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K-6 Teachers and Classrooms Need Stronger Focus on Science

SAN LUIS OBISPO – California’s elementary school teachers feel much less confident in teaching science than reading or math, and there is both the need and the potential for significant improvement in elementary school teacher preparation, according to a new report by the California Council on Science and Technology (CCST).

Currently, 50 percent of California’s students score at or below basic proficiency in science, with only Mississippi having a higher percentage of students below basic proficiency. Little science is taught in the state’s elementary schools: in one recent survey, 80 percent of K-6 teachers reported spending 60 minutes or less per week on science; and 16 percent indicated they spend no time at all on science.

The Preparation of Elementary School Teachers to Teach Science in California: Challenges and Opportunities Impacting Teaching and Learning Science is an eighteen-month study funded by the S.D. Bechtel, Jr. Foundation. The report examines the state’s process for preparing elementary school teachers to teach science.

Unlike secondary school teachers, who hold credentials that prepare them specifically to teach science or math, K-6 teachers hold a multiple subject credential, designed to equip them to teach all subject areas, including science, in their classrooms.

To complete the new study, CCST worked with the California State University Center for Teacher Quality (CTQ), which has conducted annual surveys of first-year teachers and their Principals/supervisors since 2001. The CTQ data over eight years indicate that K-6 teachers rate themselves as substantially less prepared to teach science than mathematics or reading.

It is notable that the Principals/supervisors give more positive ratings to the teachers. In the 2008 survey data, the difference between new teacher and Principal/supervisor assessment reached 20 percent. The findings are consistent with other research indicating that elementary teachers have an initial and persistent lack of confidence about science instruction.

"The fact is that despite a general rise in student science proficiency scores, and considerable focus on science and math teacher preparation at the secondary level, elementary school teachers have not shown a rise in confidence over the course of the study, suggesting that significant work



remains to be done," said CCST Education Committee Chair Stephen Rockwood.

In addition to assessing the preparedness of elementary school teachers, the study also profiles nine teacher preparation programs identified by a working group of educational experts as having initiatives reflecting promising approaches to improving the preparation of elementary teachers to teach science.

The report includes five principal recommendations:

- Share and disseminate information on existing promising programs and infrastructure proactively, including convening of a “best practices” symposium
- Adapt existing statewide teacher preparation policies to enhance K-6 science teaching, including aligning community college lower division science instruction with teacher preparation programs
- Take a leadership role in the discussion of science standards nationally and remain proactively engaged in this discussion
- Follow the recommendations for building a statewide K-8 science reform coalition that were offered by participants during the "Building a Village" Convocation from April 2009 that was organized by the National Academy of Sciences and the National Academy of Engineering.
- Use new data to guide policy and systematically collect such data from across California’s teacher preparation programs.

The California State University (CSU) System, the single largest teacher preparation system in the state, has increased its preparation of secondary science and mathematics teachers by more than 85 percent in the past five years. It is responding to the report with several initiatives that address its recommendations. It is planning a meeting on best practices in teacher preparation that will include an elementary science teacher preparation symposium. Its campuses are developing new Foundational Level General Science credential programs that include community college pathways. It will make available tools used by the Center for Teacher Quality to facilitate other institutions’ collecting and using data on the preparation of elementary teachers in science.

“Top leaders on this campus and across the CSU are committed to addressing this problem,” said Warren Baker, President of Cal Poly, San Luis Obispo, and co-chair of the national Business Higher Education Forum initiative, *Securing America's Leadership in Science, Technology, Engineering and Mathematics (STEM)*. In a statement on behalf of the CSU system and five CSU Presidents who have followed the work of the CCST closely and all strongly support its recommendations, he said “We have a deep shared concern about these issues, and a number of exemplary programs have been or are being developed on CSU campuses that we can build upon to help ensure elementary teachers across California are well-prepared in science.”

The work of the five campuses reflects examples of the approaches that are being taken across the CSU system. One example is development of a new K-8 Foundational Level General Science credential and certificate at CSU East Bay. A second, at CSU Fullerton, includes integration of



kit-based science resources in developing high level expertise in science among K-6 teachers, and also features a range of internship experiences in informal science institutions.

A third example, at CSU Los Angeles, includes a collaborative initiative with the David and Lucile Packard Foundation involving ten CSU campuses. On each, future elementary teachers will engage with elementary children in active, hands-on science in after-school programs.

A fourth example involves elementary teacher pathways in liberal studies and child development at Humboldt State. Future elementary teachers will learn inquiry-based science methods and practice them in museum settings. Another example, at Cal Poly San Luis Obispo, includes early field experiences in inquiry-based science at local elementary schools. It is part of a recently awarded federal Teacher Quality Partnership grant with CSU Bakersfield and Monterey Bay.

A summary of these campus initiatives is contained on the next page.

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One example is the planned development of a new K-8 Foundational Level General Science credential and certificate at **CSU East Bay**. The campus plans to establish a model pathway for preparation and professional development of elementary and middle school teachers in science. A new *Foundations in Science* program will prepare K-8 teachers in science content and pedagogy. It will be a new four-course sequence designed both for elementary and middle school science teachers that addresses the state's new requirements for the Foundational Level General Science Credential. It is being designed to be taken either (a) as a Minor in Science within the undergraduate curriculum to prepare future teachers or (b) as a Certificate Program in Foundational Science that provides rigorous professional development for current teachers.

At CSU Fullerton, future elementary teachers will have expanded opportunities to develop high-level expertise in inquiry-based science. One approach focuses on integration of kit-based science resources into courses, utilizing materials that emphasize inquiry and is consistent with techniques developed by the Arnold and Mabel Beckman Foundation. A second major approach is a partnership with informal science institutions. The campus will offer Promoting Resources in Informal Science Education (PRISE) internships for future elementary teachers that feature inquiry-based science at informal science organizations across Orange County, including the Discovery Science Center, Fullerton Arboretum, Ocean Institute, and Tucker Wildlife Sanctuary.

A third example involves the teacher pathways at **Humboldt State**. Future elementary teachers will learn inquiry-based science methods in a range of majors, including liberal studies and child development, and then practice them in local school and science museum settings. Current initiatives will be expanded in a unique collaboration with museum partners and providers of outdoor education. In addition, the science education option within the campus' planned Master's degree in biology will include elementary teachers and will give significant attention to inquiry-based science, as will planned science education professional development programs for current teachers, which will incorporate teacher-based research examining student outcomes.

At CSU Los Angeles, future elementary teachers will guide children – primarily from high-need, low-income elementary schools – through inquiry-based, after-school science activities through a collaborative initiative supported by the David and Lucile Packard Foundation. The project will involve Cal State L.A. and nine other CSU campuses working within the state's comprehensive after-school program to provide rich science-learning opportunities that incorporate reading and literacy development. The future teachers, about to embark on their careers, will gain valuable insights and experience working as staff members in the programs and helping children engage in hands-on science.

At Cal Poly San Luis Obispo, the science and mathematics, education and liberal studies programs have been merged. One of the objectives of this merger is to give greater attention to ensuring that liberal studies majors emerge with strong integrated preparation in content and pedagogy for elementary science. Consistent with this objective, the physical science series for Liberal Studies majors has been converted to a hands-on, guided inquiry, collaborative studio format, and similar changes in the life science course are planned. Over the next three years, Cal Poly science faculty will provide professional development to local elementary teachers in grades 3-5 through a recently awarded California Math and Science Partnership (CaMSP) grant. Many of these in-service teachers work with Cal Poly elementary teacher credential candidates.