rich mathematics through tasks that they can take to any level they want. No one is told what level they can reach and no one is held back by narrow questions that limit students’ mathematical development and creativity.

Many people across the U.S. have gross misconceptions about mathematics learning, thinking that mathematics is a narrow subject of memorization and speed and that people who do not calculate fast or memorize well are not ‘math people’. We need to change the conversations about mathematics, communicating to all children that they can learn. We also need to change the way math is taught, valuing the different ways of thinking that are so important to the subject. Mathematics, itself, needs this and although change is hard, it should be embraced.

We need to broaden mathematics and open the doors of mathematics to all students. When we do this we will see many more creative, energized young people equipped to think quantitatively about our ever-changing world. We all need this.

Jo Boaler is a professor of mathematics education at Stanford University, co-founder of www.youcubed.org, and author of What’s Math Got To Do With It: How Teachers and Parents can Transform Mathematics Learning and Inspire Success*. (Penguin, 2015) This story was produced by* The Hechinger Report*, a nonprofit, independent news organization focused on inequality and innovation in education.*