

**Achieving Results: The California State University
Mathematics and Science Teacher Initiative**
An Action Plan for Doubling Preparation of Mathematics and Science Teachers

The California State University and Mathematics and Science Teacher Preparation

The California State University (CSU) has brought together its range of programs in science and mathematics and in teacher education to address severe teacher shortages in these fields. In 2004-05, 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 are precursors to teaching credentials in mathematics, biological sciences, earth sciences, physics, and chemistry, they provide an institutional capacity to address the challenge.

The CSU Mathematics and Science Teacher Initiative¹

As a system, CSU's goal is to at least double the production of math and science teachers during the next five years. This means increasing from a baseline figure of approximately 750 new math and science teachers produced annually to a minimum of 1,500 new teachers produced in these fields by 2009-2010.

CSU's Math and Science Teacher Initiative began in 2004-05 through a planning process involving all of its 23 campuses. A seven-part action plan was developed that is focused on meeting "one goal through diverse pathways." Each campus is committed to a specific plan based on regional needs and its own strengths. Plans designate a numerical goal for increased credential production. They include a variety of promising approaches for reaching goals.

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 CSU's action plan is directed toward substantially expanding and diversifying the pool of qualified candidates for math 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. Campuses plan to use a wide range of print and electronic tools, including the World Wide Web, DVD, radio, and cable television for comprehensive and innovative marketing and recruitment approaches using a range of media.

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.

¹ See <http://www.calstate.edu/teachered/MSTI>.

A central part of the CSU strategy to expand math 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, blended programs for undergraduates in which an academic major and teacher preparation are integrated in an articulated program of study. These are particularly promising because teacher preparation begins well before California's traditional post-baccalaureate program, and college students can typically complete these programs in slightly over four years.

Several campuses are planning new pathways that will enable professionals in math and science-based fields to transition to careers in math and science teaching—including efficient, fast-track paths to the state's recently established specialized science credentials. These enable individuals with Ph.D.s to earn a teaching credential rapidly. Other approaches are focused on assisting credential candidates initially enrolled in different fields and current teachers in other fields to obtain a teaching authorization in math or science.

Component #3. Internet-Supported Delivery of Instruction

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

Program: A new online-delivered teacher preparation program led by Cal Poly San Luis Obispo.

To accommodate the needs of diversified pools of candidates, flexible preparation options are needed. Anytime, anyplace instruction is particularly advantageous for candidates who are career changers and currently fully employed. Learning from the infrastructure created for CalStateTEACH (the CSU statewide site-based credentialing program), CSU's initiative includes development of Internet-supported instruction to be available to candidates and programs statewide. Cal Poly San Luis Obispo is leading the development of this effort.

Component #4. Collaboration With Community Colleges

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

Programs: Partnerships with community colleges that align lower division and upper division math and science teacher preparation and institutionalize early recruitment and academic advising in these fields.

California's Community Colleges represent one of the largest potential recruitment pools of future math and science teachers in the state. A central component of campus plans is collaboration with community colleges in integrated 2-year to 4-year programs that provide an articulated and continuous sequence of preparation for math and science teaching. CSU campuses are working with their regional feeder community colleges to establish articulated programs, and the Chancellor's Offices of the CSU and of the California Community College have committed to system-level strategies to support local campus partnerships.

Component #5. Financial Support and Incentives

Objective: To provide financial support for new math and science teachers through the full array of available fiscal mechanisms.

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 having sufficient support for candidates through scholarships and loan assumption/cancellation programs, paid tutoring, and internship opportunities that will make teacher preparation financially attainable and attractive for college students of all backgrounds. This is particularly important because students from underrepresented groups, those most often in need of financial assistance, must increasingly be a substantial part of the math and science teacher work force. Expanding their numbers within the profession 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). Often, students do not know of their eligibility for this important state student loan pay back program. The CSU Teacher Recruitment Projects, for which \$75,000 of lottery funds are allocated on each campus, have focused their efforts on math and science teacher recruitment. Many are assisting in informing math and science teacher candidates of their eligibility for APLE loan assumption awards of up to \$19,000. CSU campuses have allocated more than \$30 million in loan assumption awards to future teachers in the past six months.

Paid tutoring is another important vehicle providing financial support and additional recruitment benefits. Research shows that the desire to assist others is a primary factor in recruitment into math and science teaching and that the opportunity to do so enhances the quality of new teacher preparation in these fields. On a number of CSU campuses, both service learning and paid tutoring are being integrated with math and science teacher recruitment. Using community service learning to foster interest in math and science teaching is a priority of the CSU system.

