

JULY 2008

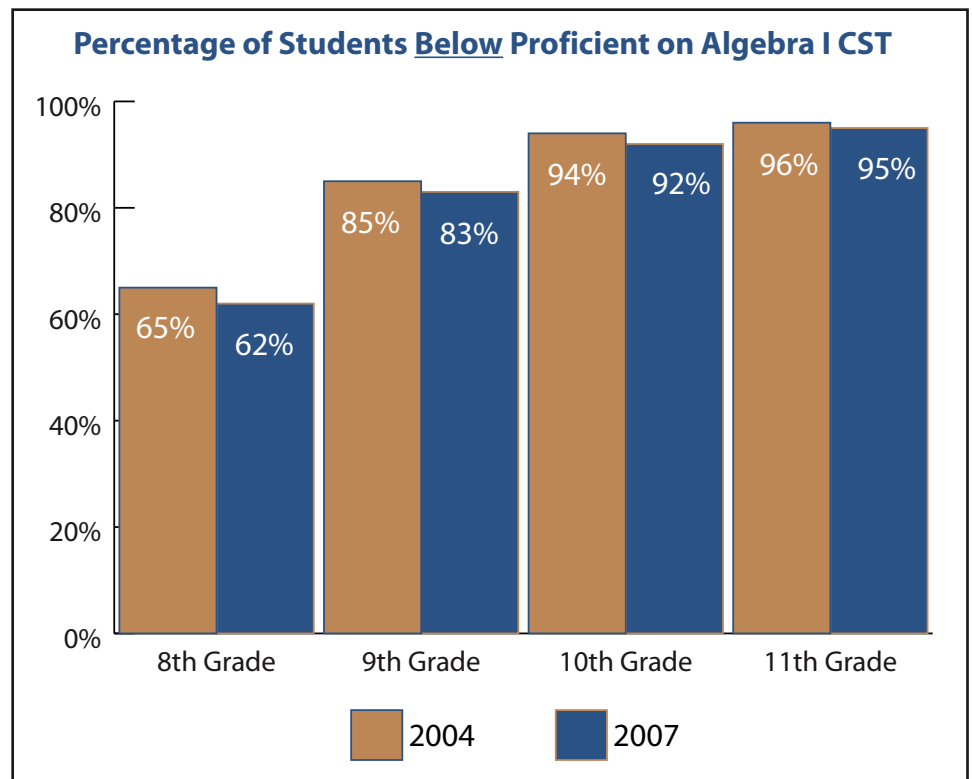
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California's Approach to Math Instruction Still Doesn't Add Up

Impending Retirements + Chronic Math Teacher Shortages = Deepening Concerns for California's Middle and High Schools

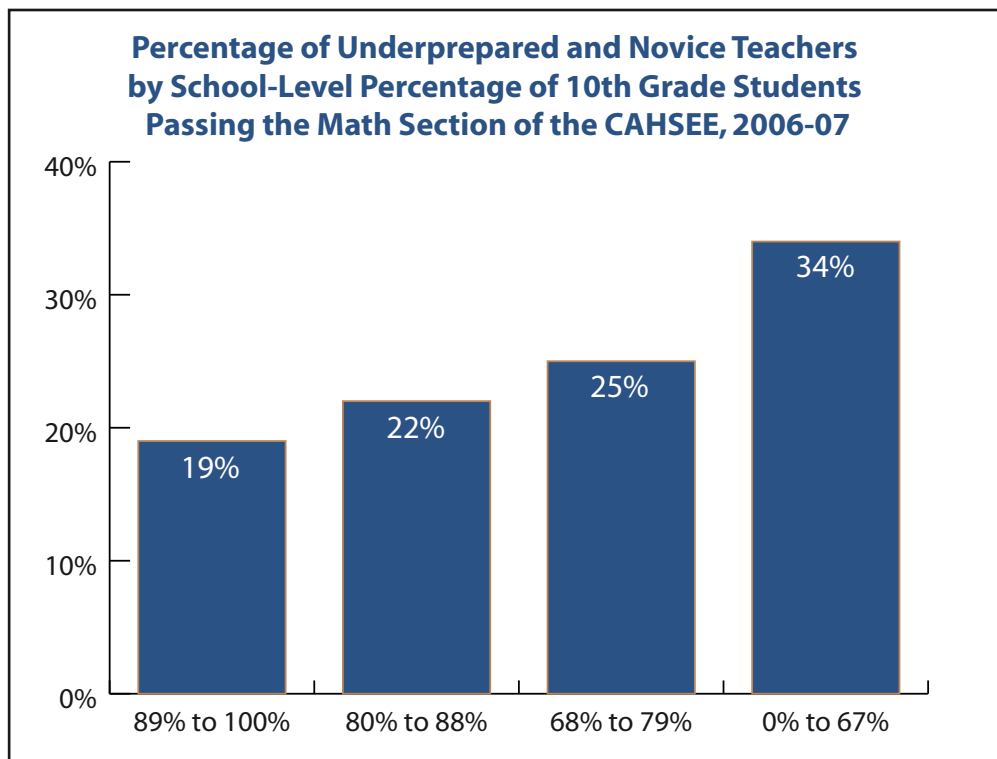
Three years ago, the Center for the Future of Teaching and Learning sounded the alarm: 8th grade Algebra I students were at risk of failing to meet the standards the state had set for them. We argued that without a concurrent boost in the number of teachers who were well-prepared and willing to take the assignments created by moving Algebra I from the 9th grade to the 8th grade, California schools and the students in them were likely to face some serious challenges. Discussions in Sacramento and at the federal level have once again brought this issue to the fore. So, what is the state's current status? Scant attention has been paid to this critical issue, and California's approach to math instruction still doesn't add up.



