THE CENTER
FOR THE FUTURE OF TEACHING & LEARNING

CENTER VIEW
Insight and analysis on California education policy

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SCIENCE TEACHING AND CALIFORNIA'S FUTURE

Often overshadowed by an emphasis on mathematics and literacy, science education has not received the attention it deserves from policy-makers—particularly surprising and disconcerting in a state that boasts the nation's most robust high tech economy.

It is very clear that California's policy-makers face real and significant challenges in supporting a high quality science education effort that will ensure that today's students meet the state's educational, technological, and economic demands. Topping the list of challenges is the serious shortage of fully prepared and effective science teachers. Cutbacks in funding for science professional development and efforts to recruit and retain teachers further undermine efforts to strengthen science education throughout the state. Additionally, the least prepared among these science teachers are concentrated in low-performing schools, a fact that raises questions about equal access to quality science instruction, particularly for the state's low-income and minority students. How policy-makers resolve these and other issues related to science education will have long-term implications for the success of California's students and the future of our economy.

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CHALLENGES FOR POLICY-MAKERS

A SHORTAGE OF FULLY PREPARED AND EFFECTIVE SCIENCE TEACHERS: *Too many students are being taught science by teachers who lack subject matter knowledge, training, and instructional skills necessary to help students learn.*

As a result of class-size reduction and student population growth, the state has experienced a severe shortage of fully prepared teachers. These shortages are alarmingly apparent in science. To ensure all classes have teachers, school districts have hired underprepared science teachers, and high schools have assigned fully credentialed faculty without the proper subject

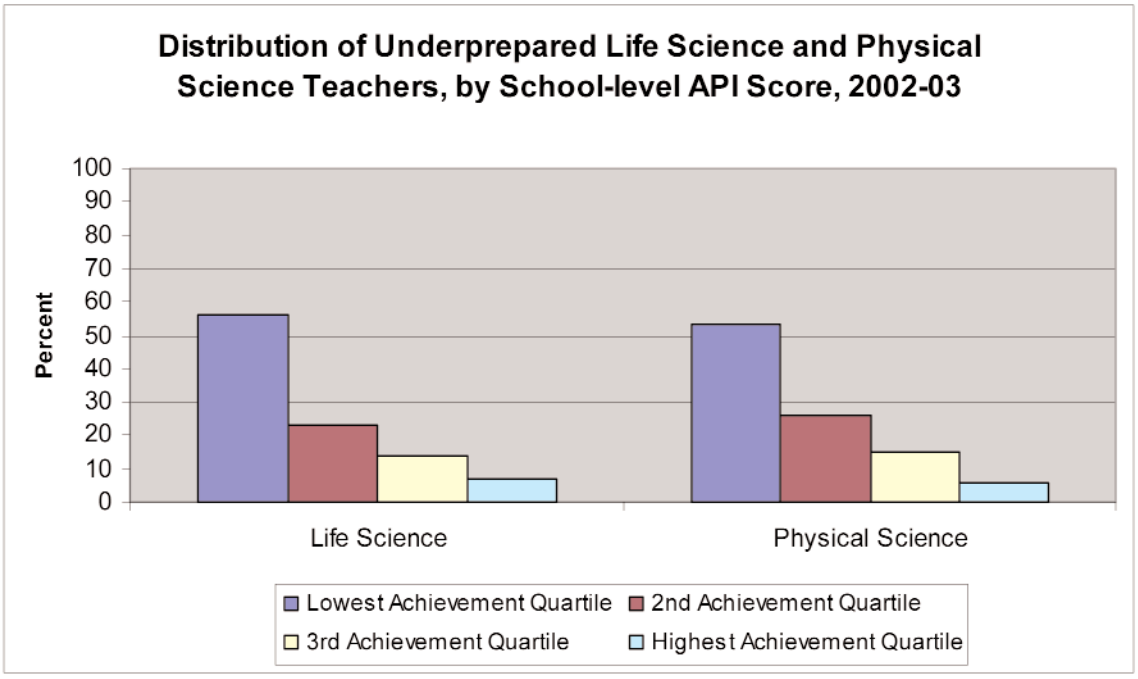
matter authorization to teach science courses. The bottom line is that too many students are being taught science by teachers who lack the subject matter knowledge, training, and skills necessary to help them learn.