An additional approach for providing financial support to candidates is through paid internships in lieu of student teaching. These internships are typically followed by full-time teaching positions in the same school or school district. Numerous CSU campuses have arrangements with surrounding school districts that provide paid internships for math and science candidates, and campus plans include expansion of these internship programs.

Component #6. Supporting and Evaluating Promising Approaches Having Scale-Up Potential

Objective: To identify cost-effective recruitment and preparation approaches.

Programs: Implementation and examination of a range of different expansion approaches.

The CSU strategy is a carefully planned effort aimed at supporting, refining, and scaling up especially promising and cost-effective approaches for preparing highly qualified math and science teachers. Priority is placed on identifying, supporting, and examining strategies for increasing credential production that have clear potential for replication at multiple campuses.

An example is seen in the development of programs that prepare candidates for the new Foundational Level math credential. The credential is designed particularly for middle school math instruction, a field in which a very large shortage of qualified teachers exists in California and nationally. There is a need for the Foundational Level math credential in most, if not all, CSU regional areas, and funds allocated to CSU in the Governor's Budget are being used in part to implement and examine a range of promising designs for the new credential.

A number of CSU capabilities can be drawn upon for examination of new designs. CSU's annual Systemwide Evaluation of Teacher Preparation is widely recognized as the largest effort of its kind in the nation. In addition, some of the new Ed.D. programs currently being planned by CSU campuses will include attention to approaches for achieving excellence in math and science education and teacher preparation.

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

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

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

Long-term success in increasing production and retention of math and science teachers requires the active participation of corporate leaders and partnerships with federal laboratories. They can assist to bring about fundamental changes in the societal value accorded math and science teaching and in the attractiveness of careers in these fields.

Business and industry involvement often includes scholarships for future math and science teachers. The CSU system has long-standing partnerships with Edison International and the Boeing Company through which both provide such scholarships. Funding for CSU professional development for K-12 math teachers is another type of support both of these corporations have provided to CSU efforts. Federal Department of Energy Labs in California have provided opportunities for paid summer participation by CSU teacher candidates in research projects, and plans are in motion to expand this effort. In a collaboration with education programs at the Jet Propulsion Laboratory (JPL), CSU established the CSU-NASA partnership several years ago. It enables CSU campuses to connect with the nation's most advanced applications of technology as they prepare future math and science teachers.

Progress Report: November 2006

Results to-date indicates that CSU's initiative is on course to achieving intended outcomes. Since launching of the initiative, credential production has increased 32%, from 768 to 1,011. In math, 68% of the increase is attributable to growth in the new Foundational Level credential. In the sciences, 35% of the increase has been in the newly authorized specialized credentials. Increases have occurred in the severest shortage fields: 18% of the increase in the sciences has been in the physical sciences (physics and chemistry), fields particularly in need of increased production.

To sustain long-term growth, recruitment efforts will be needed that significantly increase pools of credential candidates from all backgrounds. An area needing distinct attention is preparation and placement of math and science teachers in the highest poverty, highest minority schools in California. CSU is a partner with the California County Supervisors Educational Services Association in a \$2.87 million project to address this area. Another significant issue requiring attention is teacher retention. CSU campuses having California Science and Math Projects will this year begin to offer summer teacher institutes and ongoing professional development aimed at enhancing retention through a \$10.5 million *No Child Left Behind* Title II grant.

**CALIFORNIA STATE UNIVERSITY SCIENCE AND MATHEMATICS CENTERS
AND CALIFORNIA MATHEMATICS AND SCIENCE PROJECT SITES**

CSU Centers for Science and Mathematics Education

CSU Chico Center for Mathematics and Science Education
CSU Fresno Science and Mathematics Education Center
CSU Fullerton Center for Excellence in Science and Mathematics Education
CSU Long Beach Elementary Science and Math Education Project
Cal Poly SLO Center for Excellence in Science and Mathematics Education
Cal Poly Pomona Center for Excellence and Equity in Mathematics, Science and Technology
CSU Sacramento Mathematics and Science Education Center
CSU San Bernardino Center for Excellence in Mathematics Education
San Diego State Center for Research in Mathematics and Science Education

CSU California Mathematics Project Sites

CSU Chico Mathematics Project
CSU Dominguez Hills Mathematics Project
CSU Fresno San Joaquin Valley Mathematics Project
CSU Fullerton Orange County Mathematics Project
CSU Monterey Bay Area Mathematics Project
Cal Poly Pomona San Gabriel Valley California Mathematics Project
CSU Sacramento Mathematics Project
CSU San Bernardino Inland Counties Mathematics Project
San Diego State Mathematics Project
San Diego State, Imperial Valley Campus Mathematics Project
San Jose State Santa Clara Valley Mathematics Project
Cal Poly San Luis Obispo/CSU Bakersfield Mathematics Project
Sonoma State North Bay Mathematics Project
CSU Stanislaus Central California Mathematics Project

