

# Why Other Countries Do Better in Math

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*A Daily Riff Classic*

*Editor's Note: The Daily Riff asked math teacher Bill Jackson to share his insights about the latest PISA results. Bill is Math Helping Teacher for [Singapore Math](#) in Scarsdale, NY Public Schools, and has taught in the Northeast for 27 years, both in American urban and suburban classrooms and is an active global observer, participant and life-long learner in the trenches in Singapore and Japan. See more links below. - C.J. Westerberg*

## **Should Parents "Race to the Tutor"?** (Read on . . . it's not what you think)

by Bill Jackson

A recent spate of international mathematics achievement comparisons once again highlight the poor showing of U.S. students compared to their international peers. The first is from the most recent [PISA](#) released this month (not the leaning tower but the "Program for International Student Assessment").

The results showed that fifteen year-old students in East Asian nations such as Singapore, China, Japan, and Korea, as well as a few European nations, such as Finland and Switzerland, significantly outperform their American counterparts in their "ability to use their knowledge and skills to meet real-life challenges." The second, a [survey on parental attitudes](#) about mathematics education, showed among other things that parents in Singapore are much more likely to employ a math tutor to help their children, compared with the United States and England.

For over 20 years, international comparisons showing the mediocre performance of American students compared to their counterparts in East Asian and other industrialized countries in mathematics have led to outcries about the poor quality of education in the U.S. and misguided reform attempts such as No Child Left Behind (NCLB) and Race to the Top.



NCLB did not yield the positive results we intended nor will Race to the Top. Now these latest results have led some to reason that if parents would just pay for tutors like parents in Singapore, our kids would do well. Maybe we should call it, "**Race to the Tutor.**"

But why do students in these high-performing nations really do well in mathematics?

Through these studies and previous ones like [TIMSS](#), we know a lot about what happens in countries that do well in mathematics like Singapore and Japan. We know how their school systems work, what mathematics teaching looks like, what teacher's professional lives are like, what their textbooks and curricula look like, and the role of parents. What is surprising, however, is the lack of improvement we have shown as a nation and even a movement in a direction that is bound to take us in exactly the opposite direction we want to go as a nation ("Race to the Bottom?").

**Many people have suggested that cultural factors are behind the success of East Asian students in mathematics.** Although factors such as parental and societal attitudes towards education certainly play a role, I believe that they play a minor one at best. The main reason why these countries are doing so well is the high quality mathematical learning experiences they provide to children.

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Contrary to what many may think, mathematics lessons in Singapore and Japan (the two countries I am most familiar with), are generally lively, thoughtful and engaging, characterized by problem solving, analysis and discussion of multiple solution methods as well as errors, and a high level of rigor. Teachers know their subject matter, as well as know how to communicate it to children in interesting ways.

There has been much talk recently in the U.S. about the important role that good teachers play in the learning process. In fact, one might be led to believe that all we need to do is hire good teachers and get rid of the "bad" ones and children will learn. **Exactly what makes a good teacher, however, no one seems to know.** Some people believe that all you need to do is recruit the best and brightest and put them in a classroom and students will do well.

In the U.S. we often believe that good teachers just have a natural talent for teaching. Somehow, all by themselves, they figured out how to really engage students. Images of Hollywood hero teachers that can "Stand and Deliver," fill our collective mind. But in high-achieving nations like Japan and Singapore, good teachers are carefully developed over time, not born with some innate talent.

For example, in both Japan and Singapore university teacher training focuses on content and pedagogy (teaching methods) in conjunction whereas in the U.S. teaching candidates often learn little mathematical content, and pedagogy is often taught separately, divorced from the content that

teachers will teach. In fact this lack of pedagogical content knowledge ([PCK](#)) by U.S. teachers has been shown in [study](#) after study. It has also been shown that teachers in Singapore, China, and Japan have high PCK.

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But why is this? **One reason is that teachers often teach the way they were taught.** If you were taught mathematical procedures simply by rote without ever learning why they work it is likely that this is how you will teach. If you were taught in a way that develops conceptual understanding of mathematics, you will more likely teach better. Since Singaporean and Japanese educators were taught in this type of educational system, it is more likely they will teach conceptually. But this only contributes a small amount to their PCK.