	Number of High School Science Teachers With Credentials in Other Subjects	Number of Underprepared High School Science Teachers (Without a Credential)
Physical Science (N=3,411)	738 (22%)	425 (12%)
Life Science (N=3,231)	296 (9%)	407 (13%)

Source: California Department of Education, Educational Demographics Unit (2003). Public School Enrollment and Staffing Data Files (CBEDS); SRI analysis.

UNFAIR AND INEQUITABLE OPPORTUNITIES IN SCIENCE EDUCATION: *The least prepared science teachers are assigned to schools serving the state's most vulnerable students.*

Underprepared secondary science teachers are highly represented in California's lowest-performing schools. Fifty-six percent of underprepared life science teachers and 53% of underprepared physical science teachers, for example, work in schools with the lowest scores on the state's Academic Performance Index (API), schools which typically have high concentrations of poor and minority students. In contrast, 7% of the underprepared life science teachers and 6% of the underprepared physical science teachers work in schools that fall in the top quartile on the API.

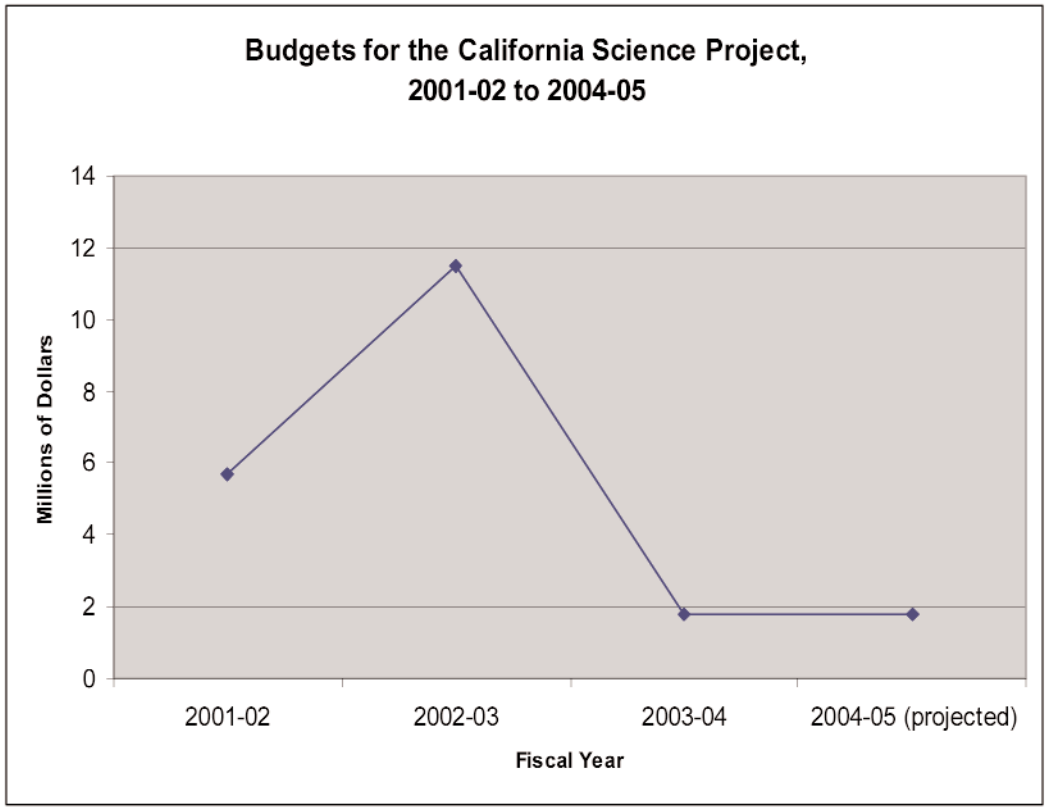


Source: California Department of Education, Educational Demographics Unit (2003). Public School Enrollment and Staffing Data Files (CBEDS); SRI analysis.

Additionally, even fully prepared K-8 teachers may not have the content background necessary to instruct their students adequately in science. Ensuring that teachers have a comprehensive understanding of the different sciences would only resolve part of the problem, however. In order to produce effective science teachers, the state must also offer ongoing high quality professional development and subject-specific instructional support to teachers.

BUDGET CUTS IMPERIL EFFORTS TO STRENGTHEN SCIENCE TEACHING IN CALIFORNIA: *Professional development, teacher recruitment and retention programs are hard hit.*

The state's budget cuts have curtailed programs that provide professional development for science teachers, and are impeding efforts to recruit and retain highly qualified science teachers. The primary state initiative for science teacher professional development, the California Science Project (CSP), has undergone dramatic cuts to its budget. The CSP saw its budget reduced from $11.5 million in 2002-2003 to $1.8 million in 2003-04, and expects to have the same amount available for 2004-05.



