Building the Case for Algebra Preparation in Early Grades

Algebra is widely considered to be a “gatekeeper” course to college and beyond. However, waiting until 9th grade to address algebra learning is much too late. There is consensus among leading researchers and think tanks that improving students’ algebra performance must begin with elementary math (e.g., Loveless, 2008; National Math Advisory Panel, 2008; National Council of Teachers of Mathematics, 2006; National Research Council, 2001).

Mark C. Long, of the Daniel J. Evans School of Public Affairs at the University of Washington, and colleagues examined the impact of various factors on students’ college readiness, including sociodemographic characteristics, educational needs, parental attitudes towards education, performance on the eighth-grade math exam, and high school math courses (Long, Iatarola, & Conger, 2009). They found:

> “...students’ eighth-grade test scores have a larger effect on both highest math course taken [in high school] and college readiness than any other characteristics that we observe. Clearly, efforts to improve the quality of K-8 education, whereby students are better prepared for high school, could contribute substantially to lowering subsequent disparities in high school and beyond. (p. 25)

Scores from even earlier grades can be highly predictive of high school achievement and college readiness. Andrew C. Zau and Julian R. Betts of the Public Policy Institute of California (2008) found that math test scores in grades 4-6 are better predictors of passing the California High School Exit Exam than scores in later grades.

This is because algebra achievement depends on mathematical foundations built in the elementary grades. The National Mathematics Advisory Panel (2008) defined eleven benchmarks that must be met to ensure students will be effectively prepared for algebra. The Panel recommends that five of these concepts be mastered by the end of 5th grade, and all eleven by the end of 7th grade.

A coherently-sequenced curriculum in the elementary grades is key to developing students’ mathematical foundations and this is precisely where US math education fails its students. While children in the US are among the highest performing in 4th grade, by the 8th grade they slide to 25th in rank among 30 developed nations in math literacy and problem solving (Baldi, Jin, Shemer, Green, Hergert, & Xie, 2007). This precipitous fall is unparalleled; no other country has a sharper drop in math ranking than the United States (Loveless & Diperna, 2000).
William Schmidt, the director of the US National Research Center for the Third International Mathematics and Science Study (TIMSS) came to the following conclusion in his analysis of US 8th-graders’ math performance compared to their peers in high-achieving math countries:

One of the most important findings from TIMSS is that the differences in achievement from country to country are related to what is taught in different countries. In other words, this is not primarily a matter of demographic variables or other variables that are not greatly affected by schooling. What we can see in TIMSS is that schooling makes a difference. Specifically, we can see that the curriculum itself — what is taught — makes a huge difference (Schmidt, Houang, & Cogan, 2002, p. 2-3).

The mathematical content of the Reasoning Mind program is based on the Russian approach to mathematics education, which is an international standard and is recognized as one of the most effective approaches in existence. The curricula of many of the world’s top-performing countries in mathematics — including China and Singapore — share common roots with the Russian curriculum.

Despite the importance of elementary math education, most efforts to improve algebra readiness and college access have been focused on 8th grade and high school. This approach has not produced good results. Chicago Public Schools began requiring high school students to take a college preparatory sequence that includes Algebra I. This policy failed to change college outcomes for the better; instead it increased the math failure and math absenteeism rates (Allensworth, Nomi, Montgomery, & Lee, 2009). A 2008 Brown Center Report on American Education found that 120,000 8th-grade students nationwide were enrolled in algebra despite only having a 2nd-grade understanding of mathematics (Loveless, 2008).

College preparatory policies that mainly concern themselves with secondary education have thus far left algebra teachers with an impossible task: they must remediate years of elementary math instruction while simultaneously teaching algebra. The Brown report found that many so-called “algebra” courses were algebra in name only; teachers spent the majority of class time teaching elementary mathematics. Algebra I teachers surveyed by the National Opinion Research Center in 2007 described their students’ readiness for algebra as fair to poor (Hoffer, Venkataraman, Hedberg, & Shagle, 2007).

Students who struggle with algebra in high school will require remediation before they are ready for college-level work. A 2003 report from the National Center of Education Statistics found that 22% of students beginning college in fall 2000 were enrolled in a remedial math course (Parsad & Lewis, 2003). The costs of providing remedial education at the college level are estimated at $1 billion annually (Breneman & Haarlow, 1998), a figure that does not include financial and opportunity costs borne by the students themselves (Merisotis & Phipps, 2000).
The causal chain is clear. Students subjected to a disorganized curriculum are unlikely to develop proficiency with fundamental concepts in elementary math. Students who lack proficiency in elementary math will struggle to complete algebra. Students who struggle to complete algebra will be shut out from many opportunities in college and beyond. Any effort dedicated to improving college readiness and college completion would be remiss in only funding secondary and post-secondary educational initiatives. Reasoning Mind, with its time-tested approach to teaching foundational math concepts, is well-positioned to arrest the drop in US students’ math performance — and then send them to college.

REFERENCES


