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Scientific Literacy: The Missing Ingredient

Dismal NAEP scores highlight lack of science education

Students' academic success in science is widely seen by political and business leaders as key to the nation's economic rebirth and future competitiveness. President Obama has made clear his belief in the importance of scientific literacy by stating that "our nation's long-term economic prosperity depends on providing a world-class education to all students, especially in mathematics and science." Here in California, strengthening education in science and related fields is seen similarly as critical to the state's future. An extensive report by the California Space Education and Workforce Institute labels education in science, technology engineering and mathematics the "essential ingredient for California competitiveness."

But given the newly released results of the National Assessment of Educational Progress (NAEP) examining student understanding of science, one has to wonder if science education isn't the missing ingredient in the fight to improve our public schools. The NAEP assessment results show that less than half of U.S. students are proficient in science. Just over one-fifth of 12th grade students (21%) perform at or above proficient levels. The results are little better for younger students, with 34% of 4th graders and 30% of 8th grade students performing at or above proficient levels. Only 1% of students scored at advanced levels.

In California, the results of the NAEP testing are particularly grim. Students in the Golden State ranked next to last among all states participating in the NAEP science assessment. The average score of 4th grade students in California was 136, lower than those in 43 states. By comparison, the average score for public school students nationally was 149. Just 22% of students scored at the proficient level and 42% scored below levels demonstrating a basic understanding of science. Latino and African-American students scored at significantly lower levels than White and Asian students.¹

NAEP Achievement-Level Percentages and Average Score Result

2009	Below Basic	Basic	Proficient	Advanced	Average Score
California	42%	35%	22%	1%	136
U.S.	29%	39%	32%	1%	149

1. SOURCE: U.S. Department of Education, Institute of Education Sciences, National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 2009 Science Assessment.

A look at student performance on California's own measurements of performance in science underscores the NAEP findings. In 2010, just over half (55%) of 5th grade students were proficient or above in science. Perhaps most troubling, there is a 30-point gap in achievement between the state's largest and fastest growing block of students – Latinos – and their White and Asian peers. Just 43% of Latino 5th graders scored at proficient levels or above in science compared to 75% of White and 77% of Asian 5th grade students. African-American students fared no better, with just 42% scoring at proficient levels or above.

2010 California Standards Test – Life Science (Grade 5)

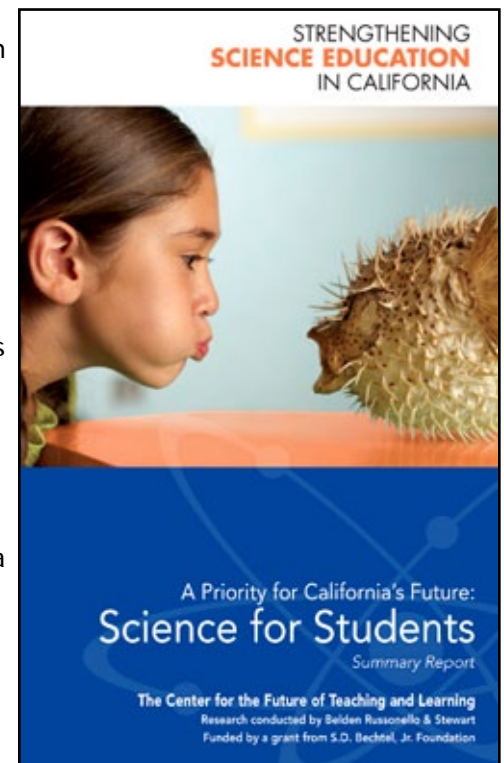
Grade 5 Students	Proficient	Advanced	Total Proficient/Advanced
Asian	29%	48%	77%
White	35%	40%	75%
Latino	30%	13%	43%
African American	29%	13%	42%

This low level of achievement is unsurprising given the realities facing our schools. While some schools in California may have exemplary science programs, many others, particularly those that have not met federal requirements for progress in mathematics and English language arts, have little time for science. Too many teachers also lack the preparation, training and resources they need to teach science effectively.

A Priority for California's Future: Science for Students

If there is a bright spot in the current debate about how to strengthen students' academic achievement, it can be found in the public's abiding interest in and support for better science education. Public opinion research conducted by Belden, Russonello and Stewart for the Center as part of the *Strengthening Science Education in California* initiative finds that Californians believe science education should be a priority for the state's schools and want it to be taught early and more often. To improve science education, the public wants students to have the labs and equipment they need, strongly supports providing teachers with specialized training, and wants more time spent on teaching science. Key findings of the research include:

- Californians believe that science education is key to the future of the state. Three-quarters of those polled say science should be a higher priority for California schools because it keeps both America and California at the forefront of technology and innovation.
- Science education should be a priority for California's schools. Nearly nine out of ten surveyed say it is very important or essential for California public schools to give all students a strong background in science.
- Science education should start early. Seven in ten say that learning science should begin in elementary school in order for students to succeed in high school.
- Science should be taught to all students. Two-thirds of Californians say all high school students should be required to study biology, chemistry and physics.



