

**Testimony Before the U.S. House Education and Labor Sub-Committee on
Higher Education, Lifelong Learning and Competitiveness
*Summit on Securing California's Competitiveness in a Global Market***

**Charles B. Reed, Chancellor
California State University System
September 21, 2007**

Introduction

Chairman Hinojosa and members of the Sub-Committee, thank you for inviting me to discuss the commitment of the California State University (CSU) to ensuring that all students in California are equipped to enter the workforce well-prepared and that the needs for skilled professionals are met in fields that are central to the state's economic competitiveness. I will focus my comments on the critically needed foundation for preparation in the science, technology, engineering and mathematics (STEM) fields, with particular attention to increasing the participation of underrepresented students in these fields. The most basic foundation for any advances in STEM fields is having sufficient numbers of well-qualified mathematics and science teachers, and I will describe the CSU commitment to doubling teachers in these fields—a major systemwide priority.

The California State University: Context

Few, if any, university systems match the scope of the CSU system. It is the largest four-year university system in the country, with 23 campuses, approximately 450,000 students and 46,000 faculty and staff. The CSU mission is to provide high-quality, affordable education to meet the ever-changing needs of the people of California. Since the system's creation in 1961, it has awarded approximately 2 million degrees. The CSU currently awards approximately 92,000 degrees and 13,000 teacher credentials each year.

The CSU plays a critical role in preparing California's youth for the job market. Our graduates help drive California's aerospace, healthcare, entertainment, information technology, biomedical, international trade, education, and multimedia industries. The CSU confers 65 percent of California's bachelor's degrees in business, 52 percent of its bachelor's degrees in agricultural business and agricultural engineering, and 45 percent of its bachelor's degrees in computer and electronic engineering. The CSU also educates the professionals needed to lead and serve in the state's major institutions. It provides bachelor's degrees to teachers and education staff (87 percent), criminal justice workers (89 percent), social workers (87 percent) and public administrators (82 percent). Altogether, about half the bachelor's degrees and a third of the master's degrees awarded each year in California are from the CSU.

One key feature of the CSU is its affordability. For 2007-08, the CSU systemwide fee for full-time undergraduate students is \$2,772. With individual campus fees added, the CSU total fees average \$3,450, which is the lowest among any of the comparison public institutions nationwide.

Close to sixty percent of the teachers credentialed in California (and ten percent of the nation's teachers) each year are prepared by the CSU. High quality teacher preparation is one of the top priorities of the system and the CSU Board of Trustees. In 2005, the system made the

preparation of additional science and mathematics teachers one of its foremost goals. Reflecting this commitment, the CSU system requested and received in the 2007-08 state budget a permanent augmentation of \$2 million to support this major commitment on an ongoing basis.

Maintaining California's Competitiveness: Mathematics and Science Teacher Preparation

Rising Above the Gathering Storm,¹ the widely respected report issued by the National Academies of Science and Engineering in 2006, underscored the centrality of the mathematics and science teaching force in securing the nation's economic future. In its recommendations, the report placed the highest priority on recruitment and preparation of outstanding candidates for teaching in these fields. It emphasized that the US system of public education is the foundation for a workforce that is proficient in mathematics and science, fields critical to the nation's economic survival, and that the most critical resource, and the one in increasingly short supply, is excellent teachers in these fields.

Two and a half years ago, I made the commitment to double the number of mathematics and science teachers prepared by the CSU by 2009-10. This meant increasing from a baseline figure of approximately 750 new mathematics and science teachers produced each year to preparation of 1,500 new teachers in these fields annually. Since that time, our Mathematics and Science Teacher Initiative (MSTI)² has increased production of teachers in these disciplines by 37.6%.

We have increased production of mathematics teachers by more than 60%, responding to significant needs in California: 35% of current middle school teachers assigned to teach Algebra 1 do not have a mathematics credential. Approximately 69,000 middle school students are enrolled in Algebra 1 classes where the teacher is under-prepared or teaching out-of-field. Students in schools that are predominantly minority are four times as likely to have under-prepared mathematics and science teachers as students in schools with few minority students.

Production of chemistry and physics teachers—fields with severe shortages—has expanded by 42%. This, too, is essential. Currently, nearly one-third of physical science teachers are either under-prepared or assigned out-of-field, and under-represented students are taught by the least qualified teachers in these fields.