***If you talk to university educators in Japan and Singapore they will tell you that their students often do not understand mathematical procedures conceptually and many are math-phobic.*** They do not assume that teaching candidates are prepared to explain mathematics to children in ways that they will understand the underlying rationale behind the procedures. Therefore great care is taken to help teaching candidates to overcome their fear of mathematics, build confidence in their own mathematical capabilities, and understand the intersection of curriculum, content, and pedagogy deeply. If we want to improve how mathematics is taught in the U.S. we need to improve the way teachers are trained. (See my posts on [teacher training in Singapore](#) and [Japan](#) to learn more about how teachers are trained.)

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When teachers get through the teacher training process in the U.S. it is expected that they are able to teach. They are placed in a classroom, observed a couple of times a year for the first three years, and if they pass muster they are given tenure. After that they are generally observed once a year by an administrator but other than that they close their door and no one, except the teacher and the students (and maybe parents), knows what really is going on. Now and then they will get some workshop-style training to learn new methods, but again, since these new methodologies are implemented in isolation, no one knows if they are being implemented properly. In short, teaching in the U.S. is largely a private matter.

***The approach to ongoing teacher training in Japan is quite different.*** Teachers engage in school-based research through a process called [lesson study](#). In lesson study, teams of teachers work together to bring to life a school-wide research goal through collaborative planning, teaching, observing and discussing live classroom lessons. In Japan it is common that students are sent home a half-day once a month except for one class that stays behind to be the subjects for a "research lesson." One teacher from the research group that planned the lesson will teach the lesson to the class while the entire staff crowds around the perimeter of the classroom to observe and take careful notes. Afterward, teachers engage in a lively discussion about what worked and did not work in the lesson, and how to improve it. An invited "knowledgeable other" such as a university professor will bring final comments to make sure that everyone grows through the process.

***In addition to lesson study, teachers observe each other on a regular basis.*** At one Japanese school that I visited every teacher must teach a public lesson in front of colleagues in the first

trimester. In the second trimester, teachers form research groups to conduct lesson study and teach the lessons at a large open house with many invited observers. In the final trimester they compile a report of the results of their research and plan research activities for the next year.

In Japan, these research reports are published and sold in large bookstores. Teachers can browse through hundreds of these published reports and purchase the ones they like to teach interesting lessons in their classrooms or learn more about topics they have had difficulty teaching. In fact the majority of educational research in Japan is done by teachers, not university researchers as is the case in the U.S. Lesson study is also very popular in Singapore and a Chinese colleague recently told me that although they generally do not conduct formal lesson study in China, all teachers must teach lessons publicly to be critiqued by colleagues.

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Good mathematics teaching in Japan and Singapore is not just the result of good training and professional development opportunities. It is also supported by [quality textbooks](#) based on national standards, something that is sorely lacking in the U.S. If you take a look at Singaporean or Japanese textbooks you will notice that they are smaller, lighter, and less expensive (because parents pay for the books) than the expensive hardcover behemoth textbooks that predominate the U.S. market. They are also more kid-friendly with cartoon characters that give helpful hints, and simple diagrams of mathematical concepts.

***A closer look, however, will reveal that these textbooks are much more coherent than U.S. textbooks.*** Topics carefully build on each other, problem sets are carefully selected, and lessons are [problem-based](#). They also contain fewer topics per grade level. This allows them to spend more time on fewer topics to learn them for mastery instead of learning superficially and repeating the same topics year to year like most U.S. math textbooks. The result is that as children progress through the grades they move on to increasingly more rigorous mathematical concepts. Japanese or Singaporean fifth grade textbooks, for example, are comparable in rigor to U.S. sixth, seventh, and even eighth grade (or so-called "Algebra I") textbooks. (See my post [Singapore Math Demystified!](#) for more about Singapore math textbooks.)

When I first started conducting lesson study together with Japanese teachers I was amazed at the high level of mathematical content knowledge that the average teacher had. After I began studying their mathematics textbooks, I realized why this is -- they have better tools than we do. Japanese and Singapore math textbooks lend themselves not only to student learning but teacher learning as well. In fact, Singaporean textbooks were intentionally designed in a way so teachers can improve their own content knowledge. I discovered that I could also gain this deep math knowledge by studying and teaching with these textbooks.

