

How To Approach Math Learning

Jo Baeler and Pablo Zoido recently published an article in *Scientific American Math*. (behind a paywall; summary here)

Every three years, the Program for International Student Assessment (PISA) tests hundreds of thousands of 15-year-olds. In the past, the US posted average scores in reading and science, but well below other developed nations in math.

The most recent results for the USA

Since 2012, data collected about how students approach math shows three distinct styles of learning. Some memorize facts; some relate new concepts to old; some self-monitor, evaluating their own understanding and focusing attention on concepts not yet learned.

In every country, the memorizers are the lowest achievers, and the U.S. has high proportions of memorizers. These memorizers are approximately half a year behind those who use relational and self-monitoring strategies. In some countries, people who use relational and self-monitoring strategies are a whole year ahead of those who just memorize the facts.

Quotes:

American schools routinely present mathematics procedurally, as sets of steps to memorize and apply. Many teachers, faced with long lists of content to cover to satisfy state and federal requirements, worry that students do not have enough time to explore math topics in depth. Others simply teach as they were taught. And few have the opportunity to stay current with what research shows about how kids learn math best: as an open, conceptual, inquiry-based subject.

The foundation all math students need is number sense — essentially a feel for numbers, with the agility to use them flexibly and creatively. A child with number sense might tackle 19×9 by first working with “friendlier numbers” — say, 20×9 — and then subtracting 9. Students without number sense could arrive at the answer only by using an algorithm. To build number sense, students need the

opportunity to approach numbers in different ways, to see and use numbers visually, and to play around with different strategies for combining them. Unfortunately, most elementary classrooms ask students to memorize times tables and other number facts, often under time pressure, which research shows can seed math anxiety. It can actually hinder the development of number sense.

I could not have said it better myself. Behind every math prodigy is a child who has spent lots of time playing with numbers, making friends with them. Today's schools often spend far too much time with formal testing, leaving too little time for just having fun with numbers.

Some people teach the facts; some teach the procedures; some teach the soul of math. Great mathematicians are like great jazz musicians; they improvise on the fly, searching for a great solution, an inspirational solution.