CSU California Science Project Sites

CSU Chico Inland Northern Science Project
CSU East Bay Science Project
CSU Fresno Central Valley Science Project
Humboldt State Redwood Science Project
CSU Northridge San Fernando Science Project
Cal Poly Pomona San Gabriel Valley Science Project
CSU Sacramento Area Science Project
San Diego State Imperial Valley Campus Imperial Valley Science Project
Cal Poly San Luis Obispo Central Coast Science Project

CSU Mathematics and Science Teacher Initiative: 2005-06

Campus Projects and Activities: 2005-06	
Campus	Primary Activities
Channel Islands	Recruit Career Changers; Offer Fast Track Specialized Science Credentials; Foundational Level Math Credential; K-12/Business Partnership
Chico	Hands on Lab for K-12 Recruitment; Blended Programs in Math, Physical Science; Foundational Level Math; Service Learning
Dominguez Hills	Recruit Career Changers; Blended Programs in Math, Science; Community Colleges– Recruitment/Articulation with 8 LA Campuses
Fullerton	Integrated Programs in Math, Biology, Chemistry, Geosciences, Physics; Foundational Level Math; Specialized Sciences Credentials; Innovative Technologies
Humboldt	Math Education Minor for Teacher Candidates; Blended Programs in Math, Sciences; Service Learning; Dedicated Dormitories, Student Interest Groups
Los Angeles	Blended Programs in Science; Foundational Level Math; Specialized Math, Science Credentials; Expedited Summer Study; Community College Bridges Program
Northridge	Comprehensive Recruitment and Strategic Marketing; Expand Upper Division/Transfer Students in Blended Math Program; Recruit from Private Colleges in Region
Pomona	Community College Integrated Programs in Math, Science; Foundational Level Math; Recruit from Agriculture, Engineering Majors; Service Learning
San Diego	Community College Recruitment via Paid Tutoring; Foundational Level Math; Specialized Sciences Credentials; Systemic Alignment with EAP and Other Outreach
San Luis Obispo	Blended Programs in Math, Biology, Chemistry, Physics; Online Programs for Math and Science Credentials; Foundational Level Math; Specialized Science Credentials
Additional Private Sector Support: 2005-06	
Boeing, Edison, State Farm Insurance	Campus Project Support; Scholarships for Math and Science Teacher Candidates; Support for Teacher Professional Development; Sponsors of Math and Science Teacher Summit

CSU Mathematics and Science Teacher Initiative: 2006-07

Planned Campus Projects and Activities: 2006-07	
Campus Math and Science Credential Pathways Growth	
Increase Blended Programs	
Technology Infused Programs	
Expand Quality Internship Programs	
Expand Current Credential Pathways	
Campus Recruitment Efforts	
Recruit Undergraduates, Community College Students, Career Changers	
Flexible and Accelerated Credential Options	
Recruitment Materials (Electronic, Paper)	
Campus Web Site Development and Publicity Activities	
Web Site Development	
Media, Publicity, Events	
Statewide Support Activities	
Conferences, Meetings	
Statewide Website Development	
Statewide Publicity Campaign	
Program Management	
Additional Grant Support Received: 2006-07	
State of California Budget Act	Mathematics and Science Teacher Recruitment Project Targeting Three High Need Regions with California County Superintendents Educational Services Association (CCSESA)
NCLB Title II State Higher Education Funds (CPEC)	Mathematics and Science Teacher Retention Initiative Focused on Summer Institutes through California Science Projects and California Mathematics Projects

CSU Math and Science Teacher Initiative:
Examples of Promising Campus Strategies
California State Polytechnic University, San Luis Obispo

California Polytechnic State University, San Luis Obispo (SLO) has embarked on a distinctive multidimensional university-wide strategy for more than doubling its preparation of math and science teachers. This strategy reflects the capabilities of the campus and the related state and national leadership of its President. The approach builds on the capacity of its University Center for Excellence in Science and Math Education and the capabilities of the campus and CSU system for online delivery of credential programs and student services.

