

Math and Science Teachers: Recruiting and Retaining California's Workforce

THE TECHNICAL DEMANDS OF A COMPETITIVE global economy have focused California policymakers' attention on education in the "STEM" fields—science, technology, engineering, and mathematics—including the foundation in these subjects provided by middle and high school teachers. Although these teachers are crucial to California's efforts to remain competitive, they can be difficult to recruit and retain. In response to a persistent shortage of fully prepared math and science teachers, policymakers and educators have launched a variety of programs to increase the supply of these professionals.

This policy brief discusses the current shortage and the challenges involved in recruiting and retaining these critical teachers. It also outlines the actions policymakers and educators are taking to address the issue.

California schools do not have enough fully prepared math and science teachers

California faces a shortage of math and science teachers, and the state's schools will need an estimated 33,000 new teachers in these subjects over the next decade, according to a 2007 report, *Critical Path Analysis of California's Science and Mathematics Teacher Preparation System*, by the California Council on Science and Technology (CCST) and the Center for the Future of Teaching and Learning (CFTL).

Because of this shortage, math and science classrooms are disproportionately being staffed by educators who do not hold the proper credentials. CCST and CFTL found that at the middle school level, 9% of math and 8% of science teachers are underprepared, meaning that they do not hold clear or preliminary credentials in the subjects that they teach. (Middle school teachers in California may hold either a multi- or single-subject credential.) The researchers also found that at the high school level, 12% of math and 9% of science

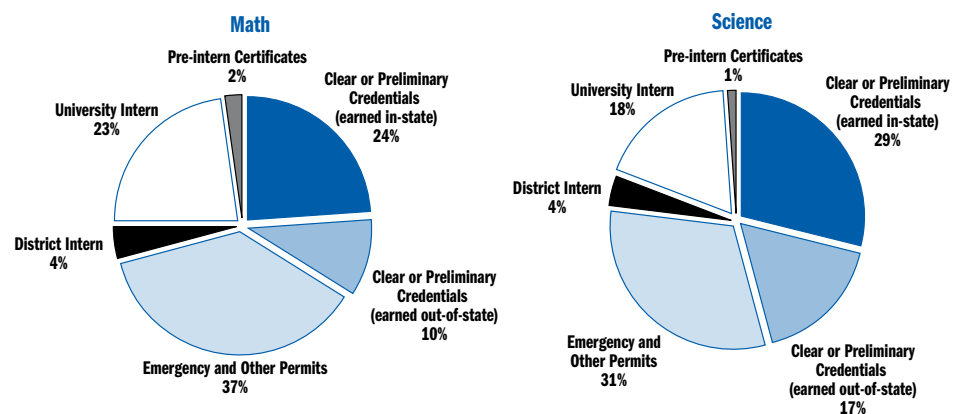
teachers are underprepared. In 2006 CFTL reported that underprepared teachers constituted a higher proportion of teachers in math and science than in the state's teacher workforce as a whole.

Newly hired math and science teachers are less likely to hold full credentials. CCST researchers estimated that only 34% of the

math teachers and 46% of the science teachers hired in 2004–05 at the secondary level held either a clear or preliminary credential (the latter is for new teachers). (See Figure I.)

The state has engaged in multiple efforts—some of which are described here—to increase the number of fully

figure 1 The majority of new math and science teachers hired in 2004–05 did not hold a full (clear or preliminary) credential



DATA: CALIFORNIA COUNCIL ON SCIENCE AND TECHNOLOGY, SECONDARY MATH AND SCIENCE TEACHER PREPARATION IN CALIFORNIA. TESTIMONY TO THE U.S. HOUSE COMMITTEE ON EDUCATION AND LABOR (2007)

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How can someone earn a teaching credential in California?

According to the California Commission on Teacher Credentialing, to receive a preliminary teaching credential in California, which is valid for five years, a person must:

- Earn at least a bachelor's degree.
- Pass the California Basic Educational Skills Test (CBEST).
- Attain and demonstrate subject-matter knowledge in the subject(s) the individual plans to teach.
- Participate in a state-approved teacher preparation program.

To receive a clear credential, a teacher must complete a beginning teacher induction program. Clear credentials must be renewed every five years.

prepared math and science teachers working in California's classrooms. However, the *Critical Path Analysis* report finds that schools—particularly low-performing ones—are still facing a shortage.