- More than eight out of ten Californians surveyed say that middle and high school science teachers should have extra preparation and special training. More than half say that elementary teachers also should have more preparation and training.
- Seven in ten think that more resources and better equipment would make a big difference in science education.
- Roughly six in ten say more time spent on science would make a big difference at the high school (63%) and middle school (57%) grades. 45% say more time on science education would make a big difference in the lower grades.

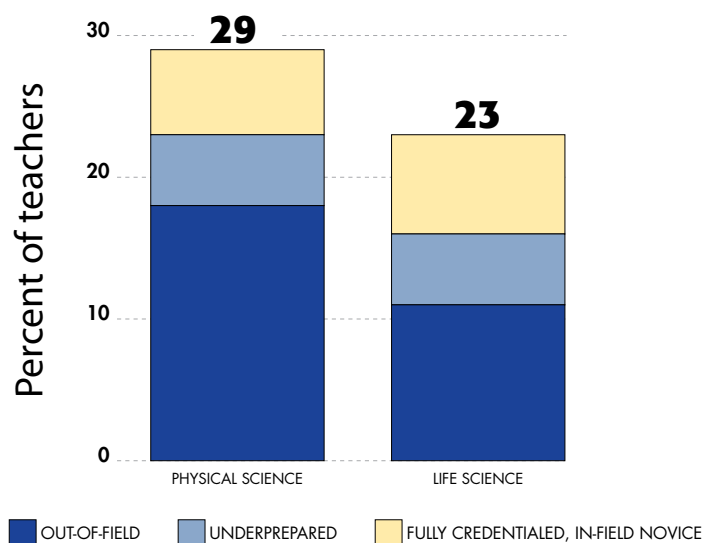
It is important to note that among those groups where student achievement in science is the lowest, parents are more likely to perceive science education to be lacking in their schools, and those surveyed express stronger support for efforts to strengthen science education. Latino parents (63%) are more likely than other groups to say that their children do not spend enough time learning science in school. African Americans (85%), Latinos (79%) and those earning \$25,000-\$50,000 annually (77%) are most likely to say that more resources and better equipment would make a big difference in science education. Latinos (67%), African Americans (66%) and low-income earners (62% of those with incomes under \$25,000) are also among those most likely to say elementary teachers should have special training.

A report and summary of the research can be found at www.cftl.org.

The Teacher Workforce

Consider further that California does not have the science teachers it needs now, and is not preparing an adequate supply of the teachers needed in the future. Analysis by SRI International commissioned by the Center shows that more than 20% of life science and physical science teachers in California high schools are either teaching out of their field of expertise, lack a credential for teaching or are new to teaching.

Out-of-field, Underprepared, and Novice High School Teachers by Assignment, 2008-09



Additionally, as research from our latest report, *California's Teaching Force 2010*, shows, between 2001-02 and 2007-08, the number of enrollees in teacher preparation programs dropped by 45%, from more than 75,000 to fewer than 45,000, a decline that only makes recruitment and placement of new science teachers more difficult.

The CenterView

As the new NAEP scores make abundantly clear, there is a large gap between the rhetoric touting the importance of science education and the realities of what is happening in schools in California and across the nation. These dismal scores should serve as a wake-up call that the need to strengthen science education is urgent and the time to act is now.

One place to start is to boost enrollment in teacher preparation programs featuring science and to take specific steps to strengthen science teaching practice for those already in the classroom. Two programs that, despite tough budget and education challenges, have proven effective in the development of new science teachers are California State University's Math and Science Teacher Initiative and the University of California's Cal Teach program.

We understand the realities of the state's budget crisis. But with public support the new governor, superintendent of public instruction, and motivated educators and leaders in the science community can begin a serious conversation about how to bridge the gap between the expectations Californians have for students' academic achievement in science and the lack of support for this important subject in our schools.

To aid in this process, the Center for the Future of Teaching and Learning has joined with colleagues at the University of California, Berkeley's Lawrence Hall of Science and SRI International to examine the status of science education in schools and classrooms across the state. With funding from the S.D. Bechtel, Jr. Foundation, we are looking closely at what is really happening with science education in the state's schools and classrooms as a base upon which critical decisions to strengthen science teaching and learning can be made.

The public's call for more and better science instruction in California classrooms is steeped in wisdom and supported by results on state and national assessments. President Obama has called science "more essential for our prosperity, our security, our health, and our environment than it has ever been." We agree.