The CSU has brought together the leadership of its undergraduate programs in mathematics and science and its teacher education programs to address severe teacher shortages in these fields. In 2005, CSU awarded 651 math, 1,930 biological sciences, and 516 physical sciences (chemistry, geosciences, and physics) undergraduate degrees. Although these are only some of the fields that lead to teaching credentials in mathematics and science, the figures provide an indication of the CSU institutional capacity that is and will continue to be built upon to prepare the mathematics and science teachers the state needs.

¹ National Academies of Sciences and Engineering. (2006). *Rising Above the Gathering Storm: Energizing and Employing American for a Brighter Economic Future*. Washington, DC: National Academy Press.

² See <http://www.calstate.edu/teachered/MSTI>.

Components of the CSU Mathematics and Science Teacher Initiative

The CSU Math and Science Teacher Initiative began in 2004-05 through a planning process involving all of its 22 campuses that prepare teachers. A seven-part action plan was developed that is focused on doubling mathematics and science credential production through multiple strategies.

Component #1. Comprehensive Recruitment Aimed at Expanding and Diversifying the Pool of Candidates

Objective: To significantly expand recruitment of new mathematics and science teacher candidates

Programs: Comprehensive, sustained, and innovative recruitment and marketing initiatives

The first component of the CSU action plan is directed toward substantially expanding and diversifying the pool of qualified candidates entering mathematics and science teaching. It is a broadly-based recruitment effort targeted to college students and recent graduates, community college and high school students, mid-career and pre-retirement professionals, recent retirees, and teachers with the potential to change fields.

Component #2. Creation of New Credential Pathways

Objective: To establish multiple new pathways to mathematics and science teaching credentials

Programs: A broad range of new programs beginning at the freshman level and continuing through fast-track post-baccalaureate options

A central part of the CSU strategy to expand mathematics and science teacher production is the creation of new credential pathways. The purpose is to establish multiple points of entry into these fields for individuals at different educational and career stages. New pathways include, for example, (1) blended programs for undergraduates in which an academic major and teacher preparation are integrated in an articulated program of study, and (2) a new Foundational Level mathematics credential for middle school teachers accessible to candidates earning a multiple subject credential for grades K-8 as well as a single subject credential for secondary grades.

Component #3. Internet-Supported Delivery of Instruction

Objective: To create systemwide Internet-supported mathematics and science credential preparation resources

Program: New online-supported teacher preparation programs in mathematics and science

To accommodate the needs of diverse pools of candidates, flexible preparation options are needed that allow for online learning. The CSU initiative includes development of Internet-

supported instruction both for preparation to pass required California Subject Examination for Teachers (CSET) tests and to make academic course work available online.

Component #4. Collaboration with Community Colleges

Objective: To implement integrated 2-year/4-year mathematics and science credential preparation programs with California's community colleges

Programs: Partnerships with community colleges that align lower division and upper division mathematics and science teacher preparation and institutionalize early recruitment and academic advising for teaching careers in these fields

A central component of the CSU approach is collaboration with community colleges in integrated 2-year to 4-year programs that provide an articulated and continuous sequence of preparation for mathematics and science teaching. The Chancellor's Offices of the CSU and of the California Community College System have entered into a Memorandum of Understanding (MOU) that advances system-level strategies to institutionalize articulated pathways.

Component #5. Financial Support and Incentives

Objective: To provide financial support for new mathematics and science teachers through the full array of available fiscal resources

Programs: Scholarships, loan assumption programs, paid tutoring, service learning, school district internships

An important component of CSU's strategy—one essential for its success—is providing support for candidates through scholarships and loan assumption/cancellation programs, paid tutoring, and internship opportunities that make teacher preparation financially attainable and attractive for college students of all backgrounds. This is particularly important because significantly increasing participation from underrepresented groups, those most often in need of financial assistance, is a central component of CSU's strategy.

A major effort has been undertaken by CSU in collaboration with the California Student Aid Commission to foster maximum utilization of California's Assumption Program of Loans for Education (APLE). This important state program for future teachers provides up to \$19,000 of loan forgiveness for new mathematics and science teachers. CSU campuses have awarded loan cancellation awards to more than 6,000 teacher education students in the past year, enabling them to enter the teaching profession in shortage fields with little or no debt.

