THE MATHEMATICS AND SCIENCE
TEACHER INITIATIVE

REPORT TO THE LEGISLATURE AND GOVERNOR
REQUIRED BY THE 2007-08 BUDGET ACT
PART II

CALIFORNIA STATE UNIVERSITY

CHANCELLOR’S OFFICE

APRIL 1, 2008
California State University Mathematics and Science Teacher Initiative

Background

California’s schools are experiencing a critical need for more fully qualified mathematics and science teachers. In turn, the state’s industries face a significant need for a workforce prepared with science, mathematics, and technology skills essential to retain California’s economic competitiveness. Creating a foundation for a scientifically and technologically literate workforce begins with developing highly qualified mathematics and science teachers.

The California State University (CSU), the state’s largest producer of math and science teachers, has made a commitment to double its annual production of math and science teachers over a five-year period. The commitment is to increase from a baseline of 750 in 2002-03 to approximately 1,500 new teachers produced in these fields by 2009-2010.

CSU Mathematics and Science Teacher Initiative

CSU began its Mathematics and Science Teacher Initiative in 2004-05 with a planning process involving all of its 23 campuses. Each campus designed its approaches based on the strengths of that campus along with the needs and opportunities in the region. A seven-part action plan was developed that is focused on meeting "one goal through diverse pathways." Each campus has a specific action plan that includes a numerical goal for increased credential production and strategies for reaching that goal.

The campus approaches are integrated within a CSU systemwide program that includes the seven comprehensive strategies for implementing the Initiative. The evidence from efforts in math and science teacher preparation indicates that there is not one simple solution to increasing production. There are multiple obstacles to increasing recruitment and production, and these need to be addressed through a multi-faceted approach.

The CSU approach includes recruitment of new students into the teaching field, financial support to assist in credential completion, increasing teacher production through new approaches that expand credential pathways, community college program alignment, online preparation, and flexible programs for career changers. A primary goal is to identify the most successful approaches to replicate and scale up across the state.

CSU Initiative Comprehensive Strategies

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

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

The first component of CSU’s approach is directed toward substantially expanding and diversifying the pool of qualified candidates for 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 in science and technology industries; military men and women leaving service; and existing teachers with potential to change teaching fields.
Campuses are using a wide range of strategies employing print and electronic tools for comprehensive recruitment of these populations through a variety of media. The CSU Teacher Recruitment Projects are offering outreach, workshops, advising, test preparation, paid tutoring opportunities, and stipends to attract students.

**Strategy #2. Creation of New Credential Pathways**

**Objective:** To establish multiple new pathways toward mathematics and science teaching credentials.

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 options and points of entry into these fields for individuals at different educational and career stages.

New pathways include innovative options that provide added methods for becoming credentialed in these fields. They include, for example, (1) the new Foundational Level math credential for middle school teachers and (2) blended programs for undergraduates in which an academic major and teacher preparation are integrated in an articulated program of study.

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. Other approaches are focused on assisting credential candidates initially enrolled in programs leading to different teaching fields and current teachers in other fields to obtain an additional teaching authorization in math or science.

**Strategy #3. Internet-Supported Delivery of Instruction**

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

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 with online support), CSU’s work includes development of field-based Internet-supported instruction that will be available to candidates and programs statewide. Cal Poly San Luis Obispo is leading this development effort.

**Strategy #4. Collaboration With Community Colleges**

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

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 a continuous and seamless sequence of preparation for math and science teaching. CSU campuses are working with their regional feeder community colleges to
establish fully aligned programs. The Chancellor’s Offices of the CSU and of the California Community College have entered into a Memorandum of Understanding that identifies and supports strategies fostering 2-year to 4-year transfer pathways.

**Strategy #5. Financial Support and Incentives**

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

An important component of the CSU strategy—one essential for its success—is having sufficient support for candidates through scholarships and loan assumption/cancellation programs, paid tutoring, and salaried internship opportunities to 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 workforce. Expanding their participation within these teaching fields is a central component of the CSU current and long-term growth plan.

A major effort has been undertaken by CSU to foster maximum utilization of California’s Assumption Program of Loans for Education (APLE). This state program for future teachers provides up to $19,000 of loan forgiveness for new math and science teachers.

Research indicates that loan debt deters students—even those having a keen desire to teach—from choosing teaching as a career due to students’ concerns about being able to pay back loans on the moderate salary of a beginning teacher. Significant outreach efforts have been undertaken and a dedicated CSU APLE web site has been established to ensure that all CSU students know of APLE and can easily access it.

