

## **No Child Left Behind Teacher Quality Mandates: Some Recommendations for Supporting Science Teachers in California**

Panel testimony prepared for the No Child Left Behind Public Hearing

Sponsored by the Berkeley Public Education Foundation, Marcus A. Foster Educational Institute, Public Education Network, and San Francisco Education Fund  
San Francisco, California, January 18, 2006

Linda S. Shore, Ed.D., Director, Exploratorium Teacher Institute,  
Exploratorium, 3601 Lyon Street, San Francisco, California, 94123

This material is based upon work supported by the National Science Foundation under Grant No. ESI 9910207. Any opinions, findings, and conclusions or recommendations expressed in this material are those of the author and do not necessarily reflect the views of the National Science Foundation.



## **Introduction**

The Exploratorium is an internationally acclaimed, hands-on museum of science, art, and human perception. The Teacher Institute has provided professional development to middle and high school science teacher for almost a quarter century. We are unique in that we provide life long support to a growing community of 2000 teachers in the form of summer institutes, Saturday workshops, web-based resources, and other programs. We mostly serve science teachers who work in urban areas in the Bay Area including San Francisco, Oakland, Berkeley, Richmond, and San Mateo County. We also have active teacher alumni from other parts of California and from districts around the country.

The Exploratorium has always been responsive to the needs of our teachers. We create new programs as a direct response to what teachers need, and they are quite honest with us about these needs. Of late, NCLB teacher quality mandates have generated the need for a program to help teachers strengthen their subject matter knowledge. In response, we recently designed and implemented a pilot program to help our community of teachers become NCLB complaint. In this testimony I will briefly review what the federal NCLB teacher quality mandates require of teachers and how California has decided to implement these mandates. I will describe some of the serious challenges to meeting NCLB teacher subject matter compliance that we have observed. Finally, I will offer some observations and make suggestions for truly insuring that our science teachers are effective.

## **Background**

NCLB not only sets accountability benchmarks for students, but it also sets competency requirements for teachers. Teachers need to demonstrate subject matter competency in all the areas that they teach. Physics teachers must possess a deep understanding of physics, algebra teachers need to fully understand algebra, U.S. history teachers need demonstrate that they know their U.S. history, and so on. The rationale is simple – because student achievement is linked to good teaching, every child must be guaranteed a knowledgeable and well-prepared teacher.

NCLB teacher quality mandates address a problem that has existed for many years, namely that too many teachers are teaching outside their field. This is happening almost entirely because

there simply are not enough teachers entering the profession to make up for the numbers leaving the profession. Retirement and attrition leave districts scrambling to fill classes with the workforce they *do* have. The number of unqualified teachers in this state is staggering. It is estimated that at least 30,000 teachers across the state – *or 10% of the workforce* – have not been formally prepared to teach the subjects they are assigned. In the sciences, the situation is even more serious where surveys suggest that 25-35% of the state’s teaching workforce is teaching out of field. In large urban districts serving traditionally underserved, at-risk students, the numbers of unqualified science teachers may well exceed 50%.

To satisfy federal mandates for teacher quality, California requires the following for science teachers. Teachers credentialed since 2002 must demonstrate subject matter competency for every science content area assigned to them. For example, a physics teacher must be competent in physics; a biology teacher competent in biology; and a chemistry teacher competent in chemistry. For example, a physics teacher must be competent in physics; a biology teacher competent in biology; a chemistry teacher competent in chemistry. This can be accomplished in one of three ways: (1) the teacher can hold a bachelors degree in the discipline, (2) the teacher can complete 32 units of upper division coursework in the discipline, or (3) the teacher can successfully pass various sections of the California Subject Examinations for Teachers (CSET) in the sciences. Because it is unrealistic to ask busy teachers to return to the university to complete additional science degrees, teachers and district administrators feel that that the most efficient to demonstrate competency under NCLB is to pass the CSET exam.

The CSET exam covers a very broad range of science content areas in great depth. Most science teachers were “going it alone” and finding that they could not pass the tests because they needed time to study, science content resources, and support. Administrators and teachers asked the Exploratorium design a program of professional development that would strengthen both content knowledge and classroom practice at the same time. Currently, with National Science Foundation support for an 18-month pilot, we are providing science content workshops, small group tutoring, and study materials for 75 science teachers preparing for the CSET.