The federal Noyce Scholarship program is another important source of financial aid. Twelve CSU campuses have received competitive grants from the National Science Foundation, averaging over \$400,000 each, to implement Noyce scholarship programs. These funds have enabled them to provide scholarships of \$10,000 per year for up to two years for future

mathematics and science teachers—both upper division undergraduates and teacher credential candidates in these fields.³

Paid tutoring is another important vehicle providing financial support and recruitment benefits. Research shows that the desire to assist others is a primary factor in recruitment into mathematics and science teaching and that the opportunity to do so enhances the quality of new teacher preparation in these fields. At CSU campuses like San Diego State University, community college students interested in mathematics or science teaching serve as paid tutors for 20 hours a week. They work with students from nearby school districts that serve predominantly minority students with the goal of increasing their preparation and participation in post-secondary education.

Component #6: Identifying and Scaling-Up Approaches Having Significant Potential

Objective: To identify and scale-up cost-effective mathematics and science teacher recruitment and preparation approaches

Programs: Expanding approaches that have been demonstrated to be effective

The CSU strategy is a carefully planned one aimed at identifying, analyzing, and scaling up especially promising and cost-effective approaches for preparing highly qualified mathematics and science teachers. Examples of strategies identified for scale-up to-date include aligned programs of preparation with community colleges, online preparation for the California Subject Examination for Teachers (CSET), and programs in which undergraduates provide lab-based science activities for local students from low-income and minority schools.

Component #7. Partnerships with Federal Laboratories, Business and Industry

Objective: To establish and institutionalize partnerships that enhance the attractiveness of teaching careers in mathematics and science

Programs: Partnerships with federal laboratories, business and industry enriching mathematics and science teachers' career opportunities

Long-term success in increasing recruitment, preparation, and retention of mathematics and science teachers requires career opportunities that encourage the brightest STEM majors to enter and remain in teaching careers. Engaging in science research at federal laboratories and/or industry sites can re-invent and revitalize mathematics and science teaching and significantly enhance the attractiveness of careers in these fields.

Consistent with the recommendations of the Business Higher Education Forum in *An American Imperative*,⁴ the report that reflects the results of a major project co-chaired by President Warren

³ Under the America COMPETES Act, total funding for Noyce scholarships through NSF is authorized to increase significantly, and the period during which candidates can receive \$10,000 scholarships is extended to three years.

⁴ Business Higher Education Forum. (2007). *An American Imperative: Transforming the Recruitment, Retention, and Renewal of our Nation's mathematics and Science Teaching Workforce*. Washington, D.C.: BHEF.

Baker, the CSU has begun an initiative with Lawrence Livermore National Laboratory aimed at enabling outstanding science undergraduates interested in becoming teaching candidates to work at the Lab on a paid basis during the summer. This type of program, which increases the quality of science teacher preparation and the interest of science majors in teaching careers, is especially promising, and we urge greater federal support for these types of programs for future teachers at federal laboratories.

CSU STEM Activities Focused on College Access and Preparation

Strengthening the K-12 pipeline by increasing the numbers of well-qualified mathematics and science teachers is one critical underpinning of improving California's competitiveness. The CSU is also engaged in a broad range of activities focused on enhancing *college access and academic preparation* for California's diverse population that contribute in significant ways to preparing the workforce that is critical to the state's economic prosperity. For example:

- The CSU is deeply engaged in efforts to ensure college access for diverse populations of high school students. The system is the most prominent and prolific system in the Hispanic Association of Colleges and Universities (HACU), with 19 of our 23 campuses participating actively. Since the 1970's, the CSU has been one of the most Latino friendly university system in the nation. Today, 26.2% of our students are Latino.
- The CSU is committed to ensuring minority parent awareness and understanding of higher education. We have a three-year partnership with Parent Institute for Quality Education (PIQE) reaching 120 middle schools, 8,000 parents, and 25,000 school children every year. Its purpose is to increase the number of students eligible to enter the CSU from underserved communities. Through this partnership, parents are receiving training and resources that will prepare their children for a college education. The partnership helps parents to create a home learning environment, navigate the school system, and work collaboratively with teachers, counselors, and principals.
- The CSU has focused outreach activities aimed at creating a college-going culture among minority and low-income students throughout their elementary and secondary experience. In a partnership with the Boeing Corporation, the CSU publishes its now widely acclaimed "How to Get to College" poster. For California students who will be the first in their families to go to college, the information in this widely distributed poster about the steps to prepare for and apply for college and financial aid is extremely valuable. CSU has distributed the poster in English and Spanish to schools throughout California and now also distributes copies in Chinese, Korean, and Vietnamese.
- The CSU has a deep commitment to outreach programs equipping students from underrepresented groups for success in college. Our federal GEAR UP, TRIO, and Upward Bound programs are the largest in the country and represent major priorities across the entire CSU system. For example, eleven CSU campuses have been the fiscal agent for GEAR UP grants totaling over \$112 million since the inception of the program in 1999, using these resources to encourage economically disadvantaged youth to aspire to college and preparing them for college and success.