On a number of CSU campuses, paid tutoring is being integrated with math and science teacher recruitment. Research shows that the desire to assist others is a primary factor in recruitment into math and science teaching. The opportunity for undergraduates to work with K-12 students as tutors in math and science not only assists them financially; it also enhances the quality of their preparation as new teachers in these fields.

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. Serving as a teacher without completing a credential is by no means optimal preparation. Nevertheless, CSU campuses meet the pressing needs of school districts by enabling math and science candidates to serve as paid interns. The campuses provide significant support for intern teacher candidates to ensure that they have the assistance they need to be successful.

**Strategy #6. Partnerships with Federal Laboratories, Business, and Industry**

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

Long-term success in increasing production and retention of math and science teachers can best be achieved through a strategy that includes the active participation of corporate leaders and partnerships with federal laboratories. Federal laboratories can help to increase the attractiveness of careers in these fields by providing opportunities
for future science and mathematics teachers to participate in paid summer research and to become members of the community of science.

CSU has entered into a partnership with the U.S. Department of Energy and the National Aeronautics and Space Administration (NASA) to provide state-of-the-art research opportunities for its science and mathematics teacher candidates. It is working with Industry Initiatives for Science and Mathematics Education (IISME) to provide similar opportunities in business and industry for new science and mathematics teachers.

**Strategy #7. Supporting and Evaluating Promising Approaches Having Scale-Up Potential**

**Objective:** To identify successful recruitment and preparation approaches with potential for expansion at other campuses.

The CSU strategy is a carefully planned effort aimed at identifying and scaling up especially promising approaches for preparing well qualified math and science teachers. Priority is being placed on identifying and examining effective strategies for increasing credential production having clear potential for replication at multiple campuses. Data on the quality and effectiveness of different approaches is being collected as a central part of the Initiative.

**CSU Mathematics and Science Credential Production**

This report provides data on credential production in response to the 2007-08 Budget Act. The report provisions of the Budget Act addressed four areas:

(a) annual number of mathematics and science teachers awarded credentials (by each CSU campus) beginning with the 2004-05 academic year (before the state first provided funding for the Initiative)

(b) an expenditure plan on the use of the funds appropriated in this provision,

(c) the effectiveness of the Initiative’s different components and activities, including an identification of best practices, and

(d) the job placement of students who earn a mathematics or science teacher credential, including the location of the K-12 school of employment and whether it is in an urban, rural, or suburban setting.

The second, third, and fourth areas were fully addressed in the CSU Mathematics and Science Teacher Initiative Report to the Legislature and Governor dated March 1, 2008. This document, Part II of the CSU report, addresses the issue of teacher credentials awarded as specified in the first component (part (a)) of the Budget Act provision.

Two types of data are provided that describe the number of mathematics and science teachers awarded credentials. Both follow reporting conventions of the California Commission on Teacher Credentialing (CCTC). They are: (a) the number of mathematics and science teachers produced by the CSU campuses and (b) the number of mathematics and science credentials recommended by CSU campuses.
Number of Mathematics and Science Teachers Produced by CSU Campuses

Table 1 (page 8) contains data for the past five years on the number of mathematics and science teachers produced by CSU campuses. The CSU Mathematics and Science Teacher Initiative began in 2002-03, and the increase from that baseline to 2006-07—from 768 to 1,289—was 68%. The first funding for the CSU Mathematics and Science Teacher Initiative was in 2004-05. The increase from that baseline to 2006-07—from 1,011 to 1,289—was 27.5%.

The increases have varied among subject areas. In mathematics, the increase has been from a 2002-03 baseline of 349 to a 2006-07 production of 788, an increase of 126%. This is to a large extent attributable to the introduction of the Foundational Level Mathematics credential. This credential is designed to address the need for credentialed middle school mathematics teachers. CSU campuses prepared 261 Foundational Level mathematics teachers in 2006-07, demonstrating a steady increase since the introduction of the Foundational Level Mathematics credential in 2003-04.

The overall increase in production of science teachers from 2002-03 to 2006-07—from 419 to 501—was 20%. The increase from the beginning of funding for the CSU Mathematics and Science Teacher Initiative in 2004-05 to 2006-07—from 487 to 501—was 43. Within the sciences, the largest gains since the 2002-03 baseline have been in chemistry and geosciences, with modest gains in physics and in biology.