New Credential Pathways and Credential Growth Strategies	<ul style="list-style-type: none"> • New blended programs in chemistry, biology, physics, and math leading to BA/credential in 4 years + 1 term • New Specialized Credentials in Biology, Chemistry, and Physics (rapid pathway for Bachelor's degree holders) • Community College transfer programs for junior year entry • Credential completion for Continuing Education Adult Degree Program Completers • Innovative online delivery of instruction and student services through hybrid model
Recruitment Strategies	<ul style="list-style-type: none"> • Target new populations: <ul style="list-style-type: none"> – Math and science majors and minors – Engineering majors (including new Engineering Education Option for undergraduates) – Community College transfers, including Continuing Education Adult Degree Program completers – Students from across the state interested in online credential coursework • Expand regional outreach with print and electronic recruitment information • Develop campus-wide advising; draw on strength of University Center for Science and Math Education • Attract undergraduates and K-12 students through professional programs of Math and Science Clubs • Extend the geographical range in which student teachers can be placed • Extend the use of online tools and Web-based technologies in recruitment • Provide CSET test preparation workshops • Offer campus tours; provide math, science, and engineering outreach to K-12 schools • Collaborate with MESA and AVID to provide high school and community college academic support • Outreach via email(s) from Admission Office focused on math and science teaching to a broad audience • Financial Aid Offices include focus on math and science teaching
Community College Strategies	<ul style="list-style-type: none"> • Host multiple activities for community college students; present math and science teaching pathways • Publicize junior year blended programs suitable for community college transfers
Fiscal Incentives and Strategies	<ul style="list-style-type: none"> • Stipends for Science Education Club Tutors and EAP Math Mentors • Websites for students to access financial aid directly from a range of departments and Admissions Office • Use of online and print tools for disseminating information about loan assumption and scholarships • Teacher as researcher industry/federal lab model for new teachers
Community Service Learning	<ul style="list-style-type: none"> • Preparation of EAP math mentors for tutoring roles • Early field experience in K-12 schools for student clubs

**CSU Math and Science Teacher Initiative:
Examples of Promising Campus Strategies
California State University, Fullerton**

California State University, Fullerton (CSUF) initiated a comprehensive, university-wide program involving 10 academic departments—with ongoing involvement of the President. Its goal is to more than double math and science teacher production; its strategies include recruitment of undergraduates from SMET, business, engineering, and other fields. It has integrated online learning tools to help candidates strengthen their content knowledge and pass the California Subject Examination for Teachers (CSET). It has created flexible scheduling, including late afternoon, evening, and summer courses.

New Credential Pathways and Credential Growth Strategies	<ul style="list-style-type: none"> • Expand enrollments in foundational level math credential; provide online learning tools in math • Offer integrated bachelor’s degree and credential program with reduced units to graduation • Assist credential candidates in other fields to switch to math or science • Encourage math and science majors and SMET-related majors to enter teaching • Teach classes at flexible times and offer innovative summer programs
Recruitment Strategies	<ul style="list-style-type: none"> • Recruit from multiple/single subject/special education candidates, current teachers • Recruit new specialized science credential program candidates from recent graduates, current teachers, and career changers • Offer summer sections of <i>Methods of Teaching Foundational Mathematics</i> and <i>Methods of Teaching Science</i> • Attract new populations from STEM and related fields: <ul style="list-style-type: none"> – Promote teaching careers in science and math departments – Recruit majors in biology, chemistry, geology, environmental science, and physics and minors in natural sciences – Encourage science majors to earn teaching credential with Master of Arts in Teaching (MAT) in Science – Distribute information in business, computer sciences, engineering, information science buildings • Recruit high achieving math and science students in local high schools; sponsor future teacher field trips to CSU Fullerton • Offer online CSET test preparation with Orange County Department of Education: pay test preparation costs and test fees • Recruit/advise Elementary/Bilingual Education candidates with math and science backgrounds • Identify and recruit teachers who need to establish subject matter competence to meet NCLB “highly qualified” criteria • Provide outreach through EAP contacts with schools; distribute Future Teacher brochures and APLE information
Community College Strategies	<ul style="list-style-type: none"> • Recruit community college students into articulated programs at Fullerton, Santa Ana, and Cypress community colleges • Provide academic advising and publicize math and science programs and APLE at community colleges • Arrange teaching of prerequisite courses at local area community colleges; align syllabi
Fiscal Incentives and Strategies	<ul style="list-style-type: none"> • Assist students with APLE loan cancellation awards and scholarships available to teacher candidates • Increase math and science intern placements (candidates are paid by school districts) • Pay full or partial costs for math and science courses in University Extended Education
Community Service Learning	<ul style="list-style-type: none"> • Offer new course that prepares undergraduates to tutor math and science in elementary, middle or high schools for 20 hours