- The CSU is dedicated to supporting talent development programs for students from underserved communities. For example, the CSU has nine MESA pre-college sites and eight MESA engineering program centers. CSU campuses with pre-college MESA programs work with over 180 schools and serve more than 9,000 students annually. Nearly 50% of the students in the MESA Community College Program in California transfer to CSU campuses and major in mathematics, engineering, science or technology.
- The CSU is engaged in partnerships having significant promise for preparing new groups of STEM professionals from diverse backgrounds who are first generation college goers. For example, we are working closely with the Hispanic Engineers National Achievement Awards Corporation (HENAAC) in planning a program that will provide early STEM career awareness and preparation for elementary, middle and high school students in inner city Los Angeles. HENAAC has developed plans for an outstanding project that will involve CSU Los Angeles as the primary higher education partner, include students, their families and teachers, and will be made possible through support of the Office of Naval Research.

While these targeted programs provide essential assistance to underrepresented students, programs that enhance the capacity of secondary schools to prepare all students for college success are also essential. The CSU *Early Assessment Program* is a nationally recognized collaboration involving the CSU, the California Department of Education, and the State Board of Education. It provides the opportunity for high school students to learn about their readiness for college-level English and mathematics in their junior year, and it makes available opportunities for them to improve these skills during their senior year so they can enter the CSU without requiring remedial coursework. By providing professional development for English and mathematics teachers across the state, the EAP is a major resource for increasing the readiness of students from high need communities to enter college ready for success.

Concluding Comments

The CSU has a significant commitment to advancing California's competitiveness, and is dedicated to building the foundations that are critical to preparing all students for STEM careers. This includes: (a) preparing the mathematics and science teachers needed to equip California's students for success in STEM fields and (b) fostering access to STEM fields among students from the underrepresented groups that are an increasingly large portion of our workforce.

When students from diverse backgrounds begin their study on CSU campuses, there are dozens of outstanding programs that enable them to select and excel in STEM fields. Programs that provide special resources for these students include, for example, the excellent Louis Stokes Alliance for Minority Participation programs, the Minority Access to Research Careers (MARC) programs, and the Minority Biomedical Research Support (MBRS) programs found across CSU campuses. Also, many of our campuses foster undergraduate and master's level research in the STEM disciplines, leading to increased readiness among our students to become research and development STEM professionals. As evidence of our effectiveness, the National Science Foundation has consistently identified the CSU as a top baccalaureate institution of origin for

STEM doctorate recipients. For example, a recent published study identified five CSU campuses among the top 50 undergraduate institutions of origin of Hispanic doctoral recipients.

There are, in addition, outstanding engineering programs that focus on increasing the numbers of underrepresented students excelling in engineering careers in the CSU. Programs such as the Minority Engineering Program (MEP) make available exceptional engineering opportunities and have significantly expanded participation of Latino and African-American students.

This past year, the CSU initiated a systemwide Professional Science Master's (PSM) program that offers innovative Master's degrees that prepare students for the state's highest growth sectors in industry and government. Eighteen PSM programs are in place or underway. Industry partners in PSM programs nationally include some of the nation's foremost science and technology firms. Enrollment of underrepresented minority students is substantial, and the 18 planned CSU programs will enable students from diverse backgrounds to develop the science, technology and management skills most needed in today's workforce.

The fundamental components of the CSU and the state's success reside in (a) developing the foundations for STEM careers through teacher preparation, (b) increasing access and participation of underrepresented groups, and (c) monitoring of the effectiveness of our efforts. These are approaches where the CSU has done more than almost any other institution in the nation and is committed to continuing its leadership.

Preparing an outstanding teaching force and making CSU a route of access for underrepresented students are guiding visions underlying our priorities as a system. We rigorously measure the outcomes of our efforts and make the adjustments to ensure our programs are effective. Through our hundreds of baccalaureate and master's degree programs, we will build on these critical underpinnings and continuously contribute to the future workforce needed to secure California's competitiveness in a global market.

I will be glad to respond to any questions you may have, and look forward to working with you in the future.