Sources: University of California Office of the President (UCOP), (2003). California Subject Matter Projects budget allocations for 2000-01 to 2003-04. Personal communication; UCOP (2004). California Science Project budget allocations for 2002-03 to 2004-05.

The state budget cuts have also nearly eliminated California's efforts to recruit and retain teachers. In 2000-01, policy-makers slated $151.6 million for the state's teacher recruitment programs. By 2003-04, funding for all of these initiatives, except APLE, a student loan repayment program, had been eliminated.

Further complicating this situation is the lack of competitive compensation packages for teachers. While teacher salaries compare poorly with the workforce overall, the disparity is even more exaggerated in science and mathematics. According to a 2002 report by the California Council on Science and Technology (CCST), California teachers overall earn nearly 20% less than they could in other professions. An inability to compete with the private sector's salary and benefit flexibility leaves districts with little leverage to attract and retain highly qualified science teachers.

THE INFLUENCE OF SCIENCE EDUCATION IN CALIFORNIA HAS DIMINISHED: *The state should use the current science textbook adoption cycle as an occasion to strengthen the importance of science education in the standards and accountability system.*

In 1998 the state adopted science standards that outlined what students at each grade level should know and what skills they should demonstrate. To complement the standards, in 2003 the state issued a framework that "provides the scientific background and the classroom context for teaching the required knowledge and skills." It also offered direction for instructional practices for K-12 science teachers.

Ironically, while the state was developing and implementing standards and a framework for science education, the influence of the subject in California's accountability measures and testing programs was being reduced. In particular, science has seen its share of the state's Academic Performance Index (API) calculations diminish. In high schools, science represented 20% of the API score in 2001-02, but that amount had been reduced to 8% by the 2003-04 school year. For elementary and middle schools, science is not part of the API determination at all.

The recently created California High School Exit Exam, part of the API determination, does not contain a science section. This reduction in the influence of science in the API runs counter to the rigorous course requirements for admission to California's public universities. The unintended consequences of policy decisions such as these may play out in schools concerned about improving their API rankings. These schools are likely to pay less attention to those subjects, such as science, that are less heavily weighted in the calculations. The decisions to narrow the curriculum to only include those subject matter areas to be tested may already be affecting the academic aspirations of California's students, including college-going rates and preparation for work beyond high school.

THE VIEW FROM THE CENTER

This spring, the California State Board of Education reversed an earlier decision that limited to no more than 20-25% the amount of "hands-on" learning included in the guidelines for textbook adoption for K-8 science instruction. At the urging of a diverse cross section of the state's business, science, and education leaders who were concerned about the impact of this decision on students' academic preparedness and the state's economic future, the 20-25% threshold became the minimum amount of hands-on instructional time rather than the maximum. While this controversy helped to bring the issue of science instruction into California's ongoing education policy discussion, it is clear that the conversation is only beginning.

In May, Governor Arnold Schwarzenegger, University of California President Robert C. Dynes, and California State University Chancellor Charles B. Reed announced an agreement regarding funding levels and institutional accountability for institutions of higher education. The compact includes specific provisions for the University of California, in collaboration with the

California State University system, to undertake a major initiative to address the shortage of science and mathematics teachers in the state.

We believe the compact is a good place to begin to address the ongoing shortage of fully prepared science teachers. But more needs to be done at the state and local levels to address the withdrawal of financial support from teacher development initiatives and the unfair assignment of the least prepared science teachers to students in greatest need. Restoring support for the California Science Project, targeted to regions of the state where the shortage of fully prepared and effective science teachers is most severe, is one low-cost approach to the problem of boosting content knowledge and instructional skills of underprepared teachers. Another is to provide planning grants to consortia of university, county office of education, school district, school site education leaders, and science and technology experts to plan, over a ten-month period, intensive science summer institutes for teams of teachers in the state's lowest-performing schools. Support for the implementation of the summer science institutes could follow in the 2005-06 budget with participation targeted to low-performing, hard-to-staff schools.

California's poor and minority students, those who are most likely to attend low-performing schools, have a tremendous stake in the future of the public school system and the state's economy. With these groups expected to be among the major population and economic drivers in the state during this century, their preparation for and participation in the high tech workforce should concern all of California's residents. The policy decisions made within the next few months regarding the support of robust, engaging science education for all students will have long-term implications for California's economic future.