In examining changes from 2004-05 (first year of MSTI funding) to 2006-07, it is important to recognize that the impacts of additional support will be primarily realized in 2007-08. Increases to-date reflect the efforts of CSU campuses over several years to increase and expedite the numbers of mathematics and science teachers for California. In the 2005-06 state budget, $250,000 of funding was provided to the CSU. This resulted in small awards issued to ten campuses in Fall 2005. These resources were used to develop and initiate new recruitment and preparation approaches. These efforts led to the identification of new pools of candidates to attract and recruit into the 2006-07 entering cohort. The majority of CSU credential candidates require two years to complete the credential in mathematics and science. Those candidates recruited in Fall 2006 will be receiving their credential in June 2008. Hence, the credential production rates for 2007-08 will be the first reliable measure of the impact of funding for the CSU Mathematics and Science Teacher Initiative.

There is, however, clear evidence in the 2006-07 data of the impact of the support of the Governor and the Legislature for the CSU Mathematics and Science Teacher Initiative. The clearest evidence is in campus-by-campus data that show changes from 2002-03 through 2006-07. Table 2 (page 9) provides these data. It shows that 21 of the 22 CSU campuses authorized to issue mathematics and science credentials demonstrated increases—most of them substantial—in the period from 2002-03 to 2006-07. In addition, 18 campuses demonstrated increases—again, many of them large—between 2004-05 and 2006-07. Examples include CSU Bakersfield, which grew from production of 25 to 68 between 2004-05 and 2006-07, CSU East Bay, which grew from 28 to 122, and CSU Stanislaus, which grew from 27 to 51.

These increases is that they provide an initial indication of the impact of state support, since the CSU strategies for increasing mathematics and science teacher production were funded with these resources. Examples are seen in the case of three campuses
with notable increases that each has had a distinct focus in their use of new resources. In the case of CSU Bakersfield, funding has gone in large part to scholarships. In the case of CSU East Bay, it has been used primary to create a Bachelor’s Plus program—a blended undergraduate/credential program. In the case of CSU Stanislaus, it has been used for comprehensive recruitment and development of online credential courses and resources. The data available at this point, although only preliminary, suggest that each of the three approaches is having a positive impact. The same conclusion pertains across CSU campuses: new strategies have been associated with positive outcomes.

Mathematics and Science Credentials Recommended by CSU Campuses

An additional measure of the success of the CSU and the impact of additional resources provided through the state budget is the number of mathematics and science credential authorizations recommended by CSU campuses. This is a measure of the total number of authorizations issued in these fields. It provides a count of not only mathematics and science teachers credentialed but also of those who have received authorizations in a number of subjects within the fields of mathematics and science.

Achieving increases in authorizations is particularly important in relation to the serious problem of the teaching of mathematics and science by out-of-field or under-prepared teachers in California. Students in the highest need schools in the state are most likely to be taught by a teacher who does not have a credential in mathematics or science. Similarly, schools in the lowest achievement quartile have a far higher percentage of out-of-field and under-prepared teachers than schools in the highest achievement quartile.

At most school sites, the most viable approach for reducing assignment of out-of-field teachers to mathematics and science classes is to have credentialed teachers in these fields who have a second or even a third authorization. The CSU biology teacher who has received an additional authorization in chemistry or the CSU chemistry teacher who has received an additional authorization in physics brings to a school site the capacity to offer courses with a fully qualified teacher in these high-shortage fields.

Table 1 (page 8) includes the total number of authorizations recommended in mathematics and science (right column). The total number of authorizations recommended in these fields in 2006-07 was 1,373, a figure that is 6.5% larger than the numbers of teachers credentialed in these fields (1,289).

The importance of these additional authorizations is especially clear in the severe-shortage fields in the sciences. The new credentialed teachers with authorizations in chemistry increased from 91 to 110, in geosciences from 55 to 70, and in physics from 37 to 59 as a result of CSU science and mathematics candidates qualifying for additional authorizations in these fields.

Table 2 (page 9) provides data on credential authorizations recommended in mathematics and science by campus. These data are particularly valuable because they indicate that some campuses have been especially effective in increasing the numbers

1 The Center for the Future of Teaching and Learning identifies teachers who are teaching on waivers and emergency permits and interns as under-prepared.
of candidates who receive additional authorizations in mathematics and science. As an example, CSU Sacramento produced 43 new mathematics and science teachers but recommended 57 new credential authorizations in these fields. San Francisco State University produced 78 new teachers but recommended 89 new authorizations in these fields, and San Jose State University produced 78 new teachers but recommended 93 new authorizations in math and science. Each of these reflects the fact that a sizable number of new teachers received authorizations in more than one subject.

