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**Commentary**

**Moving Mathematics Out of Mediocrity**

**By Steven Leinwand**

The logic for the importance of improving school mathematics programs is reasonably unassailable. The country’s long-term economic security and social well-being are clearly linked to sustained innovation and workplace productivity. This innovation and productivity rely, just as clearly, on the quality of human capital and equity of opportunity that, in turn, emerge from high-quality education, particularly in the areas of literacy, mathematics, and science. Applying the if-then deductive logic of classical geometry puts a strong K-12 mathematics program at the heart of America’s long-term economic viability.

But the problems with mathematics in the United States are just as clear. A depressingly comprehensive, yet honest, appraisal must conclude that our typical math curriculum is generally incoherent, skill-oriented, and accurately characterized as “a mile wide and an inch deep.” It is dispensed via ruthless tracking practices and focused mainly on the “one right way to get the one right answer” approach to solving problems that few normal human beings have any real need to consider. Moreover, it is assessed by 51 high-stakes tests of marginal quality, and overwhelmingly implemented by undersupported and professionally isolated teachers who too often rely on “show-tell-practice” modes of instruction that ignore powerful research findings about better ways to convey mathematical knowledge.

For 20 years, we have tinkered at the margins, merely adjusting parts of the system while ignoring the fact that the basic structure has remained largely intact and underperforming. During those 20 years, we’ve raised achievement a little and narrowed gaps a bit. But even as the need for broader and deeper mathematical literacy has grown, our traditional approach still rarely works for more than a third of our students, and it fails even more when it comes to critical-reasoning and problem-solving skills. It shouldn’t be all that surprising that on the 2006 Program for International Student Assessment, or [**PISA**](http://nces.ed.gov/pubs2008/2008016.pdf)**[Requires Adobe Acrobat Reader](http://www.adobe.com/products/acrobat/readstep2.html)**, 15-year-old U.S. students placed an unacceptable 25th out of 30 countries tested.

Fortunately, the solutions are as clear as the problems. The answers do not revolve around costly new initiatives. Moving beyond mediocrity does not have to mean new textbooks and supplemental programs, or a slew of new calculators and computers, or jumping on the latest bandwagon of benchmark assessments. Instead, our attention needs to focus on how effectively existing programs are implemented, how available technology is integrated and used to enhance the learning of skills and concepts, and why assessments that steal valuable instructional time must provide relevant information that is actually put to use to inform revisions and reteaching.

In short, it’s time to turn to the real basics of what we expect students to learn, how we convey that, how we measure student learning, and how we support teachers and reduce their isolation.

We need first to recognize that most of our major economic competitors, and nearly all of the highest-scoring countries on international assessments, have a national set of mathematics standards that guarantees a degree of coherence, focus, and alignment absent in the patchwork of state standards in the United States. A nationally mandated curriculum isn’t the answer. But a broadly accepted, strongly recommended set of world-class national mathematics standards for grades K-12 is. Such standards would provide informed guidance and attract widespread interest, yet would not fall under the antiquated rubric of “local control.”

If we took this route, textbooks could be revamped to cut redundancy and add depth and balance between procedural and conceptual understanding. The recommended math standards could delineate sensible and reasonable expectations for students at each grade level and in each course. Curriculum sequences and objectives could be crafted so that all students would reach key elements of algebra in 8th grade and leave high school with sufficient understanding of both calculus and statistics. These skills would help them thrive in the workplace and at postsecondary institutions.

Second, we need to examine what common sense, observation, and research tell us about instructional practices that make significant differences in student achievement. Such practices can be found in high-performing schools across the country. There, we see teachers making “Why?” a classroom mantra to support a culture of reasoning and justification. We see cumulative review being incorporated daily. We see deliberately planned lessons that skillfully employ alternative approaches and multiple representations that value different ways to reach solutions to real problems. We see teachers relying on relevant contexts and using questions to create language-rich mathematics classrooms.

Good mathematics instruction is hard, but it isn’t quantum physics. Yet few vehicles are currently used to model and institutionalize these techniques that make a difference. That is why compassionate, collegial, and yet candid coaching and supervision, guided by a compelling vision of high-quality mathematics instruction, can make such a tremendous difference in how much students learn and how teaching skills are strengthened.

Third, we need to address the current mishmash of assessments that has emerged from implementation of the federal No Child Left Behind Act. How can one expect instruction to focus on conceptual understanding, or communicating one’s thinking or reasoning through a complex problem, when tests hold students accountable for only low-level skills and multiple-choice answers? Accountability isn’t the problem. The problem rests with the instruments being used to hold the system accountable.

We should look at what characterizes student assessments in other countries. Most of Singapore’s tests, for example, consist of problem-oriented, constructed-response items. PISA’s items are set in realistic contexts and require thinking and reasoning about substantive mathematics, as opposed to recall and regurgitation of tangential content. Moving forward, we must look to the federal government and its research-and-development muscle and investment to create high-quality national assessments of mathematics at the ends of grades 4, 8, and 10. Until this happens, we will continue to muddle through multiple and meaningless standards with mixed signals and continued mediocrity.

Establishing a set of high-stakes, high-quality, annually released national assessments will drive improvement, reduce the current hodgepodge of state assessments, and move the United States toward a rational alignment between what is taught and what is tested.

Finally, we need to address professional isolation among teachers. It is the nature of the profession that most educators practice their craft behind closed doors. They usually go about their work unobserved and undersupported. Far too often, teachers revert to how they were taught, not how their effective colleagues are teaching. Common problems are often solved individually rather than collaboratively.

Successful enterprises don’t tolerate such conditions. We must change the professional culture of teaching. Principals must develop innovative ways to facilitate professional sharing and interaction. Middle and high school math departments must become true communities of learners.

In an example of this strategy in motion, teachers in one enterprising district I have visited regularly share and discuss their videotaped lessons. After two years of their doing so, the district finds that marginal teachers have become good teachers, and good teachers have become even better. Simultaneously, classroom practices have become far more transparent and discussions now focus on specific instructional strategies. Common problems are approached and solved collaboratively.

It is time to recognize math education as a critical component of America’s economic infrastructure. National interest supports a military for the country’s defense and an interstate highway system for effective commerce. Now, we must support—and demand—a national K-12 mathematics program that far better serves our students, our economy, and our national interest.

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