***Another reason why teachers in Japan and Singapore have high PCK is because they rotate through the grades.*** In Japan, for example, elementary school teachers must teach all grades from 1 to 6. This allows them to experience how understanding is developed at every level, where the math they are teaching is coming from, and where it is going. The typical U.S. teacher often teaches just one grade level for his or her entire career, which leads to a myopic understanding of student learning and the inability to make connections across grades. In Japan, teachers also rotate through the schools instead of staying in one school their entire career. This allows good teaching practices to be spread and ensures consistent levels of instruction across schools.

Singaporean and Japanese schools provide an excellent basic education for students, characterized by high quality curricula, well-trained teachers, and a system that supports continuous systemic improvement. ***The high mathematical achievement of students in these nations is due primarily to the excellent education they receive in school, not the fact that parents are more likely to pay for tutors.*** Parental attitudes are important but what many people miss is the fact that in the U.S. parents pay tutors for the lack of what their children learn in school while in Singapore and Japan parents pay tutors to improve their children's chances of success on high stakes entrance exams (much like parents pay for SAT tutoring in the U.S.).

In my opinion, current U.S. reform efforts are actually moving us in the opposite direction of where we need to go. **We are not clueless in America as to what we need to do to improve.** There are pockets of educational excellence in our country. Students in the Scarsdale, NY public schools participated in the last round of the PISA assessment and scored higher than Finland, the top scorer. Scarsdale has never focused on test prep or ranking teachers, but now federal mandates such as "Race to the Top" are threatening to force even excellent school districts to rate and rank teachers, and focus on standardized testing.

**Focusing on preparing students for high stakes standardized tests dumbs down**teaching and in some cases even leads to cheating. The problem is exacerbated by the fact that most state tests are based on poorly constructed state mathematics standards and narrowly focused on skills and procedures instead of critical thinking and complex problem solving. (In Singapore and Japan there are high stakes tests at the end of primary and junior high school but many educators perceive this testing culture as one of the flaws in their systems.)

**We also need to address the disparity in the quality of education between schools in wealthy communities and poor communities.** One finding of the PISA results is that successful school systems provide all students, regardless of their socioeconomic backgrounds, with similar opportunities to learn. All schools throughout Japan and Singapore provide comparable facilities, teachers, and learning opportunities, regardless of socioeconomic class. The quality of education in the U.S. varies immensely from city to city, usually with the high poverty areas getting the short end of the stick.

There is also much talk these days about firing incompetent teachers, eliminating tenure, lowering pay and benefits, and other such teacher bashing. **Instead of firing bad teachers,** why not make sure incompetent ones don't get teaching positions in the first place? And why do we expect that four or six years of college is enough to ensure quality for a lifetime? Wouldn't it be better to focus on continual improvement throughout teachers' careers as is done in Japan and Singapore? I have been teaching for over 27 years in both urban and suburban settings and in all this time I have encountered very few teachers I would consider incompetent and without hope of improvement. What teachers need is support, not a kick in the pants.

All these international comparisons may lead some to believe that there is no hope for mathematics education in the U.S. **It's not all bad news, however, and there are some encouraging signs.** Lesson study is becoming increasingly popular, and being promoted by important organizations such as the [National Council of Teachers of Mathematics](#).

Already 40 states have adopted the [Common Core State Standards](#), which are focused and coherent and based partly on the mathematics standards of Singapore and Japan. Mathematics textbooks from Singapore, Japan, and Korea are now available on the U.S. market and even large U.S. textbook companies are beginning to get in on the action. Mathematics education professors at institutions such as [DePaul](#), [William Paterson University](#), and [Keenesaw State University](#) are even

using these resources in their methods courses and linking pedagogy with the learning of mathematical content. Instead of racing to the top, we should plod along steadily in these and other thoughtful directions in a deliberate manner.

And I'd like to close with a bit of advice for teachers and parents (of which I am both). Teachers, although parents matter, it's mostly your responsibility to teach your students mathematics. This is what you get paid to do. If parents need to hire a tutor it might be because you are not doing your job. Parents, let your kids be kids, go out and play after school, have fun, and become well adjusted.

Life is more than math.

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