Districts and schools are challenged to retain, recruit, and compensate math and science teachers

The shortage of well-qualified math and science teachers in California may be due in part to the difficulty of keeping them in the classroom. Research from the U.S. Department of Education, reported by the National Science Foundation (NSF), found that math and science teachers are significantly more likely than other teachers to leave the classroom in order to pursue a different career. Turnover may be due to a variety of factors including

personal reasons, dissatisfaction with their job, and higher-paying career options outside of teaching.

In a different study, University of Pennsylvania researcher Richard Ingersoll found that school staffing problems—particularly in math and science—are often a result of attrition rather than insufficient recruitment. According to Ingersoll, nationwide the number of new math and science teachers roughly equals that of retiring teachers. But there are not enough new teachers to replace those who leave the classroom for other reasons, such as personal motives, job dissatisfaction, and the pursuit of careers with higher salaries and status.

A comparison of California teaching salaries to wages in other jobs that require similar levels of education

reveals some of the economic realities involved in recruiting and retaining these professionals. According to the Bureau of Labor Statistics, the mean annual salary for a middle school teacher in May 2006 was \$58,980; for a secondary school teacher, the salary was \$58,240. As Figure 2 shows, generally speaking, math and science teachers' annual salaries are considerably less than other math- and science-based professions. However, a look at salaries on a per diem basis provides a different perspective.

For example, in California a teacher's regular work year is approximately 185 days: 180 school days and perhaps five additional days for professional development or in-service training. By contrast, most of the occupations shown in Figure 2 are based on a five-day workweek for 52 weeks a year—or 260 days.

A physician assistant, for example, earns \$80,960 per year on average, which roughly equals a salary of \$311.38 per workday (counting paid holidays and vacation days as workdays). For computer software engineers, the same equation yields a daily rate of \$369.50. A secondary school teacher earning \$58,240 annually earns a salary of \$314.81 per workday, but that does not count any holidays or vacation days.

In addition, looking at averages can mask the wide range of salaries for teachers. According to the California Department of Education, teacher salaries in unified districts, on average, ranged from \$38,891 to \$78,167 in 2006–07. The average pay statewide for unified districts was \$63,323. (High school districts pay slightly more.)

Teachers choose to enter the profession for a variety of reasons other than those related to salary. They may be committed to their role

figure 2 | California's math and science teachers have many well-paid career alternatives based on their backgrounds

Occupation	Mean (Average) Salary
Middle School Teachers, Except Spec./Voc. Ed	\$58,980
Secondary School Teachers, Except Spec./Voc. Ed	\$58,240
Actuaries	\$92,610
Aerospace Engineers	\$97,140
Biomedical Engineers	\$85,960
Chemists	\$73,270
Computer Software Engineers, Systems Software	\$96,070
Computer Hardware Engineers	\$100,070
Electrical Engineers	\$88,280
Environmental Engineers	\$79,100
Financial Analysts	\$86,620
Mechanical Engineers	\$81,790
Network Systems and Data Communications Analysts	\$71,870
Physician Assistants	\$80,960

DATA: U.S. BUREAU OF LABOR STATISTICS, CALIFORNIA, 5/06

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as educators, enjoy a shorter work year, or value the alignment of their workday with their own children's school schedule. Teachers also receive generous retirement packages and health and welfare benefits.

Efforts to create new incentives, pathways, and support for math and science teachers gain traction

Education leaders and policymakers have been implementing a variety of incentive and mentoring programs aimed at encouraging talented individuals to become math and science teachers as well as supporting existing teachers.

Offering financial incentives is one strategy to attract more math and science teachers. This approach includes tuition and fee assistance programs, loan forgiveness, and paid internships. For example, the Assumption Program of Loans for Education (APLE), run by the California Student Aid Commission, pays a portion of students' loans (up to \$11,000) for every year they teach in hard-to-staff schools or subjects, such as middle and high school math and science. Other financial incentives are offered regionally, such as the \$3 million grant program to attract more highly qualified teachers, particularly in math and science, to low-performing schools in the Los Angeles, greater Inland Empire, and Central Valley regions.

Creating alternative teacher compensation packages is another strategy. Public school teachers are paid based on a schedule negotiated between the districts and teachers' representatives. Teachers' level of education and years of experience in the classroom typically determine their salaries. Some school districts facing critical shortages of math and science teachers have offered stipends or

bonuses—on top of the regular pay schedule—to recruit and retain these teachers, particularly in hard-to-staff schools.

Other programs aim to retain teachers through improved support on the job. One-on-one mentoring and induction, as well as professional development, have been shown to increase job satisfaction for new teachers, thereby reducing attrition. Technology may also offer additional tools. For three years, California has been part of a pilot project providing online e-mentoring for new secondary science teachers. This program, e-Mentoring for Student Success (e-MSS), is funded through the National Science Foundation and has recently been expanded to include new math teachers.