## **Challenges**

We have observed some serious challenges for meeting teacher quality objectives in science that this committee should be aware of. At the middle school level, the science curriculum is multidisciplinary - requiring middle school science teachers to demonstrate subject matter knowledge in life, earth, *and* physical sciences. To demonstrate competency through the CSET, a middle school teacher must pass at least 3 and as many as 5 individual subject matter exams in general science, earth science, chemistry, physics, and biology. But only two of these exams focus on middle school level content. The other exams are the exact same tests that high school science teachers take and do not correspond to the middle school science curriculum. Middle school teachers require a great deal of science content support to pass these challenging examinations. The CSET needs to include subject matter exams appropriate for middle school science teachers and the state needs to invest in professional development programs that help middle school science teachers strengthen their content knowledge.

High school science teachers face a similar challenge. Virtually all high school science teachers have bachelor's degrees in a science discipline such as biology, chemistry, or geology; some even have advanced degrees. Yet a high school science teacher is often asked to teach outside of their area of expertise. For example, there are simply not enough credentialed high school physics teachers in this state to cover all the physics courses we teach. As a result, a chemistry teacher with an advanced degree in chemistry is often assigned to teach the physics classes. In small high schools, this chemistry teacher might be asked to teach biology as well. But to be NCLB compliant, this teacher will need to pass the CSET examinations in all of these disciplines. Like the middle school science teacher, this chemistry teacher requires a great deal of science content support. Either we need to find some way to stop the practice of assigning high school science teachers courses outside of their expertise (which is probably impossible given the lack of certified science teachers), or the state needs to invest in professional development programs that help high school science teachers broaden their content knowledge to include other disciplines.

At the Exploratorium, we are helping middle and high school teachers pass these challenging exams, but only after supporting them through an intensive 8-week, 25-hour workshop series.

This work is expensive, costing approximately \$3000 per teacher to provide them with access to staff scientists, science educators, a teacher resource library, science materials, sample questions, study guides, and web-based tools.

The Exploratorium's challenge is finding financial support for this critically important work. Funding for our teacher professional development programs at the state and national level has almost evaporated. Based on our demonstrated success in strengthening both teacher content and practice, the museum used to receive over \$1 million each year from the California Department of Education to serve as a statewide Teacher Resource Center. In 2000 this funding was entirely eliminated due to the state's budget crisis and have not been restored. The National Science Foundation, which provided my program with about half of the support we require, no longer provides support to develop and implement science teacher professional development programs. The state and federal dollars currently available to develop and support the science teacher workforce fund the Math Science Partnership initiatives (MSP). But these grants are only available to school districts working in partnership with universities. Museums and other organizations – many with long and very successful histories of providing high quality professional development – are unable to serve as lead fiscal agents and participate in these partnerships as equals.

## **Recommendations**

- *Review and revise the CSET examination requirements for middle school science teachers.* Middle school science teachers should not be required to pass the same CSET science content examinations as their high school counterparts. CSET science examinations should be designed that more accurately reflect 6<sup>th</sup>, 7<sup>th</sup>, and 8<sup>th</sup> grade content.
- *Substantially increase the number of high quality professional development programs for secondary science teachers that develop both content and practice.* The state continues to suffer under a serious science teacher shortage that shows no sign of relief. As a result, credentialed science teachers will need to teach outside of their areas of formal training and expertise. If our students are to receive high quality science instruction, then these science teachers require high quality professional development programs that strengthen teacher content knowledge.

However, a knowledgeable teacher is not necessarily an effective one. A science teacher needs to be able to transform their content knowledge into meaningful opportunities for students to learn. Professional development programs that improve *both* content knowledge and pedagogy need to be developed and supported.

- *Funding for teacher professional development programs that are housed outside of school districts and universities is needed to insure that every science student has access to a high quality science teacher.* Throughout the state, there are institutions with long, successful histories of providing high quality professional development opportunities to science teachers. These include programs like the Exploratorium Teacher Institute. However, state and federal funding for these science teacher professional development programs has been significantly reduced over the last several years. Additional funding sources need to be identified for these programs and state and federal Math Science Partnership grants need to allow these institutions to apply as lead fiscal agents.