Some of the state funding for the CSU Mathematics and Science Teacher Initiative has been used to support activities facilitating credential candidates’ earning additional authorizations in science or math. As an example, one approach has been to provide online resources to enhance candidates’ subject matter preparation. This has enabled them to pass the California Subject Examination for Teachers (CSET) in additional fields, thereby becoming qualified to earn an additional authorization.

Discussion of Credential Data

The credential data provided in this report are an early indication of the success that has been realized through CSU campus strategies that have been developed and implemented through the budget support for the Mathematics and Science Teacher Initiative. There are, however, limitations in the data available from the California Commission on Teacher Credentialing (CCTC) that need to be recognized.

Because of the time period for earning a credential, the 2006-07 data can only be seen as an initial indicator of the impact of additional funding. By 2007-08, the credential data will be a reliable measure to evaluate the impact of additional resources.

In the development of the data for this report (Tables 1 and 2), it was not possible to ensure fully consistent data for previous years. The figures that are used for previous years are those that have been reported to the CSU by the CCTC since the inception of the Mathematics and Science Teacher Initiative. The data provided for 2006-07 provide a solid basis for consistent comparisons in future year-to-year analyses.

Conclusions

Mathematics and science teacher credential production data indicate significant increases during the period of the CSU Mathematics and Science Teacher Initiative, with gains of 68% since the baseline year. During the period of state funding for the Initiative, gains continued on a steady basis and were shown in 21 of 22 CSU campuses. In addition, approximately 6.5% of individuals recommended for mathematics or science credentials by CSU campuses earned additional authorizations in these fields, increasing the numbers of credentials awarded and contributing to the reduction of out-of-field teaching. CSU campuses have shown steady increases in teachers credentialed in mathematics and science. Even larger increases have been shown in the total numbers of authorizations awarded to CSU credential candidates in these fields. Both patterns demonstrate the substantial impact of the Initiative and suggest the positive outcomes associated with funding provided in the state budget.

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3 Data provided by the CCTC for previous years typically has not included interns. They are included beginning in 2006-07 to reflect the preparation that is now provided by campuses to intern candidates: (a) campuses are now required to provide 120 hours of instruction in advance of recommending an intern credential and (b) No Child Left Behind requires that an intern demonstrate subject matter competency in order for an institution to recommend an intern credential.
Appendices

Data Tables

Table 1. CSU Mathematics and Science Teacher Credential Production by Subject: 2002-03 to 2006-07

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<td>1,373&lt;sup&gt;c&lt;/sup&gt;</td>
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This table presents the best available data through 2006-07 for (a) mathematics and science teachers produced by the California State University and (b) mathematics and science credentials recommended by California State University campuses.

The basis for calculating teachers produced reflects discussions with the California Commission on Teacher Credentialing (CCTC) regarding a sound methodology for estimating the number of teachers credentialed. The estimate is based on the count of those individuals who have been recommended for (a) regular credentials and (b) intern credentials (including both their first and second subject authorizations). The consequence is that, as an example, a new social sciences teacher who receives an additional authorization in biology as a second subject is included.

The basis for calculating credentials recommended is that used by the CCTC for determining all math and science credential authorizations. For this purpose, the CCTC uses as its basis the credential authorizations that have been recommended for (a) regular credential candidates (including their first through seventh subject authorizations) and (b) intern credentials (using their first through fourth subject authorizations). The consequence is that a reliable count is provided of all authorizations in mathematics and science. This is important because increasing the numbers of additional authorizations within these fields can help to reduce out-of-field teaching.

<sup>a</sup> Data for 2002-03 through 2005-06 are based on figures provided earlier by the California Commission on Teacher Credentialing (CCTC). Intern data are included beginning in 2006-07 to reflect new requirements mandating preparation prior to issuance of an Intern credential.

<sup>b</sup> Teacher data for 2006-07 are based on the CSU Chancellor’s Office Analytical Studies division analysis of the CCTC 2006-07 credentials database. Numbers of teachers are based on the combined figures for regular candidates (subjects 1 and 2) and intern candidates (subjects 1 and 2).

<sup>c</sup> Credentials data for 2006-07 are based on the CSU Chancellor’s Office Analytical Studies division analysis of the CCTC 2006-07 credentials database. Numbers of credentials are based on the combined figures for regular candidates (subjects 1 through 7) and intern candidates (subjects 1 through 4).
### Table 2. CSU Mathematics and Science Teacher Credential Production by Campus: 2002-03 to 2006-07

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*Data on total CSU mathematics and science teachers credentialed in 2006-07 based on definitions provided in Table 1.
†Data on total CSU mathematics and science credentials recommended in 2006-07 based on definitions provided in Table 1.