Many other privately and publicly funded programs that provide incentives, support, and professional development operate throughout the state. However, in the *Critical Path Analysis* study, the researchers note that the success of these programs is relatively unknown because California does not have a system in place to track teacher placements.

The state's public universities plan to increase math and science teacher graduates

Lawmakers appropriated \$1.5 million in the 2006–07 budget to support statewide programs at the University of California (UC) and California State University (CSU) to prepare greater numbers of new math and

California's public universities agree to prepare more math and science teachers

With support from policymakers, the University of California (UC) and California State University (CSU) systems have announced their intention to increase the number of new math and science teachers they prepare.

- CSU's Mathematics and Science Teacher Initiative intends to double (from 750 to 1,500) the number of new math and science teachers that CSU prepares each year. The initiative includes expanded efforts toward recruitment and diversity, new credential pathways to reach out to both undergraduates and math and science professionals, and program alignment with community colleges. Each CSU campus administers the initiative differently in response to regional conditions—an approach that CSU calls "one goal through diverse pathways." For example, CSU Dominguez Hills collaborates with the Los Angeles Unified School District to train its math and science teachers, establishing training and course sites for prospective teachers at LAUSD high schools. For more information, see: www.calstate.edu/teacherED/MSTI/index.shtml
- UC's California Teach program aims to place 1,000 new math and science teachers into California classrooms each year—a fourfold increase from the 250 teachers who currently graduate from UC annually. Each of nine UC campuses implements the program differently through some combination of undergraduate courses, credentialing guidance and advising, seminars on teaching, and financial support. Many campuses have teacher recruitment and support centers housed prominently in STEM departments. At UCLA, for example, the program created two classes for STEM-focused undergraduates to observe classrooms, attend weekly seminars, and develop a lesson plan they teach at the end of the course. For more information, see: www.universityofcalifornia.edu/academics/1000teachers

science teachers. These programs (see the box on page 3) were created to encourage students who are earning bachelor's degrees in math, science, or engineering to consider teaching as a career. CSU's program received an additional \$2 million in the 2007–08 state budget, and private funds have also been donated.

With these funds, UC pledges to quadruple by 2010 the number of math and science teachers it prepares each year. CSU, which plays a larger role in preparing California's teaching workforce, pledges to double its preparation of math and science teachers during this time. Community colleges have also agreed to align their coursework with CSU's teacher preparation programs. According to

CCST and CFTL, it is too soon to predict whether these institutions will meet their targets. If UC and CSU are successful, they will produce an additional 1,500 math and science teachers each year over the following 10 years. Those 15,000 new teachers would represent a sizeable portion of the estimated 33,000 new teachers the state needs to eliminate the math and science teacher shortage in the future.

A continued commitment to support California's math and science teachers is needed

California's persistent shortage of fully prepared math and science teachers—particularly in low-performing schools—is something the state has

begun to take seriously. Initiatives to address the challenge of retaining, recruiting, and compensating these critical professionals are steps toward resolving the problem. It is not yet clear how these efforts will affect the supply of prepared math and science teachers or whether they will be enough to counteract the realities of higher-status and higher-paying jobs in other math- and science-related fields. Continued vigilance and a commitment to create innovative incentive and support systems by policymakers and education leaders may be what California needs to ensure that students receive a high-quality math and science education and are prepared, if they choose, to participate in the state's STEM workforce. ■■

To Learn More

Math and Science Education for the California Workforce: It Starts with K–12. EdSource, 2008.

A complementary report looking at math and science education in California's public schools.

www.edsource.org/pub_abs_mathscience0108.cfm

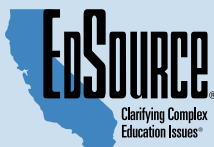
Critical Path Analysis of California's Science and Mathematics Teacher Preparation System. California Council on Science and Technology and the Center for the Future of Teaching and Learning, 2007.

A comprehensive evaluation of California's capacity to prepare math and science teachers.

www.ccst.us/publications/2007/2007TCPA.php

California Commission on Teacher Credentialing. State agency that sets standards and authorizes the licensing and credentialing of professional educators in the state. www.ctc.ca.gov

Math and Science: Gateways to California's Fastest-growing Careers. EdSource, 2008. A guide to help parents and students think about how math and science courses relate to their future options in the adult workplace. www.edsource.org/pub_abs_mathscience_QA_0108.cfm



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