Note: These percentages are based on the population of students in each grade taking and being tested on Algebra I. The numbers in these cohorts decrease each year as students pass the course and move on to the next level of math. Actual numbers can be found at the end of the document.

Poor Performance on High Stakes Math Tests

Three years ago, California's students were failing to make the grade in mathematics. The RAND Corporation had found that California's 8th grade students ranked 43rd on the National Assessment of Educational Progress (NAEP) mathematics tests. But rather than improve, the most recent data shows that the state's ranking has slipped to 47th place. And while the percentage of high school juniors who are prepared to enroll in college level mathematics courses has remained about the same (55%), 78% of students scored below the proficiency level on the California Standardized Test in Algebra I (despite a slight up-tick in scores in grades 8 through 11). Further, in 2006-2007, about a *quarter* of tenth grade students taking the California High School Exit Exam (CAHSEE) failed to pass the mathematics section of the test.



A recent update of research commissioned by the Center and conducted by SRI International found that, on average, schools with the lowest passing rates on the exit exam have far more underprepared and novice teachers than schools with higher pass rates. Students in schools with lower pass rates are nearly twice as likely to be taught by underprepared and novice teachers than students attending schools with the highest passing rates. More than one-third of underprepared and novice teachers were located in schools with the lowest pass rates on the mathematics portion of the CAHSEE.

The Teaching Crisis in Algebra

Algebra I is viewed as the gatekeeper to a sequence of higher mathematics courses as well as the key to future academic success beyond high school. To highlight the importance of Algebra I, students have been encouraged to pass the course in the 8th grade. Yet the number of middle school students enrolled in Algebra I classes in which the teacher is either underprepared or assigned "out-of-field" rose from 73,000 in 2004 to more than 74,000 in 2007. In California, about 32% of the workforce assigned to teach Algebra I in middle school do not have a subject matter credential in mathematics and may lack the background and preparation necessary to effectively teach the subject.

At the high school level, knowledge of algebraic concepts is required to pass sections of the state's high school exit exam and STAR tests. Further advanced math required for admittance to California's institutions of higher education, such as Geometry and Algebra II, as well as the recommended additional courses of Trigonometry and Calculus, consider Algebra I a prerequisite for the sequence. Yet more than 2,700 high school teachers assigned to teach mathematics are teaching out of their field of expertise or have not yet completed requirements for a teaching credential (up from about 2,000 three years ago).

Increased Enrollments in Middle Schools + Existing Teacher Shortages + Accelerating Student Academic Standards Still Equal an Increasing Demand for Skilled and Knowledgeable Math Teachers

The Center has argued that to improve achievement in mathematics and provide students the opportunity to meet the high academic standards the state has set, California needs to ensure that every student has access to a knowledgeable and skilled mathematics teacher. But the demand for these math teachers remains as high today as it was in 2004:

- Student enrollment has bulged in the middle grades, accelerating the need for fully prepared teachers of mathematics. This bulge in enrollment will continue to roll through to the high school level and peak in 2009.
- There are existing and persistent shortages of fully prepared teachers in math. *More than twenty percent* of high school math teachers are underprepared or teaching out-of-field.
- Teachers are projected to retire by tens of thousands over the next decade. Nearly one in five teachers is projected to retire within five years, and about 100,000 teachers, or *one-third of the workforce*, are expected to retire by 2017.