## **Bibliography**

California Dept of Education (2004). *NCLB Teacher Requirements Resource Guide*.  
<http://www.cde.ca.gov>

Center for the Future of Teaching and Learning (2004). *California's Teaching Force 2004: Key Issues and Trends*. <http://www.cftl.org>

Shore, L.S. (2004). Museum Experiences That Support Classroom Inquiry and Teacher Professional Development. In R. Audet and L. Jordan (Eds.) *Inquiry Across the Curriculum: Investigating Objects, Events, People, Places, and Phenomena*. Corwin Press: Thousand Oaks, CA.

## California's NCLB Teacher Requirements

	<b>"New" to The Profession</b>	<b>"Not New" to The Profession</b>
	Holds a Credential or an Intern Credential or Certificate Issued <u>on or after July 1, 2002</u>	Holds a Credential or an Intern Credential or Certificate Issued <u>before July 1, 2002</u>
<b>GRADE SPAN</b>	<b>ELEMENTARY SCHOOL</b>	<b>ELEMENTARY SCHOOL</b>
<b>REQUIREMENTS</b>	<p>1) Bachelor's degree (Sec. 3.2.1)</p> <p>2) California Credential or an Intern Credential or Certificate for no more than three years (Sec. 3.2.2)</p> <p>3) Core academic subject competence must be demonstrated by: (Sec. 3.2.3)</p> <p style="padding-left: 20px;">EXAM: Pass a multiple subjects examination approved by the California Commission on Teacher Credentialing (CCTC)</p>	<p>1) Bachelor's degree (Sec. 3.2.1)</p> <p>2) California Credential or an Intern Credential or Certificate for no more than three years (Sec. 3.2.2)</p> <p>3) Core academic subject competence may be demonstrated by: (Sec. 3.2.3)</p> <p style="padding-left: 20px;">EXAM: Pass a multiple subjects examination approved by the California Commission on Teacher Credentialing (CCTC)</p> <p style="text-align: center;">or</p> <p style="padding-left: 20px;">HOUSSE: Complete California's High Objective Uniform State Standard of Evaluation</p>
<b>GRADE SPAN</b>	<b>MIDDLE AND HIGH SCHOOL</b>	<b>MIDDLE AND HIGH SCHOOL</b>
<b>REQUIREMENTS</b>	<p>1) Bachelor's degree (Sec. 3.2.1)</p> <p>2) California Credential or an Intern Credential or Certificate for no more than three years (Sec. 3.2.2)</p> <p>3) Core academic subject competence must be demonstrated by (Sec. 3.2.3):</p> <p style="padding-left: 20px;">EXAM: Pass a subject matter examination approved by the CCTC in each subject taught</p> <p style="text-align: center;">or</p> <p style="padding-left: 20px;">COURSEWORK: In each core area taught complete a:</p> <ul style="list-style-type: none"> <li>A) CCTC approved subject matter program, or</li> <li>B) Major, or</li> <li>C) Major equivalent, (32 semester units or the equivalent) or</li> <li>D) Graduate degree</li> </ul>	<p>1) Bachelor's degree (Sec. 3.2.1)</p> <p>2) California Credential or an Intern Credential or Certificate for no more than three years (Sec. 3.2.2)</p> <p>3) Core academic subject competence must be demonstrated by (Sec. 3.2.3):</p> <p style="padding-left: 20px;">EXAM: Pass a subject matter examination approved by the CCTC in each subject taught</p> <p style="text-align: center;">or</p> <p style="padding-left: 20px;">COURSEWORK: In each core area taught complete a:</p> <ul style="list-style-type: none"> <li>A) CCTC approved subject matter program, or</li> <li>B) Major, or</li> <li>C) Major equivalent, (32 semester units or the equivalent) or</li> <li>D) Graduate degree</li> </ul> <p style="text-align: center;">or</p> <p style="padding-left: 20px;">ADVANCED CERTIFICATION: National Board Certification in the core area</p> <p style="text-align: center;">or</p> <p style="padding-left: 20px;">HOUSSE: Complete California's High Objective Uniform State Standard of Evaluation</p>

From "Improving Teacher Quality," California Department of Education, <http://www.cde.ca.gov/>