Policy Considerations

The Governor, Superintendent of Public Instruction and the State Board of Education are justifiably concerned about the number of students failing to meet state and federal standards in mathematics. But missing in the debate thus far is the recognition that, without more teachers developing a deep understanding of the subject as well as the skill required to deliver that curriculum powerfully and well, it is likely that Californians will see the same numbers of students succeed in 8th grade Algebra I three years hence as they did three years ago. To ensure students meet state and federal standards, their teachers must get the training necessary to develop the knowledge and skills to effectively teach Algebra I. Unfortunately, teacher professional development programs have repeatedly been cut in recent years and are likely to fare poorly in current policy deliberations. Moreover, those programs with the most sustained funding are those targeting math and reading professional development for K-3 teachers. In short, not only are middle and high school students in desperate need of high quality mathematics teachers, the state's existing professional development programs that might serve to boost teachers' knowledge and skill in this area still are not targeted or designed to do so. Because Algebra I is so critically important to students' long-term success in mathematics, the state should set as a high priority that every middle school student in California be taught by a well-prepared and effective Algebra I teacher.

The Center View: In order to ensure students can meet the new state and federal requirements for mathematics, California should establish the infrastructure necessary to prepare and place an adequate number of fully prepared and effective 8th grade Algebra I teachers.

In light of the State Board of Education’s decision to require all 8th grade students to be tested in Algebra I – essentially requiring them to take the Algebra I course – the Center strongly urges California’s Governor and Legislature to commit the necessary resources to build the capacity of the teacher workforce to meet this demand. This means putting into place the infrastructure necessary to produce an adequate number of knowledgeable and effective teachers of mathematics, place them where they are needed most, and provide the materials they need to do the job well. Further, commitment to deepening subject matter content knowledge and pedagogical skill is required for those Algebra I teachers already hired, yet assigned out-of-field in the area of mathematics.

One place to start is to implement summer institutes for 8th grade Algebra I teachers, an enterprise in which the state already has some experience. In 2000, the California Professional Development Institutes (CPDI) were established to provide intensive professional development programs for up to 70,000 teachers statewide. As part of that effort, the state budget set aside \$2.5 million to establish Algebra summer institutes. These institutes were provided through the collaborative efforts of the University of California, the California State University, independent colleges and universities, and the K-12 community. With their intensive two-week summer program followed by additional assistance throughout the school year to total 160 hours of training, the CPDI was generally considered an effective model for teacher professional development.

The funding for the Algebra I summer institutes was eliminated; we propose that these institutes be reinstated. We suggest that they be conducted on college campuses or schools located in urban centers where the shortage of fully-prepared teachers is the greatest. The institutes should provide teachers with 80 hours of *high quality*, intensive professional development plus an additional 80 hours of follow-up aimed at improving their content and pedagogical knowledge in algebra. Providing \$2000 stipends will offer an incentive for participation and reward efforts for self-improvement. We would also urge the state to put into place, beginning immediately, a thoughtful and thorough planning process in order to ensure teachers’ time is well spent.

Private foundations, business and industry can also help by targeting support to high quality professional development for middle grades math teachers in urban areas. The cost of providing these institutes and incentives for the middle school teachers currently teaching Algebra I without the necessary background is relatively low for a state the size of California: \$3.6 million. Given the high stakes for students’ success in high school and beyond, and the complex subject matter content that teachers are expected to deliver, that’s a small price to pay for such a large return on investment.

*Notes: 160 hrs=Two week institute (80 hrs) + 40 hrs face-to-face follow-up + 40 hrs teacher work at site. Estimated cost derived from:
\$3500 X 1030= \$3,608,500

2004 Algebra I CST	8	9	10	11
Students Tested	190179	222333	135614	66221
% of Enrollment	37.8 %	43.1 %	28.5 %	15.8 %
% Advanced	8 %	1 %	0 %	0 %
% Proficient	27 %	14 %	6 %	4 %
% Basic	27 %	29 %	23 %	18 %
% Below Basic	30 %	43 %	52 %	55 %
% Far Below Basic	8 %	13 %	19 %	23 %

2007 Algebra I CST	8	9	10	11
Students Tested	239240	271300	140317	72218
% of Enrollment	48.7 %	51.6 %	28.0 %	15.6 %
% Advanced	9 %	1 %	0 %	0 %
% Proficient	29 %	16 %	8 %	5 %
% Basic	27 %	28 %	25 %	20 %
% Below Basic	25 %	37 %	43 %	46 %
% Far Below Basic	9 %	17 %	24 %	28 %